the pattern of communication and cooperation between the echocardiographic anesthetist and the surgeon—both verbally have to act like a single person.

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Safe sternal reentry in the setting of a giant aortic pseudoaneurysm and aortic regurgitation

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See related commentary on pages e96-7.

A rare but potentially devastating complication of aortic surgery is the development of a large pseudoaneurysm, which results from dehiscence of a previously placed aortic graft from 1 or both suture lines.^{1,2} Critical to a successful outcome in this scenario is a strategy that will prevent catastrophic hemorrhage and ensure cerebral protection should the pseudoaneurysm be directly entered during sternal reentry, which may be unavoidable depending on its size and location.³ When clinically significant aortic regurgitation is present, adequate measures to prevent left ventricular (LV) distention must be factored into the setup of cardiopulmonary bypass (CPB) and operative planning. The purpose of this report is to describe a complex aortic case that encompassed these considerations in the surgical approach.

CASE REPORT

A 66-year-old man with a previously repaired type A dissection presented with worsening shortness of breath

alleviated by lying on his right side. Computed tomography of the chest revealed a giant ascending aortic pseudoaneurysm compressing the right pulmonary artery and vein secondary to dehiscence of the aortic graft from the proximal and distal anastomoses (Figure 1). Moderate-to-severe aortic regurgitation was demonstrated by transthoracic echocardiogram. Shortly after admission, respiratory and acute renal failure developed in the patient.

The patient was taken urgently to the operating room to remove the previous aortic graft and reconstruct the thoracic aorta. The patient was peripherally cannulated for CPB via the axillary artery and femoral vein. A left anterolateral thoracotomy was then made, and the fourth intercostal space was entered. The LV apex was visualized, and pledgeted sutures were placed to secure an LV vent. Bilateral carotid artery cannulation was then performed via cervical cut-down to allow for selective antegrade cerebral perfusion, which was achieved using 14F pediatric cannulas (Figure 2).^{3,4} Flow rates of 750 mL to 1.0 L/min at 9°C were achieved, and the carotid arteries were clamped proximal to the cannulation sites, which served to protect the brain from air embolism in the event of entry into the pseudoaneurysm during sternal reentry. Inflow of normothermic blood from the LV sump did not affect pump outflow temperature to the carotid arteries. Electroencephalographic quiescence was observed before sternal entry and throughout the case.

The patient was cooled to 34°C, and the sternum was entered 140 minutes into the operation. During sternal reentry, CPB flow was temporarily reduced from full flow (5.5 L/min) to partial flow (3.6 L/min). Re-

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FIGURE 1. Admission computed tomography angiogram showing a giant ascending aortic pseudoaneurysm (*left, arrow*) with compression of the right pulmonary artery and vein (*middle, arrowheads*), aneurysmal dilation of the aortic arch, and (*right*) close proximity to the posterior sternum.

sternotomy was performed without complication. The pseudoaneurysm was next opened under moderate hypothermic circulatory arrest (25°C, nasopharyngeal).⁵ A total arch replacement was performed with an end-to-end anastomosis to the descending aorta and reimplantation of the arch vessels. Total moderate hypothermic circulatory arrest time was 34 minutes. Equal cooling to both cerebral hemispheres was maintained during this time via selective cerebral perfusion through the carotid arteries. The sinotubular junction and coronary ostia were grossly distorted requiring a Cabrol aortic root replacement with a valved homograft and end-to-end anastomoses of the right and left coronary arteries to

8-mm polytetrafluoroethylene grafts that were implanted end-to-side to the root replacement. Crossclamp and CPB times were 168 and 345 minutes, respectively.

Intraoperatively, the patient required transfusion of 18, 15, and 4 units of packed red blood cells, fresh-frozen plasma, and cryoprecipitate, respectively, and 7 packs of platelets. He had a protracted intensive care unit course (12 weeks) secondary to respiratory and renal failure, but no neurologic sequelae. He is currently alive, living at home 2 years postoperatively.

CONCLUSIONS

Selective antegrade cerebral perfusion via carotid artery cannulation allowed safe sternal reentry and replacement of the thoracic aorta in a patient with a giant ascending aortic pseudoaneurysm.

Conflict of Interest Statement

Authors have nothing to disclose with regard to commercial support.

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FIGURE 2. Preparation for sternal reentry in the setting of a giant aortic pseudoaneurysm with aortic regurgitation. Peripheral CPB was initiated via the axillary artery and femoral vein, LV apical vent via left anterolateral thoracotomy, and selective antegrade cerebral perfusion via bilateral carotid artery cannulation.

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Key words: ascending aorta, reoperative cardiac surgery, selective antegrade cerebral perfusion, carotid artery cannulation

EDITORIAL COMMENTARY

More than one way to skin a cat

Joseph S. Coselli, MD, and Ourania Preventza, MD

See related article on pages e94-6.

The phrase “more than one way to skin a cat” raises a visual image of the mistreatment of our furry feline friends. A southern interpretation, however, is derived from the numerous ways to skin a catfish. Catfish don’t have scales and, consequently, have to be skinned. You can start from the head, you can start from the tail, you can go up and down the middle, and so forth.

In this issue of the *Journal*, Wehman and colleagues¹ describe a complex aortic case that involves the successful repair of a giant pseudoaneurysm of the aorta in a patient who previously had an ascending graft replacement for aortic dissection with dehiscence of the aortic valve and valvular insufficiency. The main thrust of their report focuses not on the specific techniques of separating the sternum from the pseudoaneurysm but rather on cerebral protection.

After Michael E. DeBakey’s first successful replacement of the transverse aortic arch,² the landscape changed entirely in 1974 when Randall Griepp³ demonstrated the

clinical effectiveness of deep hypothermic circulatory arrest for arch replacement. Three of four patients survived neurologically intact after undergoing arch replacement, showing clearly that hypothermia provided not only adequate brain protection but also a quiet, dry field in which to conduct aortic reconstruction.

Despite the proven benefits of hypothermic circulatory arrest alone, it remains a challenge to provide adequate global cerebral protection, and of course there is the ever-present risk of stroke. Historically, the sites of cannulation for pump return have been the ascending aorta and the femoral artery. In patients with a significant burden of atherosclerosis, peripheral vascular disease, or both, however, these sites are not optimal. In an effort to provide a safe yet prolonged circulatory arrest period for complex arch reconstruction, antegrade cerebral perfusion has increasingly gained in popularity.^{4,5} Sabik and colleagues⁶ at the Cleveland Clinic made an important contribution in this area by helping to popularize the use of the axillary artery as an alternative peripheral site of arterial cannulation. That technique is particularly useful in assisting antegrade cerebral perfusion via the right common carotid artery. Urbanski⁷ made a further contribution by using left common carotid artery cannulation in 2 patients, each with acute aortic dissection and malperfusion, for both cardiopulmonary bypass and antegrade cerebral perfusion during aortic arch repair.

Wehman and colleagues¹ have carried the concept further with bilateral carotid artery exposure through separate small neck incisions and direct cannulation, for both cardiopulmonary bypass and antegrade cerebral perfusion, with the addition of a left ventricular vent inserted through a separate small thoracotomy incision. Under the protection of antegrade cerebral perfusion and reduced flow, they achieved sternal reentry uneventfully, then entered the large pseudoaneurysm under moderate hypothermia. Total transverse arch and root replacement were then carried out successfully. Despite a complex postoperative course, they report the patient to be doing well 2 years later. With

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