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Utility of Omentoplasty in Mediastinitis Treatment following Sternotomy

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ABSTRACT

Background: Mediastinal infection is one of the most serious complications that occurs following open-heart surgery by sternotomy. In the present study, omentoplasty was initially and aggressively used to treat the infection and prevent the recurrence caused by bones in cases of mediastinitis following open-heart surgery at our clinic.

Methods: Among the 3656 patients who underwent surgery at our department of cardiovascular surgery between January 1996 and December 2012, omentoplasty as a treatment for mediastinitis was applied to 19 (0.51%) patients (of which 13 were males) following sternotomy. The cases were revised on the 15th day following the first surgery and/or when there was a suspicion of mediastinal infection. The necrotic skin, subcutaneous tissue, and bone tissue were resected, and all the affected sternal tissues were removed until healthy hemorrhagic areas were reached.

Results: The average age of the patients was between 49 and 81 years (mean: 65.7 ± 10.5 years). The mean age of the men was 66.08 ± 12.7 years (age range: 49-81 years) and that of the women was 63.2 ± 6.8 years (age range: 55-71 years). The male to female ratio was 2:1, and in both the male and female groups, the approximate age ranged from 55 and 70 years. In the intraoperative cultures received from wound cases, the most common agent of infection was methicillin-resistant coagulase-negative staphylococci. Purulent leaks from eight patients stopped in approximately 4 days. Purulent leaks from the other 11 patients continued until the 6th day, and thus, medical dressing also continued, after which the leaks stopped on the 15th day. The approximate postoperative hospital stay was 32 days (range: 13-63 days).

Conclusion: Omentoplasty in heart surgery can be considered an effective method when used to control infection and treat secondary poststernotomy mediastinitis.

INTRODUCTION

Mediastinitis is defined as the infection of the mediastinal organs and the mediastinal space. While esophageal perforation, retropharyngeal abscesses, penetrating trauma, or infection by microorganisms are considered as its determinants, currently, a majority of mediastinitis cases emerge as a postoperative complication of cardiac or thoracic surgery [Braxton 2000]. Mediastinitis is seen as a serious postoperative complication of cardiac surgery following sternotomy, with the incidence ranging from 0.4% to 5.1% for all surgeries [Braxton 2000]. Antibiotic prophylaxis, antiseptic measures, and good preoperative preparation reduces the incidence of mediastinitis. Erythema, purulent discharge, wound dehiscence, sternal mobility, fever, and leukocytosis aid the clinical diagnosis for mediastinitis. Surgical debridement performed by opening the sternum, specific antibiotic treatment, careful local debridement and irrigation and aspiration systems have long been used as the primary treatments. However, these measures are insufficient in certain cases, and in addition to the traditional treatment, there is a need for grafts that can be bloodshot in the anterior mediastinum. Aggressive surgical treatment in the early stages can lead to a markedly better clinical outcome. Myoplasty is another method used for these complications, and its benefit is determined by the status and viability of the adjacent muscle tissue. Because of its immunogenic and angiogenic properties, omentum versatile anatomy is useful when myoplasty is not a good option and is known to produce effective results in the control of mediastinal infection.

MATERIALS AND METHODS

Between January 1996 and December 2012, omentoplasty was performed in 19 patients (13 [68%] males) for the treatment of mediastinitis following sternotomy at our department of cardiovascular surgery. Patients were screened retrospectively from hospital records. During the operation, the sternum was opened, and the required debridement and washing were performed (Figure 1). The necrotic skin, subcutaneous tissue and bone tissue were resected. All the affected sternal tissues were curetted until healthy hemorrhagic areas were reached. The abdomen was then opened by the general surgeons via a supraumbilical median incision. Following liberalization of the omentum, the infected tissues beneath the sternum were cleaned and the omentum was shifted to the mediastinum in a pedicled manner (Figure 2). The omentum was fixed to the mediastinum with sutures (Figure 3), and the abdomen was closed in accordance with the procedures following an omentoplasty (Figure 4). Following the omentoplasty, the sternum was drained via aspiration and a drain was placed in the mediastinum. The sternum was closed by sternum steel wires and bands, and the operation was terminated by releasing the pectoral muscle and pulling off the sternum. Perioperative wound cultures were obtained from all the patients, and appropriate antibiotic therapy was administered.

