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Case Study

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Repair of ascending aortic pseudoaneurysm eroding through the sternum

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Abstract

In reoperation for an ascending aortic pseudoaneurysm eroding through the sternum, a left ventricular vent allows careful unhurried sternal division under deep hypothermic circulatory arrest. We repaired ascending aortic pseudoaneurysms in 2 patients who had undergone aortic valve implantation 6 and 21 months earlier. A minithoracotomy was made in the left 5th intercostal space, and a vent was placed in the left ventricular apex. Repair was accomplished with a bovine pericardial patch reinforced with a Teflon felt strip. Both patients made an uneventful recovery with good functional status at discharge at the 8- and 18-month follow-up.

Keywords

Aortic pseudoaneurysm, Sternal erosion, Deep hypothermia, Left ventricular vent

Introduction

Pseudoaneurysm of the ascending aorta eroding through the sternum is rare.[1,2] Without reoperation, it expands progressively and ruptures or becomes a source of persistent infection or systemic embolism.[3] Reoperation is associated with considerable hospital mortality, predominantly due to high risks of uncontrollable hemorrhage, end-organ dysfunction, and embolism.[3,4] The best technical approach remains uncertain. The condition poses technical challenges for the surgeon, including safe reentry into the chest, management of the circulation, cerebral and myocardial protection, and the repair itself.[5] We describe the technique used to repair aortic pseudoaneurysms in two patients referred to our institutes, which allowed careful unhurried sternal division under deep hypothermic circulatory arrest. Early left ventricular apical venting avoided cardiac distention when the heart fibrillated.

Case reports

The first patient was a 65-year-old woman who had a 28-mm bileaflet mechanical aortic valve implanted at another institution 21 months earlier. She had been readmitted 1 month postoperatively with fever, and blood culture was positive for *Pseudomonas aeruginosa* but no vegetation on the prosthetic valve was seen on echocardiography. She was treated with intravenous ceftazidime 1 g and piperacillin-tazobactam 4.5 g 8-hourly for 6 weeks, during which she became afebrile. The second case was a 28-year-old man who had undergone aortic and mitral valve replacement (bileaflet mechanical devices, aortic 22 mm and mitral 26 mm) 6 months earlier in another city. Both patients presented with a visible, expansile, and pulsatile subcutaneous mass over the mid-sternal area, and underwent redo surgery at the earliest opportunity. Preoperative computed tomographic angiography (CTA) showed a pseudoaneurysm of the ascending aorta extending through the sternum into the subcutaneous tissues (Figure 1). The surgical and anesthetic techniques adopted were similar. Swan-Ganz and radial artery lines, a nasopharyngeal temperature probe, Foley catheter, and

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transesophageal echocardiography probe were placed for intraoperative monitoring. Cardiopulmonary bypass was established via the right common femoral artery and vein. The temperature was reduced to 19°C (blood) and 17°C (nasopharyngeal) in both cases. A 5-cm minithoracotomy was made via the left 5th intercostal space, and a vent was placed in the left ventricular apex (Figure 2) through a pledgeted pursestring suture, and secured before the heart fibrillated. When the desired temperature was achieved, the circulation arrested, the heart and aorta were decompressed, and an incision was made through the sternotomy scar. Resternotomy was easily achieved with an oscillating saw, and the pseudoaneurysm was entered. The prosthetic aortic valves appeared to be in excellent condition with no evidence of infection or vegetation, and the aorta was clean in both cases. This was also the finding on the pre-bypass transesophageal echocardiography. The operation therefore proceeded according to the plan conceived prior to cardiopulmonary bypass. The defect was identified on the anterior surface of the proximal ascending aorta, along the aortotomy suture lines from the previous operation in both cases. The pseudoaneurysm cavity was cleared of clots and sent for culture. Repair was accomplished with a bovine pericardial patch sutured to the edges of the defect with a continuous 4/0 Prolene suture, reinforced on the aortic side with a Teflon felt strip. The circulation was restarted, and after deairing, the patient was rewarmed. Transesophageal echocardiography showed well-functioning prosthetic valves in both patients, with no perivalvular leakage and unchanged good ventricular function. The cardiopulmonary bypass time was 117 and 160 min and circulatory arrest time was 30 and 20 min, respectively. Both patients required blood transfusions and recovered uneventfully. The first patient's hematoma was found to be sterile; however, *Acinetobacter baumannii* was grown from the hematoma of the second patient who received 9 million IU of colistimethate sodium intravenously, followed by 3 million IU 8-hourly until 2 weeks after discharge. Interestingly, both patients had suffered a local or systemic Gram-negative infection at some point after their initial operation. Both made an uneventful recovery with a good functional status at the time of discharge and at the 8- and 18-month follow-up, respectively (Figure 3).

Discussion

The surgical management of ascending aortic pseudoaneurysm eroding through the sternum remains a challenge and carries high morbidity and mortality rates.[4] We have described a strategy that may reduce the associated surgical risk. Femorofemoral bypass and deep hypothermic circulatory arrest enables organ preservation and allows adequate time to perform the redo

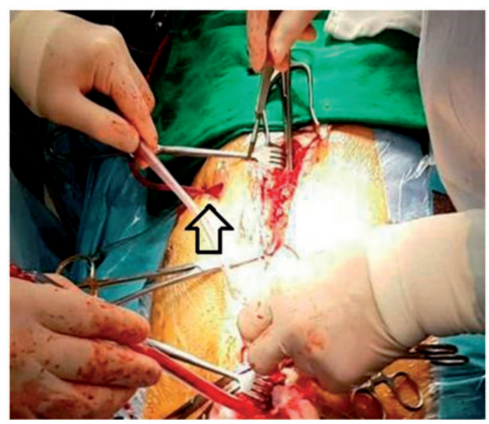

Figure 2. The left ventricular apical vent inserted through a 5-cm anterior thoracotomy in case 2.

