Surgical site infection

NICE guideline

Draft for consultation, April 2008

If you wish to comment on this version of the guideline, please be aware that all the supporting information and evidence is contained in the full version.

Contents

Introduction

Surgical site infection (SSI) is one of the Healthcare Associated Infections (HCAIs); the others principally affecting surgical patients being postoperative respiratory and urinary tract infections, bacteraemias (including meticillin resistant *S. aureus* and intravascular cannula infections) and antibiotic related diarrhoeas (particularly *C. difficile* enteritis). SSIs have been shown to be responsible for up to 20% of all HCAIs and at least 5% of patients undergoing a surgical procedure develop an SSI. An SSI may present as a relatively trivial and spontaneously limited wound discharge, for example 8-9 days after a breast operation, or as a life-threatening postoperative complication, such as a sternal infection after open heart surgery. Most SSIs are potentially preventable as their occurrence usually depends on contamination of an incision during surgery with the patient's own endogenous organisms. Later contamination with exogenous organisms is less common. In both cases however the establishment of an infection relates to the amount and pathogenicity of the micro-organisms present and the adequacy of the patient's host response, in turn related to their comorbidity.

Definitions of infection have proved difficult and there are many systems available but they all depend on the adequacy of post discharge surveillance. The Centres for Disease Control 30 day definition (with up to a year for prosthetic surgery such as hip replacement) has proved the most used in research studies. With the advent of Independent Sector Treatment Centres, polyclinics, fast-track and day case surgery, SSIs are being increasingly passed into primary health care. Superficial SSIs, which are the commonest, are seen 8-10 days postoperatively where primary care may be both ill equipped or ill-prepared to manage them In addition there may be a risk that antibiotics are overused in preference to the removal of a suture and the release of pus. If reporting of all SSIs is to become mandatory (it already is for elective orthopaedic surgery for example in England) then surveillance will have to extend beyond the patient stay if the prevalence and incidence is to

be accurately recorded and this will require extra personnel. Research studies have shown that the incidence of SSI is underestimated and, in addition, a considerable financial burden to health care systems has been highlighted which does not include the considerable indirect costs arising from loss of productivity and quality of life issues.

Because of the advances in surgery and anaesthesia older and sicker patients, who are at greater risk of infectious complications, may now be more often considered for surgical treatment than in previous years. The postoperative continuum into primary care needs to be addressed and in this Guideline it has been recognised that there are many factors in the pre-, intra- and postoperative phases of care that can reduce the risk of SSI development.

The Guideline makes recommendations for prevention and management of SSIs based on rigorous evaluation of the best available, published evidence. It has also been developed with the interests of information for patients and carers, as well as health care staff involved in surgical patients' care. Recommendations for research have been made when uncertainty persists and could be realistically addressed by further evaluation. Where the background evidence is not clear then the GDG have made balanced interdisciplinary opinions for best practice.

Implementation of the Guideline will not necessarily involve major changes in current practice but it does recommend the pooling of best practice into 'care bundles' which should reduce the risk of SSI. The introduction of the Guideline into patient care needs to be across the whole spectrum of care from the decision to operate to recovery and return to normal life style.

The guideline will assume that prescribers will use a drug's summary of product characteristics to inform their decisions for individual patients.

Patient-centred care

This guideline offers best practice advice on the care of both adults and children with surgical site infection.

Treatment and care should take into account patients' needs and preferences. People with surgical site infection should have the opportunity to make informed decisions about their care and treatment, in partnership with their healthcare professionals. If patients do not have the capacity to make decisions, healthcare professionals should follow the Department of Health guidelines – 'Reference guide to consent for examination or treatment' (2001) (available from www.dh.gov.uk). Healthcare professionals should also follow a code of practice accompanying the Mental Capacity Act (summary available from www.dca.gov.uk).

If the patient is under 16, healthcare professionals should follow guidelines in 'Seeking consent: working with children' (available from www.dh.gov.uk).

