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VALVULAR HEART DISEASE MINI-FOCUS ISSUE

INTERMEDIATE

CASE REPORT: CLINICAL CASE

Percutaneous Paravalvular Leak Closure Early Post-MV Replacement With Retrieval of Embolized Muscular VSD Device

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ABSTRACT

This report describes a case of paravalvular leak (PVL) closure 20 days after surgery that was complicated by an embolized 10-mm device in a patient who underwent redo PVL closure after 6 months. Waiting for 3 months postoperatively to close a PVL is recommended. If earlier leak closure is mandatory, accepting a suboptimal result with a moderate residual leak is advised. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2019;1:471–6)

Paravalvular leak (PVL) is a complication of valvular replacement in 6% to 15% of patients; percutaneous closure is used as first-line therapy in high-surgical risk patients (1). Increasing experience with percutaneous PVL closure in many tertiary centers has made this procedure relatively safe and efficient (2). Surgical approaches to mitral PVL have included antegrade transseptal, retrograde transfemoral, and transapical techniques (3). Few reports have studied redo PVL closure, which is mostly performed for new PVLs; however, this procedure is feasible and has a favorable success rate (4). The safety and feasibility of PVL closure in the short-term setting, within 1 month of surgery, need more research. We present a case of PVL closure 20 days after surgery that was complicated by an embolized 10-mm device in a patient who underwent redo PVL closure after 6 months.

LEARNING OBJECTIVES

- Early postoperative closure of PVL is better postponed for 3 months to allow stabilization of the defects to hold the closure devices and avoid complications.
- If PVL closure in the first postoperative month is clinically indicated, acceptance of suboptimal results with moderate residual leaks is recommended to prevent complications.
- Real-time 3-dimensional echocardiography can guide the PVL closure procedure.

HISTORY OF PRESENTATION

A 45-year-old man, who did not have diabetes or hypertension, presented to our center (Madina Cardiac Center, Madina, Saudi Arabia) with severe shortness of breath on the 20th postoperative day after mitral valve (MV) replacement.

From the Madina Cardiac Center, Madina, Saudi Arabia. Both authors have reported that they have no relationships relevant to the contents of this paper to disclose.

Informed consent was obtained for this case.

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ABBREVIATIONS AND ACRONYMS

MV = mitral valve

PVL = paravalvular leak

vSD = ventricular septal defect

PAST MEDICAL HISTORY

He had undergone mechanical MV replacement because of rheumatic severe mitral stenosis and regurgitation 20 days earlier. After shifting the patient to the intensive care unit, he had acute heart failure with severe pulmonary congestion. Echocardiography revealed a severe PVL that the surgeon had failed to close.

EXAMINATION

The examination showed a pansystolic grade IV/VI murmur with maximum intensity at the apex and bilateral fine basal crepitations.

DIFFERENTIAL DIAGNOSIS

This patient had a clear case of decompensated heart failure secondary to severe PVL post-MV replacement.

