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Closure of a Prosthetic Mitral Valve Paravalvular Leak Using a Ventricular Septal Defect (VSD) Amplatzer Occluder Device

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
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Conflict of interest: None declared

Patient: Female, 52-year-old
Final Diagnosis: Paravalvular leak
Symptoms: Abdominal discomfort • Early satiety • lower extremity edema • nausea • orthopnea • shortness of breath
Medication: —
Clinical Procedure: Percutaneous closure of mitral paravalvular leak
Specialty: Cardiology

Objective: Unusual clinical course

Background: Paravalvular leaks (PVL) are becoming more commonly experienced in clinical practice due to the increasing number of mitral valve replacements performed. There are about 182 000 valve replacements performed annually, with a 5–15% prevalence rate of paravalvular leaks. Due to increased mortality associated with surgical repair, percutaneous transcatheter closure procedures are increasingly being performed as an alternative to repeat surgery.

Case Report: We present the case of a 52-year-old woman with past medical history of mitral valve endocarditis who developed worsening acute heart failure 1 month after surgical bioprosthetic mitral valve replacement. Transesophageal echocardiography at the time revealed dehiscence of the bioprosthetic mitral valve and severe mitral regurgitation. She subsequently had emergent surgical bioprosthetic mitral valve replacement and annular reconstruction. The post-operative course was complicated by increasing dyspnea and lower-extremity edema, with recurrent pericardial tamponade requiring placement of a pericardial window. Based on her multiple comorbidities, most notably the concomitant right ventricular failure with severe pulmonary hypertension and prior pericardial patch repair with compromise of her mitral valve annulus, she was deemed inoperable for re-do surgery and eventually underwent a successful percutaneous closure of the mitral paravalvular leak with a ventricular septal defect (VSD) Amplatzer occluder device. The patient made good recovery and was discharged home a few days after the procedure.

Conclusions: Although use of the Amplatzer VSD occluder device for this indication currently remains off-label, our report supports the use of the VSD occluder device in this subset of patients considering the high mortality rates associated with repeat surgical procedure.

MeSH Keywords: Cardiac Catheterization • Heart Valve Diseases • Mitral Valve • Septal Occluder Device

Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/928003

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Background

Paravalvular leaks (PVL) are becoming more commonly experienced in clinical practice due to the increasing number of mitral valve replacements performed. There are about 182 000 valve replacements performed annually, with a 5–15% prevalence rate of paravalvular leaks [1]. About 1–5% of paravalvular leaks result in serious clinical consequences ranging from hemolytic anemia to congestive heart failure [2]. Due to increased mortality associated with surgical repair, percutaneous transcatheter closure procedures are increasingly being performed as an alternative to repeat surgery. We present the case of a 52-year-old woman who had a prosthetic mitral valve PVL successfully closed with a Ventricular septal defect (VSD) Amplatzer occluder device via an antegrade transseptal approach.

Case Report

A 52-year-old woman with a history of intravenous drug abuse and mitral valve infective endocarditis presented to her local emergency room with a 1-week history of worsening shortness of breath on minimal exertion, orthopnea, and lower-extremity swelling. She also had nausea, early satiety, and abdominal fullness/discomfort. She denied chest pain or palpitations but reported a 9-kg weight gain since the onset of symptoms.

One month prior to this presentation, she was admitted to the hospital for sepsis and acute hypoxic respiratory failure due to acute respiratory distress syndrome requiring intubation. She was subsequently found to have methicillin-sensitive *Staphylococcus aureus* (MSSA) bacteremia and mitral valve endocarditis. A transthoracic echocardiogram at the time showed a large vegetation on the mitral valve with evidence of mitral valve perforation and severe mitral regurgitation. Transesophageal echocardiography revealed a large 2.7×2.1 cm vegetation on the posterior leaflet of the mitral valve with evidence of associated leaflet perforation (**Figure 1**). She was transferred to our hospital for further management and was initially treated with intravenous antibiotics but continued to deteriorate and developed acute heart failure requiring emergent surgical bioprosthetic mitral valve replacement and annular reconstruction. Intraoperatively, the mitral valve was noted to be severely damaged by the vegetation, with perforation and annular abscess, and she underwent bioprosthetic mitral valve replacement and annular reconstruction of the posterior aspect of the annulus with a pericardial patch. Her post-operative course was complicated by recurrent pericardial tamponade requiring placement of a pericardial window; however, she made a good recovery and was discharged home with physical therapy. The patient improved and did well for approximately 1 month after discharge, when she again began to experience increasing dyspnea and lower-extremity edema. This resulted in multiple visits to her local hospital, where transthoracic echocardiography demonstrated newly elevated mitral valve diastolic inflow gradients and increasing pulmonary hypertension. She also had several hospital admissions for treatment of congestive heart failure with intravenous diuretics. She eventually failed outpatient diuretic regimens and was admitted to the hospital.

