Repair of paravalvular prosthetic mitral valve leaks with septal occluder devices in severely high-risk patients: a word of caution

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Abstract

Paravalvular leak following a mitral valve replacement is a complication seen in approximately 1 of 10 replacements. The corrective method has traditionally been reoperation. Septal occluder devices are more commonly being utilized as an alternative percutaneous correction method. We report the use of septal occluder devices in the repair of mitral paravalvular leak in two patients at severely high EuroSCORE II mortality risk. In both patients, the occluder devices became unstable, leading to a recurrence of severe paravalvular leak.

Keywords: Minimally invasive • Valve repair • Percutaneous • Mitral valve • Valvular leak

INTRODUCTION

Mitral paravalvular valve leak (PVL) following the replacement of the mitral valve with a mechanical valve prosthesis is a challenging complication. The incidence of PVL following mitral valve replacement is estimated at 1–12% [1, 2]. The accepted method of repair has been reoperation. However, due to co-morbidities many patients are not surgical candidates. Even if the patient is eligible for surgical repair, mortality is not encouraging. Mortality after a second complete replacement of the mitral valve has been reported to be as high as 22% [2]. Besides a high procedural mortality, reoperation is associated with significant complications. Percutaneous catheter-based repair utilizing septal occluder devices has been suggested as a method for providing minimally invasive treatment to high-risk patients who are otherwise not surgical candidates [3].

Recent retrospective studies have demonstrated fair device deployment and low procedural mortality in patient cohorts at low-to-moderate risk of procedural mortality [3, 4]. Device delivery and post-procedural complications, including mortality, continue to dampen the widespread acceptance of this approach [3, 4]. This report demonstrates the attempted repair of mitral PVL utilizing septal occluder devices in two severely high EuroSCORE II mortality-risk patients who acutely experienced device instability and recurrence of severe PVL.

CLINICAL SUMMARY

Patient 1

A 53-year old Caucasian woman presented with cardiogenic shock, congestive heart failure, atrial fibrillation, acute renal failure, chronic obstructive pulmonary disease and severely elevated pulmonary artery pressures. She had a considerable history of drug abuse. The left atrium was severely dilated, and the left ventricle displayed concentric hypertrophy with an ejection fraction of 45%. A transoesophageal echocardiogram (TEE) noted severe mitral regurgitation (MR) secondary to the PVL involving a mitral valve prosthesis (Fig. 1a). The prosthesis was implanted 11 years ago and secured with interrupted Teflon pledgeted sutures. A EuroSCORE II risk calculator estimated a mortality risk of 55%. The patient desired a minimally invasive approach.

A left thoracotomy under echocardiographic and fluoroscopic guidance was performed with direct transapical catheterization of the left ventricle. Four Amplatzer ventricular septal occluder devices of sizes 4 mm (n = 1), 6 mm (n = 2) and 8 mm (n = 1) (AGA Medical Corporation, Plymouth, MN, USA) were implanted. Peri-procedural TEE demonstrated the elimination of PVL without mechanical valve interference (Fig. 1b).

Two weeks later the patient presented with lower extremity edema and shortness of breath. A TEE demonstrated device instability and severe MR involving multiple devices (Fig. 2a). Re-operative mitral valve replacement was successful in repairing the PVL (Fig. 2b). The patient was discharged home 14 days after the mitral valve replacement in stable condition.

Patient 2

A 74-year old Caucasian male presented with worsening dyspnoea and intermittent chest pressure. He had a history of rheumatic fever, chronic obstructive pulmonary disease, atrial fibrillation, hypertension, peripheral artery disease, myasthenia gravis and three previous mitral valve replacements over the last...
30 years. The latest mitral valve replacement, 8 years ago, was secured using interrupted Teflon pledgeted sutures. TEE demonstrated a severely dilated left atrium, eccentric left ventricular hypertrophy, pulmonary hypertension and severe MR secondary to PVL. Due to the history of multiple sternotomies and a calculated EuroSCORE II mortality risk of 38%, the patient was referred for percutaneous closure of the PVL.

The percutaneous femoral arterial/venous access was gained with a trans-septal puncture under the TEE guidance. A 12/10-mm septal occluder was engaged in the leak from the left ventricular side and was pulled back until properly seated. Postoperative TEE demonstrated a well-seated occluder device providing complete closure of the PVL. The mitral valve was shown to be well functioning without obstruction from the occluder device.

