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IMAGES IN INTERVENTION

Plug and Clip

Percutaneous Repair of a Perforated Mitral Valve Complicating Severe Functional Mitral Regurgitation

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A 45-year-old woman presented with persistent heart failure after repeated aortic root enlargement and mechanical aortic valve replacement (AVR). Echocardiography revealed a perforated A1 mitral valve (MV) scallop (6 × 4 mm) near the lateral trigone and severe functional mitral regurgitation (FMR) due to bileaflet tethering (**Figures 1A and 1B,** Video 1). In view of high reoperative risk, the heart team recommended percutaneous plugging of the perforated leaflet and transcatheter edge-to-edge repair (TEER) to treat the FMR. Device simulation on patient-specific 3-dimensional printed model showed that the soft 6/4-mm Amplatzer Duct Occluder II (Abbott) fit the defect optimally without obstructing the left ventricular outflow tract (**Figures 1C and 1D**).

After transseptal access, a 7-F Judkins right 4.0 guiding catheter (Cordis) through an Agilis medium curl (Abbott) was used to engage the perforation. Then, a telescoping system was implemented using an angled Glidewire (Terumo), a Navicross microcatheter (Terumo), and a 5-F ST01 guiding catheter (Terumo) to cross the perforation (**Figures 2A and 2B,** Videos 2 and 3). This eliminated the need for a stiff wire and hence avoided potential injury or impingement of the soft mobile MV and hemodynamic instability. A 6/4-mm Amplatzer Duct Occluder II was successfully deployed, with trivial residual leak (**Figure 2C,** Video 4). Transesophageal echocardiography showed persistent severe FMR, and TEER was performed over the A2-P2 segment using the MitraClip G4 NTW (Abbott), reducing mitral regurgitation to mild and the V wave from 83 to 23 mm Hg (**Figures 2D to 2F,** Videos 5 and 6). The patient's symptoms improved to New York Heart Association functional class I to II at 1 month.

In contrast to a previous report of MitraClip placement to stabilize the mobile MV before plugging a perforation,[1] our case illustrates that plugging a perforation in a mobile MV, facilitated by using a telescoping delivery system followed by TEER for residual FMR, is feasible. This approach: 1) allows reassessment of the severity of FMR after plugging; 2) reduces the risk for inadvertent dislodgement of the MitraClip during plugging; and 3) maintains safe access across the MV in the presence of mechanical AVR if additional rail support is needed during plugging. The case also highlights the importance of preprocedural simulation using a patient-specific 3-dimensional printed model to choose the optimal device that will seal the perforation without interfering with the left ventricular outflow tract and AVR.

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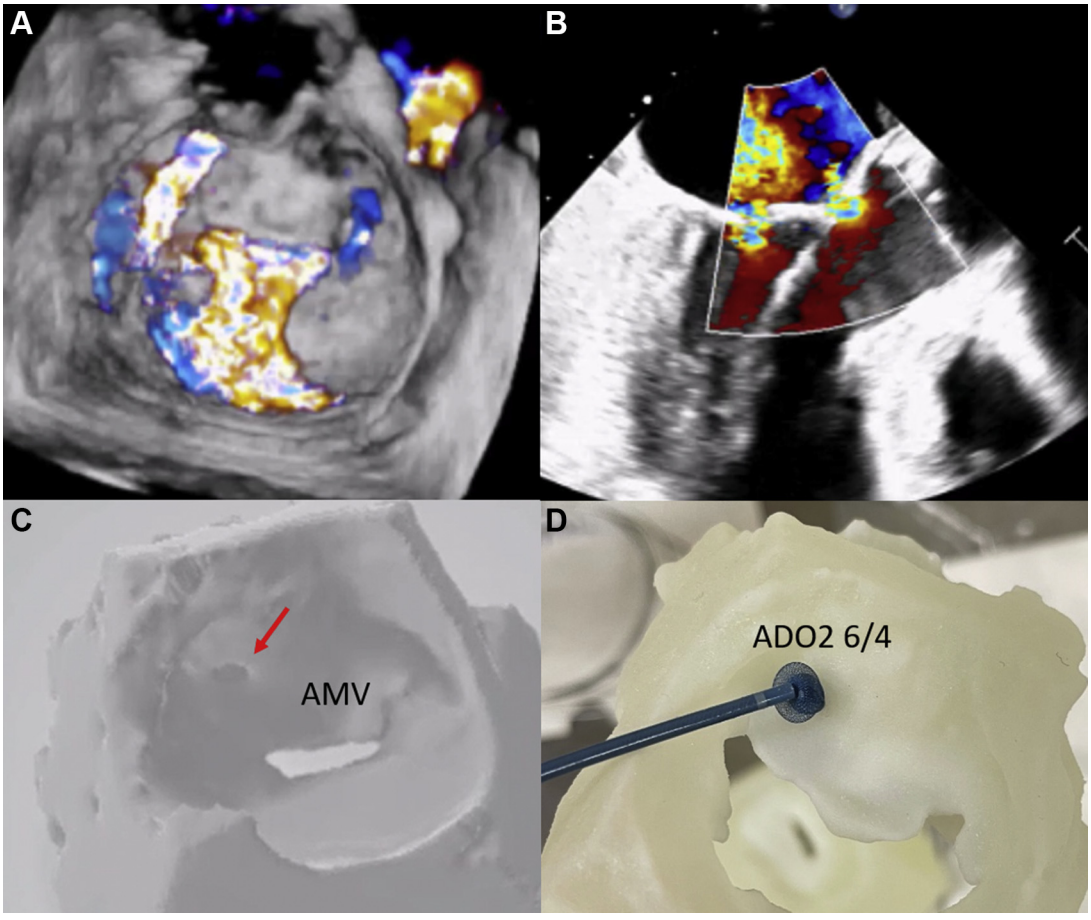
FIGURE 1 **Preprocedural Images**



