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IMAGES IN INTERVENTION

Mitral Bioprosthetic Valve Fracture

Bailout Procedure for Undersized Bioprosthesis During Mitral Valve-in-Valve Procedure With Paravalvular Leak Closure

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A 76-year-old obese man (body mass index 30.8 kg/m^2, body surface area 2.35 m^2) with a history of mitral valve replacement and coronary artery bypass grafting was admitted to our hospital with decompensated heart failure. The patient underwent surgical mitral valve replacement with a 25-mm Mosaic valve (Medtronic, Minneapolis, Minnesota) for possible mechanical valve endocarditis, at an outside hospital 2 months before admission. Echocardiogram revealed severe paravalvular leakage (PVL) in 3 areas with a mean diastolic gradient of 10 mm Hg (**Figure 1A**, Online Video 1). Pre-procedural computed tomography (CT) showed a valve inner diameter of 20.7/20.3 mm (area 2.9 cm^2) (**Figure 1B**). Due to the acuity of his presentation and his previous complicated post-operative course, the heart team decided to proceed with transcatheter PVL closure.

The procedure was performed in the cardiac catheterization laboratory under general anesthesia. Transseptal puncture revealed a left atrial v-wave of 48 mm Hg. Three 12-mm Amplatzer Vascular Plug II devices (St. Jude Medical, St. Paul, Minnesota) were placed in the anterolateral PVL. Two plugs (a 12-mm and a 14-mm Amplatzer Vascular Plug II) were placed in the posteromedial PVLs. After deploying 5 plugs, the mean mitral gradient increased to 13 mm Hg with a significant decrease in PVL, but no decrease in the v-wave, suggesting unchanged or worsening afterload to the left atrium (**Figure 1C**). Because the persistent diastolic valve gradient reflected probable patient-prosthetic mismatch (PPM), and pre-procedural CT showed low risk of left ventricular outflow tract obstruction, an attempt was made to fracture the surgical valve and increase the valve area. A 26-mm Sapien-3 was implanted transseptally inside of the Mosaic surgical valve (gradient decreased to 12 mm Hg), and then the Sapien-3 was expanded with simultaneous cracking of the surgical valve with a 24-mm True balloon (Bard Peripheral Vascular, Tempe, Arizona) at 15 atm, followed by a 25-mm True balloon (**Figures 1D and 1E**, Online Videos 2 and 3). Despite balloon rupture, the final mean gradient was decreased to 8 mm Hg (average heart rate of 95 beat/min, atrial fibrillation) with only mild residual regurgitation (**Figure 1F**, Online Video 4). The left atrial v-wave decreased to 30 mm Hg. At the end of the procedure, the atrial septal defect was closed with a 12-mm Amplatzer septal occluder (St. Jude Medical). Post-procedural CT revealed an outer transcatheter valve diameter of 24.7/24.4 mm (area 4.7 cm^2), exceeding the pre-procedural surgical valve inner diameter and supporting the existence of valve fracture. An echocardiogram showed only mild mitral regurgitation with a mean gradient of 8 mm Hg (**Figures 1G and 1H**, Online Video 5). The regurgitant fraction by magnetic resonance imaging was 8%. The patient was discharged with symptomatic improvement on post-operative day 6.

