Case Report

Transapical Closure of Mitral Prosthetic Paravalvular Leak

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Clinically significant mitral prosthetic paravalvular leaks may occur in up to 5% of patients following surgical mitral valve replacement. Successful closure may offer relief from symptoms of heart failure and hemolysis, but surgical closure is associated with increased morbidity and mortality. Alternative transcatheter closure techniques are being developed. We present a patient who was successfully treated via a transapical approach with deployment of an Amplatzer Duct Occluder Type I closure device under real-time two-dimensional transesophageal echocardiography.

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Clinically significant paraprosthetic mitral valve leaks may occur in up to 5% of patients following surgical mitral valve replacement. Since surgical closure is associated with increased morbidity and mortality, alternative transcatheter closure techniques have been developed. We present a patient who was successfully treated with a closure device via a transapical approach under real-time two-dimensional transesophageal echocardiography.

Case presentation

A 72-year-old female presented with heart failure symptoms and New York Heart Association (NYHA) functional class III. Echocardiography revealed a bileaflet mitral valve prolapse, moderately severe mitral regurgitation, severe pulmonary hypertension (60 mmHg), and preserved left ventricular ejection fraction. Coronary angiography revealed a moderate stenosis in the mid left anterior descending artery (LAD). Comorbidities included mild chronic kidney disease, hypertension and chronic atrial fibrillation on anticoagulation. The patient underwent open heart surgery and, after two unsuccessful attempts to repair the mitral valve, a 25 mm Magna bioprosthesis was implanted in the mitral position. Additionally a tricuspid valve ring (#30 Carpentier Edwards) was implanted and the LAD was bypassed using the left internal mammary artery. Post-procedure echocardiography revealed moderate paravalvular regurgitation originating from the anteromedial aspect of the prosthetic valve. The *vena contracta* was estimated at 0.4 cm. The jet was eccentric and bordered the intratrial septum, reaching the posterior left atrial wall (Figure 1). Blunting of the systolic forward flow in the pulmonary veins was also noted. The postoperative course was complicated by the development of respiratory failure and hemodynamic instability requiring inotropic and vasopressor support. The decision was made to proceed with closure of the paravalvular leak. However, in view of the patient's critical condition and the difficulties encountered during

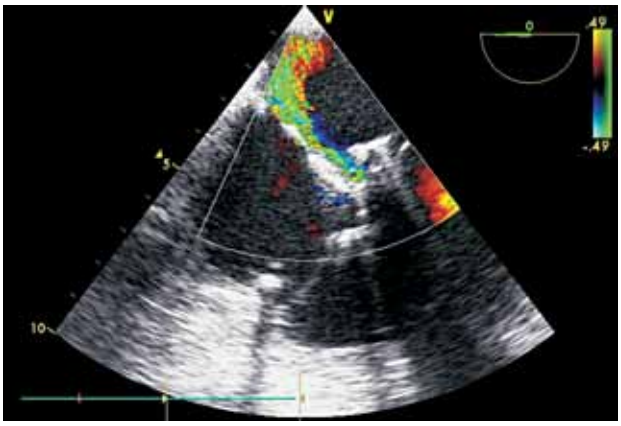

Figure 1. Eccentric jet of mitral paravalvular regurgitation towards the interatrial septum and the posterior wall of the left atrium.

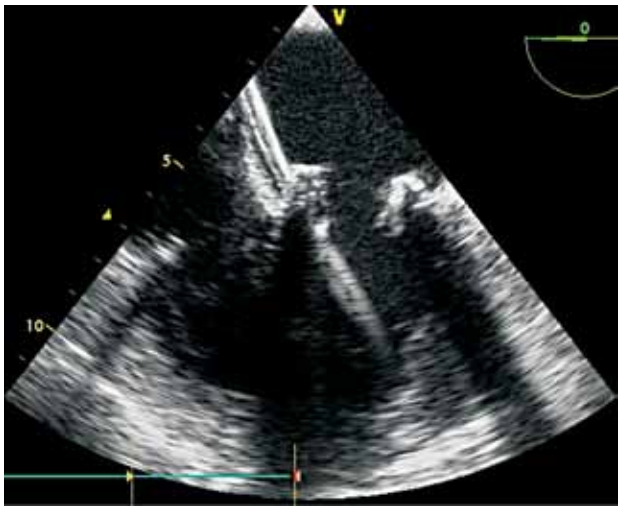

Figure 2. A multipurpose catheter and an Amplatz extra stiff wire through the leak with no effect on the prosthetic valve function.

the previous mitral valve surgery, it was decided that a percutaneous approach would be more suitable. Furthermore, because of the unfavorable location of the leak for transseptal access, the transapical approach was chosen.

