

The Association for Perioperative Practice Infection control



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5. Infection control

Introduction

Surgical site infections (SSIs) remain the third most common healthcare-associated infection (HCAI) in the UK (Health Protection Agency [HPA] 2011). The most recent prevalence surveys of HCAIs in UK hospitals indicate that at any one time between 6 and 8% of patients have an HCAI and that SSIs account for up to 16% of all HCAIs (HPA 2011). According to a 5-year NHS SSI surveillance study, the cumulative inpatient or readmission-detected SSI incidence ranges from 8.7% in large bowel surgery to <1% in hip and knee replacement surgery (Public Health England [PHE] 2018). Although SSIs are an avoidable cause of harm associated with healthcare, they continue to be a significant burden (World Health Organisation [WHO] 2018).

Every SSI is an additional use of NHS resources, increases the discomfort of the patient and reduces the quality and safety of patient care (National Institute for Health and Care Excellence [NICE] 2014). The additional time patients spend in the hospital due to an SSI varies from 3 to 54 days, depending on the surgical speciality and procedure. The pain, anxiety and loss of earnings that patients experience due to SSIs has a negative impact on their health-related quality of life (Pinkney et al 2013, Badia et al 2017). Also associated with SSIs are significant costs to healthcare organisations, owing to prolonged postoperative hospitalisation, surgical reintervention, increased medical staffing needs and the cost of investigating and treating the infection (Badia et al 2017).

Microbial contamination of the wound site can occur by several routes and pathogens. The most common microorganisms isolated from SSIs across all surgical categories are Enterobacteriaceae, *Staphylococcus aureus*, methicillin-sensitive *Staphylococcus aureus*, coagulase-negative staphylococci, *Enterococcus*, *Pseudomonas*, *Streptococcus* and methicillin-resistant *Staphylococcus aureus* (PHE 2018). One major source of infection is the flora on the patient's skin. Contaminated-type surgeries may further increase the bacterial load of the site with genital, intestinal, respiratory and urinary flora. Alongside this, the surgical staff, operating environment and surgical instruments are all potential sources of bacteria (Jolivet & Lucet 2018).

Minimising the risk of SSIs requires measures to be taken before, during and after surgical procedures involving a cut through the skin (NICE 2019):

- removing microorganisms that normally colonise the skin, e.g. by using evidence-based antiseptic skin preparation
- preventing the multiplication of microorganisms at the operative site, e.g. by using prophylactic antibiotics in procedures that carry an increased risk of SSIs, e.g. clean surgery involving the placement of a prosthesis, clean-contaminated or contaminated surgery (NICE 2019).
- minimising the number of microorganisms introduced into the operative site from airborne particles, instruments and equipment, e.g. by wearing correct surgical attire, maintaining instrument sterility and minimising staff/movement in the theatre
- enhancing the patient's defences against infection, e.g. minimising tissue damage and maintaining normothermia
- preventing access of microorganisms into the incision postoperatively by using appropriate interactive wound-dressings (NICE 2019).

Protecting patients and staff from infection

In addition to practices directed at reducing introduction of bacteria into the wound site, the compliance of all staff with evidence-based infection prevention and control protocols is essential to protect patients and staff from infection. Infections often occur when pathogens cross-contaminate different sites on the same patient, or when they are spread between patients. In addition, bloodborne viruses such as hepatitis B, hepatitis C and HIV present a particular hazard in the operating environment, where the risk of splashing with blood/body fluid is high and exposure to blood occurs in the presence of sharp instruments.

The delivery of care must routinely ensure that all risks of transmission are minimised, in particular through (Loveday et al 2014):

- hospital environmental hygiene
- hand hygiene
- use of PPE
- safe use and disposal of sharps
- principles of asepsis

Everyday practice within healthcare organisations must include the rigorous application of infection prevention and control measures. These should be carried out consistently by all surgical staff members during the care of all patients. Perioperative practitioners have a professional duty of care to minimise the risk of infection to their patients, their co-workers, and to themselves.

In England and Wales, the Code of Practice on the prevention and control of infections sets out ten criteria against which a registered provider is judged against to ensure compliance with the registration requirement for cleanliness and infection control (Department of Health [DH] 2015). Other parts of the UK have country-specific guidelines:

- In Scotland, all healthcare organisations should adhere to the Standard for HCAI (Healthcare Improvement Scotland [HIS] 2015), which is aligned with the National Infection Prevention and Control Manual (Health Protection Scotland [HPS] 2015)
- In Northern Ireland, the Northern Health and Social Care Trust is responsible for the delivery of safe and effective health and social care services. Their strategy should be implemented in accordance with the Regional IPC Manual for Northern Ireland (NHSCT 2014, PHA 2015).
- In Wales, national infection control policies are available from the Welsh Healthcare Associated Infection Programme (2015).

National evidence-based guidance on the prevention of HCAI in NHS hospitals in England was updated in 2014 (Loveday et al 2014). Recommendations for evidence-based practice to prevent SSI are also contained in two clinical guidelines from NICE (2008, 2019).

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5.1 Preparation of staff

The standard

All staff entering restricted areas of the operating department wear designated theatre attire to minimise the risk of infection to themselves and the patient.

The rationale

Designated theatre attire minimises the risk of exposure of staff and patients to infection.

Although surgery takes place in numerous types of settings, a patient's surgical outcome is greatly influenced by establishing and maintaining an aseptic environment. All staff must ensure the minimisation of microorganisms introduced into the perioperative setting, e.g. by maintaining personal hygiene, wearing the designated theatre attire correctly, reporting potential health problems and monitoring visitors. Local policy needs to show consideration for the issues surrounding cultural and religious beliefs in the wearing of theatre attire and should consult the local infection control team to balance cultural needs with patient safety (The Association for Perioperative Practice [AfPP] 2007a). All departments must have written procedures that state the correct protocols for preparation of all staff and visitors upon entering and leaving all areas of the perioperative environment. Staff must be made aware of these policies and procedures (DH 2015).

The purpose of theatre attire is to provide a barrier that protects the patient from microorganisms shed into the environment from surgical staff, and to protect the outside environment from theatre contaminants. Theatre attire is also a means of identifying theatre staff. NICE concluded that all staff should wear specific theatre wear in all areas where operations are undertaken (NICE 2019).

Personal protective equipment (PPE) should be worn per standard precautions and health and safety guidelines (Health and Safety Executive [HSE] 2015). Employees have a responsibility to cooperate with any measures that their employer may take to protect their health in the workplace.

Recommendations for local policy

Theatre attire

Theatre attire is designed to minimise the transfer of microorganisms from the mucous membranes, skin and hair of the surgical team to the patient. It also provides the surgical team with some protection from exposure to blood and body fluids from the patient. When selecting theatre clothing, it is important to consider the quality of material in relation to the dissemination of airborne bacteria and bacterial strike-through. More closely woven materials such as disposable gowns and drapes minimise the dispersal of microorganisms from the skin of the wearer and are associated with lower risks of surgical wound infection (Al-Hashemi 2013). The barrier properties of linen degrade with washing and gowns and drapes must be replaced after a certain number of wash cycles per manufacturer instructions (Woodhead et al 2002).

- 5.1.1 Surgical drapes and gowns must be waterproof, disposable, and meet the European standard for surgical clothing and drapes (BS EN 13795-1:2019) for resistance to wet and dry bacterial penetration (British Standards Institution [BSI] 2019).
- 5.1.2 All staff entering restricted areas of the theatre suite should don clean theatre attire, e.g. hats, cotton scrub suits/ disposable scrub suits, non-slip antistatic shoes etc. Clean attire must be donned before every re-entry to restricted areas, according to local policy (Association for Perioperative Registered Nurses [AORN] 2019).

- 5.1.3 Changing rooms should be situated in an area adjacent to the restricted/semi-restricted area of the theatre suite and reached through an exterior corridor.
- 5.1.4 Changing areas should ensure privacy and have wash/shower facilities available. Changing areas should also have adequate provision for storing personal and theatre clothing. Storage areas should be clean and dry.
- 5.1.5 Sufficient supplies of theatre clothing should be provided daily, and clean theatre clothing should be protected from possible contamination during transfer and storage.
- 5.1.6 Theatre attire should consist of a two-piece trouser suit. It should also be:
- made of a close-knit material with antistatic properties
 - resistant to fluid penetration/bacterial strike-through
 - flame-resistant
 - lint-free, as lint can increase the number of airborne particulates
 - coloured, to reduce glare
 - cool and comfortable with maximum skin covering
 - professional in appearance
- 5.1.7 Theatre attire should be provided freshly laundered and in good condition.
- 5.1.8 If theatre attire becomes wet or soiled it must be removed immediately and placed into containers designated for contaminated laundry, to reduce the potential for cross-contamination. If there is extensive contamination of the body, then a shower should be taken before clean attire is donned. Soiled attire should be laundered in a health-care accredited facility. Home laundering is not recommended as it cannot be monitored for quality, safety or efficiency. (AORN 2019).
- 5.1.9 Theatre attire should be changed following environmental cleaning of the operating theatre and before the commencement of a new operating list.
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Cover gowns/laboratory coats

- 5.1.10 Theatre attire should be removed before leaving the theatre environment and placed into an appropriate container. When leaving the clinical area, staff should change into their outdoor clothes.
- fresh, clean attire should be donned on return to theatre
 - used theatre attire should not be stored in lockers for further use
 - theatre attire should not be worn outside the clinical area or in public places
- 5.1.11 If theatre staff are required to leave the theatre environment without changing, fully fastened and clean disposable over-jackets may be worn, as determined by the local infection control policy. If this is an authorised practice, then a sufficient supply of clean cover gowns must always be available. There is currently little evidence showing that the wearing of cover gowns reduces the risk of surgical site infections (Woodhead et al 2002). A risk assessment in these situations can best determine the course of action required by the individual practitioner. It is recommended that clean theatre attire is donned before participating in additional clinical intraoperative work.
- 5.1.12 Any cover gowns used should either be disposable and non-woven or reusable and woven (WHO 2016).
- 5.1.13 All staff should wear appropriate theatre attire and restrict their movements in and out of the operating theatre (NICE 2019).

Laundering of theatre attire

The purpose of laundering is to remove and kill microbes present in the fabric. All processed linen should be visibly clean without discolouration or staining (HPS, 2018). The BS EN 14065 is a European standard that provides a system for ensuring the microbiological quality of processed linens (The Department of Health [DH] 2016b) The Department of Health provides a framework for local policies and procedures concerning the decontamination of linen in health and social care (DH 2016).

- 5.1.14 Contaminated linens should not be processed in domestic machines, as they are not typically programmed for thermal disinfection (HPS 2018). Soiled linens should be washed at 65°C with a minimum 10 minute wash cycle or 71°C with a minimum 3 minute wash cycle (HSE, undated online guide).
 - 5.1.15 Linen segregating systems should implement colour coding in line with the local policy to ensure that clean, used, heat-labile and infectious materials are separately processed. Infectious linen from suspected or confirmed category 4 infections, e.g. viral haemorrhagic fevers, should not be returned to the laundry. They must be disposed of according to the local waste disposal policy (HPS 2018).
 - 5.1.16 Laundry should be contained in clean and dry containers during transfer to and from theatres.
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Headwear

- 5.1.17 All head and facial hair should be completely covered by a headcover/cap to minimise the risk of microorganisms being shed into the surgical wound. Headwear should be donned prior to donning the scrub suit to prevent hair or dandruff being shed onto scrub clothing. Head coverings should be removed when travelling between buildings, before leaving the facility, or if they become soiled (AORN 2019).
 - 5.1.18 Disposable headwear is preferable; however, cloth hats are permissible if laundered and inspected for holes/imperfections in an approved facility and not at home. Bouffant and hood style covers are preferred as they cover side hair, ears and hair at the nape of the neck.
 - 5.1.19 Headwear should be changed daily, unless it becomes soiled, when it should be changed immediately. Headwear should not be worn outside of the theatre environment.
 - 5.1.20 After use, headwear should be discarded into an appropriate container for disposal or laundering.
 - 5.1.21 Headwear should always be worn in laminar flow theatres during prosthetic implant operations (Woodhead 2002).
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Jewellery

- 5.1.22 Staff should remove jewellery prior to surgery. Hand jewellery e.g. rings, watches, bracelets etc. should be removed before washing hands, donning gloves and entering the operating theatre (WHO 2016, NICE 2019). Rings with sharp surfaces, e.g. stones, have the potential to perforate gloves and contaminate the sterile area (WHO 2009).

Fingernails

- 5.1.23 Fingernails should be clean, short and free from nail varnish. Long or sharp fingernails easily puncture gloves, increasing the risk of harming the patient through bacterial transfer. Fingernails should be no longer than 2mm (AORN 2016a). If there is dirt visible beneath the nail, the debris should be removed under running water using a nail cleaner and antimicrobial soap or alcohol-based hand rub (ABHR) (WHO 2016).
- 5.1.24 Artificial fingernails should not be worn, as they are associated with gram-negative bacterial infections (AORN 2016a, AfPP 2017, NICE 2019). The application of artificial material to protect the nail, nail sculpting and nail jewellery may also be associated with the same risks. There is also a possibility of local infection of the individual who has undergone the nail technology, which can then be transferred to the patient (WHO 2009).
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Footwear

- 5.1.25 The Personal Protective Equipment at Work Regulation 1992, Regulation 4, requires every employer to provide suitable PPE to each employee who may be exposed to any risk while at work (HSE 2015). Footwear in theatres should provide adequate protection, e.g. minimise the risk of exposure to blood or other infectious material, sharps injuries, and slips (HPS 2015b). A risk assessment should be carried out to determine whether the type of footwear is suitable for decontamination. Footwear should provide antistatic properties in accordance with BS EN ISO 20347 (BSI 2012). Footwear that is not supplied by the employer may not meet all the necessary standards. Additionally, if a person is injured while wearing footwear that wasn't supplied by their employer in relation to the correct PPE requirements, then any injury compensation claim may be dismissed on the grounds of failure to comply with the relevant health and safety requirements.
- 5.1.26 Footwear should be well-fitting, supportive and protective. They should have low heels and non-skid soles. Shoes should protect from spillages by enclosing the entire foot, i.e. the toes and the heel (HPS 2015a).
- 5.1.27 Footwear worn in theatres should be for that use only and should be cleaned regularly and when contaminated with blood/body fluid. Appropriate solutions should be used for cleaning. Contaminated footwear should be disinfected in a designated washer-disinfector, or autoclaved when visibly contaminated (HPS 2015a). All staff are responsible for ensuring that their footwear is decontaminated.
- 5.1.28 Footwear should be removed in an area outside the operating theatre and not left in a contaminated state or on changing room floors. Footwear should be clean and stored, ready for use (Clarke et al 2017).
- 5.1.29 The use of overshoes in the theatre currently has no consensus. Although overshoes may be associated with lower levels of bacterial contamination of the tops of shoes, whether or not they reduce SSIs remains unclear. However, if overshoes are used, they should be removed before leaving the theatre environment (HPS 2015a). Patient overshoes are associated with the risk of bacterial contamination of bedsheets if they are not removed (Galvin et al 2016).

Masks

The primary purpose of surgical masks is to prevent splashes and droplets contaminating the wearer's nose, mouth and respiratory tract. They do not protect against airborne particles and are not classified as respiratory protective equipment (Coia et al 2013). There is currently insufficient evidence to determine whether the use of a mask reduces the risk of SSIs (Lipp & Edwards 2012). However, masks do form part of the protective equipment for theatre staff against splashes of bodily fluids (NICE 2016). For example, in the case of the scrubbed surgical team, they may prevent large droplets from the mouth and nose entering the surgical site. Specialist masks, such as surgical n95 respirators, offer protection from inhalation of surgical smoke and laser plume as they reduce inhalation of a wide range of hazardous particles (Benson et al 2013). Filtration levels vary according to manufacturers' specification, and masks should be selected according to the necessary level of protection (HSE 2013). Seek advice from the local infection control team where patients with pulmonary tuberculosis or other infections transmitted by an airborne route require surgery.

