Transcatheter Mitral Valve Replacement After Transcatheter Electrosurgical Laceration of Alfieri STItCh (ELASTIC):
First-in-Human Report

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A 78-year-old woman was referred with refractory heart failure. She had previous surgical mitral valve repair with a 32 Carpentier-Edwards Physio ring (Edwards Lifesciences, Irvine, California) and a polypropylene Alfieri stitch.

Echocardiography demonstrated restricted mitral valve leaflets, 2 eccentric regurgitant jets, and pulmonary vein flow reversal (Figure 1). Two orifices were evident on echocardiography and computed tomography (Figure 2).

The heart team determined the patient unsuitable for repeat cardiac surgery or standalone transcatheter mitral valve replacement (TMVR) due to high expected risk of valve maldeployment, “watermelon seeding” malapposition, and underexpansion with severe paravalvular leak due to the Alfieri stitch. A decision was made to use LAMPOON-related techniques (1,2) to cut the Alfieri stitch immediately before transseptal TMVR (Figure 3).

The institutional ethics review board of Emory University Hospital approved this retrospective report.

Two 6-F guiding catheters were advanced from trans-femoral sheaths retrograde into the left atrium through the separate mitral valve orifices. An 0.014” guidewire was advanced from one catheter and snare-retrieved from the second to form a guidewire loop around the Alfieri
stitch (Figure 4). The guidewire loop was electrified and tensioned, lacerating the anterior leaflet tip horizontally adjacent to the suture. The result was a single mitral orifice in which the transcatheter heart valve was deployed (Figure 5).

Blood pressure reduced transiently during retrograde catheter manipulation but not laceration, requiring intra-aortic balloon pump counterpulsation. Laceration was successful requiring 2 to 3 s of continuous duty cycle (“cutting”) radio-frequency energy at 70 W. The valve was well seated with a good hemodynamic result (Figure 6). The patient was discharged on day 9 with class I symptoms and no stroke.

Patients with previous Alfieri stitch or MitraClip (Abbott Vascular, Santa Clara, California) may be excluded from TMVR. We describe a technique to resect the anterior leaflet tip from the suture attachment, enabling TMVR.

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REFERENCES


FIGURE 1. Baseline Transesophageal Echocardiography of Double Orifice Valve
(A) Surgeon’s view showing mitral annuloplasty ring and Alfieri stitch apposing A2 and P2 mitral scallops. (B) Two eccentric regurgitant jets through medial and lateral mitral valve orifices. The mean mitral valve gradient was 6 mm Hg. L = lateral orifice; LA = left atrium; LV = left ventricle; M = medial orifice.
FIGURE 2. Baseline 3-Dimensional Computed Tomography Reconstruction
The mitral valve annuloplasty ring, leaflets, and Alfieri stitch viewed from (A) the atrium and (B) the ventricle demonstrating a double orifice mitral valve.
FIGURE 3. Baseline Computed Tomography Multiplanar Reconstruction

(A) Slice at the level of the mitral annuloplasty ring showing the relationship of the aortic and mitral valve planes. (B) Slice at the level of the leaflet tips showing the Alfieri stitch, medial and lateral mitral valve orifices, and planned laceration plane (dashed yellow line). Retrograde access across the aortic valve was chosen to better direct lacerating catheters toward the anterior leaflet edge of the Alfieri stitch. A = anterior; AoV = aortic valve; L = lateral; M = medial; P = posterior.
FIGURE 4. The ELASTIC Procedure

(A) Two 6-F JL3.5 catheters (Medtronic, Minneapolis, Minnesota) are positioned retrograde in the left atrium, through the medial and lateral mitral valve orifices, respectively. A stiff 0.014-inch guidewire (Astato XS 20, Asahi Intecc, Aichi, Japan) from one catheter is snared from the second catheter and externalized. Precise transseptal puncture for transcatheter mitral valve replacement was guided by transesophageal echocardiography and performed using an electrified 0.014-inch guidewire through a steerable sheath (Agilis medium curl, St. Jude Medical, St. Paul, Minnesota) and accompanying dilator. (B) The midshaft of the guidewire is kinked, denuded, and positioned to straddle the Alfieri stitch (asterisk) between 2 retrograde guiding catheters. Nonionic 5% dextrose is injected through both catheters during electrification to reduce the nontarget conduction and enhance laceration. A 29-mm SAPIEN 3 valve (Edwards Lifesciences) is positioned over a 0.035-inch Confida guidewire (Medtronic, Minneapolis, Minnesota) in the left atrium ready for deployment after laceration. L = lateral catheter; M = medial catheter.
FIGURE 5. Single-Orifice Mitral Valve
(A) Surgeon’s view showing mitral annuloplasty ring, single-orifice mitral valve, and transseptal transcatheter heart valve (THV) being positioned for deployment. (B) Three-dimensional Doppler color flow demonstrating a single regurgitant jet through the mitral valve. LVOT = left ventricular outflow tract; MVO = mitral valve orifice; S = septum.
FIGURE 6. Valve Deployment

(A) A SAPIEN 3 valve (Edwards Lifesciences, Irvine, California) well deployed in the mitral annuloplasty ring with ventricular flaring. (B) Well-expanded and circularized SAPIEN 3 valve with circumferential annular apposition. The final transmitral gradient by invasive catheter measurement was 1 mm Hg, left atrial V-wave decreased immediately from 30 to 19 mm Hg, there was mild commissural paravalvular leak and no left ventricular outflow tract obstruction. THV = transcatheter heart valve.