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Transcatheter Tricuspid Valve-in-Valve Implantation With a Novel Balloon Expandable Myval THV

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The transcatheter tricuspid valve-in-valve implantation has not yet been clarified, and several case series have documented results in patients with tricuspid bioprosthetic valve degeneration who underwent transcatheter implantation of Edwards SAPIEN XT and SAPIEN 3 (Edwards Lifesciences, Irvine, CA) and Medtronic (Minneapolis, MN) valves. Here, we present the case of a patient with severe bioprosthetic tricuspid valve stenosis who was successfully treated with the transfemoral route through the 29-mm novel balloon expandable Myval transcatheter heart valve (Meril Life Sciences Pvt Ltd, Vapi, Gujarat, India) system.

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Tricuspid valve (TV) surgery is usually performed with a bioprosthetic valve (BPV) or ring method and valve durability is less longevity than other valvular prostheses.[1] The transcatheter tricuspid valve-in-valve (TVIV) or valve-in-ring implantation is on the way to an important alternative to high-risk redo surgery in patients with degenerated tricuspid BPV.[2] Unlike common valve-in-valve therapy in the aortic position, there are only a few results for the tricuspid position. We report our experience of TVIV with the novel balloon-expandable Myval transcatheter heart valve (THV) system (Meril Life Sciences Pvt Ltd, Vapi, Gujarat, India) in patients with Ebstein anomaly presented degenerated tricuspid BPV.

A 59-year-old male patient was referred to our clinic from the center where he presented with recently increased edema in the legs, abdomen, and New York Heart Association class III dyspnea. Eleven years ago, he underwent a TV operation with a 31-mm bioprosthesis St. Jude Medical Epic (St. Jude Medical, Inc, St. Paul, MN) due to the Ebstein anomaly. Transthoracic echocardiography revealed TV bioprosthesis stenosis or degenerated with a mean gradient of 15 mm Hg with moderate mitral regurgitation, mild impaired right ventricular dysfunction, massive right atrial dilatation, and a preserved left ventricular ejection fraction (60%) (Video 1). Multislice computed tomography showed that degeneration of BPV without thrombus and vegetation. Although it would not affect the progression of the case, the lack of transesophageal echocardiography images may be a limitation for the case. The patient was evaluated by the heart team, and TVIV was recommended as reoperation carries a high risk of mortality and morbidity. Written informed consent was obtained from the patient for the procedure.

As a result of multislice computed tomography and transthoracic echocardiography evaluation, it was decided to perform the procedure through the femoral vein without transesophageal echocardiography. Our preference would be Edwards Sapien XT or SAPIEN 3 (Edwards Lifesciences, Irvine, CA), which were previously used in these patients, but because these were not available due to insurance problems, we wanted to use the Myval THV, which is the most similar to these valves and previously used in aortic valve-in-valve procedures. The outer diameter of a 31-mm bioprosthetic valve has a true inner diameter 29 mm in the product literature. Thus, we decided to use a 29-mm Myval THV. We decided to send the stiff guidewire to the pulmonary artery because the patient's right ventricle was not large enough and we experienced difficulties while passing the pigtail catheter to the valve. Even if we crossed the TV with 6F multipurpose MPA-1 (Cordis, Ascot, Berks, UK), 6F Amplatz left 2 (Boston Scientific, Marlborough, MA), and hydrophilic vertebral catheters, and 0.38-0.35 inch hydrophilic guidewire, we could not cross the stiff guide wires to the pulmonary artery. Then we crossed the valve with 5F pigtail catheter and an Amplatz Super Stiff guidewire was placed into the distal left pulmonary artery (Figure 1A). However, after experiencing difficulty crossing the wires and catheters, and considering that it would be difficult to advance the Myval system, a second back-up Meier 0.035 inch × 300 cm guidewire (Boston Scientific, Marlborough, MA) was implanted distal to the pulmonary artery using the previous method (Figure 1B).

