Left Ventricular Outflow Tract Pseudoaneurysm after Aortic Valve Replacement: Case Report

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A 68-year-old woman was admitted for angina pectoris and general fatigue without symptoms or signs of infective endocarditis. The patient had undergone re-replacement of an aortic prosthetic valve three months previously. Transesophageal echocardiography revealed an echo-free cavity in the mitral-aortic intervalvular fibrosa region just below the aortic annulus, communication of the echo-free cavity with the left ventricular outflow tract, and turbulent flow into the cavity. Left ventriculography revealed a cavity that arose just below the aortic prosthetic valve, and which expanded in systole and collapsed in diastole. Coronary angiography showed significant stenosis of the proximal right coronary artery, but neither stenoses nor compression were found in the left coronary artery. Patch closure of the pseudoaneurysm and aortic root replacement using a Freestyle valve with reconstruction of the coronary arteries were successfully performed. Surgical trauma to the intervalvular fibrosa during removal of the original prosthetic valve may have caused pseudoaneurysm formation in this patient.

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Although left ventricular outflow tract pseudoaneurysm (LVOT PsA) is often found in infective native or prosthetic valve endocarditis in the aortic position, non-infected LVOT PsA is extremely rare (1). A few non-infected LVOT PsA have been documented in the literature as a complication of aortic valve surgery, aortic valve replacement (AVR) or chest trauma (1-4). Non-infected LVOT PsA is usually located in the mitral-aortic intervalvular fibrosa, and may rupture into the pericardium, causing fatal tamponade; alternatively, it may compress the coronary arteries, causing angina pectoris (1-4). Hence, surgical repair of the pseudoaneurysm is essential. Successful surgical management requires information on the exact location and extension of the pseudoaneurysmal cavity, as well as on the involvement of the mitral-aortic intervalvular fibrosa (5).

Herein, the case is described of a non-infected LVOT PsA after AVR, and its successful surgical management is reported.

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Case report

A 68-year-old woman was admitted to the present authors' hospital five years after having undergone aortic and mitral valve replacement respectively with 21- and 27-mm St. Jude Medical (SJM) valves (St. Jude Medical, Inc., Minneapolis, MN, USA). A diagnosis had been made for non-structural dysfunction of the aortic prosthetic valve as a result of pannus formation. Following removal of the aortic SJM valve, a 21-mm Freestyle valve (Medtronic Inc., Minneapolis, MN, USA) was implanted in the subcoronary position. The patient recovered uneventfully and was discharged on the 14th postoperative day.

Three months later, the patient was readmitted for angina pectoris and general fatigue, but without any symptoms or signs of infective endocarditis. On admission, her condition was stable, her blood pressure was 110/70 mmHg, and pulse rate 104 per min with an irregular rhythm. No cardiac murmur was heard, and the closing sounds of the mitral prosthetic valve were clearly audible. Chest radiography showed moderate cardiomegaly with a cardiothoracic ratio of 0.64, while electrocardiography revealed atrial fibrillation without left ventricular hypertrophy. Transesophageal echocardiography (TEE) showed an echo-free cavity posteriorly in the mitral-aortic intervalvular fibrosa region, just below the aortic annulus

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Figure 1: Transesophageal echocardiograms (A, long-axis; B, short-axis) showing an echo-free cavity in the mitral-aortic intervalvular fibrosa region just below the aortic annulus. Ao: Aorta; LA: Left atrium; P: Pseudoaneurysm.

(Fig. 1). Communication of the echo-free cavity with the LVOT (Fig. 1) and a turbulent flow into the cavity were also delineated on echocardiograms. The size of the cavity was measured as 11×13×25 mm. The aortic and mitral replacement valves were evaluated echocardiographically as being normal. Computed tomography also revealed a cavity which extended posteriorly from the LVOT to the space between the aortic root and the left atrium. Left ventriculography showed a cavity that arose just below the aortic bioprosthesis in the posterolateral direction, and which expanded in the systole and collapsed in the diastole (Fig. 2). No communication to the other cardiac chambers was found. Coronary angiography showed significant stenosis of the proximal right coronary artery, but no stenoses or compression were found in the left coronary artery (Fig. 3). Based on these findings, the diagnosis of LVOT PsA in the mitral-aortic intervalvular fibrosa and significant stenosis of the proximal right coronary artery was made, and patch closure of LVOT

Figure 2: Left ventriculograms (A, systolic; B, diastolic) showing the cavity (arrows) that arose just below the aortic prosthetic valve and which expanded in systole and collapsed in diastole.

