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Aorta: Case Report

Cardiomegaly Status After Open Repair of an Arch Aneurysm

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This report describes a patient with a thoracic aortic aneurysm who presented with chest pain and dyspnea. Preoperative studies revealed a massive cardiomediastinal silhouette. Within hours after the operation, a profound reduction in cardiomegaly was observed. Herein, we describe the distinctive imaging and technical aspects of the surgical procedure.

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Aneurysms of the aortic arch are typically associated with the ascending aorta and less commonly may extend to the descending thoracic aorta (DTA) or thoracoabdominal aorta. Most patients with aortic arch aneurysms are asymptomatic, and these aneurysms are typically discovered incidentally. Symptoms may be manifested—particularly in cases of large arch aneurysms—and include stroke, dysphagia (due to esophageal compression), dysphonia (resulting from recurrent laryngeal nerve compression), dyspnea (due to lung compression), and syncope resulting from rupture.

A 60-year-old woman with a history of smoking and hypertension presented with a 3-day history of chest pain and shortness of breath. Initial physical examination revealed blood pressure of 160/80 mm Hg, weight of 54.5 kg, and body mass index of 16.3 kg/m^2. On admission, laboratory results showed a hemoglobin level of 13 g/dL, creatinine level of 1.1 mg/dL, and white blood cell count of 9×10^9/L.

Preoperative chest radiography displayed a significant enlargement of the cardiomediastinal silhouette, consistent with an aortic aneurysm and pericardial effusion (Figure 1). Computed tomography angiography with intravenous administration of contrast material revealed the presence of a thoracic aortic aneurysm involving the distal ascending and aortic arch as well as the proximal DTA, measuring 6.2 cm in diameter (Figure 2).

Preoperative echocardiography revealed normal left ventricular size and systolic function, with a left ventricular ejection fraction of 60% to 65%. The estimated right ventricular systolic pressure was 52 mm Hg, indicating moderate pulmonary hypertension. Notably, severe tricuspid regurgitation was observed. A 3.5-cm circumferential pericardial effusion was observed. No evidence of pericardial tamponade was seen. The patient was scheduled for urgent surgical procedure and underwent open repair under total cardiopulmonary bypass and systemic hypothermia to a temperature of 20 °C. Blood cardioplegia was perfused at 4 °C. This was supplemented with continuous retrograde cold blood, keeping the myocardial septal temperature below 15 °C. The ascending aorta, transverse aortic arch, and proximal DTA were resected and replaced with a 30-mm Gelweave (Terumo Aortic) woven Dacron graft repair with an added 18-mm Dacron graft selected for graft replacement of the aneurysm. The graft was sutured to the proximal DTA in an end-end fashion (zone 3 arch) by a running 3-0 Prolene suture with anastomosis of the left subclavian artery (LSA) in a beveled fashion. The innominate artery was bypassed with the 18-mm Dacron graft with a running 4-0 Prolene suture, and flow was restored. The left common carotid artery was bypassed with a 12-mm Dacron graft with a running 4-0 Prolene suture. The procedure was performed through a median sternotomy.

The patient was extubated within the first 8 hours after the operation. A chest radiograph on the first postoperative day (16 hours after surgical procedure) exhibited remarkable improvement, demonstrating a significant decrease in the cardiomediastinal silhouette by 40%. The postoperative echocardiogram revealed a significantly improved overall estimated ejection fraction, ranging from 75% to 80%, with only mild tricuspid

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regurgitation. A trivial pericardial effusion was observed (Figure 3).

After intensive care medical treatment, intravenous diuresis, and respiratory physical therapy, the patient was discharged home 9 days after the operation. Histopathologic analysis revealed a chronically dissected aortic wall with a fibrotic and organized dissection fork along with notable damage and loss of medial elastin fibers, as observed through elastin stain.

Postoperative computed tomography angiography performed 1 month after the intervention revealed a patent graft without stenosis or abnormalities. The patient remained asymptomatic during the 1-year follow-up, with no medical or surgical complications.