The procedure was performed in the operating room under general anesthesia and with continuous 2-dimensional transesophageal echocardiography (TEE). A mini thoracotomy was performed by the cardiothoracic team and the apex of the left ventricle was exposed. An area in the apical anterolateral region was chosen and puncture was performed using a straight needle. Subsequently, an 8 F sheath was inserted over a standard J wire and was positioned in the mid left ventricle. Anticoagulation was administered with use of unfractionated heparin. A straight 0.035" coronary wire was advanced under TEE guidance, steered to the area of the paravalvular leak, and successfully passed to the left atrium. TEE revealed no change in the function of the prosthetic valve. An 8F delivery catheter was subsequently advanced over an extra stiff guidewire and positioned within the left atrium (Figure 2). An 8/6 mm Amplatzer Duct Occluder (AGA Medical Corporation, Plymouth MN, USA) was then partially deployed (Figure 3A); however, since it was evident that there was still a significant degree of paravalvular regurgitation (Figure 3B), it was withdrawn and replaced with a larger one measuring 12/10 mm. During partial deployment (Figure 4A) there was evident marked reduction in the degree of paravalvular regurgitation (Figure 4B), and the occluder was thus fully deployed. After the removal of the sheath from the left ventricle, closure was achieved using purse-string sutures. The patient remained hemodynamically stable throughout the deployment sequence. At the end of the procedure, a rapidly expanding pericardial effusion was noted on TEE and the patient became hemodynamically unstable. Repeat sternotomy was performed and the site of bleeding was assessed to be at the puncture site of the left ventricle; hemostasis was performed successfully. The patient was transferred to the ICU in a hemodynamically stable condition.

Discussion

Paravalvular leak (PVL) refers to blood flowing through a channel between the annulus of the implanted valve and the surrounding cardiac tissue because of a lack of appropriate sealing. The incidence of clinically significant PVLs is of the order of 1-5% and symptoms mostly relate to the development of heart failure, hemolytic anemia and infectious endocarditis.[1] Echocardiography is critical in the diagnosis with assessment of size, location, and severity of regurgitation.

Traditionally, therapy for clinically significant paravalvular regurgitation involves surgery, especially in patients with infectious endocarditis, with a need for concurrent coronary bypass, or with associated mechanical instability of the prosthesis.[1] For mitral PVLs in particular, surgery has been shown to improve survival, NYHA class and hematocrit levels as compared to conservative therapy.[2] However, repeat surgery exposes the patient to the increased risks of sternotomy and cardiopulmonary bypass and requires careful planning.

