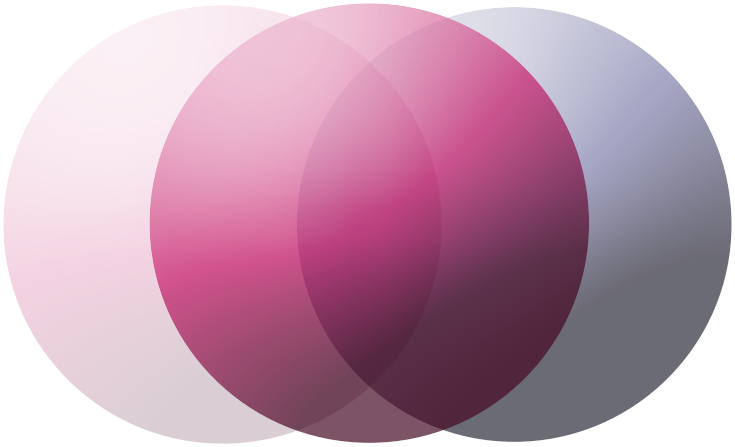
WUK BPS

Best Practice Statement

Post-operative wound care: reducing the risk of surgical site infection

2020



SSI and other surgical wound complications

Wound healing process and the role of dressings

Patient risk factors

Antimicrobial stewardship practices

Strategies to reduce SSI risk

Wounds UK

BEST PRACTICE STATEMENT: POST-OPERATIVE WOUND CARE – REDUCING THE RISK OF SURGICAL SITE INFECTION

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Wounds UK
A division of Omniamed,
108 Cannon Street,
London
EC4N 6EU, UK
Tel: +44 (0)20 3735 8244
Web: www.wounds-uk.com

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EXPERT WORKING GROUP:

- **Ibby Younis,** Consultant Plastic and Reconstructive Surgeon, University College London Hospital (UCLH) Skin Cancer Multi-Disciplinary Team (MDT)
- **Fiona Downie,** Nurse Consultant for Tissue Viability, Papworth Hospital NHS Foundation Trust; Senior Lecturer, Faculty of Health, Education, Medicine and Social Care, Anglia Ruskin University
- **Jacky Edwards,** Nurse Consultant in Burns, Manchester University NHS Foundation Trust; Honorary Senior Lecturer, Manchester University; Chair of Surgical Wound Stream of National Wound Care Strategy
- **Martin Kiernan,** Visiting Research Fellow, Richard Wells Research Centre, University of West London; Director of Clinical Research and Education for Gama Healthcare
- **Melissa Rochon,** Quality & Safety Lead for Surveillance, The Royal Brompton and Harefield NHS Foundation Trust
- **George Smith,** Consultant Vascular Surgeon, Hull University Teaching Hospitals NHS Trust; Senior Lecturer and Honorary Consultant in Vascular Surgery, Hull York Medical School

Introduction

Guide to using this document

This document was developed with the overall objective to:

- Raise awareness of surgical site infection (SSI) surveillance and clarify areas for improvement
- Promote antimicrobial stewardship and highlight issues related to antibiotic resistance
- Develop strategies for the prevention of post-operative SSI by providing practical tips for clinicians and patients.

The document was derived from a 1-day meeting of the Expert Working Group that was convened to discuss post-operative SSI prevention strategies.

To emphasise the importance of patient involvement, each Best Practice Statement (BPS) is accompanied by a related Patient Expectation that supports communication with the patient and explains what the patient should expect from their care. All patient communication should take into account the individual's needs, concerns, readiness to learn, preferences, barriers and limitations.

The Expert Working Group recognises that some elements of best practice may be difficult to achieve in some care settings. However, the hope is that, by setting out what is best practice and the processes required, clinicians may be supported in the quest for any organisational changes necessary for delivery of best practice.

A surgical site infection (SSI) is an infectious process present at the site of surgery (Stryja et al, 2020). SSIs are the third most commonly reported type of healthcare-associated infection (HCAI; Hegarty et al, 2019) as well as the most costly (World Health Organization [WHO], 2016), representing a burden to individuals, their families/carers and health services.

If the infection becomes systemic, SSIs can be potentially life-threatening, resulting in significant patient morbidity and mortality (WHO, 2016).

Rates of inpatient SSI have been established by high-quality studies and prospective surveillance. However, incidence rates of SSI in the community are less clear. This may be due to the trend for earlier hospital discharge, or lack of reporting and documentation (Public Health England [PHE], 2019). Under-reporting, or reporting of composite endpoints such as 'wound complications' or 'surgical site incidences' (e.g. wound breakdown, seroma, haematoma), means that post-surgical complications may not be captured in hospital-based surveillance studies, particularly if infections are relatively minor and are not reported by the patient to their GP, or by the GP to the surgical team. Therefore, the true cost of SSIs to the patient, family and organisation may be grossly under-estimated in the community (Oliveira et al, 2007).

Research suggests that standardised education is lacking for clinicians involved in dressing surgical wounds (Eskes et al, 2014). It is estimated that nearly 50% of SSIs could be prevented by following evidence-based guidelines (Meeks et al, 2011; Center for Disease Control, 2016).

This document focuses on post-operative strategies specifically aiming to prevent SSI, rather than other surgical site incidences or complications.

BPS 1: SSI and other surgical wound complications

All clinicians involved in the care of wounds, including primary care and community staff, should understand the clinical criteria and risk factors for SSI.