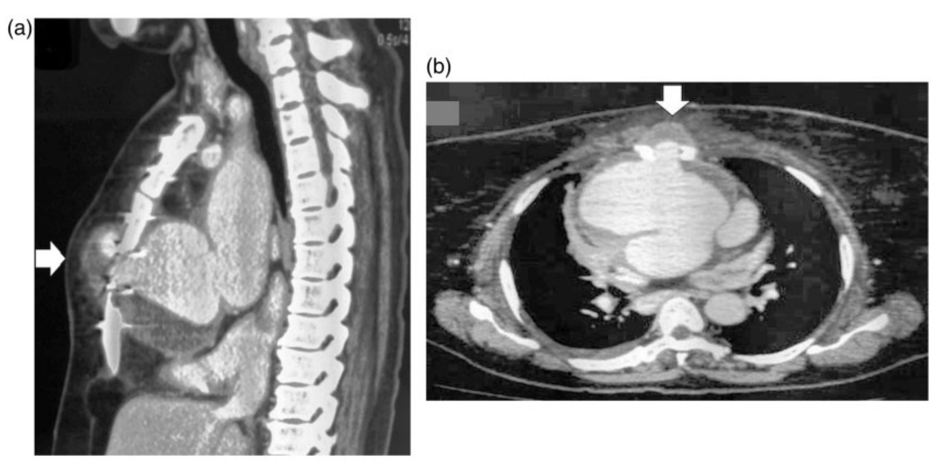

Figure 1. Preoperative computed tomography angiograms demonstrating a pseudoaneurysm of the ascending aorta eroding through the sternum into the subcutaneous tissue in (a) case 1 and (b) case 2.

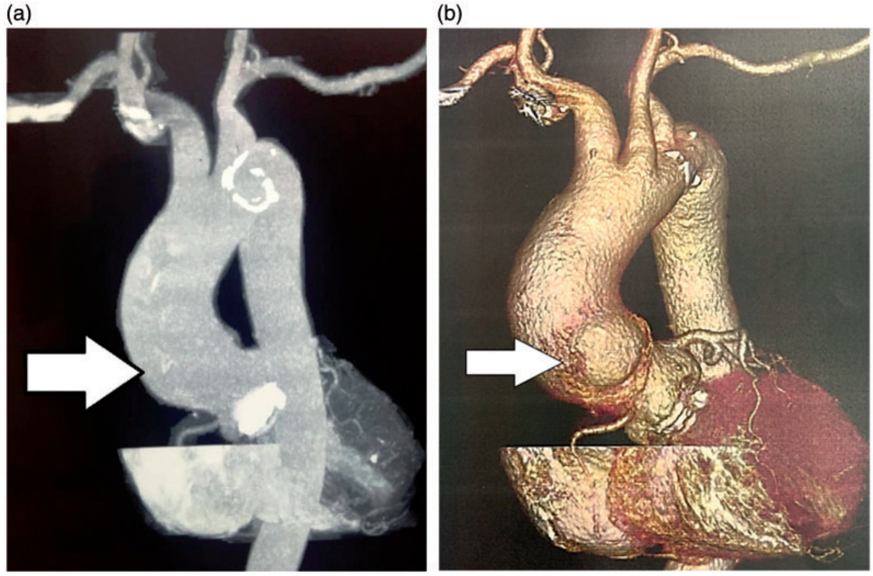

Figure 3. (a, b) Computed tomography angiogram at the 8-month postoperative follow-up in case 1. Arrows indicate the site of pseudoaneurysm repair.

sternotomy and repair the aortic defect in a still and dry field. A left ventricular apical vent is easily placed through a left anterior minithoracotomy, and is a useful adjunct to avoid ventricular distension during cooling.[2,6] It allows the heart to fall away from the sternum and may help to avoid cardiac injury during sternal reentry. Alternatively, a percutaneous transjugular pulmonary artery vent can be placed. In patients whose CTA suggests descending aortic disease, right axillary artery and femoral vein cannulation should be preferred in order to avoid a retrograde embolism. If graft replacement of the aorta is required, the aorta will need to be dissected circumferentially, and either crossclamping and cardioplegic arrest with whole body perfusion or hypothermic circulatory arrest with antegrade cerebral perfusion should be planned. These strategies should help to ensure reproducible outcomes in this difficult clinical situation. Despite the increased risk of mortality due to fatal bleeding from rupture of the pseudoaneurysm upon sternal reentry, specially with bony involvement,[1,7] successful surgical correction is possible with good long-term results.[8] Case-specific preoperative planning and selection of the appropriate technique can improve outcomes. Because the pseudoaneurysm can recur,[4] and aortic disease may progress, careful follow-up with CTA or magnetic resonance angiography is warranted after such repairs.

Declaration of conflicting interests

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