

# Simultaneous Transfemoral Mitral and Tricuspid Valve in Ring Implantation: First Case Report with Edwards Sapien 3 Valve

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**ABSTRACT:** Patients with advanced valvular disease may be at high or prohibitive risk for surgical management. We describe a patient with previous mitral and tricuspid valve repair and recurrent admissions for New York Heart Association Class IV heart failure symptoms due to severe mitral stenosis and severe tricuspid regurgitation. Due to her comorbidities and two previous sternotomies, the patient was at high risk for surgery. We performed a simultaneous transfemoral mitral and tricuspid valve-in-ring implantation. This is the first report of its kind using a Sapien 3 valve (Edwards Lifesciences).

## BACKGROUND

Surgical valve repair and the less-common valve replacement remain the most performed tricuspid and mitral valve-related interventions in the United States.<sup>1,2</sup> However, not all patients can undergo these procedures because of prohibitive or high surgical risks. Transcatheter valve-in-ring (VIR) procedures in both mitral and tricuspid positions can be attractive options for high-risk patients with previous surgical repair.<sup>3,4</sup> Even so, the decision to use transcatheter options in high-risk patients involves several factors, including limitations of preoperative imaging modalities, technical difficulties with the structure of the previously implanted ring compared to that of the transcatheter valve, and limited data on the efficacy and feasibility of these procedures.<sup>5,6</sup> We report a case of simultaneous implantation of both transcatheter mitral and tricuspid valves using a transfemoral approach.

## RELEVANT HISTORY AND PHYSICAL EXAM

A 54-year-old female was admitted with New York Heart Association class IV symptoms for the past 4 months. She had undergone valve repair for mitral and tricuspid regurgitation 9 years earlier as well as coronary artery bypass, and she had end-stage renal disease and systemic lupus erythematosus. At the time of her valve repair, valvular lesions were thought to be due to leaflet atrophy and annular dilatation secondary to systemic lupus erythematosus. At that time, she received a 29-mm Attune (St. Jude Medical) flexible adjustable annuloplasty ring in the mitral position and a 29-mm Simulus (Medtronic) adjustable ring in the tricuspid position. Upon admission during her current visit, a physical exam revealed jugular venous distension up to the angle of her jaw, faint S1, a positive hepatojugular reflux, and severe lower-extremity edema.

## RELEVANT INVESTIGATIONS BEFORE INTERVENTION

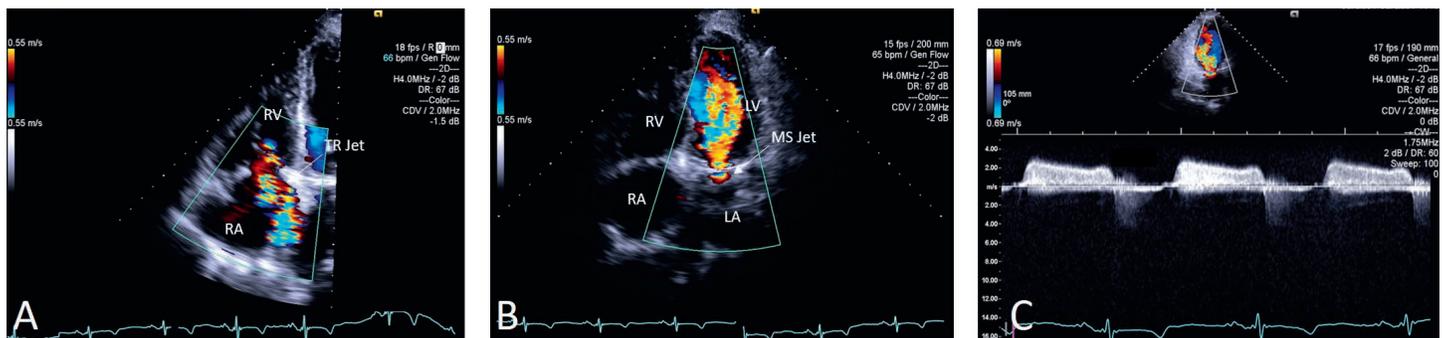
Severe tricuspid regurgitation (Figure 1 A) and severe mitral stenosis (Figure 1 B) were noted on transthoracic echocardiogram. The mean gradient across the mitral valve (Figure 1 C) was 18 mm Hg (heart rate 66 beats/min). Transesophageal echocardiogram revealed similar findings (Figure 2, all panels) with the addition of a 7-mm x 7-mm nodule noted at the junction of the left atrium (LA) and left atrial appendage (LAA). The reader thought that this indicated a thrombus. Coronary computed tomography angiogram showed patent bypass grafts and a heavily calcified mitral valve with an estimated area of around 0.8 cm<sup>2</sup>. Although it was difficult to estimate the extent of tricuspid regurgitation in this study, the regurgitation appeared significant given engorgement of the hepatic veins.