Best Practice Statement

Patients should be advised of their risk of developing surgical complications, including SSI, whether or not their surgery included an implant. Post-surgery, the team should explain the wound closure material used and the related after-care: this may be absorbable or non-absorbable sutures, surgical clips and/or surgical glue adhesive. The normal healing process for the patient's wound type should be explained, along with expected changes in appearance over time. The patient should be informed when and where to seek help and advice in case of concerns. If the wound appears infected or breaks apart, the patient should seek immediate medical attention.

Patient expectation

SURGICAL COMPLICATIONS

All surgical wounds are at risk of developing complications, such as surgical wound dehiscence (SWD), seroma, haematoma, delayed healing, poor quality or abnormal scar formation, incisional hernia and SSI. Surgical wounds can be divided into four different classifications, which can determine their risk of post-operative SSI; see Box 1 (NICE, 2019).

SWD is the separation of the margins of a closed surgical incision, with or without exposure or protrusion of underlying tissue, organs or implants. Separation may occur at single or multiple regions, or involve the full length of the incision, and may affect some or all tissue layers.

SWD increases the risk of SSI and vice versa (Figure 1). Although there is a link between the two, a dehisced surgical incision may or may not display clinical signs and symptoms of infection, and not all infected or inflamed wounds dehisce (WUWHS, 2018).

DEFINITIONS OF SSI

An SSI is a post-surgical infection that can affect either the incision or deep tissue at the operation site (Center for Disease Control, 2016; PHE, 2019). There are three types: superficial incisional, deep/open incisional and organ/space incisional.

Superficial incisional infection

Infection occurring in the skin and subcutaneous tissue within 30 days of a procedure, or up to 1 year for patients receiving an implant. Clinical signs and symptoms for superficial incisional infection are listed in Table 1 (Stryja et al, 2020).

Deep/open incisional infection

Infection within 30 or 90 days of procedure involving the fascial and muscle layers. Clinical signs and symptoms for deep/open incisional infection are listed in Table 1 (Stryja et al, 2020).

Organ/space incisional infection

Infection within 30 or 90 days of procedure involving any part of the anatomy, other than the incision, that is opened or manipulated during the surgical procedure; for example, a joint or the peritoneum. Clinical signs and symptoms for organ/space incisional infection are listed in Table 1 (Stryja et al, 2020).

Any suspected infection should be confirmed using the clinician's judgement, or positive culture from a wound sample if the wound was deliberately opened. Microbiology criteria require pus cells to be present in addition to a positive culture from wound samples.

Box 1. Surgical wound classifications (NICE, 2019)

Clean: an incision in which no inflammation is encountered in a surgical procedure, without a break in sterile technique, and during which the respiratory, alimentary or genitourinary tracts are not entered (e.g. surgical wound following primary closure – hernia, varicose veins)

Clean–contaminated: an incision through which the respiratory, alimentary, or genitourinary tract is entered under controlled conditions but with no contamination encountered (e.g. surgical wound at risk of infection due to location – elective cholecystectomy)

Contaminated: an incision undertaken during an operation in which there is a major break in sterile technique or gross spillage from the gastrointestinal tract, or an incision in which acute, non-purulent inflammation is encountered (e.g. surgical wound – elective colorectal). Open traumatic wounds that are more than 12 to 24 hours old also fall into this category

Dirty or infected: an incision undertaken during an operation in which the viscera are perforated or when acute inflammation with pus is encountered (e.g. emergency surgery for faecal peritonitis), and for traumatic wounds if treatment is delayed, there is faecal contamination, or devitalised tissue is present (e.g. burns, diabetic foot ulcers – drainage of abscess, faecal peritonitis).

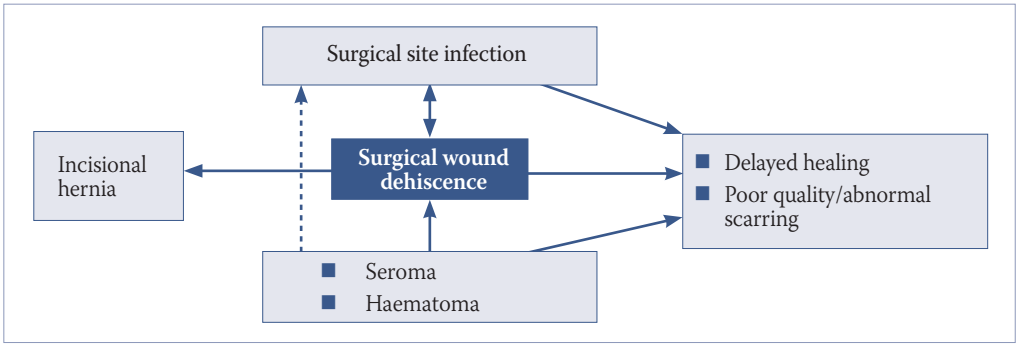

Figure 1: The relationship between different types of post-operative surgical site complication (WUWHS, 2018)

The following are not considered to be related to SSI:

- Inflammation in response to surgery (early post-operative period)
- Mechanical ('clean') dehiscence
- Erythema ('discolouration' associated with the patient's own healing process)
- Stitch abscess.

The signs and symptoms of inflammation can be very similar to that of infection (Table 1). It should be noted that fever in the first 48 hours after surgery is unlikely to be due to SSI (Stevens et al, 2014; WUWHS, 2018).

Early diagnosis of SSIs is key to avoid further deterioration and complications, and should be made on the basis of clinical signs and symptoms. These signs and symptoms may appear while the patient is in the acute or community setting.