- 5.1.30 The selection of facial protection should be based on an assessment of the risk of exposure to splashing of blood and body fluid during the procedure. Protective face shields should be worn whenever activities could place staff at risk of splashes or aerosol contamination. Protective face shields should be worn whenever activities could put staff at risk of splashes or aerosol contamination (NHS Improvements 2019). For example:
- Specific face masks and eye protection are required when dealing with specific risks, e.g. respiratory PPE for surgical smoke plume or lasers. Surgical masks and high filtration surgical laser masks do not provide sufficient protection from particulates to be considered respiratory PPE (Benson et al 2013).
 - For joint replacement, revision and complex surgery, a well-fitting disposable hood, visor mask and a disposable gown should be used.
- 5.1.31 Masks should be applied before hand antisepsis.
- 5.1.32 Masks should cover the nose and mouth, fitting the contour of the face and should be tied securely.
- 5.1.33 Masks are likely to accumulate microorganisms from the wearer during use and should be handled as little as possible. Avoid touching the mask after application, and discard by handling the ties.
- 5.1.34 Used masks should be immediately discarded into the designated waste container after each case or if the mask becomes contaminated
- 5.1.35 Masks should not be left around the neck or put into pockets for future use. Hands should be washed following mask removal.
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Patient attire

- 5.1.36 To reduce bacterial contamination from patient's clothes, patients entering the theatre environment should remove all of their clothing and change into clothing appropriate for surgery, e.g. theatre gowns and caps. For minor procedures, e.g. cataract surgery, patients may enter the theatre wearing their own clothes and footwear provided that it does not interfere with the procedure. Most patients feel more comfortable in their own clothing, particularly if allowed to keep on their underwear.

Visitors to the perioperative environment

- 5.1.37 People are the primary source of microorganisms that increase the risk of SSIs, and so the number of visitors to the theatre environment should be restricted. Visitors to the theatre environment include:
- relatives (in particular, parents)
 - students (from various health professions)
 - visiting health professionals (e.g. surgeons)
 - allied health professionals (e.g. lab technicians, maintenance workers)
 - medical device representatives
- 5.1.38 Theatre facilities must provide guidelines and policies for visitors entering the theatre environment, which should take into account infection control standards and practices and restrictions on traffic in the theatre environment.
- 5.1.39 There is no evidence that visitors entering only the anaesthetic room increases the risk of infection. Cover gowns are therefore not required (Woodhead et al 2002). If visitors enter the operating theatre itself, then theatre attire should be worn.
- 5.1.40 Patients in the perioperative environment have the right to confidentiality and privacy. This consideration should be reiterated to all persons entering the theatre suite.
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5.2 Standard principles for preventing healthcare associated infections

The standard

A set of standard infection control and prevention precautions are applied at every contact between patients and healthcare providers (HCPs).

The rationale

These precautions reduce the risk of transmission of infections between patients and staff by reducing exposure to blood, bodily fluids and microorganisms. In turn, this minimises the spread of infections within the healthcare facility.

Every HCP has a duty of care to protect themselves and others from the spread of infection by applying standard infection control practices. Epic3 provides an evidence-based review of these protocols: National Evidence-based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England (Loveday et al 2014). The recommendations fall into five categories:

- decontamination of equipment and the environment
- hand hygiene
- use of personal protective equipment (PPE)
- safe use and disposal of sharps
- principles of asepsis

The purpose of these standard precautions is to minimise the risk of transmission of infection between patients, and between patients and staff by reducing the exposure of healthcare staff to blood and body fluids. In the healthcare environment, the risk of exposure to blood and body fluid should be assessed for each activity to be completed rather than assessing the risk posed by the individual patients. The standard infection control precautions should be applied based on this assessment. This process should be applied in all clinical areas. Determining which precautions to apply should include the consideration that every patient has the right to be treated with dignity and respect. Precautions should be applied when necessary, as determined by a risk assessment. For example, eye and face protection should be worn if blood/body fluid contamination is anticipated (NHS England and NHS Improvement 2019).

Recommendations for local policy

Management considerations

- 5.2.1 In addition to protecting patients from infection, infection control procedures are an essential part of health and safety. The following legislation addresses infection prevention and control in healthcare settings:
- The Health and Social Care Act 2008: Code of Practice on the prevention and control of infections and related guidance
 - Health and Safety at Work Act 1974
 - Control of Substances Hazardous to Health Regulations (COSHH) 2002
 - Personal Protective Equipment Regulations 1992
 - Management of Health and Safety at Work Regulations 1999
- 5.2.2 All staff must take every reasonable precaution to minimise occupational exposure of themselves and others to potential pathogens. A risk assessment should be used to determine which precautions to apply.
- 5.2.3 Any concerns that staff may have regarding occupational exposure should be addressed by their manager, health and safety teams and the local occupational health department, following local policy.
- 5.2.4 Providers of healthcare in England are regulated by the Care Quality Commission (CQC), who monitor, inspect and regulate services to make sure they meet the fundamental standards of quality and safety. The inspection of surgical services assesses the systems in place for promoting patient safety by reducing the risk of healthcare-associated infections (HCAIs). Practitioners should be aware of the requirements of the Code of Practice on the prevention and control of infections (Department of Health [DH] 2015) and the CQC Inspection Framework NHS Acute Hospitals: Core Service Surgery (CQC 2017).

Standard precautions

The use of appropriate PPE such as gowns, gloves, eye protection, face shields and aprons are required to minimise both the risk of surgical site infections (SSIs) and to protect staff from occupational exposure to potential biohazards. All staff who are performing tasks where there is a risk of exposure to blood or body fluids should wear appropriate PPE, e.g. gloves and plastic aprons. When there is a risk of splashing or aerosol contamination with blood or body fluids, eye/face protection must also be worn (NHS England and NHS improvement 2019).

Skin

- 5.2.5 All staff must cover cuts and skin abrasions on their skin with waterproof dressings to protect against contamination with blood or body fluids.
- 5.2.6 Staff who have exudative lesions, eczema or weeping dermatitis should be reviewed by the infection control lead to assess whether they can administer direct patient care, participate in surgical procedures or handle medical devices used in invasive procedures.

Hand hygiene

Transmission of bacteria via the hands is a significant factor in the acquisition and spread of HCAs (Loveday et al 2014). Microorganisms can be transferred between people either directly through skin-to-skin contact, or indirectly, through a contaminated environmental source. The hands are permanently colonised by a resident flora of microorganisms that are mainly of low pathogenicity but may cause infection if they are introduced into susceptible tissues such as the surgical wound (Loveday et al 2014). Transient bacterial contamination of the hands is caused by touching contaminated surfaces (people or the environment). The bacteria are then transferred to the next person or object touched.

Hand hygiene is an essential step in reducing the risk of HCAs (NHS England and NHS Improvement 2019). The recommended procedure for hand antisepsis is to clean the hands with antimicrobial soap and water or a suitable alcoholic-based hand rub before donning surgical gloves (World Health Organisation [WHO] 2016). This process reduces the number of bacteria on the hands and is an evidence-based practice for reducing HCAs (WHO 2016, Loveday et al 2014, Association of periOperative Registered Nurses [AORN] 2019).

- 5.2.7 Hands must be decontaminated immediately both before every episode of direct patient contact and after any activity or contact that potentially results in the hands becoming contaminated. Several situations necessitate hand decontamination, as outlined by the following examples (Loveday et al 2014):
- immediately before and after each episode of direct patient contact including clean/aseptic procedures
 - immediately after contact with body fluids, mucous membranes and non-intact skin
 - immediately after any activities or contact with objects and equipment in the immediate patient environment
 - immediately after the removal of gloves

Frameworks can be used to aid the training of staff and monitoring of hand hygiene practice, e.g. Five Moments for Hand Hygiene (WHO 2009).

- 5.2.8 All healthcare establishments must have a hand hygiene policy that clearly outlines what is expected of staff in terms of hand decontamination practices and compliance, as well as detailing the levels of hand hygiene applied within the healthcare environment.
- 5.2.9 Alcohol-based hand rub can be used to decontaminate hands unless they are visibly soiled or potentially contaminated with blood or body fluids, in which case use soap and water (WHO 2016, Loveday et al 2014).
- 5.2.10 To facilitate effective hand hygiene, staff should keep fingernails short and free from false nails and polish and remove wrist and hand jewellery (National Institute for Health and Care Excellence [NICE] 2019, AORN 2019). Hand washing should encompass all areas of the hands and arms, up to the elbows. The hands should be wet under running water before applying soap to prevent skin irritation. The handwash solution must be vigorously rubbed over all surfaces of the hand (Loveday et al 2014, Association for Perioperative Practice [AfPP] 2017). After washing, hands must be thoroughly dried with good quality paper towels to minimise skin damage.

Protective personal equipment

PPE protects staff and reduces opportunities for microorganisms transfer between patients. The selection of PPE for a procedure must be based on an assessment of the anticipated level of risk of contamination of the staff's skin or clothing by the patient's blood or body fluid and take into account current health and safety legislation (Loveday et al 2014).

Gloves

- 5.2.11 Gloves must comply with BS EN 455-2:2000, the European standard on medical gloves for single use (British Standards Institution [BSI] 2000). They must meet quality standards, be free from pinholes and must not tear or split easily. Latex-free gloves should be available for patients and staff who have an allergy to latex.
- 5.2.12 Gloves must be worn as single-use items. They must be put on immediately before beginning any procedure involving contact with blood/body fluid and removed as soon as it is completed. They must also be changed between patients or if visibly contaminated. Gloves should never be decontaminated and re-used (WHO 2016).
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Eyes and mouth

- 5.2.13 The risk of splash or aerosol contamination must be assessed on an individual basis. If blood/fluid or aerosol contamination is anticipated, either a disposable fluid-repellent mask and goggles or full-face visor must be worn to prevent exposure from blood and body fluids to the skin and mucous membranes.
- 5.2.14 Masks must be removed carefully and discarded immediately after each procedure and changed if visibly contaminated.
- 5.2.15 Eating, drinking and applying cosmetics, contact lenses or lip balm should be prohibited in clinical areas to avoid contamination of mucous membranes by blood/body fluids.
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Gowns and aprons

- 5.2.16 Disposable plastic or fluid repellent aprons or gowns must be worn by staff if contamination of clothing with blood and body fluids is anticipated. They must be removed before leaving the operating room.
- 5.2.17 Scrub staff must wear fluid-repellent gowns. The gowns should comply with the European standard on surgical clothing and drapes, BS EN 13795-1:2019, for resistance to penetration by blood and other body fluids, whether single-use or reusable (BSI 2019). They must be durable and able to maintain their integrity during use. Gowns must be removed after every procedure or patient contact (Health Protection Scotland [HPS] 2015a).
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Sharps

- 5.2.18 Employers must ensure that sharps are only used when necessary. Where sharps usage is unavoidable, sharps with built-in safety mechanisms should be used wherever possible (Health and Safety Executive [HSE] 2013c, Royal College of Nursing [RCN] 2013). All staff must adhere to local policy on the handling and disposal of sharps.
- 5.2.19 The use of sharps bins should be in line with policy and guidance included in the Health Technical Memorandum 07-01 (DH 2013).

Bins should be:

- assembled according to the manufacturer's instructions
- free from protruding sharps
- stored off the floor
- labelled correctly with the date, time, and signature of the staff that assembled the bin
- only filled to the recommended levels and then replaced
- closed using the temporary closure mechanism when the bin is not in use

- 5.2.20 Sealed and locked bins should be stored in a locked holding area, cupboard or container away from public access.
- 5.2.21 Safe sharp devices should be used wherever possible (HSE 2013c). Sharps should always be taken to the patient before they are prepared, to reduce the risk of needle stick injuries. A blunt fill needle should be used to draw solutions up from glass vials. A blunt filter needle should be used to draw up solutions from glass ampoules.
- 5.2.22 Needles and syringes must not be re-sheathed or disassembled. Discard them as one unit at the point of use.
- 5.2.23 An appropriate device must be used for the careful application and removal of surgical blades to and from their handle.
- 5.2.24 Sharps and needles should not be passed hand to hand by the surgical team, and handling should be kept to a minimum. Sharps should be placed in a neutral zone for retrieval.
- 5.2.25 During procedures, needles and sharps should be placed in a disposable device that is within the sterile area but away from the operating field. This device should be disposed of safely at the end of the procedure.
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Spillage of blood and body fluids

- 5.2.26 A policy should be in place for dealing with spillages in the workplace, and it should be easily accessible to all staff. The policy should:
- Provide safe systems to deal with a range of spillages that may occur within the workplace.
 - Identify the type of protective clothing that is required and where it can be found.
 - Provide precise requirements for decontamination of spillages.
 - Identify the systems in place for reporting and investigating spillage incidents and provide guidance on how to use them.
- 5.2.27 Spillage kits should be provided at suitable locations in the department, such as the secure waste storage area. Staff should be trained before using spillage kits. The provision and use of spillage kits promote policy adherence and compliance with regulations, e.g. COSHH (HSE 2013a).
- 5.2.28 Suitable containers or receptacles for the safe disposal of all items and materials used in dealing with a spillage should also be available, to ensure the safe and secure waste disposal of all items following the Health Technical Memorandum (HTM) 07-01 (DH 2013).
- 5.2.29 If there is a risk of excessive blood/body fluid loss, (e.g. transurethral resection of the prostate), collecting drapes or a waste management system should be used to reduce the risk of spillage.
- 5.2.30 Floor suction devices should be considered to reduce the risk of spillage.
- 5.2.31 All spillages must be dealt with as soon as possible. All spillages should be cleaned before disinfecting the area.
- 5.2.32 All agents used to manage the spillage should be used per the manufacturer's instructions.
- 5.2.33 If a healthcare organisation has any equipment containing mercury, then there should be a specific spillage policy and spillage kit available for use in these areas. A risk assessment concerning the need for mercury should be undertaken, and a written policy on the procedure for mercury spillages should be available.

Accidental exposure/sharps injury/conjunctiva/mucous membrane splash

There is a small but significant risk of developing potentially life-threatening diseases due to the acquisition of bloodborne viruses following a sharps injury. For example, there have been at least twenty cases of Hepatitis C amongst healthcare workers in the UK since 1997 (Public Health England [PHE] 2014). All transmissions documented between 2004-2013 involved penetration of the skin by contaminated sharps. Mucocutaneous exposure, i.e. contamination of the inside of the mouth, eyes, or a broken area of skin, also presents a risk of infection of bloodborne viruses, although this risk is lower than in percutaneous exposure (RCN 2013). (See section 5.9 for prevention of bloodborne virus infection.) Healthcare organisations should refer to PHE for Integrated guidance on health clearance of healthcare workers and the management of healthcare workers living with bloodborne viruses (hepatitis B, hepatitis C and HIV) (PHE 2019).

- 5.2.34 All personal injuries or ill health occurring at work must be reported to the departmental manager. Local procedures should follow Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) (HSE 2013b). The theatre manager should liaise with and take advice from the occupational health officer and infection control coordinator.
- 5.2.35 Under the Health and Safety at Work Act 1974, all individuals should take responsibility for ensuring their health and safety and should report concerns and seek advice on hazardous practices from the health and safety lead for the department.
- 5.2.36 In the event of an injury with a contaminated sharp instrument, the following actions should be implemented immediately (RCN 2013, HPS 2015b):
- encourage bleeding of the wound by applying gentle pressure - do not suck the wound
 - wash the area thoroughly with running water
 - dry and apply a waterproof dressing as necessary
 - if body fluids splash into the mouth, do not swallow. Rinse out several times with cold water
 - if body fluid splashes into the eyes, rinse/irrigate with water or washout kits
 - for contact lenses, irrigation should occur before and after removal
 - report the incident to the line manager and complete an incident form, as per trust policy
- 5.2.37 Staff should seek immediate advice and support in the event of potential exposure, and a specialist must assess the risk of infection. Post-exposure prophylaxis (PEP) treatment protocols should be started immediately after the injury if advised (RCN 2013).
- 5.2.38 Employers need to communicate the importance of follow-up and treatment, which includes attending all appointments for blood tests. Staff must be released from work to attend the follow-up appointments. Counselling should be available for all staff at risk of sharps injuries. For detailed guidance, refer to HIV Post-exposure Prophylaxis: guidance from the UK Chief Medical Officers' Expert Advisory Group on AIDS (DH 2008).
- 5.2.39 Every healthcare organisation must have an inoculation/splash injury policy that includes defined arrangements for advice and support for staff working out-of-hours.

Waste disposal

The proper management of waste must not be overlooked in healthcare practices. It is a vital aspect of infection control and is governed by both European and UK legislation. HTM 07-01 provides comprehensive guidance on waste disposal (DH 2013).

