

Preventing and managing surgical site infections

Health-care-associated infections are a public health challenge and a considerable media and public concern. In a UK prevalence survey, surgical site infections accounted for 14% of health-care-associated infections; almost 5% of patients having surgery developed a surgical site infection (Smyth et al, 2008). Surgical site infections may affect the superficial tissues of the incision, the deep fascial and muscle layers, or an organ or body space encountered during the operation. They are associated with increased morbidity, mortality and costs of care, and doubling of the length of hospital stay (Leaper et al, 2004; Coello et al, 2005).

The risk of developing a surgical site infection depends on the number of microorganisms which remain in the wound at closure, their virulence and ability to multiply and invade tissues, and the host's immune defences. The source of pathogens is mainly endogenous, from the patient's skin, mucous membranes or hollow viscera; or less commonly exogenous, from operating personnel, the operating room environment or equipment used during the procedure.

The risk of a surgical site infection is therefore increased by factors which increase the risk of endogenous contamination, for example when the dense flora of the bowel is encountered; or of exogenous contamination, for example operations with long exposure of tissues. Factors which diminish the systemic or local immune response also increase the risk of surgical site infections, although robust evidence for a link is lacking and the risk probably varies with different types of procedure and surgical skill. Therefore, the evaluation of evidence relating to prevention of surgical site infections is complex.

Defining a surgical site infection depends on clinical signs and symptoms rather than positive microbiological results alone and, since studies use different definitions, results can be difficult to com-

pare. This limits the data available from which to draw conclusions about the efficacy of practices to reduce surgical site infections (Wilson et al, 2004). Prevention requires adherence to time-honoured principles of asepsis, ensuring that non-sterile items are not brought into contact with the 'sterile field'. However, this is based on theoretical rather than research evidence and further illustrates the difficulty of clearly defining which elements of surgical care determine the risk of an surgical site infection.

What is the evidence?

The National Institute for Health and Clinical Excellence (NICE) (2008) guideline on the prevention and treatment of surgical site infection presents the available evidence and provides clinicians with guidance on those measures for which there are clear indications of effectiveness. This guideline followed the process outlined in the NICE (2007) guidelines manual. After a scope was developed stakeholders were invited to comment during a consultation period. A guideline development group, consisting of health-care professionals, representatives for patients and carers, and a NICE technical team was established to formulate and agree on clinical and health economics questions within the scope.

Evidence was identified from systematic searches of bibliographic databases. Meta-analysis was performed where sufficient numbers of similar studies were identified. In areas where clinical research evidence was lacking, the guideline development group considered other evidence-based guidelines, or their collective experience, to identify good practice. The guideline development group also formulated recommendations for future research. Stakeholder organizations were invited to comment during consultation and amendments were incorporated. Some aspects of operating theatre discipline were not addressed as they are covered by other guidance.

Preoperative recommendations

In the preoperative phase the key recommendations are:

1. Hair removal does not reduce the risk of surgical site infection, the use of razors increases the risk, and hair should only be removed using electric clippers with disposable heads; electric clippers are cost-effective compared to either razors or depilatory cream in an economic analysis
2. Preoperative showering is recommended, but showering with chlorhexidine is not a cost-effective intervention to prevent surgical site infections compared to using detergent or bar soap
3. Preoperative application of nasal mupirocin does not reduce the overall risk of surgical site infection
4. There is no evidence that mechanical bowel preparation reduces the risk of surgical site infection in colorectal surgery.

Perioperative recommendations

In the perioperative phase, evidence supported the following recommendations:

1. Antibiotic prophylaxis should be given before clean surgery involving a prosthesis, and in clean-contaminated or contaminated surgery. There is evidence that a single intravenous dose at induction of anaesthesia is usually adequate
2. Preparation of the skin with an antiseptic solution should be undertaken immediately before an incision is made
3. If required, only iodophore-impregnated incise drapes should be used as non-impregnated drapes increase the risk of surgical site infection.

Other traditional doctrines of theatre practice evoke concern and debate but evidence relating to the risk of surgical site infection was lacking. Examples include the use of sterile theatre clothing, the wearing of non-sterile theatre wear outside the theatre area, and removal of jewellery, artificial nails and nail polish. The advice of the guideline is that these reflect theatre

discipline which should be maintained to provide a safe environment for patients and staff. Standard principles of effective methods of hand decontamination should also be applied but there is insufficient evidence to favour a specific approach to hand decontamination.

Postoperative recommendations

In the postoperative phase the guideline makes the following recommendations:

1. Surgical wounds healing by first intention can be managed with a simple, interactive dressing such as a semi-permeable film to promote healing in a moist wound environment
2. Surgical wounds which are laid open, or separate following infection, heal by secondary intention and it is recommended that a tissue viability expert is able to advise on the most appropriate of a wide range of dressings. There is no evidence that any particular method of wound cleaning or dressing change minimizes the risk of surgical site infection.

The guideline recommends that patients are given information about the risk of surgical site infection and the measures taken to minimize them. Surveillance to measure the risk of surgical site infection provides information for patients and the clinical team, and combined with feedback has been associated with reductions in rates of surgical site infections (Haley et al, 1985). However, differences in definitions, methods of case-finding, mix of patients and approach to analysis may affect the rates reported (Leaper et al, 2004; Wilson et al, 2007). Shorter lengths of postoperative stay need systems which recognize surgical site infections that occur after return to primary care.

The benefit of nasal decontamination with mupirocin warrants broader investigation to examine outcomes other than surgical site infection and associated cost, such as the impact on microbial resistance. The efficacy of optimization of the patient's perioperative condition, in particular the effect of supplemental oxygenation and glucose control, merit further research. Similarly, there is no clear evidence for risk of surgical site infection associated with differences in materials used for surgical gowns, types of wound irrigation, application of antiseptic or

antimicrobial agents before wound closure or for debridement, and methods or materials used for wound closure. Research into the clinical and cost effectiveness of these aspects of care is recommended by the guideline.

Conclusions

National benchmarking surveillance systems have been established and reported reductions in rates of surgical site infection (Wilson et al, 2006). Assuring best practice by defining that key measures or care bundles are observed has also been advocated (Department of Health, 2008). While it may not be possible to eliminate surgical site infection completely, the recommendations from the NICE guideline provide a valuable addition to the best, evidence-based practice to prevent and manage these important health-care-associated infections. **BJHM**

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KEY POINTS

- The risk of surgical site infection can be reduced by implementing best practice in the care of patients undergoing surgery.
- Key recommendations for preventing surgical site infection are: avoid hair removal, shower preoperatively, administer antibiotics where indicated using a single dose at induction of anaesthesia where possible, and clean the skin with antiseptic immediately before making the incision.
- Surgical wounds should be covered with a simple interactive dressing postoperatively.
- Surveillance of surgical site infections makes an important contribution to reducing rates.