Table 1. Signs and symptoms of superficial, deep/open and organ/space incisional infection (adapted from Stryja et al, 2020)

Superficial incisional infection	Deep/open incisional infection	Organ/space incisional infection
■ Increased pain and tenderness at the surgical site ■ Localised swelling and induration ■ Localised heat and redness ■ Purulent drainage ■ Cellulitis limited to the wound and adjacent soft tissues ■ Evident superficial wound abscess	■ Increased pain at the surgical site ■ Spreading induration and swelling ■ Erythema and heat at the surgical site ■ Purulent drainage from the incision ■ Spreading cellulitis at the surgical site ■ Evident deep wound abscess or fasciitis ■ Separation of the edges of incision, exposing the deeper tissues ■ Unexpected post-operative fever accompanied by increasing wound pain and/or wound dehiscence ■ Pathological blood test findings (elevated C-reactive protein, white blood counts, erythrocyte sedimentation rates, pro-calcitonin)	■ Purulent drainage from a drain placed through the skin into the organ or body space ■ Organ or body space abscess diagnosed by radiological or histopathological examination ■ Evidence of infection involving the organ or body space seen on direct examination during surgery ■ Post-operative fever ■ Positive result of blood cultures, deep tissue biopsies, surgical sampling or pathological blood test findings (as in deep SSI)

BPS 2: Wound healing and the role of dressings

All clinicians involved in the care of wounds, including primary care and community staff, should understand the wound healing process of a surgical wound and the role of dressings.

Best Practice Statement

Before patients leave hospital, they should be provided with after care advice, including the signs and symptoms of SSI, relevant contact details and, if required, sufficient dressings (e.g. 3-day supply) to manage until the first nurse appointment, along with any self-care guidance. For some types of surgery, a nurse appointment may not be required if sutures do not require removal; therefore, patients should be able to contact their GP practice or surgical team (depending on local policy) if there are signs suggesting infection. The discharging organisation may provide a photograph of the wound at discharge, so patients and clinicians can monitor changes to the surgical site.

Patient expectation

WOUND HEALING PROCESS

Wound closure occurs in one of three ways (Myers, 2008):

- **Primary wound closure (healing by primary intention)**: describes the healing of wounds with minimal tissue loss that are amenable to approximation of wound edges.
- **Secondary wound closure (healing by secondary intention)**: describes the healing of a wound in which the wound edges cannot be approximated.
- **Delayed primary closure (healing by tertiary intention)**: describes healing that is a combination of healing by primary and secondary intention.

Wound healing, leading to closure, is a complex process with three phases (Table 2), with the third stage starting at up to 21 days post-surgery (Son and Harijan, 2014). While most surgical wounds will heal by primary intention, some will heal by secondary intention, usually because the wound has intentionally been left open or has dehisced following primary closure (Salcido, 2017).

The appearance of a healing surgical wound and resulting scar will change over time, which is the normal process of wound healing; during the first 10 days, a scar may appear red and raised (Son and Harijan, 2014).

ROLE OF DRESSINGS

In order to reduce SSI risk, it is now generally accepted that surgical dressings should be kept undisturbed for a minimum of 48 hours after surgery, and up to 4 days if possible, unless leakage occurs or symptoms change (Stryja et al, 2020). This is reflected in various post-operative care plans. The purpose of the dressing should be communicated to patients, families and carers: to cover and protect the wound from external contaminants, reduce the risk of infection and support wound healing.

Photo at Discharge initiative

The majority of SSIs present after discharge (Wolberg et al, 2016). The Photo at Discharge (PaD) initiative provides a colour picture of the patient's wound, accompanied by assessment and care advice, which is given to the patient and carer(s) and healthcare providers (https://www.nice.org.uk/sharedlearning/photo-at-discharge-pad-improving-information-to-patient-and-carers-reduces-readmission-for-incisional-surgical-site-infection). This aims to improve the link between acute and community care, as the baseline image can be helpful to identify whether infection has developed. The photo is uploaded to the electronic patient record, to aid remote multidisciplinary review of wounds, improve continuity of care, and potentially contribute to antibiotic stewardship, by improving sensitivity of SSI detection, thus reducing the risk of overtreatment (Sanger et al, 2016). Initially used for patients following cardiac surgery, this initiative is readily transferable to other surgery types under surveillance. PaD has received broad support from patients and carers as a shared record of care and means of communication and information-sharing (Rochon and Morais, 2019).

Table 2. Stages of wound healing and accompanying patient expectations

Stages	Patient expectation of wound healing
Inflammatory phase	It is normal to see some redness/inflammation at this stage, as the immune system destroys bacteria and removes debris. This is essential for the next stage in healing. If signs and symptoms of inflammation persist, or the wound becomes painful or oozes pus/purulent exudate, medical attention must be sought.
Proliferative phase	Once clean, the wound begins to repair by filling the wound, contracting at the edges and new skin (epithelialisation) covering the surgical site.
Maturation phase	New tissue will gain strength and flexibility and can last up to 2 years.

BPS 3: Patient risk factors of SSI

Before surgery, the patient should be assessed for the pre-operative, intra-operative and post-operative risk factors of SSI and other surgical complications. After surgery, the patient risk factors should continue to be reviewed and managed.

Best Practice Statement

Patients should expect to have a pre-operative assessment where the surgical team will discuss their SSI risk. Patients may be asked to modify their lifestyle temporarily to reduce their risk. This may include, for example, smoking cessation, stopping taking particular medication, abstaining from alcohol or reducing weight. After surgery, patients should expect to continue to follow instructions to manage their SSI risk.