## CLINICAL DECISION MAKING

Considering the patient's comorbid conditions and two prior sternotomies, we decided that she was at very high risk for adverse events if a third sternotomy was attempted. After receiving anticoagulation for LA thrombus and optimization of volume status, the patient was taken to a hybrid operating room for simultaneous transcatheter mitral and tricuspid valve-in-ring implantation.

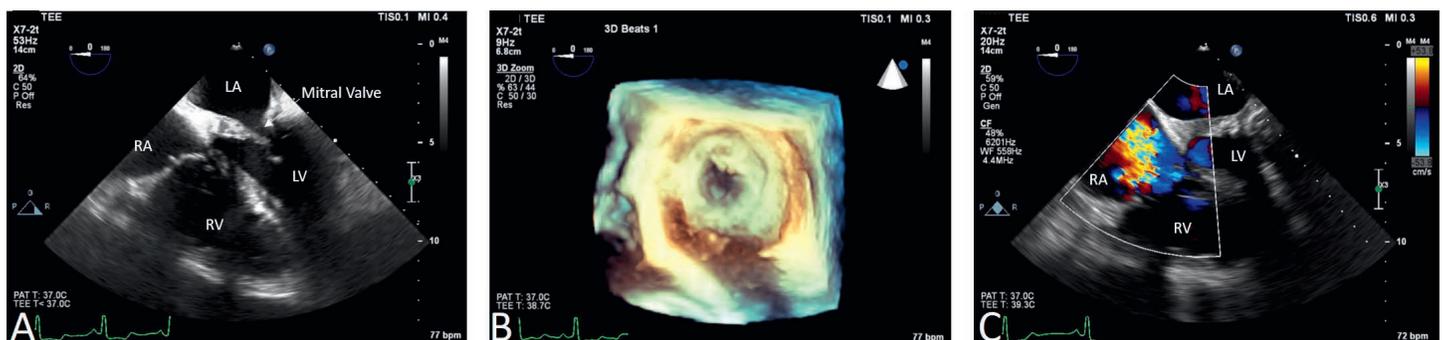
## INTERVENTION

A temporary pacemaker wire was advanced to the right ventricular apex through left femoral access. The right femoral vein access was used to advance the PREFACE Guiding Sheath (Biosense Webster, Inc.) with a radiofrequency NRG Transseptal Needle (Baylis Medical Company, Inc.). The PREFACE sheath was then advanced across the interatrial septum under



**Figure 1.**

Preprocedure transthoracic echocardiogram. (A) Color Doppler map shows a tricuspid regurgitation jet that is impinging on the myocardial wall. (B) Color Doppler shows turbulent flow across the stenotic mitral valve. (C) Continuous-wave (CW) Doppler across the mitral valve shows the mean gradient of 18 mm Hg at a heart rate of 66 bpm. RA: right atrium; RV: right ventricle; LA: left atrium; LV: left ventricle; TR: tricuspid regurgitation; MS: mitral stenosis



**Figure 2.**

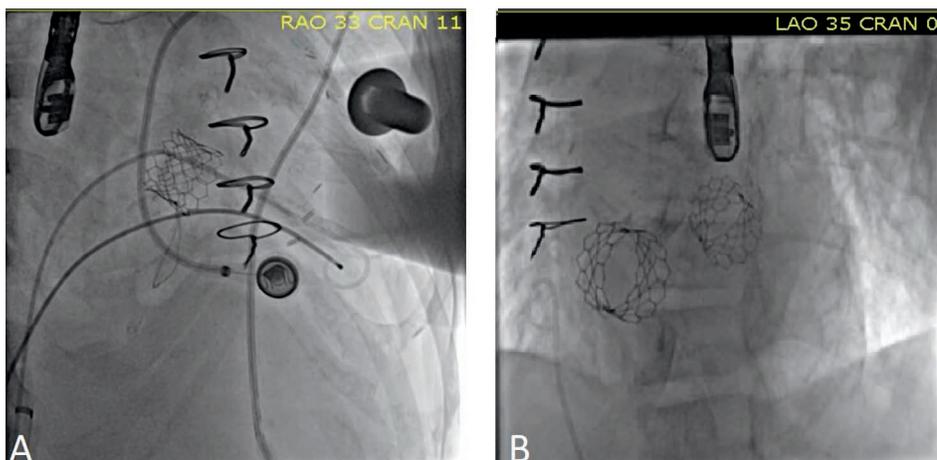
Preprocedure transesophageal echocardiogram. (A) Severely stenotic mitral valve as visualized on transesophageal echocardiogram. (B) Reconstruction of mitral valve visualized during diastole by 3-dimensional echocardiography. (C) Wide open tricuspid regurgitation jet seen during systole. LA: left atrium; LV: left ventricle; RA: right atrium; RV: right ventricle