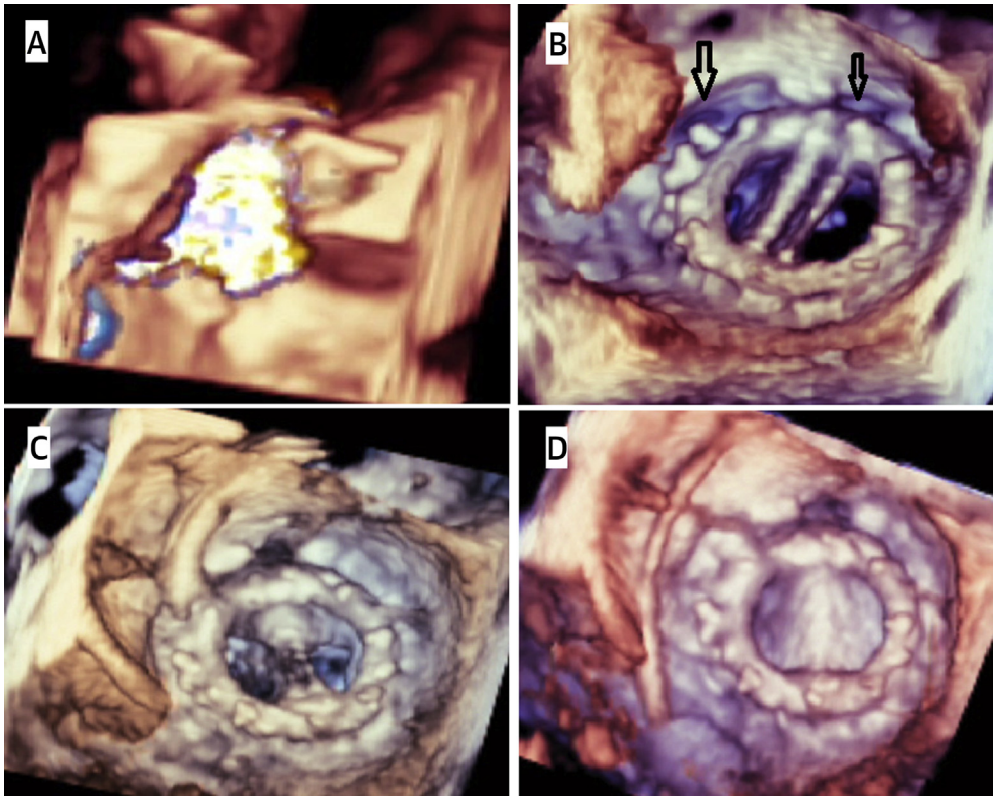
INVESTIGATIONS

Transesophageal echocardiography with real-time 3-dimensional (3D) imaging revealed severe PVL (**Figure 1A**, Video 1) with 2 large leaks at 10 o'clock and 1 o'clock in the surgical view (**Figure 1B**, Video 2). Because of the high surgical risk in this patient, the heart team decided to perform percutaneous PVL closure. Deployment of 2 ventricular septal defect (VSD) closure devices at the 2 leaks was planned.

MANAGEMENT

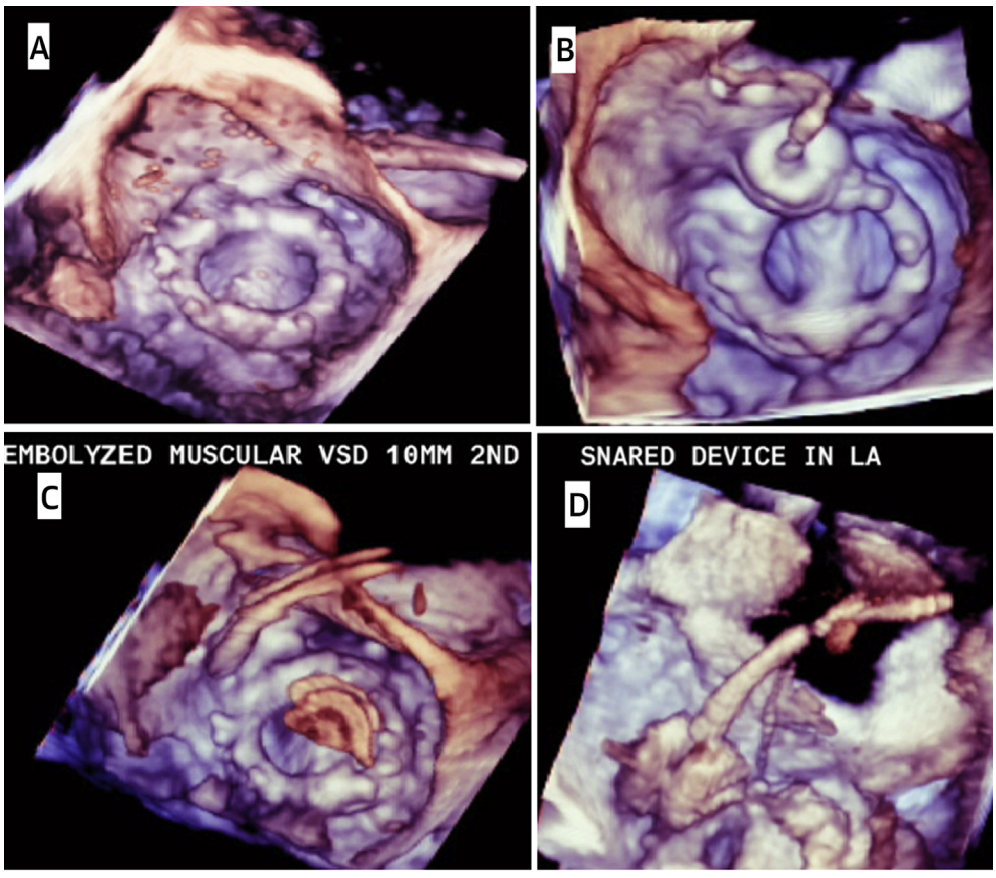
Real-time 3D transesophageal echocardiography images guided the whole procedure. Device size was determined by 3D full-volume imaging with color using the vena contracta, the effective orifice area of the jet, and the dimensions of the defect. The VSD device had a waist and 2 discs that exceeded the waist size by 8 mm all around; this device was selected