Patient expectation

RISK FACTORS

The major, moderate and minor risk factors for SSI are presented in Table 3. Box 2 includes wound and patient factors that may suggest there is a lower risk of SSI development (WUWHS, 2018).

Box 2. Factors that may suggest low risk for SSI (WUWHS, 2018)

- Tension-free surgical wound
- Primary closure surgical wound
- No fat necrosis
- Patient does not possess major or moderate risk factors for SSI.

Patient risk factors explained

Obesity: Morbidly obese patients (BMI ≥40 kg/m^2) have a significantly longer mean operative time and higher mean intra-operative blood loss, which may contribute to high risk of SSI (Jibodh et al, 2004). Surgery often requires larger incisions for better access, and can be complicated by increased fat, which is poorly vascularised. This can result in reduced oxygen and nutrients to the healing tissues, which can be compounded by the patient's nutritional status. Increasing BMI is also linked to changes in skin microbiota (Rood et al, 2018).

Diabetes mellitus: Abnormal glycaemia has a multifactorial negative effect on the cells involved in wound healing (Wukich et al, 2011). Hyperglycaemia as a result of diabetes can also weaken the patient's immune system. Resultant neuropathy and reduced blood flow to the extremities can increase infection risk and also reduce the tensile strength of the wound.

Current or recent smoking: Smoking compromises the immune system and increases susceptibility to infections; smoking can also lead to an iron imbalance, and bacteria thrive on iron. Reduced oxygenation to tissues inhibits the cell activity required for wound healing processes, increasing the risk of complications (Kong et al, 2017).

Emergency surgery: For emergency surgery, complete pre- and peri-operative infection prevention strategies or risk factor management may not be possible due to time constraints. These patients are often very physiologically unwell (i.e. acidosis, hypoxia), which interrupts the normal immune cell response post-surgery (Wingert et al, 2016).

Age >65 years: Older age can increase SSI risk due to an increase in comorbidities and a decrease in immune activity with increasing frailty (Wingert et al, 2016).

Extended duration of surgery: Longer operative times are associated with higher risk factors and more complex surgeries. Longer exposure of the internal cavity to air-borne microbes increases the risk of contamination. It should be noted that the natural ingress, or settling, of bacteria during surgery does not trigger the same inflammatory response as acute, gross contamination (Berbari et al, 2012).

Inadequate surgical closure: This means the wound is left open and exposed to air-borne microbes that may cause contamination. Gaps in surgical closure may lead to inappropriate wound tension, which can reduce perfusion. Poor use of wound closure material can provide a focus for bacteria (Blencowe et al, 2019). Inadequate closure of dead space allows collection of seroma or haematoma within the wound.

Peri-operative hypothermia: This reduces the body's homeostasis and is linked with prolonged recovery from anaesthesia and a longer length of hospital stay (PHE, 2019). Hypothermic patients have reduced blood supply to the wound site due to peripheral vasoconstriction, which inhibits wound healing processes.

Surgery type: Colorectal surgery is associated with a high rate of SSI due to frequency of bowel flora; vascular surgery is associated with a high rate of SSI due to frailty and multiple comorbidities of the patient group (PHE, 2019). For gynaecological and obstetric-related surgery, the extent of SSIs and surgical complications may be underestimated. Under-reporting may be due to patients being managed in the

community, as they often do not return to obstetrics if complications occur. This group is at high risk of infection due to the location of the wound, the activity of the mother and the potential misconception that caesarean and other obstetric-related wounds are minor. NICE (2019) recommend that sutures rather than staples should be considered to close the skin after caesarean section to reduce the risk of superficial wound dehiscence.

Table 3. Main risk factors for SSI, which may vary depending on surgery type (adapted from WUWHS, 2018)

Category	Modifiable patient-related	Pre-operative	Peri-operative	Post-operative
Major	■ BMI ≥35.0kg/m^2 ■ Diabetes mellitus ■ Current or recent smoking	■ Emergency surgery ■ Age >65 years	■ Extended duration of surgery ■ Inadequate surgical closure ■ Perioperative hypothermia	■ Mechanical pull on incisional wounds ■ Patient/family touching the wound
Moderate	■ COPD ■ Malnutrition: hypoalbumin-aemia (serum albumin <3.0g/dl) ■ Anaemia ■ BMI 30.0–35.0 kg/m^2 ■ Alcohol abuse	■ Male gender ■ ASA Physical Status ≥2 ■ Previous wound healing problems ■ Immunosupp-ression ■ Long-term steroid use ■ Malignant disease ■ Chemotherapy ■ Radiotherapy ■ Uraemia ■ Peripheral vascular disease ■ Suboptimal timing or omission of prophylactic antibiotics	■ Blood transfusion ■ High wound tension closure ■ Tissue trauma/ large area of dissection and/or undermining	■ Failure to wean from ventilator ■ One or more other surgical complications ■ Premature suture removal
Minor	■ BMI 25.0–29.9 kg/m^2 ■ Congestive cardiac failure ■ Cardiovascular disease	■ Extended pre-operative hospitalisation or residency in a nursing home	■ Failure to obliterate dead space	■ Trauma across incision

ASA=American Society of Anaesthesiologists; BMI=body mass index; COPD=chronic obstructive pulmonary disease

BPS 4: Initiatives to reduce SSI incidence in the UK

Comprehensive, standardised SSI surveillance programmes should be encouraged and supported by all members of the MDT who work within wound and surgical care. Where surveillance activities are limited by availability of resources, surveillance should be targeted at the surgical specialities that present most risk.

