Transcatheter Closure of Left Ventricular Pseudoaneurysm After Mitral Valve Replacement

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Left ventricular pseudoaneurysm (LVPA) is a rare but lethal complication of mitral valve replacement (MVR) or myocardial infarction. Early correction is necessary for patients with extensive and expanding LVPA. We report a transcatheter closure of LVPA after MVR. A 63-year-old woman presented with an LVPA 2 months after MVR. The repeated computed tomographic scan and transthoracic echocardiography showed enhancement of pseudoaneurysm. The LVPA was closed successfully with Amplatzer Vascular Plug using a transcatheter approach.

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Left ventricular pseudoaneurysm (LVPA) is an infrequent but highly lethal complication of myocardial infarction and mitral valve replacement (MVR) that occurs in less than 0.1% of MVR.[1] Although the clinical signs are highly variable depending on location and size of the LVPA, the presentation is generally dyspnea, chest pain, pericardial tamponade, and rarely with the asymptomatic course.[2] Prompt diagnosis is essential for early surgical intervention in cases of significant, expanding LVPA; however, there may be a role for conservative follow-up in cases of small pseudoaneurysms.

A 63-year-old woman with dyspnea class III (New York Heart Association [NYHA] classification), atrial fibrillation, and severe rheumatic mitral stenosis underwent MVR with a 27-mm Medtronic ATS valve (Medtronic, Minneapolis, MN) and DeVega tricuspid annuloplasty at our hospital, 3.5 years before presentation. She also underwent a cryomaze procedure using the ATS CryoMaze Surgical Ablation System (Medtronic) and left atrial appendage ligation for atrial fibrillation. The posterior mitral leaflet was partially preserved. All procedures were performed via a median sternotomy. She was discharged 7 days postoperatively after an uneventful recovery.

The patient was readmitted to our hospital with a noninfectious discharge at the inferior aspect of the incision, 2 months after MVR. Transthoracic echocardiography (TTE) revealed a normally functioning prosthetic mitral valve and an abnormal sac on the posteromedial wall of the left ventricle (LV). Contrast-enhanced computed tomography (CT) revealed a pseudoaneurysm originating from the posteromedial wall of the LV immediately below the implanted mitral valve. The pseudoaneurysm measured 27 × 14 × 15 mm, with its neck measuring 5 mm in diameter (Figure 1).

No sternal wound dehiscence was observed, and wound culture results were negative. After sternal wound debridement, we decided to adopt a conservative approach with close follow-up, owing to the high mortality and morbidity risks associated with surgical repair and the small size of the sac. The patient was discharged and followed-up with TTE and CT.

She returned 1 month later with new-onset dyspnea and chest pain. TTE revealed enlargement of the LVPA (75 × 50 × 30 mm). Conventional angiography also revealed an enhancing of the pseudoaneurysm with a narrow neck (Figure 2, Video). The orifice of the aneurysmal sac was located posterior to the LV and immediately below the mitral annulus. Our heart team decided to perform transcatheter closure of the LVPA.

A multidisciplinary team performed the entire procedure using general anesthesia in a catheterization laboratory. A 0.035-inch wire followed by a pigtail catheter was carefully introduced into the LV using a 6-French sheath via the right transfemoral arterial approach. Left ventriculography was performed at left oblique 40-degree and cranial 20-degree positions, and a pigtail catheter was inserted into the LVPA through the aortic valve. Contrast angiography was performed to confirm that the catheter was placed in the optimal position (ie, away from the LV cavity). Subsequently, the delivery sheath was introduced into the LVPA under transesophageal echocardiographic (TEE) guidance, and the Amplatzer Vascular Plug III 9AVP3-063 (St. Jude Medical, Saint Paul, MN) was implanted into the LVPA neck. Left ventriculography and TEE were repeated to confirm optimal implantation of the plug device, and minimal contrast agent was identified within the device (Video).

The procedure was completed uneventfully, and the patient was extubated the following day. She was discharged on postoperative day 4 and followed up with monthly TTE and CT every 6 months during the first year and once a year thereafter. CT performed 2.5 years after transcatheter closure revealed no contrast agent filling the LVPA, which had reduced in diameter from 75 to 40 mm. The patient has been followed up for 3.5 years and has been asymptomatic (NYHA class I).