FIGURE 1 Severe Paravalvular Leak, Deployed First Device



(A) Full volume with color, severe paravalvular leak. See Video 1. **(B)** The leak appeared as 2 separate defects **(arrows)**. See Video 2. **(C)** Trans-septal catheter directed to pass through the first defect. See Video 3. **(D)** Deployment of first 8-mm ventricular septal defect closure device. See Video 4.

FIGURE 2 Snaring of Embolized Second Device



(A) Transseptal catheter passed through the second defect. **(B)** Second 10-mm ventricular septal defect closure device deployed successfully and released. See Videos 5, 6, and 7. **(C)** During the trial to deploy the third device, the second device embolized and floated in the left atrium. See Videos 9 and 10. **(D)** Transseptal snare succeeded to catch the embolized device. See Videos 11 and 12.

because of the large size of the leak. Meticulous assessment of leaflet movement is mandatory because the left ventricular disc can trap 1 leaflet. Transseptal access was achieved using an Agilis 8.5-F tip deflectable catheter (Abbott, Abbott Park, Illinois) to facilitate crossing the defects. The first 8-mm muscular VSD device was deployed successfully at 10 o'clock in the lateral leak (**Figures 1C and 1D**, Videos 3 and 4). The transseptal catheter crossed the second defect (**Figure 2A**), and another 10-mm VSD closure device was deployed successfully and released (**Figure 2B**, Videos 5, 6, and 7). Both devices remained stable in position. Transesophageal echocardiography (3D full volume with color) revealed residual moderate PVL medial to both devices (Video 8). Through the aortic valve, a wire crossed the leak, snared from the left atrial cavity and exteriorized from the femoral vein. While trying to cross the leak with a 7-F TorqVue delivery sheath (Abbott), the second device dislodged into the left atrial cavity (**Figure 2C**, Videos 9 and 10). To snare a similar device, an assembly was formed of a 20-mm loop snare loaded on a Judkins right (JR) guiding catheter through a 10-F TorqVue sheath that came through the 18-F sheath in the groin. This assembly helped the operator to catch the device, snare it (**Figure 2D**, Videos 11 and 12), and exteriorize it through the large sheath in the groin. Another larger, 12-mm device was positioned at 1 o'clock with a residual moderate PVL (Video 13). The patient improved clinically and was discharged home after 1 week. Six months later, the patient still was having shortness of breath and was in New York Heart Association functional class II. The patient was admitted for elective closure of the residual leak.