Two months postoperatively, TEE demonstrated mobility of the occluder device resulting in a severe PVL. The patient developed worsening congestive heart failure and renal failure. He refused further intervention and was discharged under palliative care.

**DISCUSSION**

Percutaneous repair of the PVL was developed in 1992 and has been explored. Initial postoperative morbidity and mortality are excellent; however, device deployment and clinical success continue to be the primary concerns [3, 4]. Unsuccessful deployment was attributed to the physical and technical demands of the procedure, specifically the navigation and deployment across the defect, device interference with the mechanical valve prosthesis or persistent PVL despite proper device placement [3, 4].

In a recent study by Sorajja et al. [3], they suggested that the severity of the residual PVL after percutaneous repair directly affects the long-term durability of symptom relief. In our experience, both patients experienced an acute recurrence of severe PVL despite initially displaying complete occlusion of the PVL on echocardiogram. Within 2 weeks and 2 months respectively, echocardiographic imaging demonstrated device instability in both patients after initially demonstrating a complete elimination of the initial defect. Other possible explanations may involve the altered geometry of the left heart chambers noted in both patients as well as the compounding factors associated with the high EuroSCORE II mortality risk.

The patients in this report had an EuroSCORE II mortality risk of 55 and 38%, respectively. This risk translates to a society of thoracic surgeons (STS) mortality risk of 21.2% and 18.2%, respectively. In the large study by Sorajja et al. [3], the average STS mortality risk for the patient cohort was 6.7%. Thus, the patients we report were at a much greater risk and may have performed and recovered differently. The degree of surgical risk seen in this...
report is a complication not yet described in the attempted repair of mitral PVL.

The conventional method for surgical repair of PVL offers consistent, clinically supported results in patients who are considered low-risk surgical candidates. Septal occluder devices have been shown to be feasible in low-to-moderate EuroSCORE II mortality-risk patients [3, 4]. This report demonstrates a unique application of septal occluder devices in that they were applied to severely high mortality-risk patients. Based upon the incidence of acute device failure, as seen in our patients, we advocate that mitral valve replacement remain the accepted method of care when treating mitral PVL in severely high mortality-risk patients.

Conflict of interest: none declared.

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eComment. Percutaneous closure of prosthetic mitral paravalvular leaks with Amplatzer devices

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I have read with great interest the article by Smith et al. [1]. They address one of the most important potential complications of the closure of paravalvular valve leaks (PVL) with an Amplatz septal occluder device. Indeed, we have previously also published the direct relationship between residual mitral PVL and its closure by means of septal occluder devices [2]. PVLs are a common finding in mitral valve surgery. They are detected in up to 28% of the cases of mitral valve replacement, mainly related to the surgical technique, and the incidence may be as high as 32% when transoesophageal echocardiogram is available and utilized for this purpose [3]. However, most of the PVLs are small and generally benign. Surgery is clearly indicated in patients requiring blood transfusions and those with congestive heart failure. This has been developed as an alternative treatment option avoiding redo operation, as mortality rate increases with the number of previous operations. Amplatzer occluders rarely close the defect entirely. In a series reported by Shapira et al. [4], a residual leak was observed in 90% of the cases after PVL closure with an Amplatzer occluder. This is probably due to the fact that this is a circular device not designed for PVL closure, which commonly exhibit a crescent shape. In an attempt to completely close the defect, larger occluders are utilized. The larger the Amplatzer occluder, the higher the probability of interference with the prosthesis. Merin et al. [5] reported a case of impingement of valve leaflet motion. In our case, both complications described above occurred [2]. These are excellent examples to demonstrate that current devices frequently used for transcatheter percutaneous closure of PVLs are not geometrically adapted to the anatomy of PVLs.

Although the advent of percutaneous devices permits less invasive alternatives for PVL closure, what is certain is that transcatheter treatment for closure of the PVL is one of the most challenging procedures, and current literature documents ambiguous results. Further efforts in the development of defect-specific devices may result in an improvement in patient outcome.

In conclusion, percutaneous therapy by means of Amplatzer devices for PVL closure is not free of complications, and should be considered only for selected patients.

Conflict of interest: none declared.

References