Prevention and management of sternal wound infections

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Central Message

The article describes guidelines for the prevention and management of sternal wound infections.

Perspective

The article reviews guidelines to help reduce the incidence of sternal wound infections.

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Although the incidence of sternal wound infections has decreased to 1% to 4% of all cardiac surgery procedures, they continue to be associated with increased morbidity and mortality, and decreased long-term life expectancy.[1-3] They prolong hospital length of stay and can raise hospital costs by as much as US$62,000.[4] Sternal wound infections are now publicly reported, and the US Center for Medicare and Medicaid services will no longer reimburse hospital costs incurred in the treatment of deep sternal wound infections (DSWI) following coronary artery bypass graft (CABG) surgery.[5]

Despite the significant clinical and economic consequences of sternal wound infections, there are currently no specific guidelines in cardiac surgery for the prevention and treatment of sternal wound infections. What follows are recommendations for the prevention of wound infections during the preoperative, intraoperative, and postoperative periods, as well as principles for the most effective methods and techniques to treat sternal wound infections to achieve the lowest morbidity and mortality as derived from evidence-based recommendations (Tables 1 and 2).

METHODS

A literature search was performed using PubMed and Google Scholar up to March 2015 using the MeSH headings "Sternal Wound Infections - Prevention and Treatment," "Treatment of Mediastinitis," "Topical Antibiotics in Cardiac Surgery," "Wound VAC Therapy for Sternal Wound Infections," and "Prevention and Treatment of Sternal Instability." Editorials and articles involving prevention and therapy for wound infections in noncardiac, nonsternotomy patients were excluded.

The systemic review was reported according to the Preferred Reporting Items for Systemic Reviews and Meta-Analyses (PRISMA) guidelines[6] (Figure 1).

DEFINITIONS

In defining sternal wound infections it is important to distinguish between DSWI and superficial sternal wound infections (SSWI).[7,8]

A SSWI involves only the skin, subcutaneous tissue, and/or pectoralis fascia. There is no bony involvement. The incidence of SSWI ranges from 0.5% to 8% with a combined morbidity and mortality of 0.5% to 9%.[7]

As defined by the Centers for Disease Control and Prevention, DSWI require the presence of one of the following criteria: (1) an organism isolated from culture of mediastinal tissue or fluid; (2) evidence of mediastinitis seen during operation; or (3) presence of either chest pain, sternal instability, or fever (>38°C), and purulent drainage from the mediastinum, or isolation of an organism present in a blood culture or a culture of the mediastinal area.[8] Although the incidence of DSWI reported from 217,829 cardiac surgery procedures for 2013 in the Society of Thoracic Surgeons Adult Cardiac Surgery Database was less than 1%, the morbidity can be as high as 40% in some series.[7]

Scanning this QR code will take you to the article title page.

Abbreviations and Acronyms

BMI = body mass index
DSWI = deep sternal wound infections
ICU = intensive care units
MRSA = methicillin-resistant Staphylococcus aureus
MSSA = methicillin-sensitive Staphylococcus aureus
NPWT = negative pressure wound therapy
PCR = polymerase chain reaction
PRISMA = Preferred Reporting Items for Systemic Reviews and Meta-Analyses
SSWI = superficial sternal wound infections
STS = Society of Thoracic Surgeons

TABLE 1. Classification of recommendation and level of evidence

Class I
Procedure/treatment should be performed
— is recommended
— is indicated
— is useful/effective/beneficial
Class IIa
Procedure/treatment is reasonable to perform
— is considered useful/effective/beneficial
— is probably recommended or indicated
Class IIb
Procedure/treatment may be considered
— may/might be considered useful/effective/beneficial
— is unclear or not well established
Class III
Procedure/treatment should not be performed
— may be harmful
— is not indicated
— is not recommended
Level A: Recommendation based on multiple randomized trials or meta-analyses
Level B: Recommendation based on evidence from a single randomized trial or nonrandomized studies
Level C: Recommendation based on expert opinion, case studies, standard of care

PREOPERATIVE PREVENTION

Screening for Nasal Carriers of *Staphylococcus*

- All cardiac surgery patients should have nasal swabs or polymerase chain reaction (PCR) testing, if available, before surgery.

Class I Recommendation; Level of Evidence = A.

Most cardiac surgical wound infections are caused by *Staphylococcus* species. Most of these infections arise from the patient's own nasal flora. Twenty to thirty percent of the general population are carriers of *Staphylococcus aureus*.[9] The risk of a *S aureus* infection is increased 3-fold in patients who are carriers of *S aureus*.[10] Although 5% to 15% of patients admitted to intensive care units (ICUs) are methicillin-resistant *S aureus* (MRSA) carriers, the risk of MRSA bacteremia postoperatively is significantly higher in these patients than the risk of a methicillin-sensitive *S aureus* (MSSA) bacteremia in MSSA carriers.[11] PCR assays provide rapid screening (<12 hours) for carriers of *Staphylococcus*. However, the assay adds to the cost of screening and is not available in all hospitals. Intranasal mupirocin results in immediate decolonization of MSSA in >90% of cases.[12] However, it results in decolonization of only 45% to 50% of patients with MRSA.[13,14]

Nasal Disinfectants

- Routine mupirocin administration is recommended for all cardiac surgery procedures in the absence of PCR testing or nasal cultures positive for staphylococcal colonization.

Class I Recommendation; Level of Evidence = A.

DNA fingerprint analyses have demonstrated that the genotype of *S aureus* isolates recovered from the sternum of patients with mediastinal wound infections and the nares are identical.[15]

Cimochowski and colleagues[16] found that mupirocin significantly decreased the incidence of sternal wound infections in a single-center, retrospective study involving a cohort of patients who underwent cardiac surgery. Topical intranasal therapies have emerged as the preferred method to eradicate staphylococcal colonization, and mupirocin has emerged as the topical antibiotic agent of choice for elimination of *S aureus* in nasal carriers. In a randomized, double-blind, placebo-controlled, multicenter trial involving both cardiac and noncardiac surgical patients, 2% mupirocin ointment (Bactroban; GlaxoSmithKline, Research Triangle Park, NC) in combination with chlorhexidine gluconate soap significantly decreased the incidence of DSWI and hospital length of stay.[17] Carriers of *Staphylococcus* were rapidly detected by PCR testing, and mupirocin was initiated within 24 hours of surgery and continued for 5 days. Other studies have found no effect of mupirocin treatment in the incidence of wound infections.[18-22] However, subgroup analyses of these studies showed that there was a significant decrease in wound infections in patients who had positive nasal cultures for *Staphylococcus* organisms who were treated with mupirocin. There are several reasons for the lack of the therapeutic effect of mupirocin in these studies. Many were performed in patients with a low risk for infection. The incidence of wound infection was small, and the studies were underpowered to detect differences in therapeutic interventions. Because mupirocin has minimal