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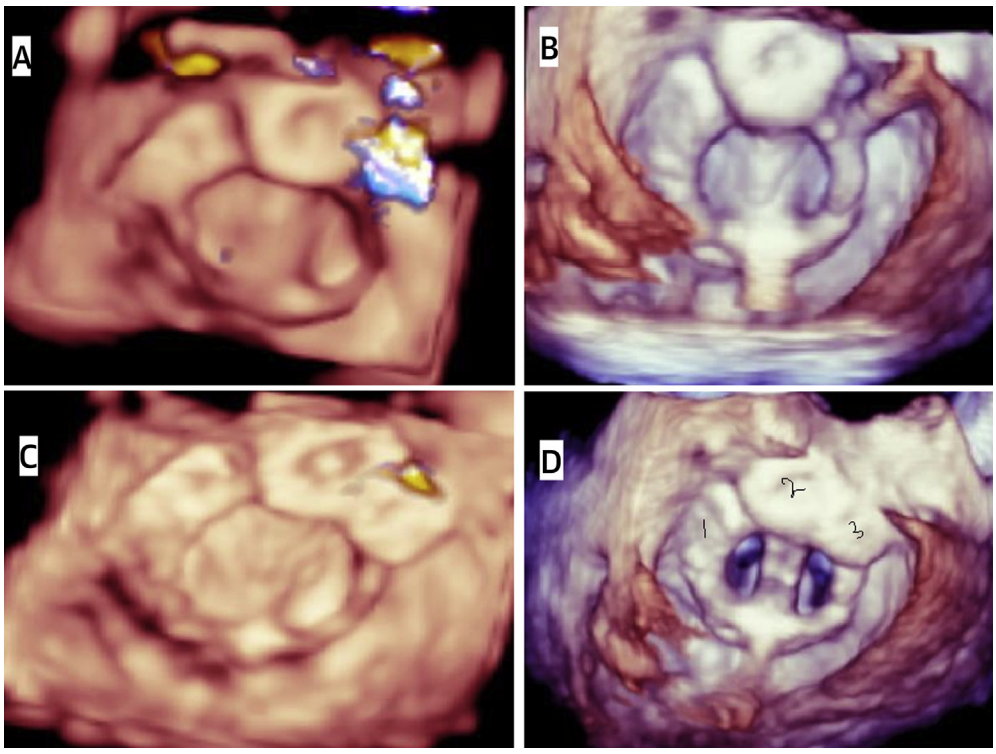
FIGURE 3 Closure of Residual Leak After 6 Months



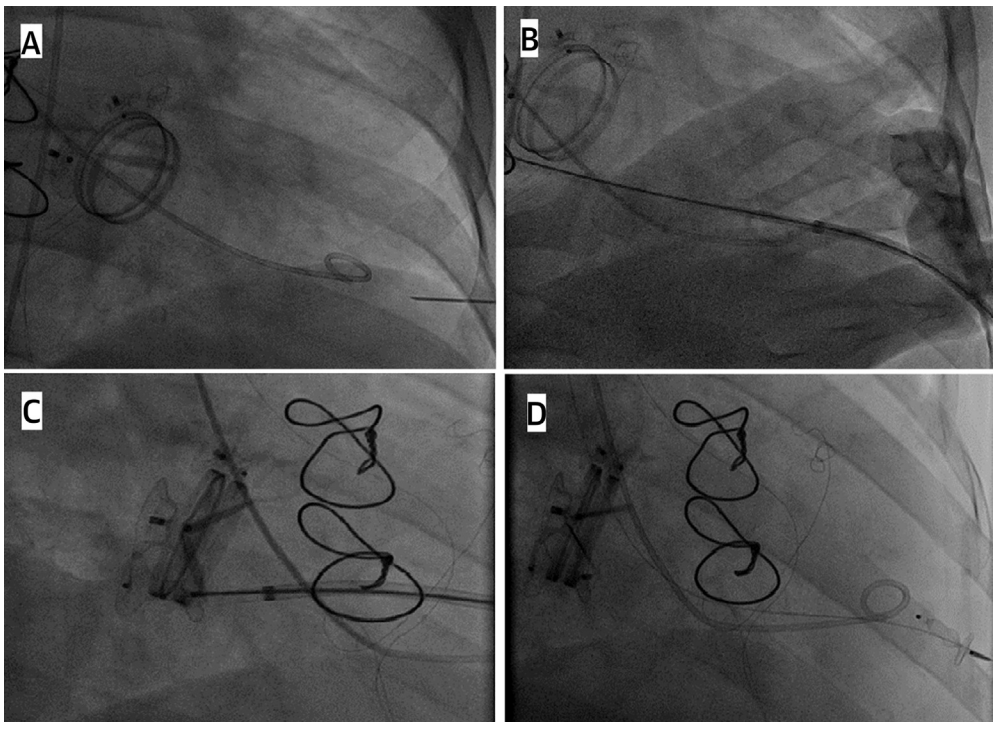
(A) Another 12-mm ventricular septal defect closure device deployed; still moderate leak medial to the device. **(B)** After 6 months, another set to close the defect, this catheter passing the defect from a transapical approach. **(C)** Deployed third device with residual trace leak. **(D)** The 3 devices seen in place; the mitral valve is fully opened with no restriction to its leaflets.