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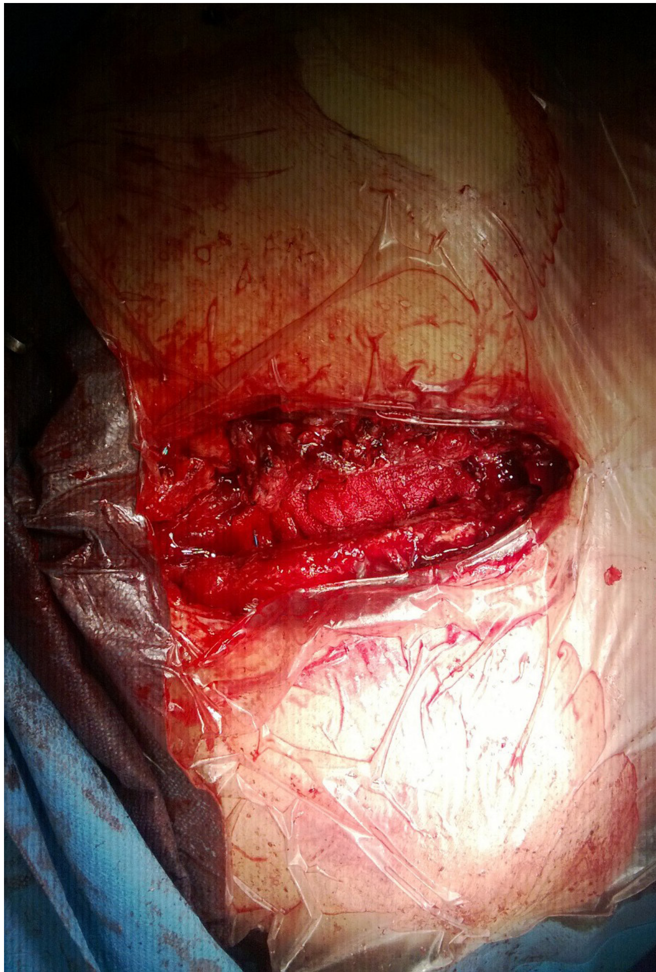

Figure 1. During the operation, the sternum was opened, and the required debridement and washing were performed. The necrotic skin, subcutaneous tissue, and bone tissue were resected. All the affected sternal tissues were curetted until healthy hemorrhagic areas were reached. The abdomen was then opened by the general surgeons via a supraumbilical median incision.