The Controlled Waste Regulations define clinical waste as waste from a healthcare activity that contains or is contaminated by (Environmental Protection 2012):

- viable microorganisms, or their toxins, that are known or reliably believed to cause disease in humans or other living organisms
- medicine that contains a biologically active pharmaceutical agent
- sharps, body fluids, or other biological material (including human and animal tissue) that are contaminated with a dangerous substance within the meaning of Council Directive 67/548/EEC

Healthcare waste should be assessed to determine if it is clinical waste. It should be classified as hazardous or non-hazardous according to its medicinal, chemical or infectious properties. This assessment determines the level of controls required for its safe disposal. Some waste generated in clinical settings is classified as offensive/hygiene waste, i.e. waste that is non-infectious but may cause offence due to the presence of recognisable healthcare waste items, body fluids, or odour. Such waste can be disposed of by landfill or municipal incineration.

All aspects of health and safety legislation for the workplace are within the remit of the Health and Safety Executive for England, Scotland and Wales. The Health and Safety Executive for Northern Ireland oversees these requirements in Northern Ireland. Anyone involved in policy regarding disposal of perioperative waste should refer to COSHH regulations (HSE 2013a). In Scotland, the Special Waste Amendment (Scotland) Regulations implement the requirements of the European Hazardous Waste Directive.

5.2.40 A healthcare waste disposal policy should be in place and accessible to all staff. The policy must comply with three separate areas of regulation, as follows:

- health and safety
- environment and waste
- transport

5.2.41 Everyone involved in the management of waste has a duty of care to implement infection control protocols, from the point at which the waste is generated until the final disposal. The process requires a reasonable standard of care to minimise the risks of spillage and damage to waste receptacles that may lead to waste escaping, e.g. overfilling of bags leading to the bag splitting or bursting when placed in a storage or transport container.

5.2.42 Effective waste management includes segregating waste, storing it safely, and ensuring it is collected frequently. Healthcare waste should be stored securely to prevent the escape of waste and potential harm to the environment and the public. Failure to do so is a breach of the statutory duty of care (DH 2013).

- 5.2.43 Waste should be contained in appropriate coloured sacks:
- Black sacks may be used for non-clinical waste such as paper wrappings and packaging.
 - Yellow sacks/leak-proof rigid yellow containers with red lids should be used for anatomical waste from operating theatres that requires disposal by incineration.
 - Orange sacks should be used for clinical waste that may be treated to 'render it safe'. Treatment or incineration should be carried out by an authorised and licensed centre.
 - Orange sacks may also be used to segregate infective and potentially infective waste.
 - Tiger sacks (yellow/black striped) may be used for offensive/ hygiene/ sanitary waste. It should be disposed of in a landfill or incinerated within a suitably permitted facility.
- 5.2.44 Sacks should be filled to a maximum of three-quarters and tied at the neck to ensure a sufficient seal, e.g. a swan neck seal.
- 5.2.45 Waste sacks should be contained in appropriate coloured bins:
- Sharps should be disposed of in a designated sharps disposal container. Containers should be filled to a maximum of three-quarters, at which point they should be sealed. Waste for segregation must be labelled at the point of origin, e.g. the clinical area.
 - Sharps that are contaminated or contain incompletely discharged medical products, with the exception of cytotoxic drugs, should be disposed of in yellow sharps containers with a yellow lid. These bins are designated for incineration (DH 2013).
 - Sharps that are not contaminated by medicinal products should be disposed of in a yellow sharps bin with an orange lid. These bins can be sent for incineration or alternative treatment (DH 2013).
 - Sharps waste contaminated with cytotoxic and cytostatic drugs should be discarded in a yellow sharps bin with a purple lid. These bins are designated for incineration (DH 2013).
 - Anatomical waste should be disposed of in UN-approved rigid yellow containers with red lids and should be clearly labelled (DH 2013). Human tissue waste disposal should be in accordance with the Human Tissue Act 2004, Part 3, Section 44. It is classified as clinical waste.
- 5.2.46 Radioactive waste must be disposed of in line with HTM 07-01. Waste must be handled by a licensed facility, with all waste appropriately segregated and labelled. Containers must be rigid, contain absorbent materials, contain no hollow surfaces on the outside and be large enough for all labels and markings (DH 2013). All staff must receive training before disposing of radioactive waste.
- 5.2.47 Disposal of fluid waste must follow the local policy, which must be in agreement with the relevant authority. Care should be taken to avoid splashing. When suction units are utilised, they should be fitted with closed disposable containers to minimise risk to staff.
- 5.2.48 Foetal tissue should be disposed of in accordance with the guidance published by the Human Tissue Authority (HTA 2015). In Scotland, foetal tissue should be disposed of as specified by guidance from the Scottish government (2015).
- 5.2.49 Linen must be segregated following guidance from the Department of Health (2016) to prevent contamination of laundry staff. Laundry bags should be colour-coded per the local policy.

- 5.2.50 If a medical device contains another hazardous substance such as nickel, cadmium or mercury-containing batteries, then it must be identified and disposed of as determined in HTM 07-01 (DH 2013). The receptacle used for disposal should clearly identify the hazard contained within it.
- 5.2.51 If a medical device has been adequately decontaminated or is unused, then it may be disposed of as clinical waste. See 5.2.54 for any medical devices containing hazardous substances.
- 5.2.52 The use of disinfectants must be in line with COSHH regulations (HSE 2013a). Staff must undergo competency assessment and suitable training before using disinfectants.
- 5.2.53 Suitable PPE should be available for staff involved in waste disposal appropriate. Staff must decontaminate their hands immediately after disposing of any waste.
- 5.2.54 Staff must receive suitable training and a competency assessment before coming into contact with waste.
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5.3 The environment

The standard

Systems are in place to minimise exposure of the surgical incision to microbial contamination from the operative environment.

The rationale

Reducing airborne bacteria and subsequent environmental contamination can reduce the introduction of bacteria into the surgical incision during surgery.

People contribute to the spread of bacteria by shedding skin particles, commonly referred to as squames, into the operative environment. Airborne microorganisms carried on the squames may then enter the surgical site by falling directly into the wound or by first settling on exposed instruments and equipment before being transferred into the wound, resulting in surgical site infections (SSIs) (Noguchi et al 2017). Greater movement of people through the operating room increases the dispersion of airborne bacteria and makes ventilation of contaminated air less effective (Agodi et al 2015, Suleyman et al 2018, Jain and Reed 2019). Protocols to reduce the introduction of bacteria into the surgical incision should include minimising movement of staff, use of ventilation systems and proper cleaning of the operative environment.

Recommendations for local policy

Movement of staff

Airborne contamination of surgical incisions is a significant cause of infection. Surgical staff are the greatest cause of microbial air contaminations in the operating theatre because they continuously shed skin and fabric lint (Wilson 2015). Microbial air contaminants increase with the number of staff in the operating room, regardless of whether laminar airflow is in place (Agodi et al 2015). The purpose of controlling theatre traffic, i.e. movement within and to-and-from the theatre, is to minimise the dispersion of bacteria and reduce the risk of contaminating the surgical site. Policies should be implemented to ensure that the movement of staff in and out of the theatre area is minimised (National Institute for Health and Care Excellence [NICE] 2019).

Each perioperative environment should have established controls intended to minimise the numbers of theatre staff and the throughput of traffic. The design of the department often predetermines these patterns and each area should be clearly indicated:

- unrestricted areas, where traffic is not limited
- semi-restricted areas, where traffic is limited to authorised, correctly attired staff and patients.
- restricted areas, where traffic is very limited, and staff must be correctly attired, e.g. the operating theatre

Staff should be aware that the healthcare environment and equipment are vehicles for the transmission of infection (Suleyman et al 2018). This risk is increased in the operating environment, where invasive procedures expose vulnerable tissues (Wiseman 2004).

Ventilation systems

In ventilated theatres, the risk of airborne microbial contamination is reduced by:

- filtration of supplied air
- dilution of contaminated air in the theatre
- preventing the entry of contaminated air from areas outside the theatre

Dilution is achieved by ensuring a high rate of air change. Ventilation machines increase airflow by creating differences in pressure so that air flows from clean areas to designated 'dirty' areas, e.g. the disposal room and corridors. For air to flow out of the clean areas and into the surrounding 'dirty' rooms, the instrument lay-up room should have the highest air pressure, followed by the operating room, followed by corridors or other non-restricted areas (Wilson 2015).

Air changes for a conventional theatre should be set at a minimum of 15 changes per hour and may increase to more than 25 hours per air for specific rooms. Healthcare organisations should refer to the Health Technical Memorandum (HTM) 03-01 for guidance on the recommended air changes for different areas within an operating suite (Department of Health [DH] 2007).

Healthcare organisations must adhere to operating theatre design specifications and regulations, which describe the standards required to maintain effective ventilation and air quality, e.g. HTM 03-01: Specialised ventilation for healthcare premises (Department of Health [DH] 2007, Part A). Protocols must exist to ensure that filters are efficient and effective and that they are changed regularly. In the past, humidification was required to control the risks associated with the use of flammable gases, microbial contamination and electrostatic charges, which posed a fire hazard. Technology and advancements in flooring materials and anaesthetic gases mean that humidification is no longer necessary unless there is a particular requirement for it (DH 2007, Part A).

The temperature should be maintained between 18 and 25°C. It can be varied within this range to meet the needs of the patient and the procedure. For the prevention and management of hypothermia in adults having surgery, healthcare organisations should refer to NICE 2008.

Cleaning of the theatre environment

The hospital environment must be visibly clean, free from dust and soil, and acceptable to patients, visitors and staff (Loveday et al 2014). The national standards of specifications for cleanliness issued by the National Patient Safety Agency (NPSA) enables healthcare organisations to have in place a robust programme. This programme facilitates the routine and accurate monitoring of technical standards of cleanliness (NPSA 2007). The performance of different healthcare organisations may also then be compared.

Colour coding of hospital cleaning materials and equipment should adhere to the national colour coding system, detailed in the NPSA colour coding poster (NPSA, undated). Colour coding for Ireland is available from the Ireland Health and Safety Executive (HSE) (2012). Colour coding for Scotland is available from National Services Scotland (2008). Current recommendations on cleaning standards are detailed in the British Standards Institution (BSI) revised cleaning specification PAS 5748:2014, which is free for all NHS staff and institutions to download (BSI 2014).

Within the healthcare environment, cleaning procedures are determined by the extent of the risk posed by the area. Department/wards fall into one of four risk categories: very high risk, high risk, significant risk and low risk. The criteria used to determine the categories are based on the following:

- risk of infection
- occupational health and safety risk for staff
- health and safety risk for public
- clinical governance agenda
- litigation
- risk of poor public image
- lack of confidence
- risk of the service providing poor value for money

The operating department is categorised as 'very high risk.' This means that consistently high cleaning standards must be maintained throughout the day. Areas adjoining very high-risk areas, i.e. staff lounges, offices and bathrooms must also receive intensive levels of cleaning.

Theatre traffic

- 5.3.1 The number of staff in the theatre at any given time should be no more than the minimum staff required to conduct the procedure safely.
- 5.3.2 Movement both within and in-and-out of the operating theatre should be restricted during instrument preparation and operative procedures.
- 5.3.3 An effective air changing ventilation system should be in operation in line with best practice guidance and the local infection control policy.
- 5.3.4 The doors to the operating theatre should remain closed to ensure effective ventilation. As far as possible, all potential equipment and supplies for a procedure should be available in the theatre before the procedure commences. This reduces theatre traffic; maximising the efficiency of the ventilation system and minimising dispersal of airborne bacteria.

Environmental cleaning

- 5.3.5 A policy for cleaning the theatre environment should be developed in collaboration with the local infection control team and housekeeping services. The policy should ensure that audits are undertaken at regular intervals to ensure compliance with NPSA guidelines (NPSA 2007). Staff should wear personal protective equipment (PPE) during cleaning and select the level of protection based on an assessment of the risk of exposure to blood and body fluids. Eye protection, face mask or visor should be worn where there is a risk of splashing. Specific spillages of blood or body fluids should be dealt with by following local policy (see 5.2.26-5.2.33).
- 5.3.6 Any equipment introduced to the operative field must be cleaned immediately before the procedure to ensure that it is dust-free. Equipment must be cleaned again immediately after the procedure to remove any blood or body fluid. Large equipment should be covered and stored in an appropriate area to reduce the risk of dust contamination.

Between procedure cleaning procedures

- 5.3.7 Disposal of clinical waste, laundry and used instruments should be in line with national and local policies. The following resources provide guidance on best-practice: HTM 07-01 Safe management of healthcare waste and HTM 01-01: Management and decontamination of surgical instruments (medical devices) used in acute care, Part A (DH 2016b). For decontamination of linen, refer to Health Technical Memorandum 01-04: Decontamination of linen for health and social care DH 2016a).
 - 5.3.8 The operating table and related accessories should be decontaminated between all procedures. Thorough cleaning with detergent is usually adequate. Exceptional circumstances include extensive contamination with blood, or for a specific patient infection for which local infection control policy recommends disinfecting contact surfaces, e.g. multi-resistant pathogens. Further advice should be sought from the local infection control team.
 - 5.3.9 Mattresses that are torn or damaged must be replaced. The damaged mattress should be decommissioned, removed from circulation and disposed of in line with local policy.
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Daily terminal cleaning procedures

- 5.3.10 All equipment should be cleaned and all portable equipment removed from the theatre following cleaning.
 - 5.3.11 Windowsills, overhead lights, cabinets, waste receptacles, equipment, and furniture should be cleaned with a detergent solution and disposable cloth.
 - 5.3.12 Scrub sinks in scrub areas should be cleaned with water and detergent applied with a disposable cloth.
 - 5.3.13 Shelves should be emptied, wiped with detergent and water and dried before replacing supplies.
 - 5.3.14 Storage containers should be wiped with detergent and water and dried before being replaced on the shelves.
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Management considerations

- 5.3.15 Surfaces should be kept free from visible dirt, and special attention should be given to areas that are likely to become heavily contaminated, e.g. horizontal surfaces.
- 5.3.16 Walls with intact surfaces acquire very few bacteria, even if left unwashed for long periods. Washing twice a year to remove visible dirt is adequate (Woodhead et al 2002). Walls should be cleaned whenever there is a possibility of contamination. Spot cleaning should be carried out for any visible dirt (NPSA 2007).
- 5.3.17 Any areas of peeling paint on the walls must be repainted or covered with a new wall finish.
- 5.3.18 For other surfaces, standard housekeeping methods are adequate, e.g. daily damp cleaning of ledges and shelves).
- 5.3.19 Floors of the operating room should be cleaned at the end of each session and be scrubbed daily.
- 5.3.20 Floors should be free of litter, dust, marks, water or spillages.
- 5.3.21 Floors should be free from floor polish build-up.
- 5.3.22 Specific spillages of blood or body fluids should be treated with an appropriate disinfectant and removed immediately (see 5.2.26-33).
- 5.3.23 Suction machines should be cleaned thoroughly at the end of the list or if visibly contaminated. Disposable suction liners should be discarded after each procedure, in line with standard clinical practice.

- 5.3.24 The team leader should visually inspect the environment for cleanliness before starting the operating list. Immediate action should be taken to correct any aspects of cleanliness that do not meet the standards specified in the local policy.
- 5.3.25 For procedures considered carry higher risk of contamination, e.g. involving infected wounds, patients colonised with antibiotic-resistant bacteria or *Clostridium difficile*, the operating theatre should be cleaned (as 5.3.8) after the procedure. There is no specific requirement to place such procedures at the end of the operating list, provided there is sufficient time allowed to clean the contact surfaces after the procedure. Similarly, the theatre does not need to be left empty for a prolonged period after the operation as any airborne particles will settle or be eliminated by the air handling system during the cleaning procedures (Woodhead et al 2002, Woodhead & Fudge 2012).
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Cleaning equipment and materials

- 5.3.26 A disposable single-use lint-free cloth is recommended for all operating theatre cleaning.
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Floor scrubbing machines

- 5.3.27 Cleaning machines should be decontaminated and stored according to local policy.
- 5.3.28 Floor-scrubbing machines should have detergent reservoirs that can be cleaned. The brushes and pads of scrubbing machines should be detachable. They should be removed and thoroughly washed and dried after each use. Disposable accessories are preferable.
- 5.3.29 Brushes and pads used in operating theatres should be autoclaved at least weekly. Each theatre should have individual brushes and pads. There should be a local policy in place for the colour coding of brushes and pads, which should be adhered to.
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Mops

- 5.3.30 Mop heads should be single-use and disposable.
- 5.3.31 A new mop head should be used for every patient.
- 5.3.32 Mop heads should be disposed of according to the type of contamination present.
- 5.3.33 Mop buckets for spillage should be emptied, washed and dried and stored inverted after each use and kept dry until the next occasion that they are required.
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Detergents and disinfectants

- 5.3.34 Detergents and disinfectants should be used in line with the manufacturer's instructions and local infection control policies.
- 5.3.35 Disinfectants must be used at the correct concentration and only mixed immediately before use. Staff handling disinfectants or using them must be adequately trained beforehand and initially supervised to assess their competency. Staff must wear appropriate PPE when using disinfectants.
- 5.3.36 Disinfectants must be stored and labelled correctly according to Control of Substances Hazardous to Health Regulations (COSHH) regulations (HSE 2013a).
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5.4 Surgical hand antisepsis, gowning and gloving

The standard

Standard procedures are in place for surgical hand antisepsis, gowning and gloving.

