CASE REPORT

Aorto-pseudoaneurysm-ventricular regurgitation after aortic root replacement

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Abstract
We describe a 48-year-old man with aorto-pseudoaneurysm-ventricular regurgitation. It was due to disruption of both proximal and distal anastomoses after aortic root replacement for detachment of a prosthetic valve implanted for a sinus of Valsalva aneurysm with aortic valve regurgitation. The chest was opened during cardiopulmonary bypass using a deep hypothermic circulatory arrest to avoid rupture of the aneurysm because of a close relation between the pseudoaneurysm and the sternum. Aortic root re-replacement was performed successfully.

Key words
Pseudoaneurysm · Sinus of Valsalva aneurysm · Aortic root replacement

Introduction
Pseudoaneurysm is a rare but potentially lethal complication of aortic composite Dacron graft procedures. Depending on the location and rapidity of development of the anastomotic dehiscence, patients may be asymptomatic or present with cardiogenic shock. We encountered aorto-pseudoaneurysm-ventricular regurgitation due to disruption of both proximal and distal anastomoses after aortic root replacement with a composite Dacron graft, which was considered to be rarer entity.

Case
A 48-year-old man was admitted to our hospital with congestive heart failure due to aortic valve regurgitation (AR). Enhanced computed tomography (CT) revealed a sinus of Valsalva aneurysm (SVA) (Fig. 1). Aortography revealed severe AR and an SVA. He had previously had suppurative spondylitis at age 34 years and underwent antibiotic therapy. He had no history of autoimmune disorder, such as Behçet’s disease.

He underwent aortic valve replacement (AVR) with direct closure of the defect in the SVA during the first operation. Pathology examination of the SVA wall suggested that infection was the cause. Aortitis was not diagnosed. The aortic valve leaflet was edematous and became fragile. Because no bacterium was detected from the tissue, antibiotics were not introduced.

At 71 days after the AVR, cardiac auscultation revealed a Levine 3/6 diastolic regurgitation murmur at the left parasternum, and transthoracic echocardiography revealed moderate-to-severe AR and dehiscence of the aortic prosthetic valve. He then underwent aortic root replacement because the aortic root was fragile with inflammation and it was impossible to preserve it. A composite Dacron graft was implanted on the left ventricle muscle itself to avoid detachment of the graft. A graft interposition technique with an 8-mm graft was used to reconstruct the left coronary artery, and the Carrel patch technique was used to reconstruct the right coronary artery. The composite graft was not wrapped with the aneurysm wall. The operative specimen culture revealed no bacterium.

The patient suddenly had hemoptysis 34 days after the root replacement, and CT scans demonstrated suspicion of bleeding from the right upper lung that adhered...
to the mediastinum. Lobectomy was carried out to control the bleeding.

Cardiac auscultation revealed a Levine 3/6 diastolic regurgitation murmur at the left parasternum 9 days after lobectomy, and transthoracic echocardiography revealed a low echoic area around the graft. Graft wall contraction and expansion simultaneous with the left ventricle was detected (Fig. 2). Mild-to-moderate regurgitation into the left ventricle around the composite graft was detected (Fig. 3). Enhanced CT suggested blood flow from the distal graft anastomosis into the left ventricle around the graft (Fig. 4), indicating aorto-pseudoaneurysm-ventricular regurgitation due to disruption of both proximal and distal anastomoses. CT demonstrated a close relation between the pseudoaneurysm and the sternum. Therefore, the chest was opened during cardiopulmonary bypass (CPB) using deep hypothermic circulatory arrest to avoid rupture of the aneurysm. To secure total flow without exposing the heart, the femoral vein and internal jugular vein were chosen for venous drainage, and the femoral artery was selected for perfusion.

Dehiscence of both distal and proximal anastomoses was diagnosed intraoperatively, and aortic root replacement was carried out. Much more proximal left ventricular outflow than for the first operative proximal anastomosis was chosen to prevent redehiscence of the composite graft. The left coronary artery was reconstructed with the 8-mm graft that was used during the first operation. The right coronary artery was reconstructed with the Carrel patch technique, the coronary ostium was cut at the first operation’s composite graft wall, and the graft wall was anastomosed to the new composite graft.

The patient’s postoperative course was complicated. Paralysis was diagnosed with his left arm and right leg. Complete atrioventricular block was detected, and pacemaker implantation was needed. It took him a long time to recover consciousness, possibly because of the effect of the circulatory arrest. Postoperative CT revealed a perfect repair of the aortic root. He was discharged with slight disability 47 days after the last operation. In the outpatient clinic at the 6-month follow-up visit, he was well recovered without recurrence of the pseudoaneurysm.

**Discussion**

Pseudoaneurysms are rare but potentially lethal complications of aortic composite Dacron graft procedures. Depending on the location and rapidity of development of the anastomotic dehiscence, patients may be asymptomatic or present with cardiogenic shock.1

Diastolic regurgitation into the left ventricle is thought not to happen after aortic root replacement with a composite graft because perivalvular leak does not occur even when proximal anastomotic dehiscence is diagnosed. Both proximal and distal anastomotic disruption is needed to make a shunt from the aorta to the pseudoaneurysm to the left ventricle. Graft wall contraction and expansion movement was detected with transthoracic echocardiography. The movement of the graft wall contraction indicates the existence of higher pressure in the pseudoaneurysm than in the aorta during the systolic phase, which suggests blood flow from the left ventricle into the pseudoaneurysm. During the diastolic phase, pressure in the pseudoaneurysm is lower than in the aorta because of blood flow into the left ventricle, which causes expansion of the graft wall. Management of an aortic pseudoaneurysm may include an operative procedure, deep hypothermic circulatory arrest, and transfemoral balloon aortic occlusion.2

Most SVAs are congenital in origin, secondary to incomplete fusion of the aortic media to the annulus fibrosis.3 Less frequently, they are acquired as a sequel of endocarditis, atherosclerosis, cystic medial necrosis, or trauma.4 Surgical repair of an unruptured SVA entails exclusion of the aneurysm sac and closure of the sinus defect using an expanded polytetrafluoroethylene (ePTFE) patch or a pericardial patch. The use of an ePTFE patch is preferred over the pericardial patch.

**Fig. 1** Enhanced computed tomography (CT) reveals a sinus of Valsalva aneurysm before the first operation. Ao, aorta.