echocardiographic guidance. After ballooning the septum with a 40- x 12-mm balloon, an Agilis NxT steerable introducer (St. Jude Medical) was placed across the septum and was then used to cross a J-wire across the mitral valve. A 23-mm Edwards Sapien 3 valve was deployed across the mitral valve with rapid ventricular pacing (Figure 3). Three-dimensional reconstruction of the mitral valve and gradient across the valve are shown in Figure 4. Hemodynamics were measured before and after the valve deployment, and a ventriculogram was performed after deployment. No regurgitation of contrast into the left atrium was noted. The Agilis NxT steerable introducer was then put back into position across the tricuspid valve, and a pigtail catheter was used to place the SAFARI Guidewire (Boston Scientific) into the right pulmonary artery. The 29-mm Edwards Sapien 3 valve was put in position across the tricuspid valve after assembly in the inferior vena cava. Once in position, the valve was slowly expanded without rapid pacing, held for 5 seconds, and then deflated (Figure 3 B). The postprocedure right-sided ventriculogram showed no leak of contrast into

the right atrium. Right femoral vein access was closed using a Perclose ProGlide closure system (Abbott Vascular) while manual pressure was held for hemostasis of the left femoral vein. The patient tolerated the procedure well. Postprocedure echocardiogram showed an estimated mean mitral valve gradient of 8 mm Hg at a heart rate of 68 beats/min. Tricuspid regurgitation was graded as trace by the reader. The patient was discharged home in stable condition.

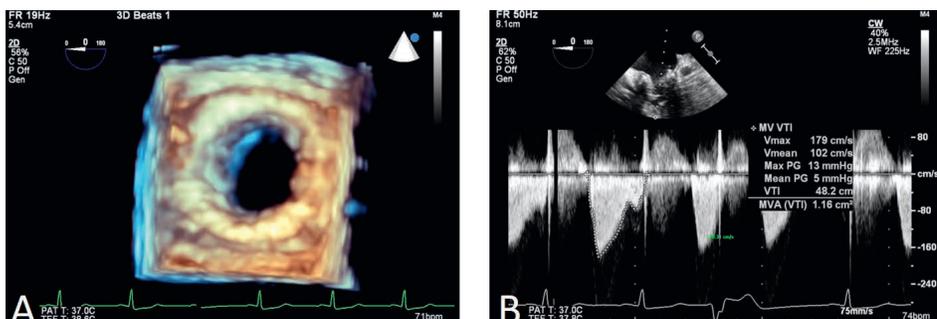
**DISCUSSION**

More than 10,000 mitral and tricuspid valve surgeries are performed annually in the United States.<sup>1,2</sup> There are several patients who are at very high or prohibitive risk for adverse events arising from these procedures. We describe a patient with prior mitral and tricuspid repair and coronary artery bypass who now presented with severe mitral stenosis and tricuspid regurgitation. Her risk for surgical complications was high because of comorbid conditions and previous sternotomies.



**Figure 3.**

Intraoperative fluoroscopy. (A) Fluoroscopy (RAO projection) showing a 23-mm Edwards Sapien valve in the mitral position after deployment and dilatation with a balloon. (B) Fluoroscopy (LAO projection) showing a 29-mm Edward Sapien valve in the tricuspid position and a 23-mm Edward Sapien valve in the mitral position.



**Figure 4.**

Intraoperative transesophageal echocardiogram. (A) Reconstruction of the mitral valve visualized during diastole by 3-dimensional echocardiography after deployment of a 23-mm Edwards Sapien 3 valve. (B) Continuous-wave (CW) Doppler across the mitral valve shows the mean gradient of 5 mm Hg at a heart rate of 74 bpm after deployment of a 23-mm Edwards Sapien 3 valve.

Limited data regarding the efficacy and feasibility of VIR implantation complicates clinical decision making, as do several factors related to initial repair. For example, bands or a ring can be used for mitral and tricuspid valve repair. Knowing the type of device and location of support sutures used in the initial repair is crucial because bands may not provide adequate support for a VIR procedure (particularly bands sutured to only one portion of the annulus).<sup>7</sup> In addition, annuloplasty rings are usually oval in structure, whereas transcatheter valves are circular. Hence, a semi-rigid ring will

be ideal for a VIR procedure because the transcatheter valve is less likely to become deformed when implanted in a semi-rigid ring. Despite these limitations, the VIR intervention may be the only palliation that can be offered to those patients at high surgical risk.

## CONCLUSION

Valve-in-ring procedures, though feasible, can be technically challenging because of several patient- and device-related factors. However, they may sometimes be the only palliation appropriate for a patient at high

or prohibitive surgical risk. This, to our knowledge, is first report of transfemoral simultaneous mitral and tricuspid VIR implantation with a Sapien 3 valve.

## Conflict of Interest Disclosure:

Dr. Little conducts research on behalf of Abbott, Medtronic, and Boston Scientific.

## Keywords:

valve insufficiency, bioprosthesis, percutaneous, transcatheter, intervention, LDL-C-lowering

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