The rationale

All perioperative follow the same set of clear protocol for antisepsis, which supports optimal antiseptic technique.

Surgical hand antisepsis is the first line of defence in surgical site infection (SSI) reduction, as it reduces the number of microorganisms on the skin (Association of periOperative Registered Nurses [AORN] 2019). Surgical hand antisepsis is an extension of handwashing that refers to a specific set of practices that have the aim of not only removing transient bacteria but also inhibiting the growth of microorganisms on the hands (Tanner et al 2016, Association for Perioperative Practice [AfPP] 2017). Perioperative staff must apply the fundamental principles of aseptic technique when performing surgical hand antisepsis, gowning and gloving to protect their patients from SSIs. Surgical hand antisepsis should be undertaken immediately before donning sterile gowns and gloves. This routine must be carried out each time before participating in surgical and invasive procedures to reduce the risk of cross-infection, e.g. in the event of glove perforation. Implementing a standardised asepsis procedure for all staff promotes a higher level of competence and compliance.

Recommendations for local policy

General guidelines

- 5.4.1 Healthcare organisations should establish guidelines and protocols with their local infection control teams.
- 5.4.2 All staff that work in the operating department must receive education and training on the principles of asepsis. New and returning staff should receive training.
- 5.4.3 Aseptic practice should be regularly audited to ensure that all staff are complying with the standard procedures.

Facilities

- 5.4.4 The scrub area should be separate from the operating theatre. There should be two entrances – one from the access corridor, with a door barrier, and the other from the theatre itself, with independent access. If an operating theatre has a recessed scrub area, this must be located away from the laid-up instrument trolley to prevent contamination of the instruments. The scrubbing area should be large enough to allow free movement of people, with enough space for a minimum of three people to scrub up, gown and circulate concurrently without risk of contamination from each other or from the surrounding fittings.
- 5.4.5 The height of the sink and furniture should facilitate hand and arm washing and prevent splashing of clothes. The design and drainage should ensure that the floor does not become wet during washing procedures. Foot pedals or elbow adjustments should be provided to operate taps and dispense antiseptic solutions. Hot and cold water should be provided at a steady flow rate. The maintenance of these facilities should be included in a planned preventative maintenance programme.

- 5.4.6 Sensor taps must allow a sufficient run-on time for completion of the full hand antisepsis protocol.
 - 5.4.7 Wet floors are a hazard, as they pose a risk of injury from slipping. Floor surfaces must be anti-slip. Purpose-designed absorbent materials should be used for soaking water spillages. Incontinence pads or similar items should never be used for this purpose; in addition to being unsuitable for removing spillages, they constitute a major slip hazard.
 - 5.4.8 A trolley should be provided for opening gown packs. The height of the shelf should facilitate gowning and gloving and be wide enough for gown packs to be fully opened.
 - 5.4.9 Storage facilities for all necessary sterile equipment should be available and located away from the sterile field. Where sterile equipment is stored in the scrub area, it should be in a closed storage area away from the sink area to prevent water contamination.
 - 5.4.10 The trolley used to open gowns should not be directly below any storage, so as to prevent against contamination from falling objects.
 - 5.4.11 Foot-operated disposal bins or open bins for wastepaper should be provided in the scrub room.
 - 5.4.12 The scrub area should be kept adequately stocked with the necessary equipment. The supply of sterile gowns to the scrub area should be planned to ensure adequate stock rotation.
 - 5.4.13 A choice of antimicrobial solutions should be provided in case of staff with allergies.
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Surgical skin antisepsis (procedural scrub)

Surgical skin antisepsis aims to remove debris and transient microorganisms from the hands, nails and forearms of perioperative staff; reducing resident microorganisms to a minimum and inhibiting regrowth during the surgical procedure (AfPP 2017, Spruce 2016).

- 5.4.14 All staff should be in the appropriate theatre attire before commencing surgical hand antisepsis. The correct theatre attire is a short-sleeved top tucked into the trousers, surgical mask in place, all hair covered by a surgical hat, and clean hands and nails.
- 5.4.15 Fingernails must be short and free from polish or artificial nails (including acrylic and gel). Fingernails should be no longer than 2mm, as the risk of harbouring bacteria, puncturing gloves and injuring patients increases with longer nails (AORN 2016). Although there is no clear evidence that fresh coats of nail polish increase microbial growth on the hands or an increased infection rate, it may reduce the efficiency of handwashing and chipped nail varnish may harbour bacteria or be deposited into the surgical wound (AORN 2016). Artificial nails may remain contaminated even after hand antisepsis (World Health Organisation [WHO] 2009). The risks associated with nail decoration are not reduced by using UV-treated nail polish and may increase the growth of pathogens by damaging the nail (section 5.1.23-5.1.24).
- 5.4.16 The hands and forearms should be free from lesions or breaks in skin integrity. A waterproof occlusive dressing must cover minor lesions.
- 5.4.17 An individual with a major wound or infected wound must not be on the surgical team. Staff working in theatres with exfoliative skin conditions such as psoriasis should seek advice from occupational health (NHS England and NHS Improvement 2019).

- 5.4.18 Healthcare workers are at an increased risk of dermatitis from irritation of the skin due to prolonged glove use, use of soap products, and repeated hand washing. Under UK law, the risk of work-related dermatitis must be assessed, and regular checks of staff should be carried out. Advice on dermatitis should be included in any hand hygiene training programmes. The signs and symptoms of contact dermatitis include dry, red and itchy skin, painful blistering and splitting of the skin. Dermatitis in surgical environments must be effectively managed, as any breaks in the skin place patients and healthcare providers at an increased risk of infection (Royal College of Nursing [RCN] 2013).
- 5.4.19 Dispensers should be checked to ensure that they deliver the correct amount of the product according to the manufacturers' recommendations. Do not add soap or alcohol-based formulations to partially empty soap dispensers, to avoid contamination of the product. Dispensers should not be reused.
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Surgical scrub

Implementing a single systematic method of scrubbing increases the compliance and competence of staff in carrying out effective decontamination of all areas of the hands, nails and forearms. When the hands are visibly soiled, or if it is the first wash of the day, hand antisepsis should be carried out by washing with a suitable aqueous antimicrobial surgical solution. Otherwise, an alcohol-based hand rub (ABHR) may be used (NICE 2019, WHO 2016). It should be noted that alcohol hand rubs are not cleaning agents and do not remove dirt (RCN 2013). In either case, hand antisepsis must be performed before donning sterile gloves for clinical invasive procedures.

- 5.4.20 Water should be at a comfortable temperature, with a steady flow rate. The recommended temperature is between 21.1 and 26.7°C (AORN 2016).
- 5.4.21 Where necessary, nails can be cleaned under running water using a disposable nail pick. The use of a scrubbing brush is not recommended as they may cause skin damage, which increases microbial colonisation of the skin.
- 5.4.22 Hands and arms must be wet before applying the antimicrobial handwash solution.
- 5.4.23 The wash should encompass the hands and arms to the elbows (never above the elbow), using a systematic method to cover all areas (AfPP 2017).
- 5.4.24 Each step of surgical scrubbing consists of five strokes rubbing backwards and forwards and adapts Ayliffe's six-step technique into nine steps, as illustrated below. The steps are based on the AfPP Guide to Surgical Hand Antisepsis (2017).

During each of the following steps, keep the hands (clean area) above the elbows (dirty area) while allowing water to drain away. Avoid splashing any water on surgical attire.

Step 1

Wet the hands and forearms. Apply the specified amount of an appropriate solution from the dispenser in one downward stroke action. Follow the manufacturer's instructions for the volume of solution. Work into the hands, palm to palm, encompassing all areas up to the elbow.



Step 2

Rub the right palm over back of the left palm and vice versa, with the fingers interlaced.



Step 3

Rub palm to palm, fingers interlaced.



Step 4

Rotate the hands while rubbing backwards and forwards and clasping the fingers of the right hand into the left palm, and vice versa.



Step 5

Clasp the right thumb in the left hand, rubbing and rotating, and vice versa.



Step 6

Rub fingertips on palms for both hands.



Step 7

Continue with the rotating action down opposing arms, working to just below the elbows – do not move back towards the wrist. If using ABHR, an additional dose may be required here, one for each arm.



Step 8

Rinse and repeat steps 1-7, keeping hands raised above the elbows at all times to prevent water running from the elbows towards the hands. This wash should now only cover two thirds of the forearms to avoid compromising cleanliness of hands. Local policy may include repeating these steps a third time but to the wrists only.

Step 9: Ending scrub

If using a solution, rinse hands under running water - clean to dirty area. Turn on the tap using the elbows if necessary. Open the gown pack onto a clean surface and take a hand towel. Hands are dried first, by placing the opposite hand behind the towel and blotting the skin. Use a corkscrew movement to dry from hand to elbow - do not move back down towards wrist. Discard the towel. Using a second towel, repeat the process on other hand and forearm before discarding. If using ABHR, allow hands and forearms to dry completely before donning sterile gloves.

- 5.4.25 If local policy allows for the application of alcohol hand rub for subsequent antisepsis then, the application of alcohol rub consists of five strokes rubbing backwards and forwards and adapts Ayliffe's technique following steps 2 – 7 as illustrated above (AfPP 2017). ABHR should be applied to dry hands, as moisture can impair its antimicrobial activity (WHO 2016). After applying ABHR, allow the skin to thoroughly air dry before covering the arms and donning gloves, to reduce the risk of dermatitis.
- 5.4.26 Hands must be rinsed thoroughly, allowing water to drain from the fingertips to the elbows into the sink.
- 5.4.27 Splashing surgical attire should be avoided. If surgical attire becomes excessively wet, the protection afforded by the gown may be compromised. It may be necessary to change attire before beginning the scrub procedure again.
- 5.4.28 Vigorous shaking of the hands to dispel water results in splashing of surgical attire and should be avoided.

- 5.4.29 Hands must be dried thoroughly, as wet surfaces transfer microorganisms more effectively than dry surfaces, and multi-resistant gram-negative bacteria thrive in wet and damp environments (RCN 2013). The skin should be blotted dry with sterile towels because rubbing disturbs skin cells. Fabric towels are not suitable, as they quickly harbour bacteria (RCN 2013). Adhering to the principle of working from the fingertips to the elbows and using one towel per hand is essential. Dry the hands by placing the opposite hand behind the towel and blotting the skin – then using a corkscrew movement to dry from the hand to the elbow. The towel must be discarded immediately and should not be returned to the hand after drying the arm. This process should then be repeated for the opposite hand with a clean towel.
- 5.4.30 Hands should be held higher than elbows and away from surgical attire during the process of surgical scrubbing and upon completion (AfPP 2017).
- 5.4.31 Implementing the same procedure for surgical hand antisepsis for all staff and all procedures reduces variability in technique and increases compliance with best practice. There should be a clear procedure in place that forms part of the overall hospital policy and has been written in conjunction with the infection prevention control team and chief pharmacist. It should clearly explain the scrubbing procedure and which solutions to use.

Surgical antimicrobial solutions

Three types of antiseptic solutions are available (Tanner et al 2016):

- Aqueous scrubs. These are water-based solutions, usually containing chlorhexidine gluconate or povidone-iodine, which are used during traditional surgical hand scrubbing.
 - Standard alcohol rubs. These most commonly contain ethanol, isopropanol and n-propanol, or a combination of the three. The solution is systematically rubbed onto the arms and forearms for at least the amount of time specified by the manufacturer, before letting them air dry until all the solution has evaporated. Hands should be visibly clean when scrubbing with alcohol, as it cannot remove dirt.
 - Alcohol rubs containing an additional active ingredient. These include chlorhexidine gluconate, iodophors, biguanides and phenolic compounds such as hexachlorophene and triclosan.
- 5.4.32 The ideal antimicrobial solution should be fast-acting, effective for several hours, have a broad spectrum of activity, inhibit bacterial growth for several days when applied repeatedly and be safe to use (Tanner et al 2016).
- 5.4.33 Alcohol-based solutions provide the most rapid and most significant reduction in the microbial skin count but are not effective at removing debris and soiling (Tanner et al 2016).
- 5.4.34 It is unclear whether antisepsis with soap and water or alcohol rubs are more effective in reducing SSIs. Soaps can cause drying and irritation of the skin, which may reduce adherence to hand hygiene (Tanner et al 2016, Loveday et al 2014).
- 5.4.35 Alternative solutions must be available for staff who are allergic to conventional surgical scrubs. If soap must be used, it should be combined with an alcohol solution/gel following consultation with the infection control team and occupational health department.
- 5.4.36 When performing surgical hand antisepsis using an antimicrobial solution, scrub hands and forearms for the length of time recommended by the manufacturer, typically 2–5 minutes. Long scrub times, e.g. 10 minutes, are not necessary (WHO 2016). Antimicrobial solutions must be applied in adequate volume (approximately 5ml) and have sufficient contact with the skin to achieve their optimal effect. Chlorhexidine gluconate binds to the skin and is associated with a more persistent action than povidone iodine, which is associated with rapid regrowth of bacteria after application. Chlorhexidine has been demonstrated to be a more efficacious skin asepsis agent than povidone iodine (Tanner 2016, WHO 2009).

- 5.4.37 Alcohol-based hand disinfectants have a higher efficacy against microorganisms than antimicrobial wash lotions (WHO 2009). Several studies have demonstrated the efficacy of alcohol gel formulations containing 60–95% alcohol alone, or 50–95% when combined with small amounts of chlorhexidine gluconate, hexachlorophene or quaternary ammonium compounds in reducing bacterial counts on the skin immediately post-scrub. ABHRs have been demonstrated to be less irritating to the skin than soaps. (WHO 2009).
- 5.4.38 A standardised procedure should be in place to provide guidance on the technique of surgical hand preparation using alcohol, which product to use, and the correct volume and length of exposure suitable for the selected product. Sufficient product should be used to wet the hands and forearms with the hand rub throughout the surgical hand preparation procedure.
- 5.4.39 When using alcohol for surgical hand preparation, hands and forearms must be thoroughly dry before donning sterile gloves (WHO 2009).
- 5.4.40 Selected products should be licensed for use in a hospital as a surgical scrub and contain emollients to help protect the skin.
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Face and eye protection

- 5.4.41 Before hand antisepsis, face masks should be positioned and secured to cover the nose and mouth.
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Gowning procedures

- 5.4.42 Surgical gowns and clean air suits should be CE marked. The essential requirements are detailed by the European standard for surgical clothing and drapes, BS EN 13795-1&2:2019 (BSI 2019).
- 5.4.43 The fabrics of gowns must be tested for the following characteristics (BSI 2019):
- resistance to microbial penetration (dry and wet)
 - cleanliness (microbial burden)
 - particle release
 - resistance to liquid penetration
 - bursting strength (dry and wet)
 - tensile strength (dry and wet)
- 5.4.44 BS EN 13795-1:2019 requires gowns to be able to withstand the user performing all that is required from the surgical procedure without compromising the sterile field (BSI 2019).
- 5.4.45 A variety of styles and specifications are available in both single-use and reusable gowns. It is recommended that gowns should be a wrap-around style to protect the sterile field.
- 5.4.46 Perioperative staff must be aware of:
- the specification of the gown and its suitability for the procedure to be undertaken
 - how it is packed and presented
 - how it is donned
 - once donned, what area of sterility it affords the wearer

- 5.4.47 Gowns must be presented in good condition. Any gown that does meet the required standard should be discarded following local policy. The pack details should be noted and reported to the line manager and quality control. A variety of sizes should be available to staff to avoid the use of too small or too large gowns, which would compromise the safety and comfort of the staff and reduce the effectiveness of the gown as an infection control measure. Manufacturer instructions on the use of gowns should be followed.
- 5.4.48 On completion of surgical hand antisepsis, the gown should be donned. Manufacturer instructions for donning gowns should be followed. The gown should be donned away from the sterile field. Hands and arms must be completely dry before donning the gown. Only the inside of the gown should be touched during donning. If the gown sleeves touch any unsterile object during donning, then a sterile sleeve cover should be worn, or the gown should be removed and the entire process of hand asepsis, gowning and gloving repeated (AORN 2019).
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Gloving procedures

Gloves act as a barrier to prevent transmission of infection between staff and patients. Surgical gloves must be a good fit to ensure comfort, dexterity and sensitivity.