Good communication between healthcare professionals and patients is essential. It should be supported by evidence-based written information tailored to the patient's needs. Treatment and care, and the information patients are given about it, should be culturally appropriate. It should also be accessible to people with additional needs such as physical, sensory or learning disabilities, and to people who do not speak or read English.

If the patient agrees, families and carers should have the opportunity to be involved in decisions about treatment and care.

Families and carers should also be given the information and support they need.

Care of young people in transition between paediatric and adult services should be planned and managed according to the best practice guidance described in 'Transition: getting it right for young people' (available from www.dh.gov.uk).

Adult and paediatric healthcare teams should work jointly to provide assessment and services to young people with surgical site infection. Diagnosis and management should be reviewed throughout the transition process, and there should be clarity about who is the lead clinician to ensure continuity of care.

Key priorities for implementation

Information for patients

- Patients and carers should receive clear and consistent messages about the risks and management of SSI and what measures are being undertaken to reduce them, throughout their patient journey. **1.1.1.1**
- Patients and carers should receive information on post-discharge wound care. **1.1.1.2**
- Patients and carers should be given information to help them recognise an SSI and who to contact if they are concerned. **1.1.1.3**

Hair removal

- Hair removal is not indicated for the prevention of SSI. **1.2.2.1**
- If hair has to be removed, electric clippers with single-use disposable heads should be used on the day of surgery. **1.2.2.2**
- If hair has to be removed, razors should not be used because of the increased risk of SSI. **1.2.2.3**

Antibiotic prophylaxis

- Antibiotic prophylaxis should be given to patients prior to clean surgery involving the placement of a prosthesis or implant, clean-contaminated and contaminated surgery. In addition to prophylaxis, patients undergoing surgery on a dirty/infected wound need antibiotic treatment. **1.2.9.1**

Hand decontamination (scrubbing)

- The operative team should decontaminate their hands prior to the first operation on the list using an antiseptic surgical scrub solution, with a brush for the nails. Between subsequent operations hands should be decontaminated using either an alcoholic hand rub/gel or antiseptic surgical scrub solution without scrubbing. If hands are soiled then they should be washed with an antiseptic surgical scrub solution. **1.3.1.1**

Skin preparation with antiseptics prior to surgery

- In adults, the skin at the surgical site should be prepared immediately prior to the skin incision using an antiseptic preparation (aqueous or alcohol based) - povidone iodine or chlorhexidine are most suitable. **1.3.6.1**

Perioperative warming

- Perioperative patient warming should be undertaken to reduce SSI unless contraindicated in specific circumstances. **1.3.8.3**

Closure methods

- In general, the choice of technique and material for skin closure should be guided by local protocol, costs and clinical needs. **1.3.11.1**

Wound dressings for SSI prevention

- Surgical incisions should be covered with an appropriate interactive dressing in the immediate postoperative period. **1.3.12.1**

Dressing and antimicrobial impregnated dressings for the management of surgical wounds healing by secondary intention

- Surgical wounds healing by secondary intention should be managed using an appropriate interactive dressing. **1.4.4.2**

1 Guidance

The following guidance is based on the best available evidence. The full guideline ([add hyperlink]) gives details of the methods and the evidence used to develop the guidance.

1.1 Information for patients

1.1.1 Information for patients

1.1.1.1 Patients and carers should receive clear and consistent messages about the risks and management of SSI and what measures are being undertaken to reduce them, throughout their patient journey.

1.1.1.2 Patients and carers should receive information on post-discharge wound care.

1.1.1.3 Patients and carers should be given information to help them recognise an SSI and who to contact if they are concerned.

1.2 Preoperative phase

1.2.1 Preoperative showering

1.2.1.1 Patients should shower or bathe (or be showered or bathed or bed bathed) either the day before, or on the day of, surgery.

1.2.2 Hair removal

1.2.2.1 Hair removal is not indicated for the prevention of SSI.

1.2.2.2 If hair has to be removed, electric clippers with single-use disposable heads should be used on the day of surgery.