Because the leak was medial at 2 o'clock, the transapical axis was selected to close it. A needle for apical puncture was seen and a pigtail catheter landed in left ventricular apex (**Figure 4A**, Video 14). Transapical wire passed the paravalvular leak (**Figure 3B** and **4B**). A transapical third device was deployed, with a trace leak (**Figures 3C** and **4C**, Video 15). Three devices were seen in place, and the MV was fully opened with no leaflet restriction (**Figure 3D**). The fourth device closed the apical puncture (**Figure 4D**). The patient was discharged home at the second day.

DISCUSSION

Available clinical results for PVL closure are promising, with low complication rates and high technical or clinical success rates (60% to 90%) (5). Compared with surgical closure of PVL, lower mortality rates (30-day mortality rate 4.6%) have been documented in patients treated with transcatheter closure (5). Smolka et al (6). reported transcatheter PVL closure in 49 patients, 29 in the mitral position and 20 in the aortic position. These investigators concluded that PVL closure is feasible with a high success rate and no significant complications. The clinical benefits of reduction of heart failure symptoms and hemolysis are evident after 30 days and persist up to 1 year without recurrence of PVL (6). Medial leaks in the MV are better closed using transapical access because it is difficult to cross with transseptal access. Nietlispach et al. (7) reported 2 cases of pericardial bleeding with a transapical approach with no procedural mortality. Device closure of the apical puncture is recommended to avoid or decrease the incidence of pericardial and pleural bleeding. Early postoperative PVL is mostly related to technical surgical issues. Reported cases of PVL closure in the first month postsurgery are rare. Manipulation of the defects in the first month carries the risk of enlarging the defect, thereby merging 2 or more defects and easily embolizing the devices. If clinically feasible, we suggest waiting for 3 months postoperatively to allow stabilization of the defects to hold the closure devices and avoid complications. We recommend acceptance of

FIGURE 4 Transapical Closure of Residual Leak



(A) Two closure devices in place, pigtail catheter in the left ventricular apex, a needle for apical puncture seen. See Video 14. **(B)** Transapical wire passed the paravalvular leak. **(C)** Transapical third device deployed. See Video 15. **(D)** Device closed the apical puncture.

suboptimal results in patients with moderate residual leaks, to prevent complications. Closure of the remaining leak after 6 months is associated with a lower complication rate. However, these suggestions require large clinical registries to gain more data on the midterm and long-term efficacy of early transcatheter PVL closure. We reported the feasibility of retrieving an embolized 10-mm VSD closure device from the left atrium through transseptal snaring and withdrawal of the device through the interatrial septum and femoral vein without complications.

FOLLOW-UP

During follow-up after 1 year, the patient had no more shortness of breath and no more leakage visible on transthoracic echocardiography.

CONCLUSIONS

Real-time 3D echocardiography can guide the PVL closure procedure. For PVL occurring immediately post-valve replacement, it is better to postpone closure for 3 months. If earlier leak closure is mandatory, we recommend accepting a suboptimal result with a moderate residual leak to improve the clinical situation. After 3 to 6 months, closure of residual leak can be performed safely. It is feasible to snare a 10-mm muscular VSD device from the left atrium and extract it from the femoral vein.

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KEY WORDS case report, embolized, leak, paravalvular, real-time 3-dimensional retrieval

APPENDIX For supplemental videos, please see the online version of this paper.