- 5.4.49 Surgical gloves must conform to the European standard on medical gloves for single use, BS EN 455-1 (BSI 2000). The choice of surgical glove depends on the risk of glove perforation from the surgical procedure being undertaken.
- 5.4.50 Perforation of surgical gloves during from suturing or from sharp instruments, bone fragments and natural 'wear and tear' is a common source of contamination of the sterile field and can also result in the surgical staff becoming contaminated by blood and bodily fluids.
- 5.4.51 Double gloving and glove liners may be implemented to reduce the risk of perforation (NICE 2019).
- 5.4.52 Triple gloving provides additional protection to double gloving and should be used for procedures that involve sawing, drilling or wiring (Tanner & Parkinson 2006).
- 5.4.53 The use of a coloured glove puncture indicator system (wearing a different colour glove underneath the outer glove) has been shown to enable wearers to detect perforations in the outer gloves more easily than when wearing standard gloves (AORN 2019, Meakin et al 2016).
- 5.4.54 While some surgeons suggest double gloving reduces hand dexterity and sensation compared with single gloves, it is still a recommended procedure (Tanner & Parkinson 2006). A period of acclimatisation is needed to find a comfortable combination of gloves, especially in those who have not routinely used double gloving (Fry et al 2010).
- 5.4.56 Surgeons who are reluctant to double glove should consider double gloving on the non-dominant hand, which is more at risk of puncture (Partecke et al 2009).
- 5.4.57 Wearing inner gloves that are half a size larger is associated with increased comfort (Fry et al 2010).
- 5.4.58 Alternative gloves must be available for individuals with latex allergies/sensitivities. Latex-free gloves must be available for use by all scrub staff when dealing with latex allergic/sensitive patients or those in a high-risk category. Local latex allergy policy should be in place and adhered to.
- 5.4.59 The closed method of gloving is the preferred option for donning sterile gloves to avoid contamination of the outer surface of the glove.
- 5.4.60 When gloves require changing intraoperatively due to a puncture or inadvertent contamination, the glove must be removed in a way that avoids further contamination and hands decontaminated with an alcohol-based hand gel. A new glove may be donned with assistance from a member of the surgical team.

Intraoperative and post-procedure protocol

After hand asepsis, gowning and gloving, staff must maintain the sterile area throughout the operation. This area includes:

- gloved hands and forearms
 - below the nipple line to waist level
- 5.4.61 Hands must be kept at or above waist level and below shoulder level and should be visible at all times to avoid inadvertent contamination of the sterile areas.
- 5.4.62 Scrubbed staff must only touch items and areas that are sterile. When not involved in a sterile procedure, scrubbed staff should stand with their hands within the sterile field to avoid contamination.
- 5.4.63 After a sterile procedure, gowns and gloves are clinical waste. Once untied, the gown should be pulled forward over the gloved hands, folding it onto itself. It should then be discarded appropriately.
- 5.4.64 To avoid contamination of the hand, gloves should be removed by ensuring that glove surfaces come into contact only with glove surfaces, and skin only with skin.
- 5.4.65 Single-use face masks, goggles and visors must be discarded after each procedure, handling by the ties only.
- 5.4.66 Reusable eye protection must be cleaned between procedures in accordance with the manufacturer instructions, and in an approved hospital cleaning facility according to local policy.
- 5.4.67 Staff should inspect their hands for contamination post-procedure.
- 5.4.68 Hands must be washed thoroughly once gown, gloves and face protection are removed.
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Skincare

- 5.4.69 Staff should care for their hands to ensure adequate hand decontamination and good practice.
- 5.4.70 Antiseptic solutions and soap must only be applied to wet hands. Hands must be rinsed thoroughly to remove any soap residue and then completely dried using paper towels (NHS England and NHS Improvement 2019).
- 5.4.71 When skin is damaged, it may harbour an increased number of microorganisms and may increase the risk of cross-infection. Hand creams should be used to maintain skin in good condition. Non-ionic, water-based hand creams should be used to avoid inhibiting action with some antiseptic solutions and latex gloves. The user should always check with the manufacturer of the skincare product to ensure that it is compatible with the chosen hand antiseptic agent.
- 5.4.72 Hand lotions should be provided in changing rooms, theatre scrub areas and all areas with hand washing facilities, to help staff maintain good skin condition. Hand lotions are not sterile, and outbreaks have been traced to contaminated containers. Communal tubs of hand cream should be avoided in favour of wall mounted dispensers. Containers should be disinfected before refilling (WHO 2009, RCN 2013, NHS England and NHS Improvement 2019).
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5.5 Aseptic technique

The standard

There are systems in place to ensure that surgical aseptic technique is carried out effectively.

The rationale

An important factor in patient outcomes is the quality of the aseptic technique carried out by the surgical staff.

Surgical asepsis can be defined as the state of being free from all pathogenic microorganisms. The outcome of a patient's surgical procedure is influenced by the competence, knowledge and skill of the perioperative staff in aseptic technique. All staff involved in preparing and performing surgical procedures are responsible for providing a safe environment for the patient. A safe operative environment requires the maintenance of asepsis to limit the risk of wound contamination. Measures to prevent surgical site infection (SSI) include the provision of medical devices, supplies and equipment that are free from microbial contamination at the time of use. Sterilisation provides the highest level of assurance that an object is sterile. Methods of sterilisation and decontamination are discussed in Chapter 6.

The basic principles of aseptic technique prevent contamination of the open wound by isolating the operative site from the surrounding non-sterile physical environment and creating and maintaining a sterile field.

Recommendations for local policy

General safety considerations

- 5.5.1 Proper aseptic hand hygiene is a priority when beginning any surgical procedure. The correct protocol is outlined in recommendations 5.4.18-5.4.29.
- 5.5.2 When performing a procedure, ensure that all people present (including the patient if they are to be awake during surgery) know how to prevent contamination of the sterile field, and know to avoid moving suddenly, touching the equipment, laughing, sneezing or talking over the sterile field (Doyle & Anita 2015).
- 5.5.3 Any perioperative staff who are ill should avoid performing invasive procedures and entering the perioperative environment.
- 5.5.4 Perioperative staff with infected lesions of the skin or bacterial infections of the upper respiratory system should not perform invasive procedures, take part in aseptic technique, or enter the perioperative environment.
- 5.5.5 Staff must be aware of differences between sterile items and non-sterile items and share the responsibility for monitoring aseptic practice.
- 5.5.6 The environment and all working surfaces must be cleaned in accordance with local infection prevention policies before beginning any surgical procedure.

Equipment and medical devices safeguards

- 5.5.7 All objects used in the sterile field must be sterile. All pre-sterilised articles must be checked for the sterility mark/label and assessed for intactness, dryness, the integrity of packaging and expiry date before using. Any packs found to be in an unsatisfactory condition must be discarded immediately. Torn, wet or opened packing is not considered sterile. Any packs dropped on the floor are also not considered sterile (Doyle & Anita 2015).
 - 5.5.8 Any sterile object that is touched by a non-sterile object is no longer sterile. Wherever the sterility of an object is in doubt, discard it immediately (Doyle & Anita 2015).
 - 5.5.9 Fluid flows in the direction of gravity. Keep the tip of surgical equipment facing downward to prevent fluids from contaminating the entire device (Doyle & Anita 2015).
 - 5.5.10 The sterile region extends from the chest line to the waistline at standing height. Keep all sterile equipment below the chest and above the waist. Table drapes are only sterile at waist level (Doyle & Anita 2015).
 - 5.5.11 To maintain the sterility of the field and any sterile objects, they must always be kept in sight. If the sterile field or a sterile object is no longer in sight, then it cannot be considered sterile. Staff should never turn their back to the sterile field (Doyle & Anita 2015).
 - 5.5.12 Any puncture, moisture or tear within a sterile barrier, e.g. drapes, packing and uniform must be considered non-sterile. The contamination must be immediately rectified (Doyle & Anita 2015).
 - 5.5.13 A border of 2.5cm designates the end of the sterile field. All sterile objects must be kept within the sterile field and must not touch the border (Doyle & Anita 2015).
 - 5.5.14 Sterile drapes should conform to the European standard for surgical clothing and drapes, BS EN 13795-1:2019, and must be used correctly to establish a sterile field (British Standards Institution [BSI] 2019).
 - 5.5.15 Sterile drapes should be handled as little as possible. The drapes should be applied from the surgical site to the periphery, avoiding reaching over non-sterile areas. Drapes should not be repositioned once placed to avoid contamination of the sterile field (Association for periOperative Registered Nurses [AORN] 2019).
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Scrubbed staff

Staff participating in an aseptic procedure should present themselves as recommended in Sections 5.1 and 5.4.

- 5.5.16 If gown or gloves are contaminated, they must be changed as soon as possible. Staff must consider that the imperative of maintaining the sterile field should always be balanced with ensuring the patient's safety.
- 5.5.17 Sterile staff must not contact non-sterile areas, and non-sterile staff must not contact the sterile field. For example, non-sterile staff should not lean over the sterile field (Doyle & Anita 2015). Scrubbed staff should remain close to the sterile field and not leave the immediate area. If staff leave the sterile field and exit the operating theatre, they must re-scrub before returning to the sterile field. Leaving the sterile field increases the risk of potential contamination.
- 5.5.18 Staff participating in sterile procedures must stay within the sterile boundaries, and a wide margin of safety should be given between scrubbed and non-scrubbed staff. There should not be non-scrubbed staff present within restricted areas of the theatre, and any scrubbed staff who have exited the sterile field should scrub again before returning.
- 5.5.19 When changing positions or moving between sterile areas, scrubbed staff should turn back to back or face to face to avoid contamination.

- 5.5.20 Scrubbed staff must keep their arms and hands well within the sterile field at all times. The hands should fall no lower than the waist or higher than the mid-chest. Contamination may occur if the hands are moved outside of the sterile field.
 - 5.5.21 Scrubbed staff should only be seated when this is required for the operative procedure.
 - 5.5.22 Specialised chairs/equipment/stools used within the direct operative environment should be covered with an appropriate sterile fitted cover or draping as deemed necessary.
 - 5.5.23 Circulating staff should not walk between sterile fields, e.g. between a prepared patient and the instrument trolley, and should keep a minimum of 1 metre distance from the sterile field.
 - 5.5.24 Movements within and around the sterile field must not compromise the sterility of the field. Traffic must be kept to a minimum, and doors should be kept closed (Doyle & Anita 2015).
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Special considerations

- 5.5.25 Indicated dressings must be removed carefully from the wound in the operative field before preparing the patient. This should be carried out by an assistant wearing gloves rather than a scrubbed member of the surgical team. Used and soiled dressings must be discarded immediately following local waste management policy.
 - 5.5.26 When pouring sterile solutions, only the lip and inner cap are sterile. The pouring container must not touch any part of the sterile field or the object that the solution is being poured into. Avoid splashes (Doyle & Anita 2015).
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5.6 Trolley preparation for surgical intervention

The standard

Instrument trolleys are prepared using strict aseptic technique. Once the sterile field is established, staff continue to protect against contamination from non-sterile equipment and surfaces, and from airborne microbes.

The rationale

Bacteria within the sterile field must be kept to an absolute minimum to reduce surgical site infections.

Sterile technique is used to create and maintain an area of sterility known as the sterile field (Association of periOperative Registered Nurses [AORN] 2019). There are a number of steps that must be strictly adhered to in order to establish a sterile field. These steps use aseptic technique to promote the maximum possible sterility of the operating field. Sterile technique includes inspection of medical devices for sterility, correct opening of surgical packets and making the minimum amount of movements required to set up the sterile field, e.g. when preparing the instrument trolley.

Recommendations for local policy

General considerations

The type of surgery being performed may influence the type of instrument trolley used in the procedure. All trolleys should adhere to the EU regulation on medical devices (MD 2017/745) and be stable and robust enough for the intended job (EU directive 2017). The design choice of the instrument trolley must take into account ease of movement, the ease of use afforded by the height and the ease of cleaning, and should also be in line with local infection prevention policies. Trolleys should be included in a planned preventative maintenance programme. Particular attention to the wheel mechanism is required to allow free and smooth movement. Trolleys, mayo stands, and bowl stands should be made of stainless steel or mild steel covered in nylon. All trolleys should be free of abrasions and be in good working order.

Aseptic technique for trolley preparation

- 5.6.1 There should be designated clean area for surgical trolley preparation that affords enough space to open instrument packs while maintaining a sterile field. There should be minimal movement of staff within this area during the preparation of the trolley.
- 5.6.2 All equipment for the surgical procedure must be gathered in advance, and all packs must be checked for sterility, integrity of the packaging and the expiry date. Heavy items and instrument trays should be presented to the scrubbed staff on separate trolleys.
- 5.6.3 Two members of staff are required for the preparation of sterile trolleys. It is essential that one of these members is scrubbed, gowned and gloved and follows the principles of aseptic technique. The number of staff present during instrument lay-up should be kept at a minimum to reduce the risk of airborne contamination.

- 5.6.4 Sterile fields should be prepared as close as possible to the time of use in a designated preparation room with the highest level of air changes (AORN 2019). Trolleys should not be moved between theatres – they should be prepared in the location that they will be used in. Preparation of surgical instruments in advance is not recommended as the level of contamination increases with time (AORN 2019). Continuous monitoring of the sterile field may prevent breaks in sterile technique (AORN 2019). If the period between lay-up and use is prolonged for any reason, then instruments should be protected from settling dust and other contaminants by a sterile drape (AORN 2019). Drapes must be removed with extreme care to avoid contamination of the instruments.
- 5.6.5 Local policy on laying out sterile instrument trolleys should be followed. All staff should adhere to this method to facilitate continuity of patient care and safety in the event of a sudden change of scrubbed staff during the operative procedure. Instruments may be arranged on trolleys in order of use so that instruments that are being used later can be covered with sterile drapes until they are required (AORN 2019).
- 5.6.6 All trolleys should be covered with at least two layers of sterile drapes which meet the European standard for surgical clothing and drapes, BS EN 13795-1:2019 (British Standards Institution [BSI] 2019, AORN 2019). The drapes should be of a recommended material large enough to cover the horizontal plane of the trolley. The coverage of the vertical plane must also be sufficient to prevent contamination. The trolley should be considered sterile on the horizontal plane only.
- 5.6.7 Once prepared, the trolley must be attended at all times unless instruments are protected by a sterile covering.
- 5.6.8 Scrubbed staff should move draped sterile trolleys by placing hands on the horizontal surfaces only.
- 5.6.9 All aspects of the sterile field, including the medical devices, should be established as close to the scheduled time of surgery as possible. All instruments and devices anticipated to be used should be conveniently available and ready to be opened when they are required (AORN 2019).
- 5.6.10 Trolleys should be positioned close together to ensure there are no breaks in the sterile field.
- 5.6.11 To maintain asepsis, it is essential that all staff are aware of the correct method of opening different sterile packages to avoid the contamination of contents. Packages should be opened by first peeling back the flap furthest away. The nearest wrapper should be opened last. The inside of the packaging should not be touched during opening. Outer wrappers should be secured when presenting sterile items to avoid contamination. The scrubbed staff should open packs towards themselves first and then away to avoid contamination of the sterile item. Once the flaps are open, the sterile item can be taken out of the packaging by a scrubbed practitioner. Sterile items should not be dragged over the unsterile packaging edges during removal (AORN 2019).
- 5.6.12 Sterile items should be presented directly to the scrubbed staff, or they should be placed in a designated area of the sterile field (AORN 2019).
- 5.6.13 Circulators should not reach over sterile fields.
- 5.5.14 Sterile items should be presented directly to the scrubbed staff or placed securely on a designated area of the sterile field. Items should not be thrown onto the sterile field as they may roll off or cause other items to be displaced.
- 5.6.15 Heavy items should be placed on a clean dry surface to be opened (AORN 2019).
- 5.6.16 When pouring solutions, the receiving container should be placed near the trolley edge or held by the scrubbed staff. The solution should be poured slowly to avoid splashing. The edge of a container is considered contaminated after the cap is removed and therefore the sterility of its contents cannot be guaranteed if the cap is replaced. Skin preparation solutions should be discarded once opened.