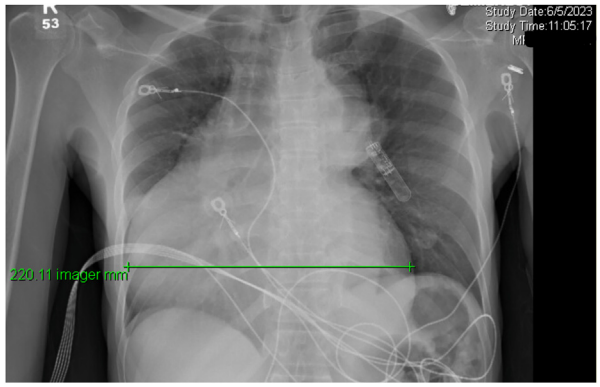

FIGURE 1 Preoperative chest radiograph. Massive cardiomegaly is revealed, with a maximum diameter of 22 cm.

COMMENT

After the images were presented in our multidisciplinary meeting, most of the physicians agreed that this was the most significant modification in cardiomegaly size they had ever witnessed within a span of less than 24 hours. Multiple causes of cardiomegaly can be recognized, including coronary artery disease (the most common), hypertensive and valvular heart disease, aortic aneurysms, idiopathic cardiomyopathy, infiltrative diseases (such as amyloidosis), pulmonary conditions (such as primary pulmonary hypertension), and chronic obstructive pulmonary disease, among others.[1]

Whereas thoracic aortic arch aneurysms are less common than ascending or descending thoracic aneurysms, they represent a life-threatening condition because of the potential risk of rupture. Aortic arch aneurysms can be extremely complex and may be manifested with symptoms including compression of adjacent structures (hoarseness, due to the compression of the recurrent laryngeal nerve, or stridor, resulting from tracheal compression), chest pain, shortness of breath, and even syncope due to rupture.

Multiple surgical procedures have been described for aortic arch reconstruction, such as island reimplantation of the supra-aortic vessels

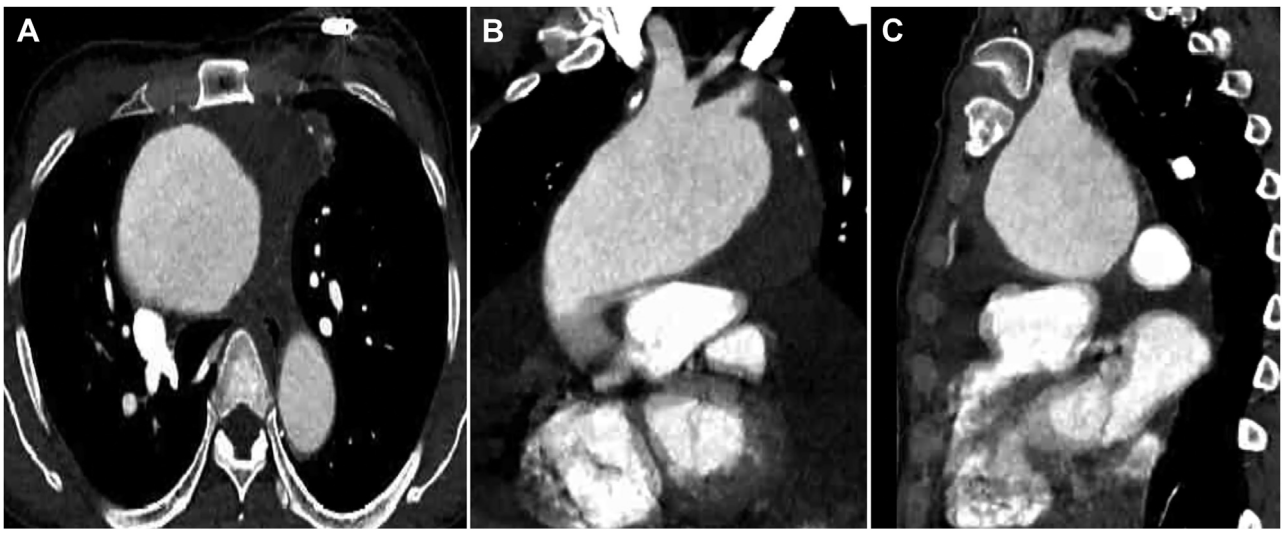

FIGURE 2 Composite image of preoperative computed tomography angiography with intravenous administration of contrast material revealing a 6-cm aortic arch aneurysm evaluated in (A) axial, (B) coronal, and (C) sagittal planes.