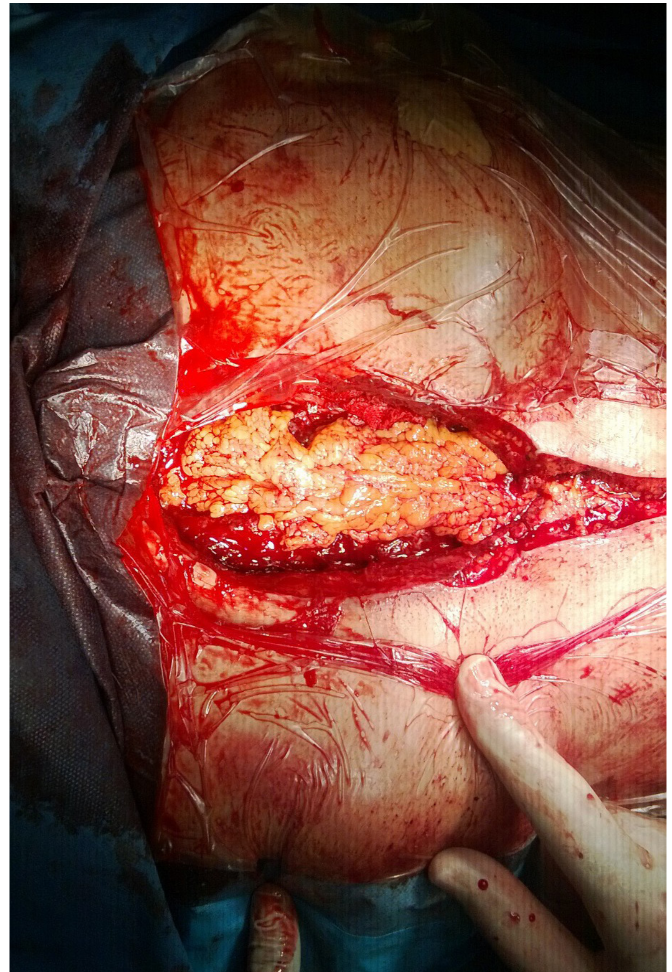

Figure 2. Following liberalization of the omentum, the infected tissues beneath the sternum were cleaned and the omentum was shifted to the mediastinum in a pedicled manner.

The patient information was obtained from hospital records, clinic controls, and operation and pathological examination reports. The patients were classified according to age, sex, and the duration of hospital stay for accompanying diseases.

RESULTS

Among the 3656 patients who were operated in our department, 19 (0.51%) patients developed mediastinitis and omentoplasty was applied to them. The patients' approximate age was 65.7 ± 10.5 years (range: 49-81 years). The average age of the male patients was 66.08 ± 12.7 years (range: 49-81 years), and the average age of the female patients was 63.5 ± 6.8 years (range: 55-71 years). The ratio of men to women was 2:1, and the ages in both the groups were between 55 and 70 years. Comorbidities were present in all the 19 (100%) patients. Hypertension was identified in 13 (64.7%) patients, diabetes mellitus in 8 (47%) patients, chronic obstructive pulmonary disease in 5 (29.4%) patients, heart failure in 3 (17.6%) patients, and deep vein thrombosis in 2 (11.7%) patients. In preoperative wound cultures, the most common factor (80%) was detected as methicillin-resistant staphylococcus aureus (MRSA). The other pathogens were pseudomonas, escherichia coli and klebsiella. After all the patients were diagnosed, antibiotic therapy was administered for the treatment of infectious diseases in accordance with the recommendations of the doctor. Moreover, according to the results of the antibiograms, relevant additions were made to the treatment. The mean postoperative hospital stay was 32 days (range: 16-63 days). No mortality was observed among the patients.

DISCUSSION

The incidence of mediastinitis following cardiac surgery has been reported to be between 0.4%-2% and 4% in various studies [Braxton 2000]. The pathogenesis of mediastinitis

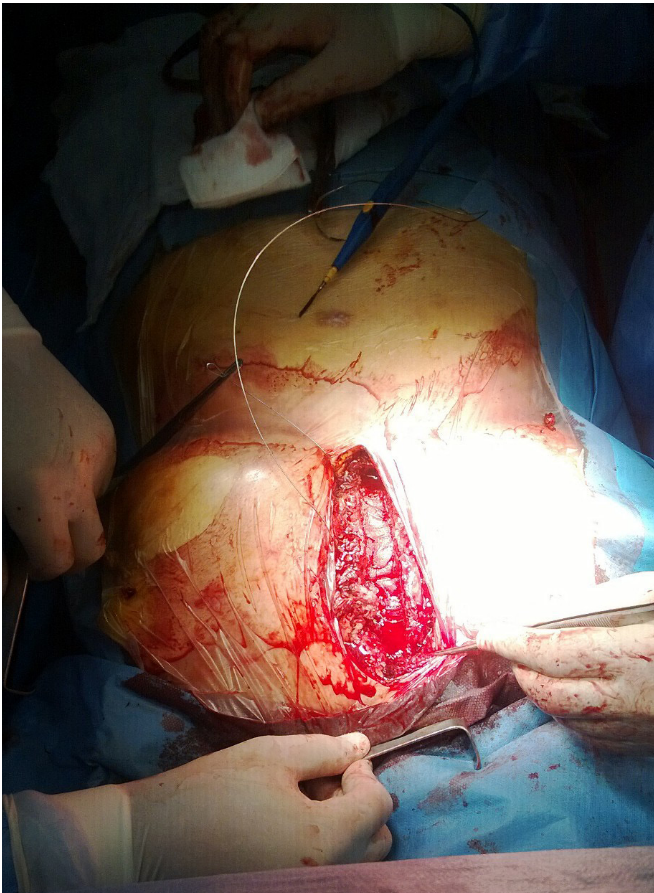

Figure 3. The omentum was fixed to the mediastinum with sutures.