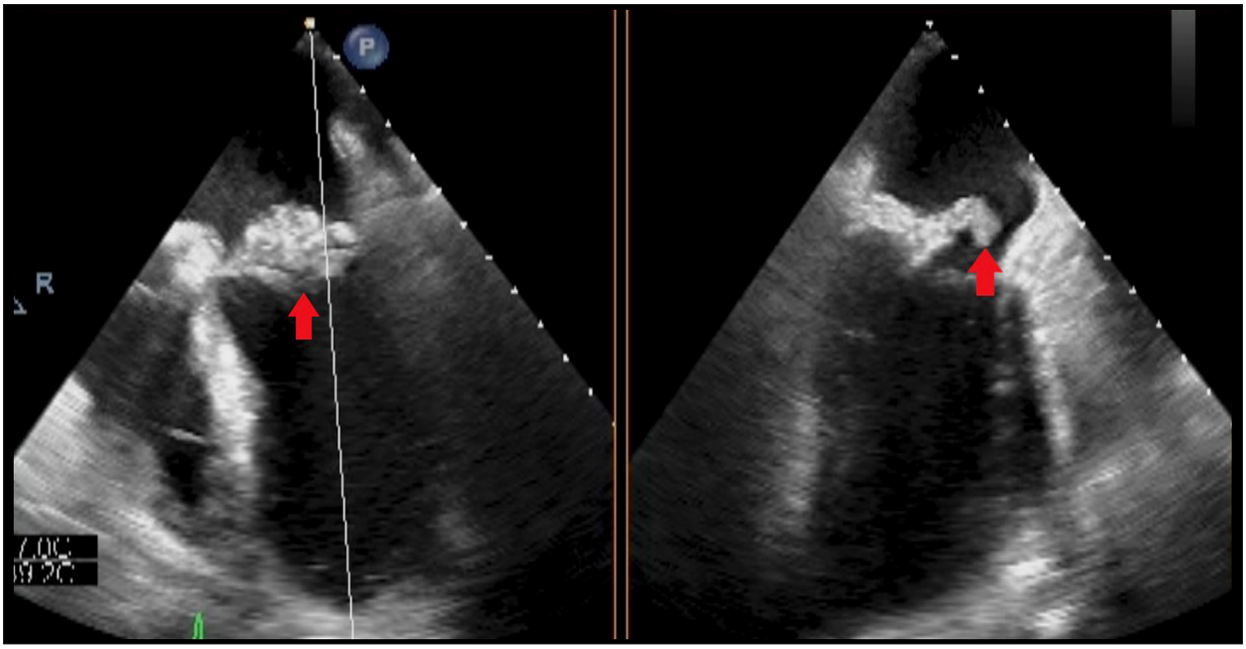

Figure 1. Transesophageal echocardiography showing large vegetation on mitral valve leaflet. A transthoracic echocardiogram showing large vegetation (red arrow) on the leaflet of the mitral valve with evidence of associated leaflet perforation.

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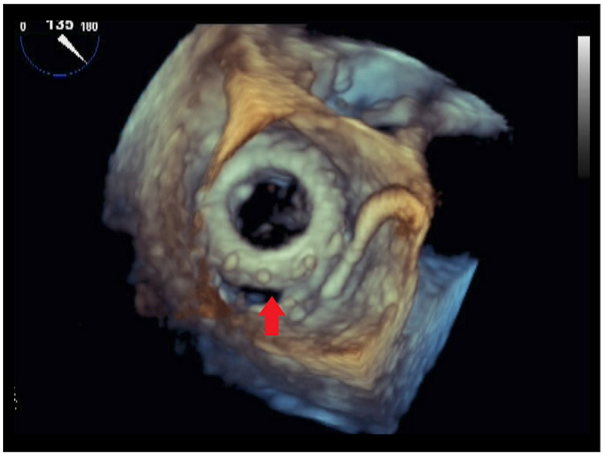

Figure 2. Transesophageal echocardiogram (TEE) showing the mitral paravalvular defect. Transesophageal echocardiogram showing dehiscence of the bioprosthetic mitral valve and annular pericardial patch (red arrow).

