



ORIGINAL ARTICLE

Treatment of sternal wound infections after open-heart surgery



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Summary Objective: The aim of this study was to investigate the proper treatment of infected median sternotomy wounds.

Methods: A retrospective study was conducted to investigate the proper treatment of infected median sternotomy wounds on patients with sternal wound infections from January 2007 to July 2009. The characteristics of the sternal infections and the treatment outcomes were analysed.

Results: Ninety-seven patients with sternal wound infections were treated. A total of 32 patients acquired the infection within one month after open-heart surgery, 10 patients got the infection one to two months after the surgery, and 1 patient died two days after debridement. There were 54 patients who acquired the infection beyond two months post-surgery, while 1 patient died on the day before the operation. One patient received four cycles of wound debridement, 18 patients received two cycles and 78 patients only received one cycle. A total of 14 patients received a vacuum-assisted closure treatment. There were 73 patients who had surgery for repair of muscle flaps, 1 patient for breast tissue flap, 63 patients for pectoralis major muscle flap, and 9 patients with rectus abdominis muscle flap. There were 12 patients who received a transverse plate fixation of the sternum with titanium plating.

Conclusion: A positive prognosis can be obtained by the algorithm treatment based on the onset and depth of the sternal infection.

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Conflicts of interest: The authors declare that they have no financial or non-financial conflicts of interest related to the subject matter or materials discussed in this article.

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1. Introduction

Open-heart surgery is usually performed through median sternotomy, as first described by Milton in 1897.¹ A rare but serious complication associated with this approach is the development of a deep sternal wound infection (DSWI), which has a 0.4–5.1% incidence of occurrence after cardiac surgery.² The development of a sternal wound infection often has a late onset and is usually detected only after discharge. DSWI can cause a high morbidity rate of up to 50%,³ with a prolonged hospital stay and an increased cost of care. In acute stages, sternal collapse and deep mediastinitis can often result in a functional disorder of the organ, which, if not treated adequately, may lead to the patient's death.^{4–9} Chronic infections are usually associated with chronic draining sinus tracts, osteomyelitis, and costochondritis,^{8,9} which can affect the patient's quality of life. Early detection and aggressive treatment with debridement, drainage, and immediate wound closure using various muscle flaps are necessary to prevent the development of sternal wound infection. Sternal stability is also an important factor in surgery; this stability can be maintained by transverse fixation of the sternum using titanium plates, if necessary.^{8,10} The current study reports on 97 patients who received sternal wound reconstruction out of 6398 patients who underwent cardiac surgery from January 2007 to July 2009.

2. Materials and methods

2.1. Patients

This study included a total of 97 patients who suffered sternal wound infections in our institution from January 2007 to July 2009. The patients consisted of 53 (54%) males and 44 (46%) females, with an average age of 57 years (22–76 years). Cardiac surgical procedures included 44 cases of coronary artery bypass graft (CABG), 32 cases of valve surgery, and 21 cases of other procedures. Over 40% of the patients were accompanied by different degrees of diabetes, hypertension and heart failure, and 90% were found to have positive bacterial culture.

Table 1 summarizes the patient data of surgical revision. A total of 33 patients underwent wound debridement within 1 month after cardiac surgery, 10 patients received it within 1–2 months after surgery, and 54 patients received it after 2 months. The reason most of the patients we treated were infected after 2 months was because patients found to have wound infection within the first postoperative month had already been debrided at the Department of Cardiac Surgery. Most of the patients we

accepted suffered serious infection or had recurrence after debridement. This study was conducted in accordance with the Declaration of Helsinki and with approval from the Ethics Committee of the Central Department of Cardiac Study of ZhongShan Hospital, Shanghai. Written informed consents were obtained from all the participants.

2.2. Treatment

Preoperative preparation included a basic evaluation of the patient, chest enhanced computed tomography (CT), bacterial cultures, antibiotics use, anticoagulant therapy, nutritional status assessment, and control of comorbidities such as diabetes mellitus and chronic obstructive pulmonary disease. All the patients were treated with various surgical procedures according to the onset of infection. In diabetic patients, preoperative glycemic index should be controlled at 8.0 mmol/L. The low protein blood syndrome should also be corrected prior to the operation.

2.3. Type I wounds

Type I wounds occur in the first postoperative month. Surgical debridement includes open wounds, lavage using antibiotic saline, removal of old sternal wires, and excision of all wound edges including skin, subcutaneous tissue, and necrotic tissue in the mediastinum. To achieve complete wound closure in the pericardium and under the sternum, drains are placed after rewiring the sternal wire and performing subcutaneous drainage. In cases of serious infection, steel wires are removed and then the sternum is fixed using a titanium plate to strengthen sternal stability.

2.4. Type II wounds

Type II wounds occur between 1 month and 2 months post-operation. These wounds manifest with purulent drainage and loose wire. Vacuum-assisted closure (VAC) is performed for wound preparation, or wound dressing is used until 8 weeks post-operation to provide the fibrous tissue with sufficient antitension support. Afterward, wire removal and wound debridement are performed, and the wound is closed using a muscle flap.

2.5. Type III wounds

Type III wounds occur more than 2 months post-operation and usually manifest with chronic draining sinus tracts, localized cellulitis, osteomyelitis, costochondritis, or a retained foreign body. At this point, radical sternal debridement is performed to remove wires and bone wax, and an extensive resection of the necrotic sternum and cartilages is conducted. The wound can immediately be repaired with the use of muscle flaps. Usually, patients with mediastinitis do not receive radical debridement, so a VAC followed by muscle flap reconstruction for secondary wound closure is used. In cases of serious sternal instability due to increased sternal necrosis elimination, a titanium plate is implanted to reconstruct the chest wall (Fig. 1).

Table 1 Timing of presentation of patients.

Timing (mo)	Patients (n)	%
<1	33 (1 died prior to debridement)	34
1–2	10	10.3
>2	54	55.7

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