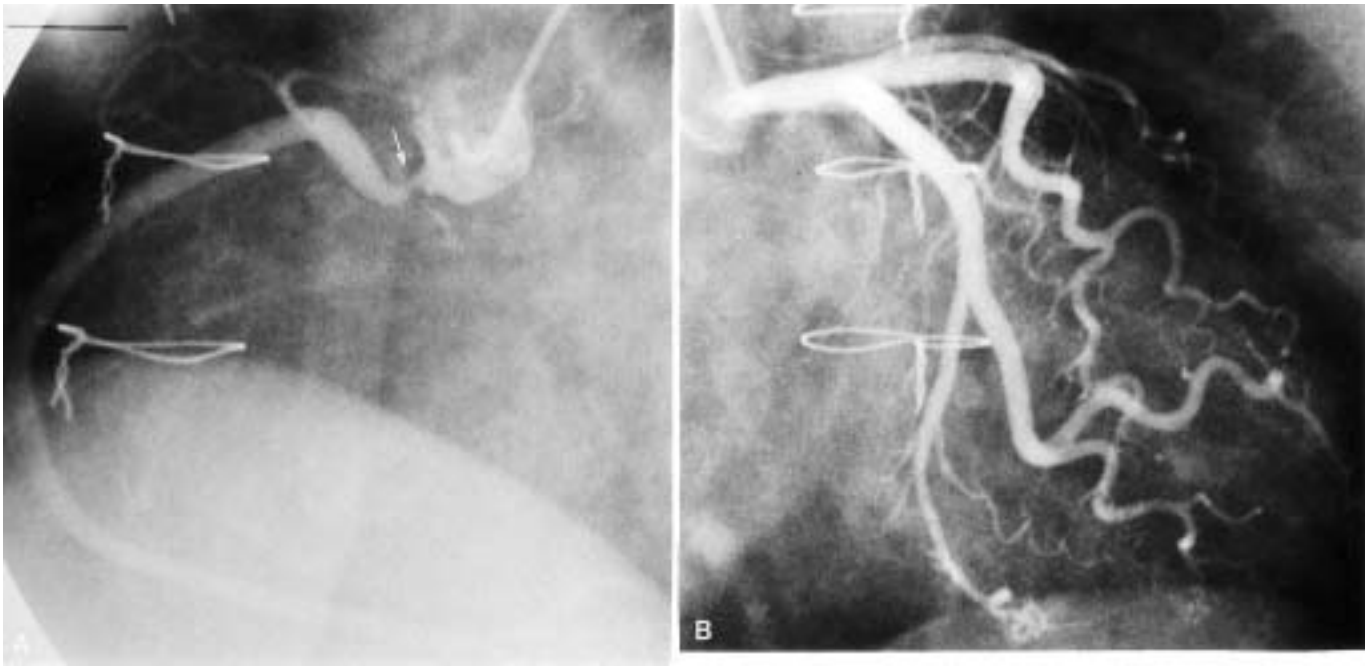

Figure 3: Coronary angiograms (A, right coronary artery; B, left coronary artery) showing severe stenosis of the proximal right coronary artery (arrow) and no stenoses in the left coronary artery.

PsA, aortic root replacement with a Freestyle valve, and reconstruction of the coronary arteries were scheduled.