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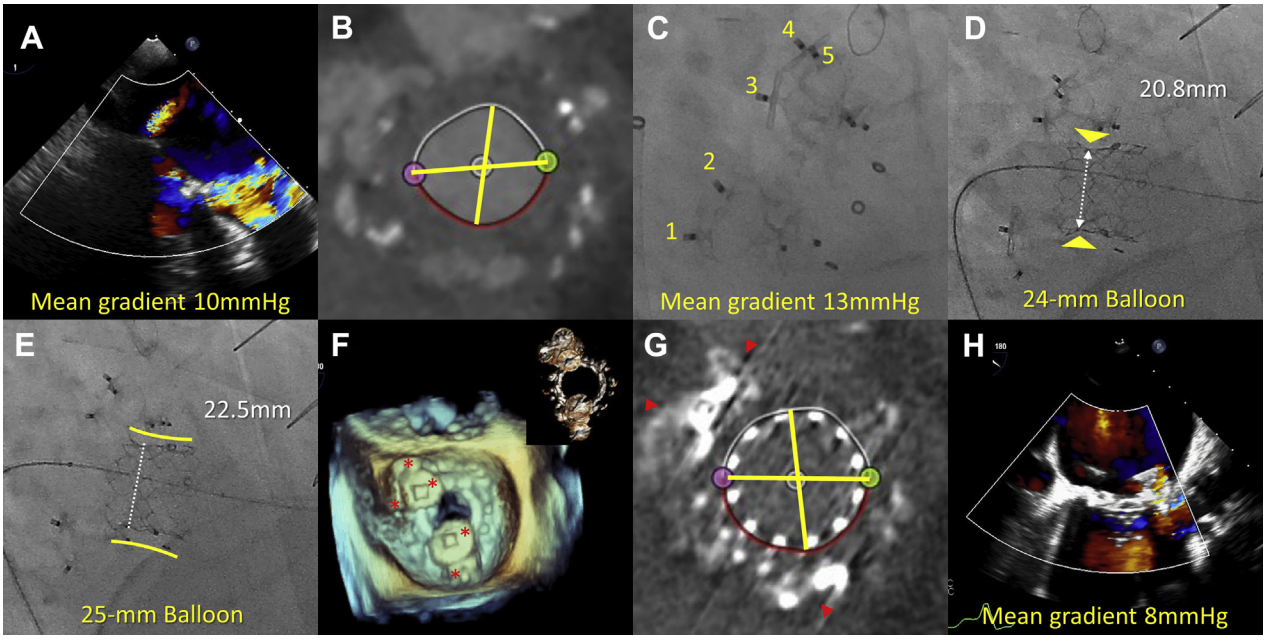
FIGURE 1 **Mitral Bioprosthetic Valve Fracture After PVL Closure and Mitral Valve-in-Valve Placement**



(A) Pre-procedural echocardiogram showing severe mitral paravalvular leakage (PVL) with a mean gradient of 10 mm Hg (Online Video 1). **(B)** Pre-procedural inner valve diameters were 20.7/20.3 mm **(yellow solid lines)** by 3-dimensional computed tomography. **(C)** Transesophageal echocardiography revealed a mean gradient of 13 mm Hg after deployment of 5 plugs. **(D)** Indentation remained on the Sapien-3 after a 24-mm balloon dilation (between the **arrowheads**) with the shortest diameter of 20.8 mm by angiography **(broken line)** (Online Video 2). **(E)** Stent was straightened after expansion by a 25-mm balloon, with the shortest diameter of 22.5 mm **(broken line)** (Online Video 3). **(F)** The final echocardiogram showed 5 plugs **(asterisks)** around the transcatheter bioprosthesis inside of the fractured surgical bioprosthesis (Online Video 4). **(G)** A 26-mm Sapien-3 inside of a 25-mm Mosaic valve with stent outer diameter of 24.7/24.4 mm **(yellow solid line)** and plugs **(red arrowheads)**. **(H)** Echocardiogram showed mild PVL with a mean gradient of 8 mm Hg (Online Video 5).

In this case, both PVL and PPM contributed to the patient's recurrent symptoms (1,2). Additionally, plugs placed to decrease the PVL may have obstructed some inflow that was treated by placement of a mitral transcatheter valve. Plug placement was used before the valve-in-valve procedure because the passage of wire through the PVL orifice may be obstructed by the transcatheter valve. Placement of the new valve following the plugs may have improved the residual leak through further compression of the leak orifice. A combination of transcatheter PVL closure and valve-in-valve implantation with a bioprosthetic valve fracture for PPM may be one solution for combined bioprosthesis failure, not only in the aortic position, but also in the mitral position (3–6).

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KEY WORDS bioprosthetic valve fracture, mitral valve, paravalvular leakage closure, valve-in-valve

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