The Videos can be viewed in the online version of this article [10.1016/j.athoracsur.2021.03.014] on http://www.annalsthoracicsurgery.org.

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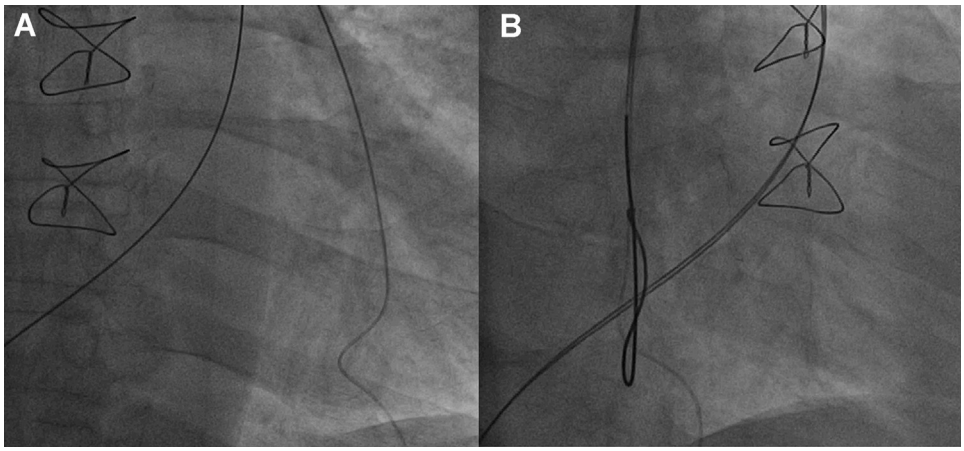

FIGURE 1 Angiographic images of first (A) and second (B) stiff guidewires placed into the pulmonary artery.

We predilated the TV bioprosthesis to complete balloon extension in the patient with a 25-mm Cristal Balloon Catheter (Balt USA Medical Devices, Irvine, CA) (Figure 2, Video 2). Then the 29-mm Myval THV balloon-expandable valve was slowly implanted in the proper position on fluoroscopy (Figure 3, Video 3). After it was seen that Myval's functions were good with hemodynamic, echocardiographic, and fluoroscopic controls, the procedure was terminated by applying figure-of-8 sutures to the femoral vein.

The patient was discharged from the hospital with a tricuspid mean gradient of 5 mm Hg after 1 day of uneventful postoperative hospitalization. At the 1-month follow-up, improvement in functional capacity was observed, and 4 mm Hg mean gradient was detected in the tricuspid valve in echocardiography (Video 4).

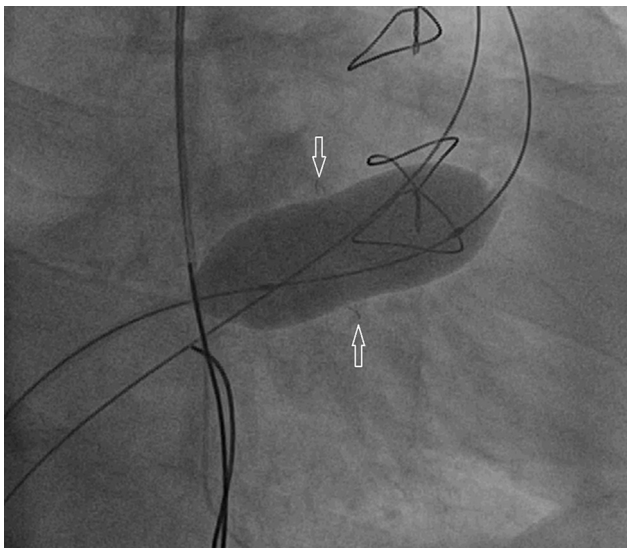

FIGURE 2 Angiographic images of 31-mm tricuspid valve bioprosthesis during predilatation. The arrows point to the tricuspid valve bioprosthesis ring.