Best Practice Statement

Patients should be informed that their care may be audited, and their wound examined, for the purpose of SSI surveillance. Patients may be able to access the infection rates of the hospital, depending on the surgery type and hospital protocols.

Patient expectation

Various national programmes and initiatives are in place to report and reduce SSI incidence. However, an agreed, robust, validated surveillance system, using uniform definitions for SSI and other surgical site complications, needs to be developed (WUWHS, 2016).

PUBLIC HEALTH ENGLAND SSI SURVEILLANCE

Well-organised surveillance and infection control programmes, including feedback of infection rates to surgeons, have been associated with significant reductions in SSI (Hughes, 1988). Implementation of SSI surveillance can help to reduce SSI rates simply by raising awareness and making staff conscious of being monitored: scrutiny encourages best practice.

A number of national SSI surveillance systems, such as the Public Health England Surgical Site Infection Surveillance System (SSISS) in England and similar schemes in Wales and Northern Ireland, provide standardised surveillance methods that enable hospitals to benchmark their rates of SSI (PHE, 2013). The aim is to improve patient outcomes by providing hospitals with their rates over time. Measuring rates against a national benchmark can both inform and influence practice, and has the potential to minimise the risk of SSI. Significant reductions in rates of SSI have been demonstrated in hospitals that participate in these benchmarking schemes.

Data is submitted to PHE by staff trained in the PHE protocol, and is managed via error and validation rules. The majority of surgical categories (excluding orthopaedics), submit surveillance data on a voluntary basis. Therefore, caution should be applied when interpreting and comparing the results of local surveillance for SSIs compared to other local, national or international rates. It is likely that hospital-based surveillance systems underestimate SSI rates, especially as SSIs can become apparent after discharge. Hospitals should be encouraged to participate in post-discharge surveillance. This is an important strategy to improve reporting and data completeness.

GETTING IT RIGHT FIRST TIME AND NHS IMPROVEMENT

Getting It Right First Time (GIRFT) works alongside NHS Improvement to improve the quality of care within the NHS by reducing unwarranted variations.

In 2017, the 95 trusts in England participated in the first GIRFT Surgical Site Infection National Survey across 13 surgical specialities. Despite some concerns over methodology and duplication of SSI datasets, GIRFT provided some interesting insight into outcomes (sepsis, reoperation and mortality) and costs (unadjusted data on avoiding delayed discharges and readmissions) associated with SSI, as well as identifying significant levels of variation in SSI rates reported by surgical units, both at a specialty and procedure level (GIRFT, 2018).

NATIONAL WOUND CARE STRATEGY PROGRAMME

Following the results of the seminal paper by Guest et al (2015), the Burden of Wounds Study, the National Wound Care Strategy Programme (NWCSP) was created to develop strategies to improve wound care in England. 'Surgical wounds' is one of the clinical workstreams and, at the time of writing, the NWCSP is working to generate a generic clinical navigation tool to form the basis for specialist customisation and referral pathways according to local protocols. The NWCSP will also make recommendations to support optimal implementation of existing guideline recommendations for preventing and treating post-surgical wound complications (e.g. NICE, 2019).

INITIATIVES IN ENGLAND AND WALES

NHS Procurement Strategy and NHS Supply Chain

In 2015, Lord Carter's report into efficiency and productivity in the NHS identified unwarranted variation in procurement across the NHS, resulting in the need to improve operational efficiencies to transform a fragmented procurement landscape.

The NHS Supply Chain is designed to help the NHS deliver clinically assured, high-quality products for the best value. In wound care, the aim is to create a national wound care formulary, in order to reduce costs nationally and reduce variation in care. A similar procurement system exists in Scotland for acute services.

While the expert panel agrees that decision-making should be based on best available evidence and price, there are concerns that this will stifle competition in the dressing market, stop innovation, and impact greatly on patient welfare, as well as impact on add-on education from companies, echoing an open letter from Harding et al (2019), highlighting 'major concerns regarding the generic product specification for wound care'.

DRIVE FOR CHANGE: CALL TO ACTION

Wound care requires a multidisciplinary team (MDT) approach and, as such, a unified MDT voice is required in order to implement change in SSI risk reduction. Sharing SSI rates with all staff may be beneficial. This could be achieved via simple measures, such as listing SSI rates as a standing agenda item for all MDT meetings.

A united approach that includes tissue viability and other specialist nurses, podiatrists, medics, consultants and surgeons from varied backgrounds (i.e. dermatology, gynaecology, plastic surgery, vascular, cardiothoracic, abdominal surgery) is required to drive change at a national level.

BPS 5: Antimicrobial stewardship practices: use of antimicrobials and antibiotics

Antimicrobial stewardship practices should be implemented, to prevent the misuse and overuse of antibiotics, in order to reduce antimicrobial resistance.

Best Practice Statement

Antibiotics are not always necessary, so patients should not expect to be prescribed antibiotics. Patients should expect that the clinician managing their care will explore practical measures to manage infection or risk of infection. This may involve the use of a topical antimicrobial such as DACC, iodine, silver or PHMB, in the form of a cream, ointment or dressing, depending on the wound, surgery type and the severity of any infection. This should be in conjunction with other infection prevention strategies, such as cleaning and hand hygiene.

Patient expectation

Antimicrobial stewardship is a multi-faceted approach that includes the optimal selection, dosage, and duration of antimicrobial treatment. The aim is to achieve the best treatment outcome, through infection prevention and management with minimal toxicity to the patient and minimal impact on subsequent resistance. There is a general misconception that any surgical complication (e.g. SWD, seroma) is synonymous with infection (WUWHS, 2018), which leads to unneccessary antimicrobial use and subsequent resistance.