1.2.2.3 If hair has to be removed, razors should not be used because of the increased risk of SSI.

1.2.3 Patient theatre attire

1.2.3.1 Specific patient theatre attire, appropriate for the procedure and clinical setting, should be worn but should have regard for patients' personal comfort and dignity, the provision of easy access both to the operative site and areas for the placement of devices.

1.2.4 Non-sterile theatre wear

1.2.4.1 Specific non-sterile theatre wear should be worn in all areas, by all staff, where operative procedures are undertaken.

1.2.5 Staff leaving the operating area in non-sterile theatre wear

1.2.5.1 Movement in and out of the operating theatre suite of healthcare personnel dressed in non-sterile theatre wear should be restricted.

1.2.6 Nasal decontamination

1.2.6.1 Routine use of nasal decontamination with topical antimicrobial agents aimed at eliminating *Staphylococcus aureus* is not recommended for the prevention of SSI.

1.2.7 Mechanical bowel preparation

1.2.7.1 Mechanical bowel preparation is not recommended solely for the prevention of SSI.

1.2.8 Hand jewellery, artificial nails and nail polish

1.2.8.1 The operative team should not wear hand jewellery, artificial nails and nail polish during operative procedures.

1.2.9 Antibiotic prophylaxis

1.2.9.1 Antibiotic prophylaxis should be given to patients prior to clean surgery involving the placement of a prosthesis or implant, clean-

contaminated and contaminated surgery. In addition to prophylaxis, patients undergoing surgery on a dirty/infected wound need antibiotic treatment.

1.2.9.2 Consider single-dose administration for prophylaxis given intravenously at induction of anaesthesia but earlier in operations in which there is placement of a tourniquet.

1.2.9.3 Consider timing and pharmacokinetics (e.g. serum half-life) of the drug when administering.

1.2.9.4 Patients should always be informed that they have received antibiotics.

1.2.9.5 For clean uncomplicated surgery, antibiotic prophylaxis may not be necessary.

1.3 Intraoperative phase

1.3.1 Hand decontamination (scrubbing)

1.3.1.1 The operative team should decontaminate their hands prior to the first operation on the list using an antiseptic surgical scrub solution, with a brush for the nails. Between subsequent operations hands should be decontaminated using either an alcoholic hand rub/gel or antiseptic surgical scrub solution without scrubbing. If hands are soiled then they should be washed with an antiseptic surgical scrub solution.

1.3.2 Incise drapes

1.3.2.1 Non-iodophore impregnated incise drapes are not recommended for routine use in surgery.

1.3.2.2 In cases where an incise drape is used, this should be iodophore impregnated (excluding those cases where the patient presents with an iodine allergy).

1.3.3 Use of gowns

1.3.3.1 Gowns should be worn by healthcare professionals in the operating theatre.

1.3.4 Disposable drapes and gowns/reusable drapes and gowns

1.3.4.1 As there is no recommendation that can be made from this evidence it is suggested that local trust protocols are implemented.

1.3.5 Gloves

1.3.5.1 Double gloving should be considered when there is a high risk of perforation.

1.3.6 Skin preparation with antiseptics prior to surgery

1.3.6.1 In adults, the skin at the surgical site should be prepared immediately prior to the skin incision using an antiseptic preparation (aqueous or alcohol based) – povidone iodine or chlorhexidine are most suitable.

1.3.6.2 In neonates local practices for the use of skin preparation should be followed.

1.3.6.3 Appropriate care should be taken to ensure drying and avoid pooling when alcohol based preparations are used if diathermy is to be undertaken.

1.3.7 Diathermy

1.3.7.1 Diathermy as a method of surgical incision should not be used as a method to reduce SSI.

1.3.7.2 If diathermy is to be used, care should be taken when using inflammable skin preparations.

1.3.7.3 If an alcoholic skin preparation has been used then the operative area should be dried, and any pooled skin preparation removed, before the use of diathermy.