On this admission, transthoracic echocardiogram (TTE) showed no clear mitral regurgitation, although imaging was somewhat technically difficult. Potential etiologies of early bioprosthetic mitral stenosis were considered, such as thrombus formation or very unusual early pannus formation from inflammation. However, TEE revealed no bioprosthetic valve mitral stenosis or findings consistent with pannus or thrombus, but showed dehiscence of the bioprosthetic mitral valve and annular pericardial patch. The defect was seen posteromedially, measuring 0.8×1.1 cm, through which there was both systolic and diastolic flow (**Figure 2**). Severe mitral regurgitation with flow reversal in the pulmonary veins was also noted, resulting in high transmitral inflow pressure gradients.

A multidisciplinary approach involving cardiac surgery and interventional cardiology was utilized. Based on her multiple comorbidities, most notably the concomitant right ventricular failure with severe pulmonary hypertension and prior pericardial patch repair during her initial surgery with compromise of her mitral valve annulus, she was deemed inoperable and the decision was made to proceed with closure of the PVL with a percutaneous device. She underwent a transseptal antegrade repair of the paravalvular leak using a 14-mm VSD occluder device under TEE guidance.

Percutaneous technique

The patient was placed under general anesthesia and surgical right internal jugular line for monitoring and medication administration. The TEE probe was inserted, and initial images were obtained. Right heart catheterization was then completed in the standard fashion. A transseptal puncture was also performed and a Baylis wire was inserted into the left atrium. After confirmation of left atrial pressure and waveform, the Baylis sheath was removed and an Agilis sheath was advanced into the left atrium. The dilator was removed, a multipurpose guiding catheter was then advanced through the Agilis and with TEE guidance, and a Glidewire was directed through the defect in the left ventricle. The guidewire was removed and an Amplatz extra-stiff wire was inserted. The guide was then removed and a 14-mm VSD occluder was advanced. The ventricular disc was deployed and withdrawn to sit within the perivalvular space (**Figure 3**). This demonstrated immediate reduction of 4+ mitral regurgitation to 2+ mitral regurgitation with significant improvement in hemodynamics (**Table 1**). TEE evaluation demonstrated that tissue capture around all

