AfPP
PROGRESSING SAFER SURGERY
The Association for Perioperative Practice

The Association for Perioperative Practice

Infection control

Patient skin preparation

@SaferSurgeryUK

afpp.org.uk • 01423 881 300

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 though 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 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).

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)

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 Selected antiseptic products should be supplied in ready-to-use, single-use containers, to reduce risk of infection from improper antiseptic use and contamination associated with multiple-use containers (Association of periOperative Registered Nurses [AORN]2019. FDA (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 Human Medicines Regulations 2012. 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 There are two factors which contribute to the effectiveness of antiseptic skin preparation, type of antiseptic solution, and method of application (Dumville et al 2013)

5.7.12 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).

5.7.13 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).

5.7.14 When using an alcohol-based solution before diathermy, avoid pooling and ensure skin is allowed to dry completely after every application (NICE 2019).

5.7.15 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).

5.7.16 Do not use wound irrigation or intracavity lavage to reduce the risk of SSIs (NICE 2019).

5.7.17 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).

5.7.18 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).

5.7.19 Methylene blue 1% can be used to mark or stain the skin.

5.7.120 Skin antiseptic solutions should be used in accordance with manufacturer instructions. Adhere to manufacturer guidance on the temperature and warming of solutions.

5.7.21 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.

5.7.22 Solutions should be disposed of in accordance with local policy.

5.7.23 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.

5.7.24 Open-systems, i.e. injectable medication, 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 (NHS England 2015), as well as the possibility of bacterial contamination. (NHS Improvement 2016, Open Government License [OGL] 2016).

5.7.25 Skin antiseptic solution should be removed from the surgical field before invasive procedures begin (OGL 2016).

5.7.26 Staff should undergo training and competency assessment in surgical skin preparation techniques before carrying out any surgical skin preparation.

5.7.27 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.

5.7.28 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.

5.7.29 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).

5.7.30 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, swab and holder for each repetition of skin preparation.

5.7.35 Use a clean applicator, swab and holder 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. Solutions must not pool around the eyes. Solutions must not enter the inner ear, as they can cause sensorineural deafness. For disinfection 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.

References

Association for Perioperative Practice, 2015.
MHRA advice on the use of Hydrogen Peroxide in surgery.
[Online.] Available: https://www.afpp.org.uk/news/MHRA-Hydorgen-Peroxide-advice.
[Accessed 15.08.19]

Association of periOperative Registered Nurses, 2014.
Guideline for Preoperative Patient Skin Antisepsis.

Association of periOperative Registered Nurses, 2017.
Guideline for Cleaning and Care of Surgical Instruments.

Badia JM, Casey AL, Petrosillo N, Hudson P, Mitchell S, Crosby C, 2017.
The impact of surgical site infection on healthcare costs and patient outcomes: A systematic review of the economic and quality of life burden associated with surgical site infections in six European countries,
Journal of Hospital Infection, 96(1), 1-5.

Casey AL, Badia JM, Higgins A, Korndorffer J, Mantyh C, Mimoz O, Moro M, 2017.
Skin antisepsis: it's not only what you use, it's the way that you use it,
Journal of Hospital Infection, 1;96(3): 221-2.

Rocos B, Donaldson LJ, 2012.
Alcohol skin preparation causes surgical fires,
The Annals of The Royal College of Surgeons of England, 94(2):87-9.

European Chemicals Agency, 2018.
Guidance on the Biocidal Products Regulation,
Volume II Efficacy - Assessment and Evaluation (Parts B+C).

EU Directive, 2017.
Regulation (EU) 2017/745 of the European parliament and of the council on medical devices.

Flanagan M, 2013.
Controlling bacterial burden: wound cleansing,
[In:] Wound Healing and Skin Integrity: Principles and Practices.

General Medical Council, 2014.
Good practice in prescribing and managing medicines and devices.

Health and Safety Executive, 2013.
Control of substances hazardous to health. The Control of Substances Hazardous to Health Regulations 2002 (as amended). Approved Code of Practice and guidance.

The Human Medicines Regulations, 2012 https://www.legislation.gov.uk/uksi/2012/1916/contents/made [Accessed December 2020]

Jolivet S and Lucet JC, 2019.
Surgical field and skin preparation,
Orthopaedics & Traumatology: Surgery & Research, 105(1), 1-6.

Lai P, Coulson C, Pothier DD, Rutka J, 2011,
Chlorhexidine ototoxicity in ear surgery, part 1: review of the literature.
Journal of Otolaryngology: Head & Neck Surgery, 40(6).

Medicines & Healthcare products Regulatory Agency, 2014a.
Chlorhexidine solutions: reminder of the risk of chemical burns in premature infants.

Medicines & Healthcare products Regulatory Agency, 2014b.
Off-label use of a medical device.

Medicines & Healthcare products Regulatory Agency, 2014c.
Hydrogen peroxide: reminder of risk of gas embolism when used in surgery,
[Online.] Available: https://www.gov.uk/drug-safety-update/hydrogen-peroxide-reminder-of-risk-of-gas-embolism-when-used-in-surgery
[accessed 07.11.19].

Medicines & Healthcare products Regulatory Agency, 2016.
A guide to what is a medicinal product.

National Institute for Health and Care Excellence, 2019.
Surgical site infections: prevention and treatment.

NHS Improvement, 2016.
Patient Safety Alert: Restricted use of open systems for injectable medication.

Open Government License, 2016.
Patient Safety Notice: Risk of death or severe harm due to inadvertent injection of skin preparation solution.

Sandle T, 2016.
Standards and controls for skin disinfection,
The Clinical Services Journal, 15 (2), 25-28.

Tanner J, Dumville JC, Norman G, Fortnam M, 2016,
Surgical hand antisepsis to reduce surgical site infection.
Cochrane Database of Systematic Reviews, (1).