- 5.6.17 Sharps should be offered directly to the scrubbed practitioner (AORN 2019).
 - 5.6.18 Any items that are placed on the trolley such that they extend beyond the edges of the trolley are at risk of contamination. Instead of being repositioned on the trolley, they should be discarded.
 - 5.6.19 Any break in aseptic technique must be acted on immediately. Contaminated equipment must be removed from the sterile field using a suitable instrument to prevent compromising sterility of the procedure. Re-gloving and re-draping should be carried out where necessary.
 - 5.6.20 The disposal of all equipment, drapes and sharps must be carried out in line with local and national guidelines and protocols for instrument decontamination and waste management. The scrub staff should, wherever possible, dispose of all contaminated materials while still gowned and gloved.
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5.7 Patient skin preparation

The standard

The risk of postoperative surgical site infections are minimised through the effective management of skin preparation of the surgical site.

The rationale

Effective skin preparation greatly reduces the number of bacteria on the patient's skin, which limits the risk of surgical site infections.

Surgical site infections (SSIs) reduce the health-related quality of life of patients and use valuable hospital resources. SSIs are the most common infection acquired in hospital and they can significantly impact the wellbeing of patients, causing anxiety, pain and distress. Patients with SSIs face extended hospital stays and longer recovery times, as well as potential loss of earnings for working patients. Alongside the negative consequences for patients, every SSI places a financial burden on healthcare organisations, with an average doubling of costs and the loss of bed space due to extended stays (Badia et al 2017).

The bacteria on the patient's skin around the surgical site is the most common cause of SSIs (Jolivet & Lucet 2019). The number of bacteria on the patient's skin can be significantly reduced by effective surgical skin preparation. The risk of even invasive surgeries can be reduced at the level of the skin through effective skin preparation (Jolivet & Lucet 2019).

Surgical skin preparation is the process of disinfecting the skin to reduce the number of transient and resident skin bacteria. Transient bacteria do not normally colonise the skin and are easily removed by washing. Resident bacteria are more difficult to remove and grow even on normal skin, which is why disinfection is required. Surgical skin preparation should be carried out on visibly clean skin. The application technique must also be effective in cleansing deeper layers of the skin, as 20% of bacteria reside under the skin and in hair follicles. Gentle back and forth application of antiseptic solution is the most effective technique for reducing the bacterial load of the skin (Casey et al 2017). Surgical skin preparation must not damage or irritate the skin, as this can increase the risk of infection.

Recommendations for local policy

Before skin preparation

- 5.7.1 Patients should shower or bath using soap on the day before or on the day of surgery. On the occasion that a patient arrives at the theatre unclean or with visibly dirty skin, the patient must be washed before skin preparation (National Institute for Health and Care Excellence [NICE] 2019)
- 5.7.2 The skin should be assessed for any breaks, cuts, abrasions and sores. Breaks in the skin reduce its effectiveness as a barrier against microorganisms. Any skin breaks should be documented. The presence of moles, warts, rashes or other skin conditions at the surgical site should also be documented.

- 5.7.3 Any patient allergies or contraindications must be identified before surgery. Allergies and contraindications may include shellfish, latex, chlorhexidine, alcohol or iodine. Patient allergies to cleansing agents should be documented and a suitable alternative for skin preparation used. Some formulations do not have UK Marketing Authorisation (formerly known as 'product licenses') for use, in which case the prescriber should follow relevant professional guidance. Medicinal products with marketing authorisation should be used wherever possible (General Medical Council 2014). For further information on the use of unlicensed products, staff should refer to Good Practice in Prescribing and Managing Medicines and Devices: Prescribing unlicensed medicines (General Medical Council 2014). Using medical devices in any way other than described by the manufacturer is considered 'off label', which places the healthcare organisation at risk of liability for any civil damage claims (Medicines and Healthcare products Regulatory Agency [MHRA] 2014b).
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Preoperative hair removal

- 5.7.4 Hair removal should not be carried out routinely (NICE 2019). The removal of hair is only necessary if the hair directly interferes with access to the incision site. In cases where hair removal is necessary, the following steps should be carried out:
- Patient consent must be obtained before hair removal, as the patient may have religious or cultural beliefs surrounding the removal of hair. The patient should be given a full explanation of how the hair will be removed and why it is necessary.
 - Hair removal should take place on the day of surgery and as close to the time of surgery as possible to minimise the risk of bacterial contamination of the skin surface.
 - Hair removal should be carried out by staff who are trained and competent in hair removal. The process should be carried out in a clean area of the surgical suite with good lighting, affording the patient privacy and dignity at all times.
 - There should be documentation of the member of staff who undertook the hair removal, the area from where the hair was removed, and the method used.
- 5.7.5 Hair must be removed by clipping using electric clippers with a single-use disposable head (NICE 2019)
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Perioperative skin preparation

- 5.7.6 Antiseptics used for skin preparation must be effective against resident and transient microorganisms. They should have a broad spectrum of activity with a fast and lasting effect against gram-negative and gram-positive bacteria, as well as viruses and fungi (Tanner et al 2016). They should be resistant to inactivation by organic matter such as blood, and should be non-toxic and cosmetically acceptable (Sandle 2016).
- 5.7.7 Antiseptics should be supplied in ready-to-use, single-use containers, as there is an increased risk of contamination associated with multiple-use containers (Association of periOperative Registered Nurses [AORN] 2014, Loveday et al 2014). Single-use applicators can standardise application methods across all staff and reduce the risk of cross-contamination (Casey et al 2017).
- 5.7.8 Products for disinfecting intact or damaged skin before medical treatment of a patient, e.g. pre-operative skin disinfection before surgery and disinfection before injection, and products with a claim of medicinal use, are classified as medicinal products (European Chemicals Agency 2018). All medicinal products must have marketing authorisation in line with the EU 2017 Regulations on Medical Devices (MHRA 2016, EU directive 2017). It is recommended to use licensed medicinal products wherever possible (General Medical Council 2014).

- 5.7.9 If antiseptic needs to be reapplied, the same antiseptic solution should be used each time.
- 5.7.10 Antiseptic skin preparation should take place immediately before the first incision is made (NICE 2019).
- 5.7.11 Alcohol-based chlorhexidine should be the first choice of antiseptic skin preparation unless it is contraindicated, or the surgical site is next to a mucous membrane. If the surgical site is next to a mucous membrane, then an aqueous solution of chlorhexidine should be used. If chlorhexidine is contraindicated, then alcohol-based povidone iodine should be used. Where both chlorhexidine and alcohol-based solutions are unsuitable, an aqueous solution of povidone iodine should be used (NICE 2019).
- 5.7.12 A risk assessment should be made before carrying out antiseptic skin preparation with alcohol-based or aqueous chlorhexidine in preterm babies, as there is a potential for severe chemical burns. (NICE 2019). This risk is greatest in infants born before 32 weeks of gestation. It is also higher in the first two weeks of life than in later stages of infancy (MHRA 2014a).
- 5.7.13 When using an alcohol-based solution before diathermy, avoid pooling and ensure skin is allowed to dry completely after every application (NICE 2019).
- 5.7.14 Skin preparation solutions should be kept as per product the storage recommendations. Risk assessments should be carried out for the storage of flammable solutions. Storage should be in line with The Control of Substances Hazardous to Health Regulations (COSHH) 2002 (Health and Safety Executive 2013).
- 5.7.15 Do not use wound irrigation or intracavity lavage to reduce the risk of SSIs (NICE 2019).
- 5.7.16 Normal (0.9%) sterile saline solution can be used for wound cleansing up to 48 hours after surgery (Flanagan 2013, NICE 2019). Instruments should be cleaned as soon as possible after use to avoid blood or other contaminants from drying and becoming difficult to remove. During surgical procedures, the scrub staff should moisten used instruments with a sterile cloth and sterile water to remove any visible contaminants. Surgical instruments with lumens should be single-use wherever possible. Reusable surgical instruments with lumens should be periodically irrigated with sterile water during the procedure to remove body tissues (AORN 2017).
- 5.7.17 Hydrogen peroxide is indicated at concentrations of up to 6% for disinfection of minor cuts, wounds and skin ulcers. However, the use of hydrogen peroxide in closed body cavities and deep or large wounds is contraindicated due to the dangers associated with the risk of embolism and should not be used in this way (MHRA 2014c, Association for Perioperative Practice [AfPP] 2015).
- 5.7.18 Methylene blue 1% can be used to mark or stain the skin.
- 5.7.19 Skin antiseptic solutions should be used in accordance with manufacturer instructions. Adhere to manufacturer guidance on the temperature and warming of solutions.
- 5.7.20 Skin solutions should be checked by the scrub and circulating staff to ensure the correct solution strength is used, and that all solutions have not passed their expiry date.
- 5.7.21 Solutions should be disposed of in accordance with local policy.
- 5.7.22 Care should be taken to avoid spillage onto the sterile field. Any spills should be dealt with swiftly. If necessary, the sterile field should be reestablished.

- 5.7.23 Open-systems, i.e. presenting solutions in pots without lids, are considered to be an indefensible practice that should not be carried out in any situation other than for the mixing of embolic solutions for embolisation procedures (NHS Improvement 2016). There is a risk that decanting solutions into unlabeled open-systems may result in inadvertent misuse due to confusion of solutions, as well as the possibility of bacterial contamination. (NHS Improvement 2016, Open Government License [OGL] 2016). Any solutions that must be decanted into containers should be poured from a height of approximately 10cm into a container at the edge of the sterile field to avoid contamination.
- 5.7.24 Skin antiseptic solution should be removed from the surgical field before invasive procedures begin (OGL 2016).
- 5.7.25 Staff should undergo training and competency assessment in surgical skin preparation techniques before carrying out any surgical skin preparation.
- 5.7.26 Skin preparation should be carried out using an aseptic and non-touch technique, i.e. using holders. A non-touch technique prevents contamination of sterile gloves. Swabs should be positioned on the sponge holder in such a way that the end of the holder cannot traumatise the patient.
- 5.7.27 Patients should not be unnecessarily exposed to ensure their dignity is protected and to prevent heat loss. The area exposed should be sufficient to enable adequate skin preparation.
- 5.7.28 Seeping or pooling of skin preparation solutions on or underneath the patient should be prevented to avoid chemical and thermal burns. Absorbent towels can be placed under the patient to soak up any excess solution. Any towels should be removed immediately after skin preparation is complete. During the preparation of elevated limbs, a safe system must be in place to absorb excess fluid and prevent solutions accumulating in tourniquets (AORN 2014).
- 5.7.29 Flammable solutions should be allowed to evaporate before placing the drapes to avoid fumes accumulating under them, to reduce the risk of chemical and thermal burns (Rocos & Donaldson 2012).
- 5.7.30 Great care should be taken to avoid solutions running onto diathermy electrode plates, electrocardiogram leads and tourniquets, to reduce the risk of chemical and thermal burns (AORN 2019).
- 5.7.31 Only the required amount of antiseptic solution should be applied. Solutions should not be poured on to the patient.
- 5.7.32 Skin preparation should proceed from clean to dirty areas. Antisepsis should start at the incision site, working backwards and forwards to ensure that it is thoroughly prepared. Skin preparation should then continue in sections moving from the incision site to the periphery.
- 5.7.33 The number of separate applications should be in line with manufacturers recommendations.
- 5.7.34 Use a clean applicator for each repetition of skin preparation.
- 5.7.35 Use a clean applicator for each additional surgical site.
- 5.7.36 The area of prepared skin should allow for the safe extension of the incision, placement of drains and for any possible movement of the drapes.
- 5.7.37 New swabs and sponge holders should be used for each new application. Swabs used for prepping should be retained as part of the swab count.
- 5.7.38 There must be documentation of the type of skin preparation used, the surgical area prepared, the condition of the skin, any visible hypersensitivity and the member of staff who undertook the skin preparation.

Additional considerations

- 5.7.39 In cases where a contaminated area is within the area that is being prepared, skin preparation should start at the surrounding skin.
- 5.7.40 Contaminated areas of skin, e.g. the perineum, anus, vagina and axilla, should be prepared last. The umbilicus, i.e. the belly button, should be prepared first to prevent contaminated solution from running onto clean skin. Care should be taken to avoid pooling of skin preparation within the umbilicus.
- 5.7.41 Skin ulcers and draining sinuses should be prepared last, as they are heavily contaminated areas.
- 5.7.42 A risk assessment should be carried out before using antimicrobials on diabetic patients, as they may have heightened sensitivity.
- 5.7.43 Additional care should be taken when preparing malignant areas to prevent the potential spread of cancer cells.
- 5.7.44 Dirt and debris should be removed from traumatic wounds by wound irrigation before preparing the skin.
- 5.7.45 Stomas should be sealed with adhesive drapes. If the stoma is part of the skin preparation area, it can be covered with a sterile swab and the area around it should be prepared first. Once the surrounding area is cleansed, the swab can be removed, and the stoma cleaned.
- 5.7.46 Delicate areas such as the eyes and ears require specialist solutions. Chlorhexidine is not recommended for facial preparation, and iodine may cause corneal damage if it is introduced into the eye. Solutions must not pool around the eyes. Solutions must not enter the inner ear, as they can cause sensorineural deafness. For sterilisation of the ear, an alternative solution should be used (Lai et al 2011).
- 5.7.47 After removing casts or dressings, the surgical site may require soaking with a sterile solution to remove skin squames or adherent dressings.
- 5.7.48 During the preparation of limbs, additional staff or equipment may be required to hold the limb securely to allow the whole circumference to be cleansed safely.
- 5.7.49 Graft and donor sites should be prepared separately to prevent cross-contamination from one site to the other. The donor site should be prepared first. Colourless antiseptic solutions allow the surgeon to evaluate the vascularity of the graft.
- 5.7.50 In order to comply with the Consumer Protection Act 1987, the following should be documented:
- documentation of consent as indicated by the general medical council/nursing and midwifery council professional body
 - the condition of the skin at the surgical site
 - any hair removal, including method and time of removal
 - the type of skin preparation used, including lot and batch number
 - the member of staff performing skin preparation
 - development of any patient hypersensitivity reactions
 - postoperative skin assessment
- 5.7.51 A documented risk assessment should be carried out before applying alcohol-based skin preparation solutions to the fragile skin of elderly patients.

5.7.52 Staff should consider carrying out a risk assessment before using iodine-based skin preparation in the following situations:

- pregnant patients
- patients who are breastfeeding
- neonates
- patients with thyroid disorders
- patients with large wounds, metabolic acidosis, hypernatremia or impaired renal function.

These situations should be discussed with the appropriate medical staff and a pharmacist to ensure appropriate care is provided.

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5.8 Draping

The standard

Appropriate sterile drapes and draping technique are used to create a sterile field around the incision site.

The rationale

Sterile drapes establish the sterile field and create a barrier between sterile and unsterile surfaces.

Draping is an essential aspect of aseptic technique. Surgical drapes are used to create a sterile barrier that isolates the operative site and covers the non-sterile area surrounding the operative site. This barrier establishes the sterile field and reduces contamination of sterile surfaces from non-sterile surfaces, such as contamination of the sterile gown from the legs of the operating table (The Association of periOperative Registered Nurses [AORN] 2019). As well as creating a sterile field, drapes are used to maintain the sterility of other equipment used during surgery, such as surgical instruments. They can also be used to extend the sterile field and to cover equipment that cannot be sterilised. The specifics of surgical drape usage should be determined by considering the condition of the patient, the type of operation, the duration of the operation, the amount of fluid contamination anticipated, the potential for infection and the type of surgical environment. The application of surgical drapes must be carried out once the patient is on the operating table, and the incision site has undergone antiseptic skin preparation.

The standard for surgical drapes

Medical devices must adhere to the EU regulation on medical devices (MD 2017/745) and be stable and robust enough for the intended job (EU directive 2017). The 'CE' mark is a declaration by the manufacturer that the product meets these mandates. Only products that comply with the essential requirements in the MDD may be placed on the market and put into service.

Surgical drapes are medical devices whose essential requirements are controlled by the European standard on surgical clothing and drapes, BS EN 13795-1:2019 (British Standards Institution [BSI] 2019).

BS EN 13795-1:2019 requires testing of surgical drapes to ensure that they meet the following standards:

- resistance to wet and dry microbial penetration
- low microbial burden and linting
- resistant to liquid penetration
- resistance to tearing when dry and wet
- bursting strength when dry and wet

The use of fire retardant and anti-static drapes is particularly important for operations involving electrocautery, lasers, fibre-optic and other electrical equipment. Manufacturers should adhere to fire regulation standards.