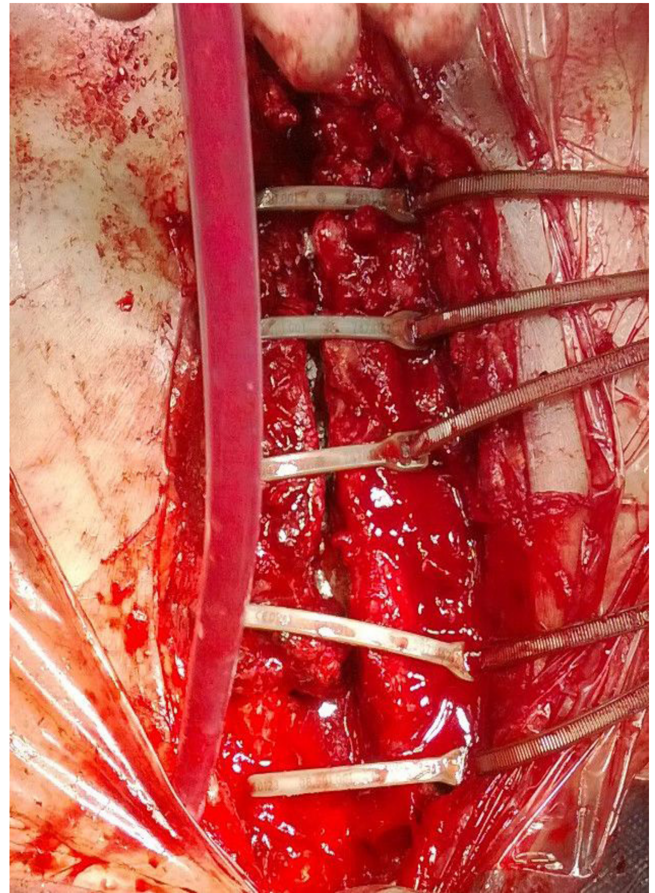

Figure 4. The abdomen was closed in accordance with the procedures following an omentoplasty.

following open-heart surgery is not well known. The most important known cause is contamination. In terms of contamination, preoperative, intraoperative, and postoperative periods carry particular importance. Preoperative poor hygiene, non-compliance with mandatory preoperative measures, and inadequate and poor postoperative wound care are the most serious risk factors for mediastinitis.

A single organism is often found to play a role in the microbiological examination of mediastinitis. According to the investigation of a large series, gram-positive bacteria (70%-80% of the cases examined were S. aureus or S. epidermidis) were found to be active in approximately 50% of the patients, both gram-positive and gram-negative bacteria in 40% of the patients, and gram-negative bacteria alone in 10% of the patients [Braxton 2000; Gummert 2002]. In the microbiological examination of the infected material, staphylococci were seen in 93% of the patients with mediastinitis, out of which 80% were reported as MRSA [Schroeyers 2001]. In another study on patients' hemocultures, staphylococci (85.7% MRSA) were detected in wound cultures [Braxton 2000]. In addition, although rare, fungal infections with mycoplasma hominis and nocardia or bacterial infections with legionella have been reported to cause mediastinitis following open-heart surgery [Zhang 1997; Hultman 2002; O'Shaughnessy 1937; Thompson 1945]. In the present study, out of 15 (80%) patients, MRSA, candida, and methicillin-resistant coagulase-negative staphylococci were present in 2 patients and E. coli and K. pneumoniae in another 2 patients.

