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Routine Use of Topical Bacitracin to Prevent Sternal Wound Infections After Cardiac Surgery

Joshua L. Chan, MD, Andrada C. Diaconescu, and Keith A. Horvath, MD

Cardiothoracic Surgery Research Program, National Heart, Lung, and Blood Institute, National Institutes of Health, Bethesda, Maryland

Background. The development of sternal wound infections remains a serious complication after cardiac surgery. A number of studies have assessed the use of topical antibiotics placed on the sternal edges. We evaluated the routine use of bacitracin ointment applied over the sternotomy skin incision as a prophylactic measure against sternal wound infections.

Methods. A retrospective review of all coronary artery bypass graft and valve surgery cases performed at a single institution between 2006 and 2015 was performed ($n = 1,495$). Appropriate preoperative intravenous antibiotics were administered for all patients. Bacitracin topical antibiotic ointment was routinely applied to the sternal surgical incision after skin closure for all patients during this period. The incidence of sternal wound infection was assessed.

Results. During this 9-year experience, no episodes of deep sternal wound infections were observed,

compared with a predicted rate of 0.29% (interquartile range: 0.19% to 0.46%) based on The Society of Thoracic Surgeons National Database risk calculator. Four episodes of superficial sternal wound infections were noted; gram-positive organisms were cultured in the majority of these cases. Bacitracin ointment was well tolerated by patients, with no serious adverse effects reported.

Conclusions. This study suggests that the routine application of topical bacitracin over the surgical skin incision is safe after cardiac surgery. Deep sternal wound infections were notably absent during this period. As a readily available and inexpensive therapy, this simple intervention may be a useful adjunct strategy in preventing sternal wound infections.

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Sternal wound infections after cardiac surgery remain a feared complication. Despite optimization of current techniques, including preoperative skin preparation, prophylactic systemic antibiotic administration, and tight glycemic control, sternal wound infections continue to be associated with significant morbidity [1, 2]. Its development increases the number of in-hospital interventions, prolongs lengths of stay, requires higher resource utilization, and reduces midterm and long-term survival [3]. In a 10-year follow-up, patients who had mediastinitis after coronary artery bypass graft surgery (CABG) were found to have a 30% lower adjusted survival rate compared with patients having an uncomplicated postoperative course [3, 4]. Further financial pressure is evident as health care institutions are no longer reimbursed by the Centers for Medicare and Medicaid Services for treatment costs related to deep sternal wound infections (DSWI) after CABG [5].

Given its impact on morbidity, mortality, and cost of care, considerable effort has been placed on developing

novel and alternative techniques to prevent the occurrence of this serious complication. For the past decade, our institution has routinely applied bacitracin ointment on the closed sternal wound incision immediately after skin closure in patients undergoing cardiac surgery. However, limited contemporary data are available for assessing the potential contribution of this technique. Therefore, we sought to evaluate the impact of prophylactic topical bacitracin application on the incidence of sternal wound infections.

Patients and Methods

A retrospective study was conducted over a 9-year period between 2006 and 2015. Study approval and waiver for the need for consent was obtained from the Institutional Review Board. This review included all patients who underwent CABG or valve surgery or both using a sternotomy approach performed at a single center. As is institutional practice, all patients showered with an antibacterial scrub the day before surgery and received standard preoperative intravenous antibiotic prophylaxis (cefuroxime 1.5 g or vancomycin 1 g if allergic to penicillin) within 1 hour before surgical incision. During prolonged procedures, cefuroxime was readministered at a redosing interval of 4 hours from the initiation of the

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Address correspondence to Dr Horvath, Bldg 10-CRC, Rm B2-3701, 10 Center Dr, Bethesda, MD 20892; email: khhorvath@aamc.org.

preoperative dose. The operative site was disinfected with a chlorhexidine gluconate-isopropyl alcohol formulation (ChloroPrep; Becton, Dickinson and Company, Franklin Lakes, NJ) and covered with an iodophor-impregnated incise drape (Ioban; 3M, St. Paul, MN). After completion of the surgical procedure, after closure of the skin incision but before removal of sterile drapes, bacitracin ointment was applied in a sterile fashion on the sternotomy incision and then covered with sterile gauze. Dressings were ultimately removed on postoperative day 2, and incisions were inspected by surgical staff twice a day. Assessment included evaluations for erythema, induration, discharge, or any other signs of surgical site infection. Bacitracin ointment was not reapplied and no additional cleaning agent was utilized. Prophylactic antibiotics (cefuroxime 1.5 g every 8 hours or vancomycin 1 g every 12 hours) were ultimately terminated 24 hours after the completion of surgery.