(A,B) Transesophageal echocardiographic images showing the perforated anterior mitral valve (AMV) and severe functional mitral regurgitation. **(C)** Segmentation of the mitral valve on the basis of 3-dimensional (3D) transesophageal echocardiography. The **arrow** indicates the perforation. **(D)** Device simulation using a 3D printed model.

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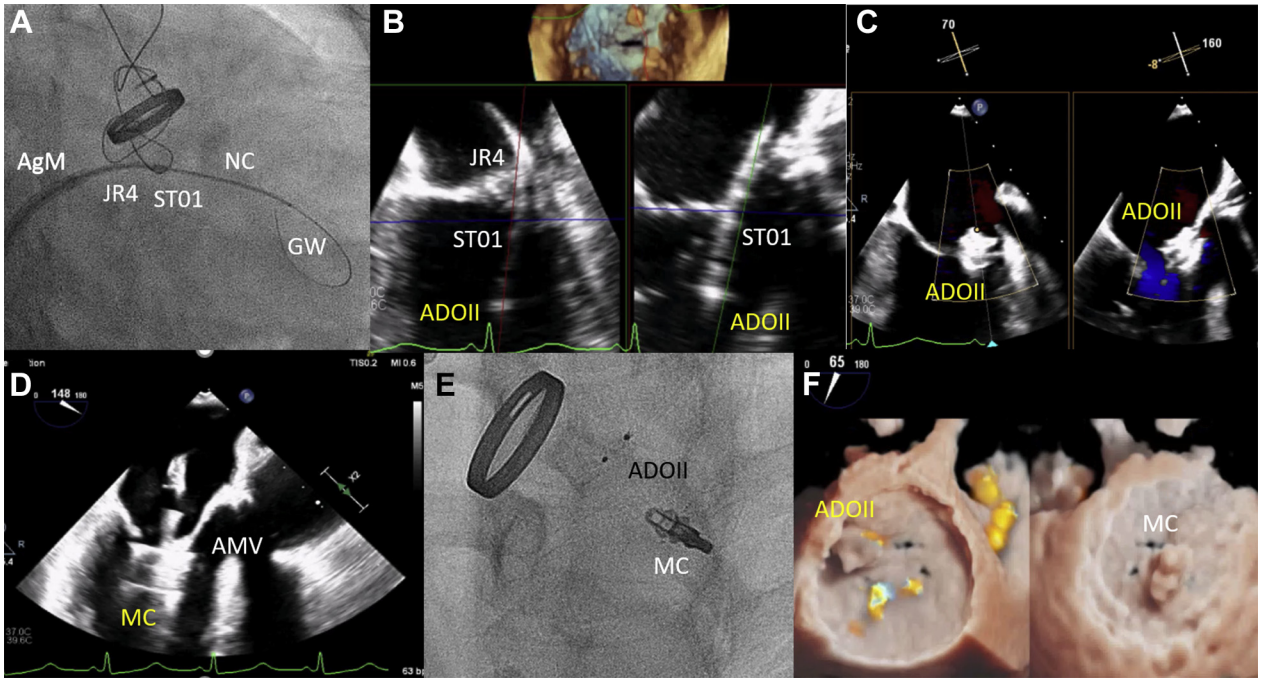
FIGURE 2 **Intraprocedural Images**



(A) Telescoping system across the perforated leaflet. **(B)** Crossing the defect using multiplanar 3-dimensional reconstruction. **(C)** The Amplatzer Duct Occluder II (ADOII) 6/4-mm device seals the perforation. **(D)** Independent grasping feature of the MitraClip G4 NTW (MC) was used to optimize leaflet insertion. **(E)** Final cine fluoroscopy. **(F)** Transesophageal echocardiography showing mild residual regurgitation. AMV = anterior mitral valve; AgM = Agilis medium curl; GW = Glidewire; JR4 = Judkins right 4.0; NC = Navicross; ST01 = ST01 catheter.

REFERENCE

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KEY WORDS clip, percutaneous repair, perforated MV, plug, severe functional MR

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