In the present study, signs of mediastinitis were seen in a majority of the patients within 14 days following the primary operation. Sometimes, this period may extend up to several months. In another study, mediastinitis occurred within the first 14 days following operation in two-thirds of the patients, and the average was found to be approximately 7 days [Jones 1997]. In our case, mediastinitis symptoms were detected at the earliest on the 10th day and at the latest on the 28th day following surgery.

Mediastinitis that develops after heart surgery is easily and more accurately evaluated by computed tomography (CT). Three important findings in CT aid the detection of mediastinitis: dehiscence in the sternum and localized fluid levels inside the mediastinum and pneumomediastinum [Lappa 2003]. Therefore, we evaluated all our patients using CT, and localized fluid levels and sternal dehiscence were identified in all our cases.

The treatment of mediastinitis following cardiac surgery is difficult. Surgical debridement is the most important step in the treatment. As per the surgeon's preference, various

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techniques can be applied after debridement. The debrided sternum can be closed as soon as possible or can be kept open and then closed after the reduction of the infection. Various washing systems can be inserted into the mediastinum, and antibiotics and polivinilionid irrigation solutions are miscible with them. However, polivinilionids or a number of other disinfectants and antibiotic solutions have not demonstrated any definite proven effects. Therefore, the use of such a washing method is controversial [Allie 2004]. Partial or total resection of the sternum may be required in some cases of serious sternum osteomyelitis and necrosis associated with mediastinitis. In some cases where the sternum cannot be closed following resection, muscle or omental flaps are convertible over the mediastinum.

Myoplasty is a common technique used by many surgeons. However, in cases with low muscle mass or widespread infection, myoplasty may not be preferred because of the infection being in the lower mediastinum. Other free or pedicled broad dorsal or abdominal rectus muscle flaps should be considered as second options because of the high local incidence of complications. The use of omentum in myoplasty is a good alternative and was preferred as an effective method in the aforementioned cases. With rich vascularization, versatility, and angiogenic and immunogenic capacity, it is preferred as an ideal flap even in highly infected areas. Krabatsch et al have evaluated tissues and long-term patency and anastomosis development [Krabatsch 1995]. Lopez-Monjardin et al compared myoplasty with omentoplasty for the treatment of mediastinitis and observed that there is a lower mortality rate and less septic complications in patients who underwent omentoplasty [López-Monjardin 1998].

The omentum is a tissue that has rich veins, a high blood flow and neovascularization; it accelerates wound healing because of its exclusive, well-developed vascularity and immunological properties [López-Monjardin 1998; Brandt 2002]. The omentum provides neovascularization, thereby increasing collateral blood flow by a factor of lipid angioma. It has been shown that the vascularity of the omentum is still open, and new vascular networks have developed years after its translocation [Brandt 2002].

However, laparotomy for omentoplasty can be more complicated in patients who are septic and in critical condition. In the literature, the omentum has been used in the treatment of abdominal and non-abdominal infections and processes that require repair [Braxton 2000]. In a study conducted with 32 patients, Schroeyers et al observed a lower incidence of reinfection by turning the pectoral muscle and omental flap following debridement [Schroeyers 2001]. All foreign bodies must be removed from the mediastinum when these operations are in progress.

Omentoplasty indications steadily increase following cardiovascular surgery. In recent years, new treatment options for mediastinitis such as hyperbaric oxygen and novel biomaterials have emerged. The commonly used methods include antibiotic therapy, aspiration systems, extensive debridement, removal of necrotic bones, and resection of the cartilage.

Nevertheless, in some patients with uncontrolled diabetes, immunosuppression, senility, and vasculopathy, there is a need to create a flap using muscle, omentum, or both to achieve better infection control by providing rich vascularized living tissue. Thus, the duration of the hospital stay can be reduced [Hultman 2002; Allie 2004]. The morbidity and mortality are reduced by minimizing the rates of reoperation, major complications, and recurrence.

Consequently, the omentum is an ideal tissue for areas that need vascular support. Based on these data, we consider it to be an effective method in terms of infection control and ease of use in patients who develop mediastinitis following cardiovascular surgery. We believe that its implementation in selected patients who develop mediastinitis will significantly reduce postoperative mortality and morbidity.

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