Characteristics of all study patients were compiled, encompassing baseline demographics, preoperative risk factors for surgical site infections, and perioperative results. Variables were obtained through a retrospective review. The primary endpoint was the incidence of wound infections occurring at chest surgical site incisions within 6 weeks of the index cardiac surgery and categorized by the extent of involvement (superficial versus deep) according to criteria established by the Centers for Disease Control and Prevention [6]. Superficial sternal wound infection was defined as involving the skin, subcutaneous tissue, or muscle above the pectoralis fascia. Deep sternal wound infection was characterized as an infection related to tissue beneath the pectoralis fascia, including the sternum and mediastinal space.

The frequency of sternal wound infections was compared with the predicted rates calculated by The Society of Thoracic Surgery (STS) National Database risk calculator, a risk-stratification model validated for CABG and valve operations [7]. Secondary endpoints included assessment of postoperative complications, intensive care unit and total hospital lengths of stay, adverse side effects from bacitracin application, and 30-day mortality. Categorical variables were defined as a percentage and continuous variables as a median with the first and third quartiles represented by an interquartile range (IQR). Statistical analyses were performed using SAS software, version 9.2 (SAS Institute, Cary, NC).

Results

During the 9-year study period, 1,495 consecutive patients underwent CABG or valve surgery that required a median sternotomy. Patient demographics are given in Table 1. The median age was 68 years (IQR: 60 to 79), 74.4% of the study population was male, and 69.1% were White. The median body mass index was 29.1 kg/m² (IQR: 26.5 to 33.7 kg/m²), and 32.3% of the total patient group were classified as obese with a body mass index greater than 30 kg/m². Assessment of known preoperative risk factors for surgical site infections revealed that more than one fourth of patients had diabetes mellitus; a majority of

Table 1. Patient Demographics

Demographics	Values (n = 1,495)
Age, years	68 (60–79)
Sex	
Male	74.4 (1,113)
Female	25.6 (382)
Race	
White	69.1 (1,033)
African American	10.1 (151)
Hispanic	6.0 (89)
Other	14.8 (222)
Body mass index, kg/m ²	29.1 (26.5–33.7)
Body mass index >30 kg/m ²	32.3 (483)
Body mass index >35 kg/m ²	12.0 (179)
Medical history	
Diabetes mellitus	30.4 (454)
Hypertension	80.8 (1,208)
Hyperlipidemia	75.7 (1,132)
Peripheral artery disease	9.3 (139)
Current/recent tobacco use	15.5 (232)
COPD	11.8 (176)
Dialysis-dependent renal failure	2.1 (31)
Immunosuppressive therapy	2.9 (43)
Congestive heart failure	17.4 (260)
Prior cardiac surgery	5.3 (79)

Values are median (interquartile range) or percent (n), unless otherwise indicated.

COPD = chronic obstructive pulmonary disease.

the population was noted to have hypertension (80.8%) and hyperlipidemia (75.7%). The rate of current or recent tobacco use was 15.5%. Other risk factors for sternal wound infections—dialysis-dependent renal failure and congestive heart failure—were present in 2.1% and 17.4% of patients, respectively. More than 5% of patients were reoperative cardiac surgery candidates.

Table 2 displays a breakdown of cardiac operations performed and perioperative variables. Coronary artery bypass graft surgery was performed in a total of 1,032 patients (69.0%), isolated valve repair or replacements in 323 (21.6%), and combined CABG and valve procedures in 140 (9.4%). More than 50% of operations were performed in an urgent or emergent setting. Packed red blood cells transfusion was required in 23.1% of patients during the postoperative period, and 2.7% required reoperative intervention. The median intensive care unit length of stay was 21.5 hours (IQR: 19.0 to 31.5), and total hospital length of stay was 5 days (IQR: 4 to 8). Overall, the unadjusted 30-day mortality rate was 3.0%.

During the study period, no episodes of DSWI were observed in any bacitracin-treated patients who underwent cardiac surgery at our institution (Table 3). Calculation of the predicted DSWI rate using the STS National Database risk calculator was performed and determined to be a median of 0.29% (IQR: 0.19% to 0.46%) or an estimated 4.3 patients in a cohort of 1,495. Four patients (0.27%) had superficial sternal wound infection;

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