1.3.8 Maintaining patient homeostasis

1.3.8.1 Oxygen should be administered to ensure a haemoglobin saturation of greater than 95% during major surgery and in the recovery period.

1.3.8.2 It is essential that a patient's physiological condition is maintained during surgery and this includes adequate perfusion.

1.3.8.3 Perioperative patient warming should be undertaken to reduce SSI unless contraindicated in specific circumstances.

1.3.8.4 Treatment to reduce raised blood glucose postoperatively, with the aim of reducing SSI should not be undertaken in patients who do not have diabetes, to prevent SSIs.

1.3.8.5 Overall, it is essential that optimal physiological homeostasis is maintained during surgery and this includes adequate perfusion, oxygenation and temperature control.

1.3.9 Intracavity lavage and wound irrigation

1.3.9.1 Wound irrigation during surgery should not be undertaken to reduce SSI.

1.3.9.2 Routine intracavity lavage during surgery to prevent SSIs should not be used.

1.3.10 Antiseptics and antimicrobials prior to wound closure

1.3.10.1 Single-use povidone iodine spray into the incision, prior to closure, should be considered in elective colorectal surgery and surgery for perforated gangrenous appendicitis in adults.

1.3.10.2 Collagen gentamicin implants into the sternal wound should be considered after cardiac surgery.

1.3.10.3 The use of intraoperative skin re-disinfection or topical cefotaxime is not recommended

1.3.11 Closure methods

1.3.11.1 In general, the choice of technique and material for skin closure should be guided by local protocol, costs and clinical needs.

1.3.12 Wound dressings for SSI prevention

1.3.12.1 Surgical incisions should be covered with an appropriate interactive dressing in the immediate postoperative period.

1.4 Postoperative phase

1.4.1 Clean technique compared with aseptic non-touch techniques for dressing changes

1.4.1.1 'Aseptic' non-touch techniques should be used for removing or changing surgical wound dressings.

1.4.2 Postoperative cleansing of the wound

1.4.2.1 If wound cleansing is indicated, sterile saline should be used.

1.4.2.2 Showering in the immediate postoperative period should not be undertaken specifically to reduce the rate of SSI.

1.4.2.3 When the surgical wound has separated or has been surgically opened to drain pus, then the use of tap water may be considered for wound cleansing.

1.4.3 Postoperative topical antimicrobials for prevention of SSI in surgical wounds healing by primary intention

1.4.3.1 Topical antimicrobial agents, such as the antibiotic chloramphenicol applied as a paste, should not be used in the postoperative management of wounds to prevent SSI.

1.4.4 Dressing and antimicrobial impregnated dressings for the management of surgical wounds healing by secondary intention

1.4.4.1 Eusol and gauze, moist cotton gauze and mercuric antiseptic solutions should not be used in the management of surgical wounds healing by secondary intention.

1.4.4.2 Surgical wounds healing by secondary intention should be managed using an appropriate interactive dressing.

1.4.4.3 Healthcare professionals should refer to a tissue viability expert for advice on appropriate dressings for the management of surgical wounds healing by secondary intention.

1.4.5 Debridement

1.4.5.1 Eusol and gauze, dextranomer and enzymatic treatments should not be used as debridement techniques in the management of SSI.

2 Notes on the scope of the guidance

NICE guidelines are developed in accordance with a scope that defines what the guideline will and will not cover. The scope of this guideline is available from http://www.nice.org.uk/nicemedia/pdf/SSIfinalscope240907.pdf.

How this guideline was developed

NICE commissioned the National Collaborating Centre for Women's and Children's Health to develop this guideline. The Centre established a Guideline Development Group (see appendix A), which reviewed the evidence and developed the recommendations. An independent Guideline Review Panel oversaw the development of the guideline (see appendix B).