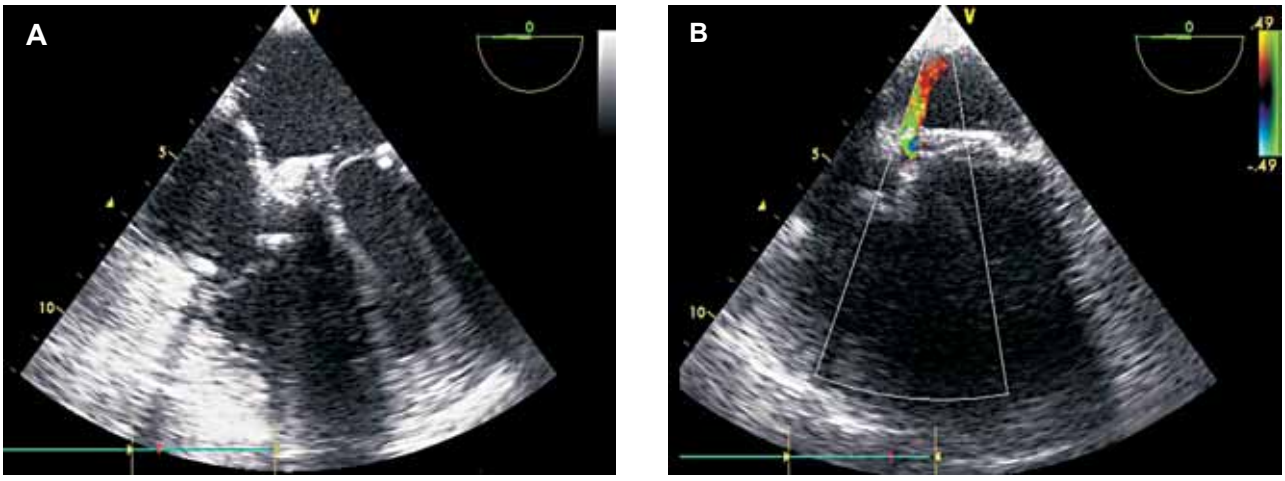

Figure 3. A. Amplatzer Duct Occluder Type I 8/6mm in place. B. Residual leak with this device led us to remove it and opt for a larger device.

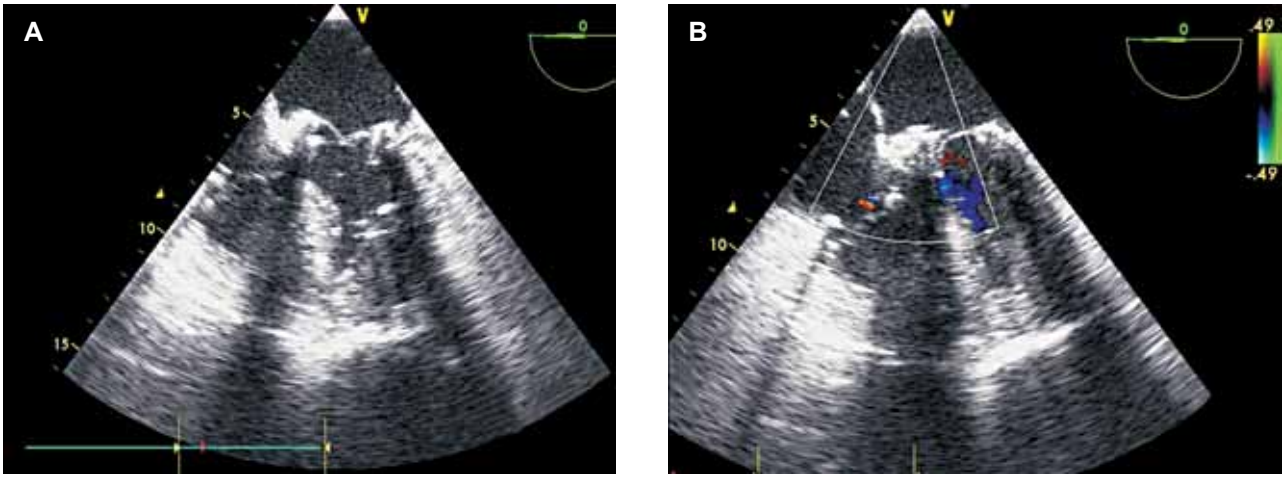

Figure 4. AB. Amplatzer Duct Occluder Type I 12/10 mm released with zero residual leak.

Recently, we have seen the evolution of transcatheter closure techniques, aiming to reduce the risk of the correction and applicable to both aortic and mitral paravalvular regurgitation.[3,4] Specifically for the mitral valve, techniques have involved access via the femoral vein, passage into the left atrium via transseptal puncture, and the deployment of a closure device in an antegrade fashion. More recently, the transapical retrograde approach has been gaining acceptance because of its many associated benefits. These include direct and easier access to multiple left-sided structures, shorter distance to the intended target, and a 30% reduction in fluoroscopy times.[5] In the series of 39 patients presented by Ruiz et al,[5] successful transapical closure of mitral PVLs was performed in all patients, with a 6.8% overall complication rate (hemothorax in 3 patients and 1 procedural related death). The use of closure devices (e.g. Cook Coils, Amplatzer ADO, or Amplatzer mVSD devices) for the left ventricular entry site seemed to improve the safety of the procedure.

In summary, the case presented highlights a novel transcatheter approach to treating mitral PVLs that is feasible, effective and significantly less invasive when compared to the traditional surgical approach. Moreover, transapical access, compared to the transseptal route, has the advantage of making any paravalvular location easily and rapidly reachable, thereby increasing the likelihood of successful closure with minimized radiation exposure. Eventually, the use of

already existing devices—and in the near future, of dedicated apical closure devices—has the potential to advance transapical mitral PVL closure to an even safer and truly percutaneous procedure.

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