COMMENT

Surgical interventions to the tricuspid valve, which was the forgotten valve in the past, have increased—whether due to primary pathology, congenital origin, or secondary reasons (left heart, annulus dilatation, medication, etc). These surgical procedures are either in the form of a bioprosthetic valve or ring. We know that when structural valve deterioration develops in BPV, redo surgery has been the gold standard for the treatment of degenerated BPV. In recent years, to overcome this problem, case reports about transcatheter TVIV or tricuspid valve-in-ring procedures have emerged due to the risk of redo surgery.[2] Technological advances in TV options suggest that surgical intervention will be performed in more and younger patients.

Of course, transcatheter aortic valve-in-valve treatments for aortic valve bioprosthesis degeneration have been pioneers on the way to TVIV. However, the aortic and tricuspid valves are very different from each other and the points to be considered in the procedures are very different. We have previously seen transcatheter TVIV performed with Edwards Sapien XT and SAPIEN 3 and Melody (Medtronic, Minneapolis, MN) valves.[3-6] In this case, we used Myval THV, a new valve system used in transcatheter aortic valve implantation, which has not previously been used in TV bioprosthesis degeneration. Myval THV is a newer-generation balloon-expandable

THV and, owing to the outer skirting in the Myval THV's design and proper deployment at the orthotopic position, the development of Myval THV is proposed to decrease paravalvular leaks.[7] We have 3 approach routes for TVIV: transfemoral, transjugular, and transatrial.[4] Thanks to the newly improved more directable and flexible valve devices, the transfemoral route is favored in most cases except horizontal TV. Similar to our case, Kronberg and associates[8] reported 2 patients who have implanted TV due to Ebstein anomaly and were treated with TVIV because of degeneration[8] and they transfemorally performed the TVIV on both patients using SAPIEN 3 valves. Another important point in TVIV: When determining the valve size, the first surgery report and the inner diameter of the valve used should be learned from the label chart. Sometimes it may be difficult to cross the degenerated TV and place the stiff guidewire into the pulmonary artery. A stiff guidewire should be placed in the pulmonary artery whenever possible, but when there is a large right ventricle, and the pulmonary artery cannot be crossed, it should require the use of a right ventricle wire loop first.

In this case report, we presented the transcatheter TVIV implantation of a novel balloon-expandable Myval THV in a degenerated TV bioprosthesis. Obviously, in the future, surgical interventions for the tricuspid valve will increase, and more transcatheter interventions will be required, therefore tricuspid valve specific devices should be developed with randomized controlled studies.

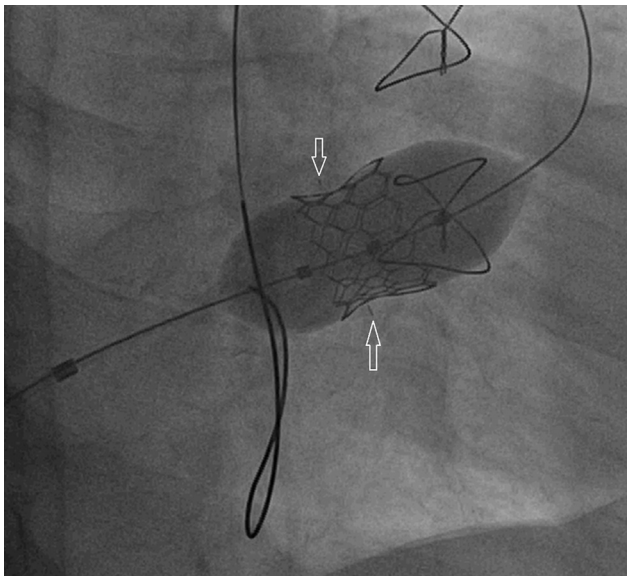

FIGURE 3 Angiographic images of implantation of the 29-mm Myval THV (Meril Life Sciences Pvt Ltd, Vapi, Gujarat, India). The arrows point to the tricuspid valve bioprosthesis ring.

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