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Figure 1. Left ventricular pseudoaneurysm (arrow in image and inset) arising from the left ventricular posteromedial wall just below the implanted mitral valve.

Comment

LVPA is a rare complication of mitral valve surgery or myocardial infarction.[2] Although LVPA can close spontaneously in a few patients, it is associated with a 30% to 45% risk of rupture if untreated during the first year, with a 20% surgical mortality rate.[3,4] Predisposing factors include resection of the posterior leaflet, excessive decalcification of the annulus, deeply placed sutures or excessive traction on sutures, placement of an oversized prosthesis, redo MVR, and female sex.[5]

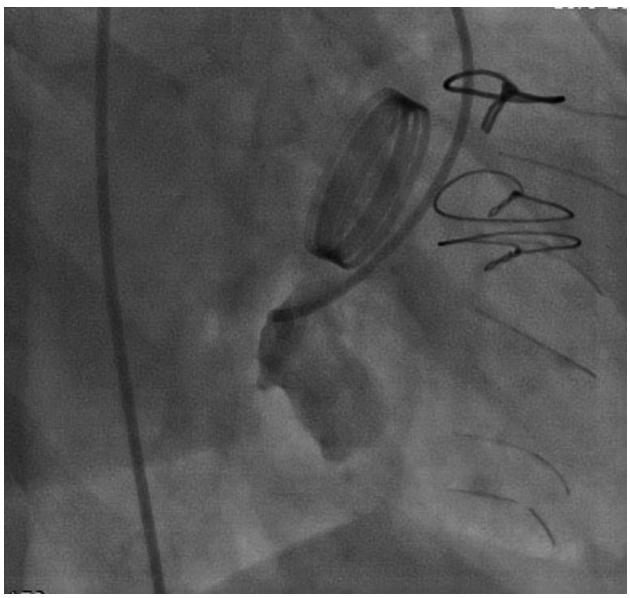

Figure 2. Conventional angiography demonstrates enhancement of the pseudoaneurysm with a narrow neck.

Even minimal injury to the annulus or the endomyocardium can cause separation of myocardial bands or between the mitral annulus and fibrous skeleton of the heart, which can predispose patients to LVPA. A small fissure might progress deeper into the myocardium secondary to elevated intraventricular pressure after cardiopulmonary bypass termination with delayed LVPA formation after MVR.[4,5]

Although most patients exhibit shortness of breath and chest pain, a few might remain asymptomatic.[1] Therefore, imaging is important for accurate diagnosis, considering the variable clinical presentation. TTE and TEE serve as first-line diagnostic imaging modalities for LVPA. Cardiac magnetic resonance imaging and CT or left ventriculography are useful for definitive diagnosis based on evaluation of the relationship of the LVPA regarding the LV.[5]

Most studies have reported early surgical repair as a first-choice treatment for this condition; however, a few clinicians reject redo surgery because of the high mortality rates.[4,5] Clinical outcomes of LVPA are unpredictable; therefore, this condition is therapeutically challenging. Sakai and colleagues[2] reported uneventful conservative management in 7 of 8 patients with LVPA complicating MVR.[2] Prêtre and colleagues have reported that surgical treatment is not warranted for a chronic, asymptomatic LVPA measuring less than 30 mm in diameter.[6] However, Frances and colleagues[4] have reported that 30% to 45% of untreated pseudoaneurysms rupture within the first year of their formation.

Although stroke can result from LVPA-induced thrombosis, and transcatheter closure is performed to prevent thromboembolic complications in patients with LVPA, transcatheter closure of an LVPA can precipitate a cerebrovascular event.[3] In the current case, the patient was asymptomatic, and the LVPA measured less than 30 mm in diameter at the first readmission. The patient was asymptomatic; therefore, we chose conservative follow-up in this case. However, progressive enhancement of LVPA, development new clinical symptoms, and the high mortality risk associated with redo surgery necessitated switching to a different therapeutic approach. Few case series and case reports have described transcatheter closure of LVPA.[3,7,8]

The clinical outcomes of LVPA complicating MVR are unpredictable, and redo surgery is associated with high mortality rates. Therefore, decision-making for optimal management of LVPA after MVR is challenging and controversial. We recommend the transcatheter closure technique as a useful therapeutic strategy for LVPA complicating MVR in patients with a high mortality risk.

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