Antimicrobial stewardship to reduce unnecessary antimicrobial use in wound management includes accurate identification of wound infection and simple infection prevention strategies (i.e. good hand hygiene, waste management, comprehensive documentation and management of the patient environment). See Box 4 (Wounds UK, 2020).

MICROBIOLOGICAL SAMPLING

The role of sampling and microbiological culture in the diagnosis of SSI is contentious. The role of a swab is to guide antibiotic selection against organisms causing clinical signs of infection, rather than to determine whether infection is present or not. Evidence suggests that there is an over-reliance on sampling, especially for superficial SSI, as swabbing may only show surface bacteria and not those in the deeper tissue. Additionally, the gene expression of bacteria has been shown to change once bacteria are removed from the wound environment; therefore, swab results may not accurately represent the bacteria in the wound (Kallstrom, 2014).

Frequent and repeated swabbing should be avoided (Box 3).

Box 3. Questions to consider when deciding whether to re-swab (Everett et al, 2018)

- Is the therapy appropriate based on the last results?
- Has the therapy had time to work (2–3 days)?
- Is there deterioration? If so, is this deterioration deep (i.e. is a tissue sample required at theatre level)?
- Are there more than two signs or symptoms of infection?

WHEN TO INITIATE SYSTEMIC ANTIBIOTICS FOR SSI

Patients with systemic signs and symptoms of SSI, or with erythema extending >5cm from the incision with induration or necrosis, should receive a course of systemic antibiotics (Stevens et al, 2014; WUWHS, 2018). The antibiotics should be selected according to the location of the incision, local antibiotic policy and resistance patterns, and targeted to the results of microbiological analysis (Stevens et al, 2014; NICE, 2019).

Topical antimicrobials, such as creams, ointments or dressings, can be used to manage local infection, or for prevention in those who are at high risk, if the product is suitable for prophylactic use. A wide range of products are available, including DACC, iodine, silver and PHMB. Systemic antibiotics are not usually recommended for a patient with only local signs and symptoms of infection. However, there may be exceptions where it is important to prevent spreading infection because the consequences may be severe (e.g. a sternotomy incision; WUWHS, 2018).

Box 4. Checklist of antimicrobial stewardship practices (Wounds UK, 2020)

- Hand hygiene: hands of clinicians, carers and family members must be decontaminated before touching a patient, their dressing or their wound.
- Waste management: unused antibiotics should not be flushed down the toilet, and any dressing or material that might be contaminated with bacteria should be disposed of appropriately.
- Full and comprehensive documentation of assessment and treatment should be carried out for all patients in order to identify patterns and associations, which may help to reduce incidence and communicate among the MDT.
- The patient's environment, in hospital or at home, should be monitored to ensure infection prevention practices are followed (e.g. surface cleanliness and the impact of clutter and the impact of pets).

BPS 6: Strategies to reduce SSI risk in hospital

Interventions to reduce the risk of SSI in hospital, pre-, peri- or post-surgery, should take place within the context of a full assessment of the patient.

Best Practice Statement

For elective surgery, the surgical team will provide the patient with practical advice to reduce SSI risk pre- and post-surgery. The patient may be expected to follow a pre-surgery plan, which includes hand hygiene, use of a body decontamination wash and not shaving the surgical area. Family members and/or carers may also be involved.

Patient expectation

All patients undergoing elective surgery should have a pre-operative assessment to identify potential wound healing problems, which should be used to inform the consent process (NICE, 2019). Where possible, this should be conducted using a validated risk assessment tool relevant to the surgical speciality. Strategies should comply with antimicrobial stewardship practices, and clinical behaviour should be assessed and reviewed (e.g. avoiding ritualistic behaviour with no evidence base).

POST-OPERATIVE CONSIDERATIONS

Post-operative care should be based on a full assessment of the patient (WUWHS, 2018; Table 4).

Appropriate wound care

Each surgical speciality has its own protocol for post-surgery dressing removal, which depends on the risk factors of the patient group and surgery type. Individual dressing wear time also applies. Surgical dressings should be kept undisturbed for a minimum of 48 hours after surgery (up to 4 days if possible), unless there are signs and symptoms indicating that earlier inspection is warranted (Stryja et al, 2020).

For closed, clean incision wounds (or caesarean clean-contaminated), dressing removal post-surgery can take place at anywhere between 2 and 7 days (Stryja et al, 2020). Serous exudate can be a normal part of surgical wound healing; however, it is important to be aware of any changes in exudate that may signify deterioration of the wound, or that healing has stalled. Observation and clinical judgement are key – frequent dressing changes and maceration of the surrounding skin and tissue breakdown should be avoided.

Dressing selection

A systematic review of previous studies showed no evidence to suggest that any one dressing is better at reducing the risk of SSIs – or reducing scarring, controlling pain or promoting patient acceptability. However, most studies reviewed were small and at high risk of bias, thus the evidence is of poor quality (Dumville et al, 2016). Additionally, since this review, more products and pathways have been developed to help reduce SSI. NICE has reviewed a number of innovative products via their Medical Technologies Evaluation Program and have produced updated guidance.

NICE (2019) recommend that surgical incisions should be covered with an appropriate interactive dressing at the end of the operation. Selecting a dressing should depend on the following considerations:

- Patient assessment: including risk of developing SSI or related surgical complication
- Type of surgery: some surgeries have a higher risk of infection and may require an antimicrobial dressing
- Method of closure
- Incision location
- Patient lifestyle and preferences
- Skin type: more fragile skin may require a less adherent dressing
- Time to first dressing change: different surgeries and localities have different protocols
- Use of negative pressure wound therapy (NPWT) dressings (also known as closed incisional NPWT)
- Contraindications.