Recommendations for local policy

Types of drapes

Drapes vary according to the economy, comfort and degree of protection required (World Health Organization [WHO] 2016). Drapes are often designed for speciality-specific procedures and named accordingly. There are several other types of drapes, such as fenestrated drapes, split drapes, aperture drapes, major and minor drapes, medium drapes, equipment drapes, leggings, isolation drapes and sterile towels. Isolation drapes are transparent drapes used to isolate necessary equipment which cannot be sterilised, e.g. X-ray equipment.

Sterile towels are used to frame the surgical site. Drapes can also be reinforced or treated to improve their performance. Some drapes have pockets for holding equipment, e.g. tubing or cabling, or pouches for the collection of fluid. As well as the varieties of drapes already mentioned, there are drapes available for microscopes, endoscopes, cameras, light handles and other surgical equipment. Drapes should be selected on the basis of their desired function.

Reusable drapes

Either sterile, disposable and non-woven drapes and gowns or sterile, reusable woven drapes and surgical gowns can be used during surgical operations for the purpose of preventing surgical site infections (SSIs) (WHO 2016).

Reusable drapes, also known as linen and cotton drapes, are the traditional form of drapes used in hospitals. Traditional drapes are comfortable, easier to drape and strong when dry. However, without continual treatment to maintain their barrier effect, they can become porous. Densely woven treated cotton allows moisture to penetrate after 75 washes, and untreated cotton allows penetration of moisture in as few as 30 washes. The efficiency of reusable drapes is also affected by repeated drying and ironing and repeated steam sterilisation cycles.

There have been technological advances in reusable drapes. They are available in a range of textile materials ranging from single-layer micro-filament yarns to tri-laminates, which incorporate a micro-porous membrane. All these provide superior barrier protection against the transfer of microorganisms than cotton.

- 5.8.1 There should be a tracking system in place to indicate the life cycle of reusable drapes so that they can be used in line with manufacturer recommendations. This record should determine when to discard drapes after the requisite number of processing cycles.
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Disposable drapes

Disposable drapes are non-woven. BS EN 13795-1:2019 also ensures that the manufacturer and processor are able to demonstrate that single-use and reusable devices are fit for practice (BSI 2019). Ensuring that the drapes purchased meet these reprocessing and testing requirements is the responsibility of each hospital department involved in the supply of drapes and gowns. Organisations purchasing drapes should be aware of the research evidence on best purchasing practices and efficient use of resources (Coles 2016).

- 5.8.2 Policies and procedures devised for drape and gown selection should be reviewed and revised in accordance with evidence-based practice.

Adhesive drapes

Adhesive drapes (also known as incision, adhesive plastic or sticky drapes) are sometimes used in addition to reusable or disposable drapes. These drapes are applied to the operative site after skin preparation. The incision is then made through the plastic. The purpose of adhesive drapes is to assist in creating a sterile area around the incision site by preventing bacteria migrating towards the wound. The success of these drapes is dependent on their adherence to the skin during surgery. Adhesive drapes can help keep the surgical drapes in position, define the surgical site, keep the skin clean and isolate areas considered to be heavily contaminated, such as stomas.

- 5.8.3 The National Institute for Health and Care Excellence (NICE) recommends using iodophor-impregnated drapes where adhesive drapes are required, unless the patient has an iodine allergy. Drapes that are not impregnated with iodophors are not recommended for routine surgeries as they have been associated with an increased risk of SSIs (NICE 2019).
- 5.8.4 The ideal requirements for adhesive drapes are that they should:
- be easy to incise
 - not allow bacteria to permeate through
 - adhere well to the skin
 - be non-irritating, elastic and transparent
 - allow the skin to breathe
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Storage of drapes

- 5.8.5 The most appropriate storage arrangements for drapes are specific to the drapes. In all cases, procedure packs must be easily accessible to staff. Storage areas, both within and outside the operating theatre should be kept clean, dry and tidy.
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Guidelines for draping

- 5.8.6 The surgical team should check the effectiveness of their draping procedures before beginning the procedure, paying particular attention to table fitments etc. Adequate time should be available for draping.
- 5.8.7 The scrub practitioner should have good knowledge and understanding of the procedure being undertaken so that they can make an informed contribution to the draping process.
- 5.8.8 Sterilisation wrap products should not be used in place of sterile drapes, e.g. using sterilisation wrap products as trolley covers.
- 5.8.9 The area surrounding the table and the patient should be as clear of equipment to prevent contamination of the drapes while establishing the sterile field. Any equipment required for the procedure should be moved into place once draping has taken place.
- 5.8.10 The patient's skin should be dry before beginning the draping procedure.
- 5.8.11 Drapes should be handled as little as possible and not fanned or waved in the air.
- 5.8.12 During draping, the drapes should be wrapped around the hands of the scrub practitioner carrying out the draping procedure so as to protect the gloves from being contaminated by the patient.

- 5.8.13 The scrub practitioner should leave sufficient space between themselves and the operating table so as to avoid contamination of their gown by the table. During the draping procedure, the side of the table closest to the scrubbed staff carrying out the draping procedure should be draped first.
 - 5.8.14 The scrub practitioner should not reach across the operating table or lean on the patient to place drapes.
 - 5.8.15 The drapes should be held high enough to prevent contact with any non-sterile areas before placing them over the patient. The distal edges of the drapes should be allowed to fall naturally. The area below the waist-level is not sterile.
 - 5.8.16 Once placed, the drapes should remain in position until the end of the operation. If they become wet or soiled during surgery, they should be removed and replaced with new sterile drapes. Contaminated gloves should also be replaced.
 - 5.8.17 If a hole is found in a drape, this must be covered with another drape or the drape discarded and replaced. If there is any doubt regarding the sterility of a drape, then it should also be discarded and replaced.
 - 5.8.18 Hair or foreign bodies found on the sterile drapes should be removed and handed off the sterile field, along with any other item that has come into contact with the foreign body, e.g. gloves. The area should then be re-covered with another sterile drape. Alternatively, the whole sterile pack can be discarded, and the process restarted using a new pack.
 - 5.8.19 Layering of drapes is no longer a standard precaution due to advances in the quality of drapes.
 - 5.8.20 Non-adhesive drapes should be carefully held in place by an atraumatic towel clip to hold the drapes together. Where adhesive drapes are used, checks should be made of the patient's sensitivity to adhesives.
 - 5.8.21 The drapes should remain in place until the dressing has been applied.
 - 5.8.22 The scrub practitioner should dispose of all drapes into appropriate bags, either for laundering or disposal, while still gowned and gloved. It is considered good practice to label any linen or waste leaving the theatre.
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5.9 Blood-borne viruses

The standard

Staff employed within the perioperative setting are aware of the risk of transmission of blood-borne viruses and adhere to standard precautions for infection prevention and control for every act of patient care.

The rationale

It is possible to be infected with certain blood-borne viruses without symptoms, and certain procedures carry a higher risk of transmission of these viruses between patients and staff. The most effective way to reduce these risks is to consistently apply infection prevention and control measures, which includes using personal protective equipment, using sharps safely and screening staff for infections.

Background

Blood-borne viruses (BBVs) are infectious viruses that some people carry in their blood. The main BBVs of concern are human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV). BBVs can also be transmitted through fluids other than the blood, for example (Health and Safety Executive [HSE] 2011, HSE undated):

- cerebrospinal fluid
- pleural fluid
- breast milk
- amniotic fluid
- vaginal secretions
- peritoneal fluid
- pericardial fluid
- synovial fluid
- semen
- other bodily fluids containing blood

Urine, faeces, saliva, sputum, tears, sweat and vomit present minimal risk of BBV transmission unless they are contaminated with blood. Care should still be taken when handling these fluids, because it is not always obvious if blood is present (HSE 2011).

Under certain circumstances, perioperative care carries the risk of transmission of BBVs between patients and staff. The majority of clinical procedures can be safely performed provided appropriate infection control precautions are applied. Every patient should be considered a potential carrier of BBVs, as it is possible to be infected without symptoms. There is also a period following infection where blood tests cannot detect HIV. Standard infection control precautions should be applied during every act of patient care to reduce any potential risk of transmission. Some perioperative care involves exposure-prone procedures, which carry an increased risk of BBV transmission. Extra precautions must be followed during these procedures.

Both healthcare organisations and their employees are obliged to ensure that standard precautions are implemented to prevent the transmission of BBVs (Public Health England [PHE] 2017). These precautions include appropriate training, screening, and reporting of any possible transmissions. Specific legislation on hazards that arise from working with biological agents such as BBVs is contained in the Control of Substances Hazardous to Health (COSHH) (HSE 2013).

Exposure-prone procedures

The risk of transmission of BBVs from an infected patient to a healthcare worker, and vice versa, is increased during exposure-prone procedures. Exposure-prone procedures include procedures where there is a possibility of injury to staff, resulting in their blood contaminating the patient's open tissues. These injuries can result from sharp instruments, or from sharp tissues within the patient's body. There are three categories of exposure-prone procedures, where the risk increases with the possibility that injury to staffs' hands could go unnoticed for any period of time (PHE 2017):

- Category 1: The hands/fingertips of staff are visible at all times, and the risk of injury is minimal, e.g. local anaesthetic injection in dentistry, removal of haemorrhoids.
- Category 2: The hands/fingertips are usually visible, and there is a minimal risk of injury, e.g. routine tooth extraction, laparoscopic or open appendicectomy.
- Category 3: The hands/fingertips are out of sight for the majority of the procedure or during a critical part of the procedure, and there is a risk of injury, e.g. hysterectomy, caesarean section, open cardiac surgical procedures.

Standard infection control precautions such as the level of personal protective equipment (PPE) selected should be applied based on the level of anticipated risk of the procedure (5.2.11-5.2.17). Staff who perform exposure-prone procedures are required to undergo additional health clearances for BBVs to protect patients from potential exposure.

Recommendations for local policy

Health

All healthcare staff, including self-employed and independent sector staff, are legally bound to protect the health of themselves, their colleagues and their patients. This protection includes minimising the risk of exposure to BBVs (PHE 2017).

- 5.9.1 Skin lesions provide the potential for BBV transmission. All perioperative staff must be in an optimum state of health. Any ill health, e.g. skin lesions, cuts or sore throats, must be reported to the team leader for a risk assessment. A referral to occupational health may be one of several appropriate responses. Any broken skin should be covered with a waterproof dressing and managers should carefully assess whether staff with broken skin can perform exposure-prone procedures.
- 5.9.2 All new healthcare staff employed or beginning training should have standard healthcare clearance (PHE 2017). This includes doctors entering surgical specialities, post-registration nurses in operating theatres, and all new theatre staff. This can also extend to returning staff, depending on the activities they have engaged in during their absence from the health service.

Standard BBV clearances

- 5.9.3 Standard BBV clearances should be implemented for all new healthcare staff (PHE 2017).
4. All new NHS healthcare staff, including returning staff who will be in direct contact with blood, blood-stained bodily fluids or patient tissues, should be offered immunisation against HBV. Their responses to the HBV vaccine should be monitored, including investigation of non-responses (PHE 2017).
 5. All new NHS healthcare staff, including returning staff, should be offered an HCV antibody test and, if positive, should be tested for HCV RNA to detect the presence of current infection (PHE 2017).
 6. All new NHS healthcare staff, including returning staff, should be offered a HIV test (PHE 2017).
 7. Healthcare staff have the right to decline testing and vaccination. Failure to test or be immunised, or receiving a positive test, does not affect the employment of healthcare staff who will not perform exposure-prone procedures. Staff who decline or fail any of the standard BBV clearances should be restricted from performing exposure-prone procedures (PHE 2017).
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Additional BBV clearances

8. As well as standard BBV clearances, additional health checks are required for healthcare staff performing exposure-prone procedures (PHE 2017).
 9. New staff performing exposure-prone procedures must be vaccinated against HBV, and their response must be checked by testing for HBV antibodies (PHE 2017). They must also be tested for HBV surface antigens (HBsAg), even if they have already received the vaccine.
 10. Several rounds of HBV clearance are required for staff performing exposure-prone procedures. The results of each test determine whether further tests must be made. HBsAg-positive staff should be tested for HBV e-markers (HBeAg), and if HBeAg-negative, for HBV DNA levels. Staff testing positive for HBeAg should not perform exposure-prone procedures. Staff with HBV DNA levels exceeding 200 IU/ml should not perform exposure-prone procedures. Further guidance on the management of HBV in healthcare staff can be obtained from the Integrated Guidance on Health Clearance of Healthcare Workers and the Management of Healthcare Workers Infected with Bloodborne Viruses (hepatitis B, hepatitis C and HIV) (PHE 2017).
- 5.9.11 Staff testing positive for HCV antibodies should be tested for HCV RNA to determine whether they are currently infected. Staff testing positive for HCV RNA should be restricted from performing exposure-prone procedures. HCV infected staff who have been treated with antiviral therapy and remain HCV RNA negative for a minimum of six-month after cessation of therapy should be permitted to perform exposure-prone procedures. A further check should be made 6 months later (PHE 2017).
- 5.9.12 Staff who will perform exposure-prone procedures should be tested for HIV. HIV infected staff must meet the following criteria before they can perform exposure-prone procedures (PHE 2017):
- either, be on effective combination antiretroviral therapy and have a plasma viral load of <200 copies/mL or;
 - be an elite controller and be subject to plasma viral load monitoring every 12 weeks, be under the joint supervision of a consultant occupational physician and their treating physician and be registered with the United Kingdom Advisory Panel Occupational Health Monitoring Register (PHE 2017).

5.9.13 HSE provide guidance on exposure to HIV, occupational or otherwise (HSE 2011).

Post-exposure prophylaxis guidance can be obtained from HIV post-exposure prophylaxis guidance from the UK Chief Medical Officers' Expert Advisory Group on AIDS (2008), with regimen updates provided by the Expert Advisory Group on AIDS (2014). These should be read alongside local needlestick policy. PHE provide guidance on the management of healthcare staff who perform exposure-prone procedures (PHE 2014).

5.9.14 Healthcare staff who apply for a post or training which may involve exposure-prone procedures and who decline to be tested for HIV, HBV and HCV should not be cleared to perform exposure-prone procedures (PHE 2017).

5.9.15 Healthcare staff have a duty of care to promptly seek medical advice for testing if they may have been exposed to HBV, HCV or HIV, occupationally or otherwise (PHE 2017).

5.9.16 Independent care providers are under ethical and legal requirements to protect the health and safety of their staff and patients. Independent care provider should refer to guidance from PHE on the management of healthcare staff infected with BBVs (PHE 2017).

5.9.17 It is recommended that all aspects of management of BBVs in healthcare staff should be co-ordinated through a consultant occupational physician (PHE 2017).

5.9.18 NHS employers are responsible for the continuing occupational health and safety needs of temporary workers, as covered by the Health & Safety at Work Act 1974. Agencies are responsible for supplying staff who are fit to practice and should ensure that all staff have the required BBV clearances.

Practice

5.9.19 Sharps should be used as little as possible

5.9.20 Always use safety devices when possible (HSE 2013b).

5.9.21 Do not re-sheath used needles.

5.9.22 Ensure that all staff are familiar with the local protocols for the use and disposal of sharps, e.g. the location of the sharps bins, and any other equipment before they undertake any procedure involving the use of a sharp (HSE 2013).

5.9.23 Do not bend or break needles or disassemble them after use.

5.9.24 Do not pass sharps directly from hand to hand. Use a receiver or similar receptacle.

5.9.25 Discard all used sharps into a sharps container immediately after completing the procedure. Do not dispose of sharps into anything other than a designated sharps container.

5.9.26 Do not fill sharps bins above the recommended level.

5.9.27 Sharps bins that are not full or that are not being currently used should be kept out of reach of children, with temporary closure mechanisms in place.

5.9.28 Sharps bins in use should be positioned at a height that enables safe disposal by all members of staff and be secured to avoid spillage.

5.9.29 Wear gloves in any situation where contact with blood is anticipated.

5.9.30 Avoid wearing open footwear in any situation where blood may be spilt, or where sharps are used.

- 5.9.31 Facial protection, e.g. masks, goggles or face shields, should be worn wherever splashing of blood or high-risk fluids is anticipated. Prescription glasses are not a suitable alternative to PPE.
- 5.9.32 Clear up any blood spillage promptly and disinfect the area following local policy and COSHH (HSE 2013). Disinfectants and spillage management packs should be used according to manufacturer instructions.
- 5.9.33 Any inoculation incidents should be dealt with promptly, safely and in accordance with local policy.
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5.10 Antimicrobial-resistant bacteria

The standard

All staff implement evidence-based infection prevention and control measures to minimise the spread of antimicrobial-resistant bacteria within healthcare settings.