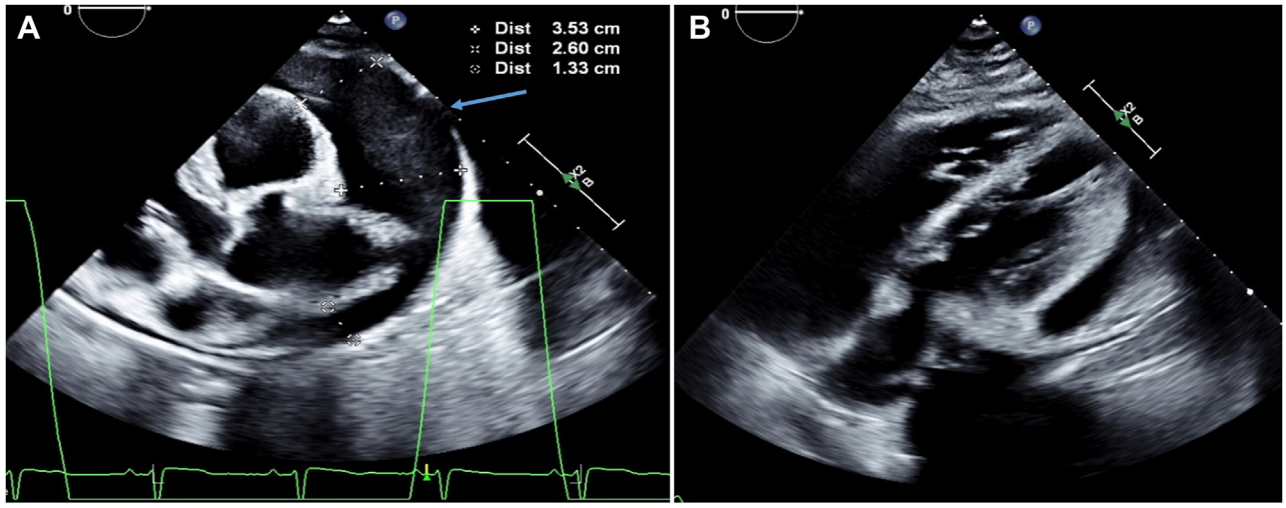

FIGURE 3 Combined echocardiography image. (A) Preoperative transthoracic echocardiogram showing a 3.5-cm pericardial effusion (arrow). (B) Postoperative echocardiogram demonstrating improvement of pericardial effusion.

and total arch repair with multiple Dacron graft side branches. Hybrid techniques include zone 0 debranching (with bypass from the ascending aorta to all 3 supra-aortic vessels); zone 1 debranching, involving bypass or transposition of the left common carotid and LSA; and zone 2 debranching (with bypass or transposition of the LSA). All of these techniques are followed by endovascular aneurysm exclusion.[2-4]

Complex, advanced endovascular total arch techniques have also been performed.[5] Minimally invasive techniques, including complete endovascular branched and multibranched reconstructions as well as a complete endovascular approach, are being presented and considered as alternatives to traditional open repair. However, open repair remains the standard for providing more durable reconstruction in treating aortic arch aneurysms.[5,6] When open repair of arch aneurysms is performed in high-volume centers and follows adequate patient selection with improvements in surgical techniques and perfusion strategy, results may be adequate, leading to excellent long-term outcomes.[7]

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DISCLOSURES

Anthony Estrera is on the advisory board of Artivion and a consultant for WL Gore and Terumo Aortic. The other authors have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

PATIENT CONSENT

Obtained through signed statement to disclose this clinical case and associated information.

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