On discharge

Before hospital discharge, where practicable, the patient's wound should be photographed. The photo should be in an accessible format (e.g. colour print out, patient-facing portal or NHS-approved app) and uploaded to the patient's record. If taken, the image should be shared with the patient, and their carers and GP.

Patients/carers should also be provided with written information about:

- The surgical intervention
- Material and type of implant, if applicable
- Closure materials
- Ongoing care
- How and when to contact secondary care
- The signs and symptoms of infection
- Hygiene (including hand hygiene)
- Instructions for self-care of their wound, which may include the patient photographing their wound and monitoring their healing.

Table 4 | Interventions for reduction of risk of surgical site complications, including SSI (NICE, 2016; WHO, 2016; Berríos-Torres, 2017; WUWHS, 2018)

Planning	Education of patient, family and carer(s) and management of expectations
	Assessment and optimisation of comorbidities that increase risk of SSI
	Nutritional supplements if necessary
	Mupirocin in combination with chlorhexidine body wash for patients at risk of MRSA infection (NICE, 2019)
	Screening for significant organisms (e.g. *Staphylococcus aureus* – WHO suggests decolonisation with chlorhexidine/nasal treatment for known *Staph. aureus* carriers or surgeries with high risk for *Staph.* infection, such as orthopaedic, vascular or cardiac)
Pre-operative	Use of an operative safety checklist (e.g. WHO Surgical Safety Checklist)
	Maintenance of normothermia (temperature should be 36°C pre-, peri- and post-operative), unless otherwise indicated
	Patient showering or bathing on day of surgery using plain or antimicrobial soap/cleanser, and using two towels to dry
	Use of clippers (rather than a razor) for hair removal; removal of any false nails
	Location of heparin injection sites away from operative site
	Management of hydration/fluid levels
	Maintenance of adequate tissue perfusion
	Timely administration of prophylactic antibiotics as indicated by local guidelines if required
	Administration of antifibrinolytic agents as indicated by local guidelines to reduce blood loss and need for blood transfusion
Peri-operative	Compliance with hygiene measures by operating room personnel
	Optimal oxygenation
	Skin preparation with alcohol-based chlorhexidine unless contraindicated
	Use of an iodophor-impregnated drape, unless the patient has an iodine allergy, if an incise drape is necessary
	Use of excellent surgical technique with gentle handling of tissues, meticulous control of bleeding and avoidance of dead space
	Avoidance of tension across incision
	Use of wound edge protectors/guards during laparotomy
	Intra-operative wound irrigation
	Surgical hand preparation: scrubbing with either a suitable antimicrobial soap and water, or using a suitable alcohol-based handrub, before donning sterile gloves; changing gloves during procedure and/or before closure of wound; double-gloving
	Covering the incision(s) with an interactive dressing under sterile conditions at the end of the operation; or consider prophylactic, closed incisional NPWT for patients at increased risk of SSI
Post-operative	Covering surgical incisions with an appropriate interactive dressing at the end of the operation
	Maintenance of the dressing over the incision for at least 48 hours unless there are signs and symptoms indicating earlier inspection is warranted
	Cryotherapy (i.e. application of ice) and compression for certain wound types
	Visitor restrictions and hygiene measures (e.g. hand hygiene and protective clothing as appropriate if delivering direct patient care)
	Monitoring incision for healing progress and signs/symptoms of infection
	Use of correct dressing removal techniques as per manufacturers' guidance (e.g. do not peel back, look and reapply)
	Use of Patient Reported Outcome/Experience Measures (PROMS/PREMS) or questionnaires
	Correct moving and handling of the patient to prevent mechanical stress and dehiscence (using specialist equipment if required)
	Fostering good communications and training between acute and community working (e.g. comprehensive documentation, Photo at Discharge initiative)

BPS 7: Strategies to reduce SSI risk in community on discharge

Upon discharge from hospital, the patient should be provided with advice from the surgical team to continue appropriate surgical site management to reduce the risk of complications, including SSIs. Education for healthcare workers in primary care should be in place to ensure consistent treatment from acute to community.

Best Practice Statement

Following discharge, the patient should be provided with information on the signs and symptoms of SSI and be given a point of contact if they are concerned about infection. It may be appropriate to give the patient instructions for self-care depending on the patient's willingness and capacity for involvement in their own care. The patient may not have a follow-up appointment with the surgical or community team depending on the type of surgery.

Patient expectation

Surgical wounds that dehisce or become infected following transfer from surgical services to primary care or community services are often 'invisible' and can be lost to follow-up if not referred back to the surgical teams. SSI prevention requires a multi-disciplinary, holistic approach, which includes the patient, family/carer(s) and organisation to provide 'quality care' for the patient. There is currently no universally accepted definition of 'quality'; however, the Health Foundation (2013) regards quality as a degree of excellence in healthcare, which must be safe, effective, timely, efficient, equitable and patient-centred (WHO, 2006).

Organisation expectation

Effective
Organisations should use best available evidence to guide protocols on SSI prevention. There are significant national (NICE, 2019) and worldwide guidelines on pre-, peri- and post-operative prevention strategies for SSIs (e.g. WHO, 2016; 2018; WUWHS, 2018).

Organisation expectation

Efficient
Organisations should implement strategies that avoid SSI misdiagnosis and the use of non-essential antibiotics and antimicrobial dressings, while also avoiding clinical inertia when treatment is required.