At surgery, a median sternotomy was performed after partial cardiopulmonary bypass (CPB) had been instituted through cannulas inserted into the left femoral artery and veins. Thereafter, the superior caval vein was cannulated via the right atrium in order to establish total CPB. The ascending aorta was clamped, and myocardial protection achieved with antegrade cold blood cardioplegia. The previously implanted Freestyle valve was found to be in good condition after its removal, but a 25×17 mm orifice of the PsA was found below the prosthetic valve, in the mitral-aortic intervalvular fibrosa. Surgical trauma to the intervalvular fibrosa during removal of the first (SJM) prosthetic valve was considered to be the cause of pseudoaneurysm formation. Tissue overgrowth from the adjacent valve and distal sutures close to the coronary orifice caused stenosis of the orifice of the right coronary artery. The orifice of the aneurysm was closed with a bovine pericardial patch, and a new Freestyle valve was then sutured to the aortic root using the full root replacement technique. After resection of the stenotic region of the right coronary artery, both coronary arteries were reconstructed with interposition of saphenous vein grafts because of difficulty in mobilization of the coronary arteries caused by stiffness of tissue. The patient was weaned off CPB without difficulty. Postoperative transthoracic echocardiography (TTE) and left ventriculography confirmed the disappearance of the LVOT PsA and patency of the coronary arteries.

Discussion

Although LVOT PsA is often found in infective native or prosthetic valve endocarditis in the aortic position, non-infected LVOT PsA - particularly after AVR - is extremely rare. Indeed, to the present authors' knowledge, only five cases of LVOT PsA after AVR have been described to date (1-4).

Pappas and colleagues (2) reported the first two cases of LVOT PsA after AVR and, based on their experience, emphasized that three factors might contribute to development of LVOT PsAs: (i) an unusually hyperkinetic heart action; (ii) an inherent weakness of the aortic root; and (iii) weakness induced at operation. In the present patient, weakness resulting from injuries to the intervalvular fibrosa - particularly due to excessive resection of the periprosthetic tissue during removal of the malfunctioning aortic SJM valve - may have been the cause of the PsA, considering that the history of infective endocarditis was negative during the most recent three months and no findings of infective endocarditis were found during surgery.

In the past, cineangiography has been the standard for diagnosing aortic root lesions (6). However, more recently a combination of TTE and TEE, including Doppler imaging, has been considered to be the most sensitive and reliable diagnostic tool for cystic lesions in the LVOT such as pseudoaneurysm in the inter-

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valvular fibrosa or aortic annular abscess. Afridi et al. (7) have shown TEE to be superior to either TTE or aortography in the detection of intervalvular pseudoaneurysms, and that intervalvular pseudoaneurysm exhibits a characteristic feature during the cardiac cycle. According to the study by Afridi et al., LVOT PsA is observed as a pulsatile echo-free pouch expanding in early systole and collapsing in diastole, located posteriorly, in the interventricular region, and bounded by the base of the anterior mitral leaflet, the medial wall of the left atrium and the posterior aortic root. A pseudoaneurysm in the intervalvular fibrosa also has communication with the LVOT, and has flows into the cavity. On the other hand, an aortic annular abscess is often seen at the level of the aortic valve or sinus of Valsalva, and has no pulsatility and an intact intervalvular region. In addition, communications with the LVOT and flows into the cavity are usually not observed in aortic annular abscesses. In the present case, all of these characteristic features of LVOT PsA were confirmed by TEE and left ventriculography.

Surgical management for LVOT PsA is always mandatory, because of potentially lethal complications resulting from rupture or coronary arterial compression. Simple closure or patch closure of the orifice of the pseudoaneurysm is usually performed through the aortic root after having removed the previous prosthesis (1-4). Although Borman et al. (1) used a Dacron patch in their two patients, in the present patient a bovine pericardial patch was employed to close the orifice of the LVOT PsA. The advantages in using pericardium for closure of an orifice of LVOT PsA are its easy handling characteristics and impermeability to blood. The possibility of late calcification of the bovine pericardium is a major concern, though David and colleagues (8) have emphasized that no evidence of either fatigue or calcification was found on bovine pericardium used for reconstruction of the mitral annulus in 56 patients during a follow up period more than seven years.

With regard to prevention of stenosis of the coronary artery after AVR with a stentless valve, great caution should be exercised in order to keep distal sutures well away from the coronary orifices (9).

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