There is more information in the booklet: 'The guideline development process: an overview for stakeholders, the public and the NHS' (third edition, published April 2007), which is available from www.nice.org.uk/guidelinesprocess or by telephoning 0870 1555 455 (quote reference N1233).

3 Implementation

The Healthcare Commission assesses the performance of NHS organisations in meeting core and developmental standards set by the Department of Health in 'Standards for better health' (available from www.dh.gov.uk). Implementation of clinical guidelines forms part of the developmental standard D2. Core standard C5 says that national agreed guidance should be taken into account when NHS organisations are planning and delivering care.

NICE has developed tools to help organisations implement this guidance (listed below). These are available on our website (www.nice.org.uk/CGXXX). *[NICE to amend list as needed at time of publication]*

- Slides highlighting key messages for local discussion.
- Costing tools:
  - costing report to estimate the national savings and costs associated with implementation
  - costing template to estimate the local costs and savings involved.
- Implementation advice on how to put the guidance into practice and national initiatives that support this locally.
- Audit criteria to monitor local practice.

4 Research recommendations

The Guideline Development Group has made the following recommendations for research, based on its review of evidence, to improve NICE guidance and patient care in the future. The Guideline Development Group's full set of research recommendations is detailed in the full guideline (see section 5).

4.1 Oxygenation

Further research is needed both to investigate the value of supplemented oxygenation in the recovery room and to understand the mechanisms associated with the prevention of SSI.

Why this is important

There have been several randomised control trials which show a contradictory effect of supplemental oxygenation in the recovery room period. Two separate trials indicate that there could be a halving of SSI rates simply by increasing the amount of inspired oxygen but the claim that an FiO_2 of 0.8 can be reached using a face mask is not possible, and all patients are already given an FiO_2 to give a haemoglobin saturation of at least 95% by their anaesthetist during the operation and in the immediate postoperative period. The mechanism for this increase of FiO_2 to be able to presumably improve blood oxygen carriage is therefore physiologically not clear. Nevertheless, this simple cheap intervention, if it works, really does need further investigation.

4.2 Perioperative blood glucose control

Research should be undertaken into the possible benefits of improved glucose control postoperatively, with adequately powered RCTs in a broad range of surgical procedures.

Why this is important

There have been several large cohort studies in cardiac surgery that indicate that tight postoperative blood glucose control can reduce the dreaded complication of sternal incision SSI in particular. A rise of blood glucose outside the normal range is typical after major trauma and has been

considered part of the ‘normal’ metabolic response. A randomised controlled clinical trial is needed, and in other fields of major surgery other than cardiac surgery alone, to show unequivocally that tight blood glucose control is acceptable (even if it lowers SSIs in general) as the lowering of glucose in the immediate peri-operative period may have unwanted complications and will require added careful surveillance. Again the physiological mechanisms why this intervention should lower SSI is not entirely clear.

4.3 Closure methods

Further research on sutures should be conducted and based on multi-centred adequately powered, single intervention RCTs.

Why this is important

Although there are many studies in the field of wound closure, there are still several areas which are unanswered. Natural suture materials such as catgut and silk should be replaced by tailor-made absorbable and non-absorbable polymers. However, it needs far more research to convince surgeons to stop using mass closure of the abdominal wall or subcuticular sutures for skin closure. The use of monofilaments or braids also depends on personal preference and further trials are unlikely to show differences in SSI. There are data to show some techniques can allow more rapid closure, such as the use of staples or adhesive acrylate glues. Again this has other disadvantages which could only be proven in what would be large, single-intervention RCTs. The use of antiseptic-coated sutures offers a novel challenge to show if SSIs can be reduced or allow less use of antibiotics.

4.4 Wound dressings for SSI prevention

There should be further research on the benefit and cost effectiveness of different types of post-surgical interactive dressings.