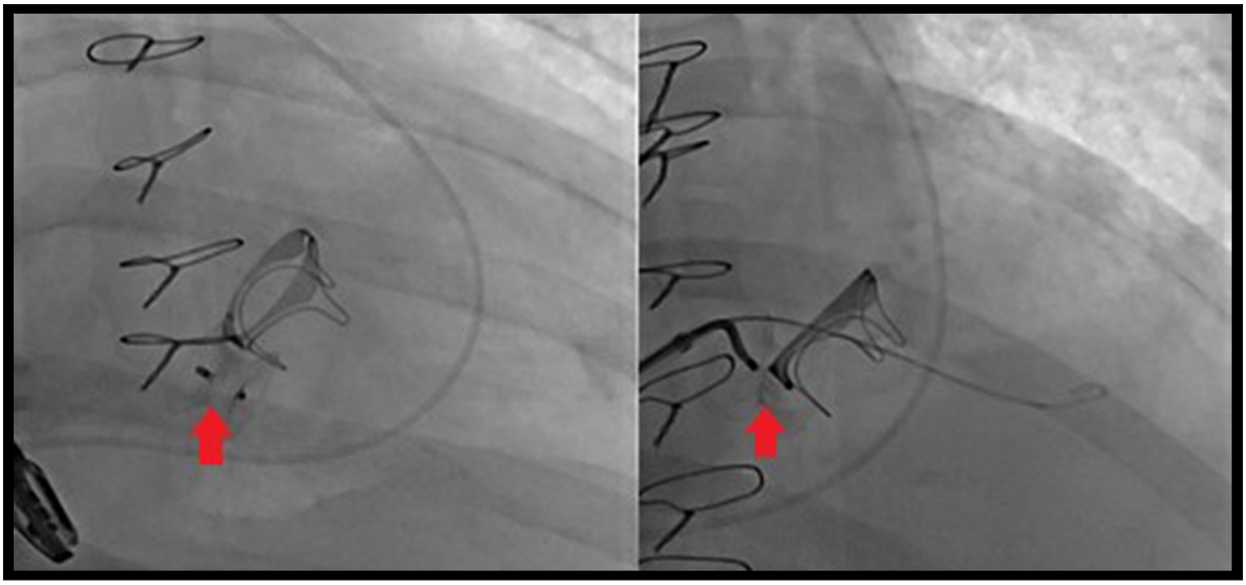

Figure 3. X-ray showing deployment of ventricular septal defect (VSD) occluder. X-ray showing the deployment of the ventricular septal defect occluder (red arrow)

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Table 1. Parameters before and after closure of the mitral paravalvular leak.

Parameters	Pre-closure	Post-closure
Mitral regurgitation	4+	2+
Mean RA pressure (mmHg)	20	10
RV systolic pressure (mmHg)	61	50
Mean PA pressure (mmHg)	45	35
Mean PCWP (mmHg)	35	22
V-wave pressure (mmHg)	45	26

rims was present and the device was subsequently released. The patient made good recovery and was discharged home a few days after the procedure. At follow-up, she reported no relapse of drug abuse.

Discussion

PVL results from inappropriate sealing between the structure of the implanted valve and the surrounding cardiac tissue, resulting in blood flow via the channel [3]. It occurs in about 5–15% of patients following prosthetic mitral valve replacement, with higher incidence following surgically implanted valves compared to percutaneously implanted ones, with the majority being crescent, oval, or round mitral PVLs [3]. Although rare, about 3% of these patients progress to heart failure, hemolytic anemia, or both, requiring prompt intervention [4]. As in our case, most patients present with signs of acute mitral regurgitation and heart failure. Our patient presented with acute mitral regurgitation resulting in congestive heart failure. The criterion standard for diagnosis is echocardiography, preferably transesophageal. Transthoracic echocardiography is not as sensitive and can underestimate the severity of the regurgitation due to the eccentricity of the mitral regurgitation jet, artifacts from the bioprosthesis, and technically challenging imaging. TEE also has more utility with increasing use of real-time 3D echocardiography to evaluate the bioprosthetic valve dysfunction and help guide the repair. Surgery has long been the criterion standard intervention strategy for repair of PVL, especially for patients with infectious endocarditis, concurrent need for bypass, or an unstable prosthesis [5,6]. However, percutaneous PVL repair has been gradually becoming more commonly used over the past decade, with large-volume centers creating tailored multidisciplinary teams and employing uniform approaches, significantly improving patient selection and timing to achieve optimal results [4]. A case series by Hernandez-Enriquez et al. suggests that even though there are similar results between percutaneous and surgical PVL closure in some series, PVL is a valid alternative to surgical correction because it is well tolerated [7]. Percutaneous valve closure is less invasive, permits multiple attempts, and is an option in patients who are at high risk for open heart surgery [8,9]. Another similar case report, by Abueletta et al., advocates that percutaneous PVL closure with VSD can be done at least 3 months after the prior surgery [10]. However, we believe it is best not to wait that long after surgery, and suggest prompt intervention because of worse clinical outcomes. Our patient's case was reviewed by the heart valve team and, due to the worsening clinical condition, a decision was made to pursue percutaneous closure using the VSD occluder. Results for percutaneous PVL closure have been promising, with low complication rates, depending on the expertise of the interventionalist. As with any other type of surgical procedure, there is still an increased risk of endocarditis, even after the procedure, especially in patients with a history of drug abuse, like this patient. Percutaneous paravalvular leak repair has been shown to improve heart failure symptoms and to decrease hospitalizations and procedure-related adverse events [11,12]. More importantly, an advantage over surgery is the improved short and midterm survival rates in patients with no PVL to mild residual leak after the procedure [4].

Conclusions

Although the use of the Amplatzer VSD occluder device for this indication currently remains off-label, this article is in support of percutaneous closure devices in mitral PVL, even as the trend toward percutaneous cardiac interventions continues to increase.

Department and Institution where work was done

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Conflict of interest

None.

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