The rationale

Infections involving antibiotic-resistant bacteria can be life-threatening, and the risk of transmission can be reduced by screening, effective hygiene practices and appropriate use of antibiotics.

Antimicrobial-resistant bacteria cause infections that can no longer be treated by medicines such as antibiotics. The rise of antimicrobial-resistant bacteria is an issue of global concern that requires immediate and effective action to be taken (HM Government 2019). Failure to address this growing threat means that future patients will not have access to effective treatment for infections, and routine surgeries may no longer be possible. It is currently estimated that by 2050, 10 million lives will be lost globally every year due to antimicrobial-resistant infections (HM Government 2019, House of Commons 2018). Effective infection prevention and control is part of the UK's five-year national action plan to tackle antimicrobial resistance (HM Government 2019). Effective prevention and control not only refer to good hygiene practices, but effective screening, monitoring and reporting of antimicrobial-resistant infections, and effective use of antibiotics (Department of Health [DH] 2014, National Institute for Health and Care Excellence [NICE] 2019b, NHS Improvements 2018).

Methicillin-resistant *Staphylococcus aureus* (MRSA) infections are still a focus of antimicrobial stewardship programmes, but there are several other types of infections that are currently being monitored. The frequency of MRSA surgical site infections (SSIs) has declined as a result of targeted infection prevention and control strategies. The proportion of antimicrobial-resistant *Clostridium difficile* (*C. difficile*) infections has risen, and there has been a worrying increase in carbapenem-resistant Gram-negative bacterial infections, which have a high mortality rate (Sartelli et al 2019, Public Health England [PHE] 2018). The overall proportion of enterococci that are resistant to glycopeptide antibiotics has remained stable over the last five years, but continue to be monitored (PHE 2018, PHE 2019).

PHE operates a mandatory enhanced reporting system for bacterial infections, as part of a targeted initiative to reduce these infections. MRSA bacteraemia, methicillin-sensitive *S. aureus* (MSSA) bacteraemia, Gram-negative (*Escherichia coli*, *Klebsiella* spp. and *Pseudomonas Aeruginosa*) bacteraemia and *C. difficile* infections are all currently monitored by PHE under the enhanced reporting system (PHE 2019). PHE also require quarterly laboratory reports, which include the total number of glycopeptide-resistant enterococci (PHE 2019). Carbapenem-resistant Gram-negative bacterial infections are also of growing international concern, as carbapenems are a class of highly effective antibiotics that are normally reserved for severe multi-drug resistant infections (World Health Organisation [WHO] 2019). Part of the UK's five-year national action plan against antimicrobial resistance is to reduce Gram-negative bacterial healthcare-associated infections (HCAIs) by 25% by 2021 (HM Government 2019).

Recommendations for local policy

MRSA/MSSA

In certain circumstances, patients should be screened for MRSA and MSSA. These circumstances include high-risk patients, high-risk procedures or admission to high-risk units. High-risk specialities are defined as vascular, renal/dialysis, neurosurgery, cardiothoracic surgery, haematology/oncology/bone marrow transplant, orthopaedics/trauma, and high-risk units include all intensive care units (adult/paediatric ICUs, neonatal intensive care units, high dependency units, coronary care units). Local risk assessments should be carried out to identify other potentially high-risk units, e.g. provision of specialist services and units with a history of high endemicity of MRSA (DH 2014). Rapid detection and decolonization of *S. aureus* carriers is an important infection prevention and control measure, as it reduces one-year mortality in surgical patients who undergo clean operations (Bode 2014).

- 5.10.1 It is recommended to screen for MRSA in all patients admitted to high-risk healthcare units. It is also recommended to screen for MRSA in all high-risk patients, i.e., those previously identified as colonised or infected by MRSA. Screening should be carried out when the patient is admitted. For some elective procedures, screening may be carried out before the patient is admitted to hospital. Patients known to be previously colonised or infected with MRSA should be tested and pre-emptively isolated pending test results (DH 2014).
- 5.10.2 MSSA is a significant cause of SSIs in the UK. Although MSSA screening is not routinely available in the UK, it may be effective in reducing SSIs (Higgins et al 2018). Screening patients for MSSA should be considered as a strategy for safer healthcare (Bode 2014).
- 5.10.3 Patients who are MRSA positive should undergo suppression/decolonisation therapy and should ideally be isolated until colonisation is no longer present (DH 2014). Organisations that do not have the capacity to isolate patients in this way should have a contingency plan that takes into account local and national guidance and patient safety.
- 5.10.4 Healthcare organisations should consider using nasal mupirocin in combination with a chlorhexidine body wash before procedures where there is a likelihood of *S. aureus* infection. The likelihood of *S. aureus* infection can be influenced by the type of procedure and patient risk factors. The potential impact of the infection should also form part of the assessment. The risk of side effects in preterm infants should be considered (NICE 2019a).
- 5.10.5 Healthcare organisations should monitor use of mupirocin and the incidence of antimicrobial-resistant infections (NICE 2019a).
- 5.10.6 In healthcare organisations with the highest rates of infection, MRSA bloodstream infections (MRSA BSIs) must undergo a formal review. Healthcare organisations should refer to the NHS Improvements for information on which trusts and clinical commissioning groups are required to undergo formal reviews for MRSA BSIs (NHS Improvements 2018).
- 5.10.7 Clear guidance should be available to all staff on the local policy for MRSA/MSSA screening.

Clostridium difficile

C. difficile is one of the most important causes of healthcare-associated diarrhoea, as it is a serious yet preventable infection with a high financial and societal burden (Tschudin-Sutter et al 2018). Elderly and vulnerable patient groups are at a higher risk of developing *C. difficile* infections, and *C. difficile* infections are also associated with the use of antibiotics (NHS improvements 2019). Surgery is also a known risk factor for the development of *C. difficile*. There has recently been a rapid increase in antibiotic-resistant *C. difficile* strains (Sartelli et al 2019).

- 5.10.8 Healthcare organisations should carry out reviews of *C. difficile* infections and outbreaks to ensure that robust systems are in place for the prevention, diagnosis and treatment of *C. difficile* infections (NHS improvements 2019).
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Glycopeptide-resistant enterococci

Glycopeptide/vancomycin resistant enterococci are a serious type of SSI, as vancomycin is a valuable last-defence antibiotic. These bacteria are included in the World Health Organisation's global priority list of pathogens that should be prioritised in research and development (WHO 2017).

9. NHS acute trusts are currently mandated to report their 3-month total incidences of glycopeptide-resistant enterococci blood culture episodes to PHE, on a quarterly basis (PHE 2019).
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Carbapenem-resistant Gram-negative bacteria

Carbapenems are broad-spectrum antibiotics that are highly important in modern medicine, as they are often the last line of treatment for multi-drug resistant Gram-negative bacterial infections (HM Government 2019). Carbapenem-resistant infections are a cause of international concern due to the threat they pose to public health (WHO 2019). Carbapenem-resistant infections will be added to the list of notifiable diseases in laboratory reporting systems as part of the UK's five-year national action plan (HM Government 2019). The European Centre for Disease Prevention and Control (ECDC) recommend timely laboratory reporting, screening and pre-emptive isolation of high-risk patients, alongside high-standard infection control and antimicrobial stewardship programmes (ECDC 2017). PHE's Acute Trust Toolkit provides expert practical advice on the management of carbapenem-resistant infections, which is recommended for both organisations with little experience of these infections and those with high levels of infection (PHE 2013).

- 5.10.10 Upon admission, all patients should be assessed for Carbapenem-resistant infection status. Patient identified as suspected cases, as defined by PHE, should ideally be isolated until three negative rectal samples have been obtained (PHE 2013). Organisations who do not have the capacity to isolate all suspected patients should develop a contingency plan and prepare their own policy assessment based on the local applicability of the PHE toolkit (PHE 2014).
- 5.10.11 Carbapenem antibiotics should not be prescribed without a documented rationale, and the length of the prescription should not be extended beyond local or national guidelines without a documented rationale (HM Government 2019).

Antibiotic resistance

- 5.10.12 Commissioners of healthcare organisations should ensure that a robust antimicrobial stewardship programme is in place across all care settings.
 - 5.10.13 Antimicrobial stewardship programmes should include monitoring and evaluation of antimicrobial prescribing to assess how it impacts local antibiotic resistance and to provide feedback to prescribers regarding prescribing practices and information on patient safety incidents.
 - 5.10.14 Healthcare staff should be able to access training and education about antimicrobial resistance (NICE 2019b).
 - 5.10.15 Antibiotic prophylaxis should not be used routinely for clean non-prosthetic uncomplicated surgery (NICE 2019a).
 - 5.10.16 Give antibiotic prophylaxis for clean surgery involving prosthesis or implant placement, clean-contaminated surgery, and contaminated surgery (NICE 2019a).
 - 5.10.17 Give antibiotic treatment to patients undergoing surgery on a dirty or infected wound (NICE 2019a).
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General considerations

- 5.10.18 Where possible, patients who have suspected or confirmed antibiotic resistant infections/colonisations should be isolated. Organisations that do not have capacity to isolate patients in this way should develop sufficient contingency plans that take into account national guidance, local policy and patient safety.
- 5.10.19 Effective decontamination of the hands after every patient contact significantly reduces the number of pathogenic bacteria and should be consistently implemented as a measure against HCAs (Loveday et al 2014).
- 5.10.20 Alcohol-based hand rubs should be used for hand decontamination except when visibly soiled or when caring for patients with vomiting and diarrheal illness, where soap and water should be used (Loveday et al 2014).
- 5.10.21 Gloves and plastic aprons should be used for contact with infected material from patients. Gloves and aprons should be discarded after contact with each patient and between different procedures on the same patient.
- 5.10.22 Theatre doors should be kept closed to aid ventilation systems.
- 5.10.23 Staff and movement in the theatre should be kept to a minimum. Antimicrobial-resistant bacteria can be dispersed on skin squames, fibres from clothing or carried as dust particles.
- 5.10.24 Patients known to carry antimicrobial-resistant bacteria can be returned to recovery. Infection prevention and control precautions must be applied to prevent cross-transmission to other patients, e.g. use of designated equipment and gloves/plastic aprons for direct contact and standard cleaning procedures.
- 5.20.25 After following the standard post-procedure cleaning protocols for patients colonised infected with antimicrobial-resistant microorganisms, further procedures can continue. Daily disinfection of high-touch surfaces may reduce contamination of staff's hands with pathogens such as *C. difficile* and MRSA (Health Protection Scotland [HPS] 2016).
- 5.20.26 Dust should be removed from the equipment in the theatre before the equipment is removed, covered and stored.
- 5.10.27 It is not necessary to place patients with MRSA at the end of a list of procedures. Following the standard recommended cleaning procedures and sufficient number of air changes are sufficient to minimise the risk of transmission to other patients (Woodhead et al 2002).

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5.11 Transmissible spongiform encephalopathy

The standard

There are systems in place that minimise the risk of transmission of transmissible spongiform encephalopathy agents in the perioperative environment.

The rationale

Transmissible spongiform encephalopathies are fatal diseases that can be spread through surgical instruments, transplants and blood transfusions. Effective infection prevention and control measures can reduce the risk of transmission.

Transmissible spongiform encephalopathies (TSEs) are rare and fatal diseases that involve progressive neurodegeneration. They are a unique type of infection caused by unconventional infectious agents called prions. The most common TSE is Creutzfeldt Jacob Disease (CJD). Other TSEs include variant CJD (vCJD), and fatal familial insomnia (FFI). TSEs have been shown to be transmitted between individuals via instruments used in surgical procedures, as well as during transplants and blood transfusions. Unlike bacterial or viral infections, TSEs are caused by agents that are resistant to conventional decontamination processes, which makes them difficult to remove from reusable surgical instruments, including endoscopes, laryngoscopes and other reusable medical devices (School of Health and Related Research 2018).

TSEs can be transmitted during invasive procedures involving tissues infected with prions. Only certain tissues are at a high-risk of containing prions, which include tissues from the brain, retinal tissue, spinal cord, and some glands. Previous cases of healthcare-related transmission of TSEs have involved human transplants of pituitary gland hormones and connective tissue from the central nervous system (Public Health England [PHE] 2015). Contact with small volumes of blood or other bodily fluids such as saliva and cerebrospinal fluid are considered low risk for TSE transmission. Transfusion of large volumes of blood carries a risk of transmission, and three cases of TSE transmission by blood transfusion have been documented to date. There is currently no evidence that TSEs are spread from person-to-person by close contact (PHE 2015, Urwin et al 2015).

An important part of infection control and prevention of TSEs in the healthcare environment is ensuring that processing of reusable surgical instruments is adequate to minimise the risk of prion transmission. Traditionally, guidance on cleaning instruments to reduce the risk of TSE transmission focused on removing visible contamination. Updated guidance recommends that protein levels on the surface are measured and kept below a minimum value. Guidance from the Department of Health on preventing the health-care related spread of TSEs has been updated with specific guidance on the decontamination of surgical instruments. Hospitals should refer to the Health Technical Memorandum 01-01 to ensure that surgical instruments are decontaminated to the accepted minimum standards and that recommended policy is followed for reducing the risk of TSE transmission in the perioperative environment (Department of Health [DH] 2016). A complete set of guidance on managing the risk of TSE transmission, including during ophthalmological procedures, can be obtained from PHE (PHE 2017). Additional guidance on the management of medical devices can be obtained from The Medical Devices and Healthcare products Regulatory Agency (MRHA 2015).

Specific regulations on working with biological agents such as those causing TSEs are detailed by The Control of Substances Hazardous to Health Regulations 2002 (COSHH) (HSE 2013). NHS bodies are required to register with the Care Quality Commission (CQC) under the requirements of the Health and Social Care Act 2008. CQC requires healthcare organisations to protect patients and staff from healthcare-associated infections (HCAs), including TSEs (PHE 2015).

Recommendations for local policy

Infection and prevention control measures must be implemented for high-risk procedures to prevent transmission of TSEs. High-risk procedures are considered to be procedures involving invasive procedures on infective tissues of patients with definite, possible or increased risk of TSEs.

- 5.11.1 Single-use instruments must be used wherever possible during high-risk procedures.
- 5.11.2 Reusable surgical instruments used on high-risk tissues should be washed to remove gross contamination and kept moist until they are decontaminated by processing at a sterile services department, after which they may be quarantined for re-use on the same patient only, unless the diagnosis of a TSE has been positively excluded (PHE 2016). A tracking system for contaminated instruments should be in place. Specific infection and prevention control measures should also be followed during endoscopy and ophthalmology procedures for high-risk cases. Healthcare organisations should refer to PHE for further information on how high-risk TSE procedures are classified (PHE 2015).
- 5.11.4 Surgical instruments used on patients confirmed to have a TSE should be incinerated, along with the box it was stored in during quarantining (PHE 2016).
- 5.11.3 Reusable surgical instruments used on low-risk tissues should be decontaminated and returned for re-use (PHE 2016).
- 5.11.4 Reusable surgical instruments should be kept moist until they have been decontaminated, to prevent drying of infectious proteins. This is particularly important during any delays in decontamination (DH 2016).
- 5.11.5 The maximum acceptable level of protein contamination after decontamination is 5µg per instrument side. A lower level is necessary for neurosurgical instruments, or for instruments coming into contact with high-risk tissues. Protein levels should be tested daily, ideally using process challenge devices (DH 2016).
- 5.11.6 Staff must have specific training before taking part in high-risk TSE procedures (PHE 2015).
- 5.11.7 Wherever possible, high-risk TSE procedures should be carried out at the end of the operation list. (PHE 2015).
- 5.11.8 Personal protective equipment (PPE) should be worn for high-risk TSE procedures. This PPE should be disposable and single-use. Disposal should be carried out in line with local policy.
- 5.11.9 It is recommended that a 'key worker' should be designated for coordinating the care of a patient diagnosed or likely to be diagnosed with a TSE (PHE 2015).
- 5.11.10 Healthcare organisations should refer to PHE for information on how high-risk TSE patients are classified (PHE 2015).
- 5.11.11 All organisations should have a local policy for the management of patients with definite, possible or increased risk of TSEs. This policy should include clearly defined roles and responsibilities and lines of communication.
- 5.11.12 All staff working in the perioperative environment should be familiar with their organisation's policy for TSE management. Staff should be familiar with the policy for managing medical devices and decontamination equipment after use on patients who are definite, probable or possible TSE cases. Staff should also be familiar with classification of high-risk patients and procedures.
- 5.11.13 Where in doubt advice should be sought from the local infection prevention and control team or decontamination lead.

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