Why this is important

There is a huge number of dressings which are available for chronic wound care which can be used for incisional sites. The use of island dressings compared with simple adhesive polyurethane transparent dressings is an

example with outcomes of not just SSI but skin complications and final cosmetic outcomes for example. There are some studies but they do not yet have enough power to show convincing differences. Research into the effect of antiseptic-bearing dressings, placed at the end of an operation or at dressing changes, would be attractive as a lowering of SSIs might be found. These antiseptics could include povidone iodine, biguanides (such as chlorhexidine) or the recent popularity of silver.

4.5 Dressing and antimicrobial impregnated dressings for the management of surgical wounds healing by secondary intention

There is a need to evaluate the modern methods of chronic wound care in terms of management of SSI including alginates, foams and hydrocolloids and dressings containing antiseptics such as honey, cadexomer, iodine or silver.

Why this is important

There are many small cohort studies which have examined the use of the wide range of dressings in SSI management after an infected wound has been opened or after there has been separation of the wound edges after an SSI. Differences are hard to see because the trials often include other wounds healing by secondary intention such as chronic venous or diabetic ulcers and pressure sores. Specific studies using antiseptics (povidone iodine, chlorhexidine biguanides or silver) and other agents such as honey do need to address this in powered randomised trials, specifically in the management of SSIs with an open wound. Similar questions need to be asked for the use of topical negative pressure which has become widely used with or without antiseptic irrigation.

5 Other versions of this guideline

5.1 Full guideline

The full guideline, ‘Surgical Site Infection’ contains details of the methods and evidence used to develop the guideline. It is published by the National

Collaborating Centre for Women's and Children's Health, and is available from www.ncc-wch.org.uk, our website (www.nice.org.uk/CGXXXfullguideline) and the National Library for Health (www.nlh.nhs.uk). **[Note: these details will apply to the published full guideline.]**

5.2 Quick reference guide

A quick reference guide for healthcare professionals is available from www.nice.org.uk/CGXXXquickrefguide

For printed copies, phone the NHS Response Line on 0870 1555 455 (quote reference number N1XXX). **[Note: these details will apply when the guideline is published.]**

5.3 'Understanding NICE guidance'

Information for patients and carers ('Understanding NICE guidance') is available from www.nice.org.uk/CGXXXpublicinfo

For printed copies, phone the NHS Response Line on 0870 1555 455 (quote reference number N1XXX). **[Note: these details will apply when the guideline is published.]**

6 Related NICE guidance

Published

Infection control: Prevention of healthcare-associated infection in primary and community care. NICE clinical guideline 2 (2003). Available from www.nice.org.uk/CG002

Under development

NICE is developing the following guidance (details available from www.nice.org.uk):

- [Short title of guideline, then colon, then full title]. NICE clinical guideline [number] ([year]). Available from www.nice.org.uk/CGXXX

- [Title of appraisal]. NICE technology appraisal guidance [number] ([year]). Available from www.nice.org.uk/TAXXX
- [Title of interventional procedure]. NICE interventional procedure guidance [number] ([year]). Available from www.nice.org.uk/IPGXXX
- [Title of public health intervention guidance]. NICE public health intervention guidance [number] ([year]). Available from www.nice.org.uk/PHIXXX
- [Title of public health programme]. NICE public health programme guidance [number] ([year]). Available from www.nice.org.uk/PHPXXX

7 Updating the guideline

NICE clinical guidelines are updated as needed so that recommendations take into account important new information. We check for new evidence 2 and 4 years after publication, to decide whether all or part of the guideline should be updated. If important new evidence is published at other times, we may decide to do a more rapid update of some recommendations.

Appendix A: The Guideline Development Group

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Appendix B: The Guideline Review Panel

The Guideline Review Panel is an independent panel that oversees the development of the guideline and takes responsibility for monitoring adherence to NICE guideline development processes. In particular, the panel ensures that stakeholder comments have been adequately considered and responded to. The panel includes members from the following perspectives: primary care, secondary care, lay, public health and industry.

[NICE to add]

[Name; style = Unnumbered bold heading]
[job title and location; style = NICE normal]