Rigid sternal fixation in the cardiac transplant population

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Infections delay posttransplantation recovery and are present in the majority of early complications causing transplantation failure. Deep sternal wound infections and mediastinitis result in multiple surgical procedures for the patient and have been shown to increase hospital stay and expenses.^{1,2}

Risk factors for development of sternal dehiscence and subsequent mediastinitis include chronic obstructive pulmonary disease, reoperation, off-midline sternotomy, renal failure, diabetes, chronic steroid use, morbid obesity, concurrent infection, and acquired or iatrogenic immunosuppression.³ Many patients undergoing cardiac transplantation have 3 or more of these risk factors, designating them as at high risk for sternal dehiscence.

Recognizing instability as the antecedent event to poststernotomy mediastinitis, multiple methods of sternal closure have been proposed. However, these methods have all revolved around different circlage techniques or other nonrigid means of fixation.⁴ We offer the use of rigid fixation in the patient undergoing cardiac transplantation both as a method of sternal fixation after the development of early dehiscence and as a means to prevent sternal infection at the time of initial sternal closure.

Patients and Methods

Ten patients undergoing cardiac transplantation (2 women and 8 men) underwent rigid fixation of the sternum over an 18-month period. The mean age was 57 years (range, 46-68 years). Six underwent rigid fixation for sternal salvage after the development of early dehiscence (within the first 10 days). Four underwent fixation as a prophylactic measure. Eight had a sternotomy before transplantation. Ischemic cardiomyopathy was the indication for transplantation in all patients.

There was an average of 1.7 fractures per sternum. Rigid fixation was performed with the SternalLock system (Walter Lorenz Surgical, Jacksonville, Fla). An average of 3.8 plates was applied per sternum.

Results

The average follow-up was 42 weeks (range, 9-76 weeks). There were no complications and no reoperations. All patients achieved successful sternal osteosynthesis (Figure 1).

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Figure 1. Intraoperative photograph depicting complete reduction.

Discussion

Rigid fixation is thought to be superior to traditional wire circlage as a method of sternal closure. This is particularly true for patients who are at high risk for the development of poststernotomy mediastinitis. At the top of this list are patients undergoing cardiac transplantation. These patients are immunosuppressed with multiple comorbid illnesses, and many of these patients have had prior sternotomies that predispose them to sternal fractures and subsequent infection. Sternal plating offers greater stability, which maintains successful bony union. A biomechanical analysis on a validated bone analog model has shown sternal separation under normal physiologic forces.⁵ In an immune-suppressed patient population, this sternal separation can quietly lead to dehiscence and devastating infection. Prophylactic treatment and early plate fixation of patients with clinical dehiscence can prevent deep sternal wound infection and subsequent mediastinitis.

Our experience with rigid fixation of the sternum extends to the patient undergoing cardiac transplantation. This population is thought to be at high risk for the development of poststernotomy

mediastinitis, a complication that could have devastating consequences. We offer rigid plate fixation as a method of both sternal fixation after early dehiscence and as a means for prophylaxis in the cardiac transplant population.

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Congenital thoracoabdominal aortic aneurysm

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Thoracoabdominal aortic aneurysms are uncommon in infancy; only a very few surgical cases are reported. In general, there is much to suggest that infection is a cause of the disease, but in the present case we suspected aberration of elastin composition from the fetal period. We report an extremely rare surgical case of congenital thoracoabdominal aortic aneurysm.

Clinical Summary

A 2-month-old boy with tachycardia and tachypnea was referred to our hospital. He had been delivered normally at full term and was well after birth; the mother's pregnancy had been uncomplicated. Nevertheless, computed tomography revealed 2 huge saccular thoracic aortic aneurysms in the posterior mediastinum and a small abdominal aortic aneurysm at the level of the celiac artery. The maximal diameter of the thoracic aortic aneurysm was 75 × 53 × 47 mm, and in part of the aneurysmal wall, a laceration and an intraluminal hematoma were recognized. In addition, the left atrium and the inferior vena cava were pressed forward by the

aneurysms (Figure 1). Angiography revealed a hypoplastic abdominal aorta and showed that the celiac artery and the superior mesenteric artery originated from the same location as the distal site of the abdominal aortic aneurysm.

An operation was performed through a median sternotomy with extension to the abdomen and a left thoracotomy. Arterial cannulas were inserted into the ascending aorta and the abdominal aorta. A venous cannula was inserted through the right atrium. After institution of deep hypothermic cardiopulmonary bypass, the aorta was divided just distal to the origin of the left subclavian artery. The aneurysmal wall was very thick, but there was no calcification or mural thrombosis and the inside was comparatively smooth. The descending aorta from the distal site of the left subclavian artery to the proximal site of the celiac artery was replaced with a 10-mm Dacron graft (Hemashield; Meadox Medicals, Oakland, NJ) while the heart was beating. Microscopic examination of the resected specimens revealed fragmentation and configuration change of elastic fibers in the media and secondary increased findings of fibroblasts and collagen fibers in the adventitia (Figure 2). Infiltration of inflammatory cells was not detected. Aortography showed smooth reconstruction of the descending aorta except for a slight dilatation of the abdominal aorta at the level of the celiac artery (Figure 3). The patient had an uneventful postoperative course and was discharged with no complication.

Discussion

Thoracoabdominal aortic aneurysm is extremely rare in infancy, with few surgical cases reported.¹⁻⁴ Infection, connective tissue disease, and trauma have been nominated as causes of the disease, but there is much evidence that the disease is caused by infection from the umbilical artery catheter. With respect to the origin bacteria, staphylococcus has been documented in 51% of cases.¹ On the other hand, cases with unknown etiology have also been

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