Organisation expectation

Person-centred
Organisations should create a good practitioner–patient relationship to ensure SSI risk is optimised pre-, peri- and post-operatively on discharge. The patient should be empowered to take part in their own care if they are able and have the desire to do so.

Organisation expectation

Equitable
Organisations should create an environment whereby clinicians provide care that does not vary according to personal characteristics such as gender, race, ethnicity, geographical location, physical ability or socioeconomic status.

Organisation expectation

Safe
Organisations should act on the results of SSI surveillance and utilise post-operative strategies and protocols that avoid harm as a result of SSIs.

Organisation expectation

Timely
Organisations should ensure staff are aware of the signs and symptoms of SSI to ensure treatment is received in a timely fashion, and avoid life-threatening situations, such as SSI-related sepsis.

Continuity of care

Continuity of surgical site management post-discharge is key. However, colleagues in primary care and community services often report difficulties in obtaining secondary care surgical expertise following discharge (Edwards, 2019).

Healthcare education

Guidance for care of complications post-discharge from surgical services is required (Edwards, 2019). Infection prevention and control (IPC) pathways and roadmaps can enable all staff to contribute to a healthcare culture in which patient safety is of the highest importance – e.g. Scottish Infection Prevention and Control Education Pathway (NHS Education for Scotland, 2020).

Referral

If SSI is suspected once a patient has been discharged, local referral pathways to a relevant outpatient surgical clinic should be considered.

Dressing change technique

Ideally, dressing change should be undertaken in a clean area with minimal air disturbance; for example, as opposed to a busy ward at peak activity. Standard infection control precautions for dressing change technique include the use of a medical adhesive remover to reduce pain and skin damage, if necessary. It is important that clinicians caring for wounds exercise strict asepsis in order to minimise risk of SSI (Loveday et al, 2014). The Aseptic Non Touch Technique (ANTT) is advised for wounds healing by primary intention (NICE, 2019). After 48 hours, non-sterile gloves can be used; if the wound is already contaminated, sterile gloves will be redundant.

Patient self-care

Instructions for self-care of the surgical site should be in a suitable format for the patient, taking into account the patient's willingness and capacity for involvement in their own care. Some patient groups may require specific assistance, such as those with wounds in anatomical locations that they would struggle to inspect themselves, or people with cognitive decline who may tamper with dressings and increase infection risk. Where self-management and monitoring is not possible, carer(s) and family member(s) may help to identify the signs and symptoms of infection. Resources, such as NICE-endorsed educational videos may be useful (Royal Brompton & Harefield NHS Trust, 2018: https://www.nice.org.uk/guidance/ng125/resources/endorsed-resource-surgical-site-infection-prevention-video-series-4778834077).

Box 5 includes take-home messages for patients and primary and community healthcare workers to reduce the risk of SSI.

Box 5. Take-home messages for primary and community clinicians, carers, family members and patients to reduce SSI risk

- It is important to recognise the signs and symptoms of SSI
- Dressings are designed to act as a protective barrier for the wound bed from external contaminants
- Good hand hygiene practices should be followed when touching the wound and/or surrounding area
- Local pathways and reporting procedures should be followed if SSI is suspected
- Antimicrobial stewardship practices should be followed.

SUMMARY

- It is estimated that SSIs affect one in three patients undergoing surgery globally (WHO, 2016).
- Clear communication and integrated working between acute and community teams can help prevent and manage SSIs in the community.
- Clinical pathways are a useful tool to guide appropriate, clear patient management plans.
- Patient involvement is key to success in SSI prevention: wherever possible, clinicians should communicate with the patient and their carer(s), explaining what patients should expect and how they can be involved in their own care where appropriate.

Glossary

Antimicrobial stewardship: An approach to treatment that includes the optimal selection, dosage, and duration of antimicrobial treatment. The aim is to achieve the best treatment outcome, through infection prevention and management with minimal toxicity to the patient and minimal impact on subsequent resistance.

Crepitus: Crackling feeling or sound detected on palpation due to gas in the soft tissues, which is a sign of SSI.

Haematoma: Localised bleeding outside of blood vessels, due to either disease or trauma, including injury or surgery, and may involve blood continuing to seep from broken capillaries.

Incisional hernia: Hernia that occurs through a previously made incision in the abdominal wall – i.e. the scar left from a previous surgical operation.

Sepsis: A potentially life-threatening condition caused by the body's response to an infection.

Seroma: A pocket of clear serous fluid that sometimes develops in the body after surgery. This fluid is composed of blood plasma that has seeped out of ruptured small blood vessels and inflammatory fluid produced by the injured and dying cells.

Surgical site infection (SSI): A local infection that occurs at a surgical site within 30 days of the operation, or within 1 year if there is an implant present (WHO, 2016).

Surgical wound dehiscence (SWD): Separation of the margins of a closed surgical incision, with or without exposure or protrusion of underlying tissue, organs or implants. Separation may occur at single or multiple regions or involve the full length of the incision. It may affect some or all tissue layers. A dehisced incision may or may not display clinical signs and symptoms of infection. Note that other types of closed wound may also dehisce – e.g. traumatic wounds that have been sutured (WUWHS, 2018).

Swab: Microbiological sampling method that is used to guide antibiotic selection against organisms causing clinical signs of infection, rather than to determine whether infection is present or not. Frequent and repeated swabbing should be avoided. Swabbing should only be performed when there are signs or symptoms of infection and not used solely to diagnose SSI.

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