Masters of Cardiothoracic Surgery

LAMPOON transseptal mitral valve in ring

Norihiko Kamioka[1], Jaffar M. Khan[2], Robert J. Lederman[2], Peter Block[1], Vasilis C. Babaliaros[1], Adam B. Greenbaum[1]

[1]Divisions of Cardiology, Emory University School of Medicine, Atlanta, GA, USA; [2]Division of Intramural Research, Cardiovascular Branch, National Heart Lung and Blood Institute, National Institutes of Health, Bethesda, MD, USA

Correspondence to: Vasilis C. Babaliaros, MD. Emory University Hospital F606, 1364 Clifton Road, Atlanta, GA 30322, USA. Email: vbabali@emory.edu.

Submitted Aug 09, 2018. Accepted for publication Oct 15, 2018.
doi: 10.21037/acs.2018.10.04
View this article at: http://dx.doi.org/10.21037/acs.2018.10.04

Introduction

The number of transcatheter mitral valve treatment options has been increasing. Among these, transcatheter mitral valve-in-ring or valve-in-mitral annular calcification (MAC) are more challenging compared to transcatheter mitral valve-in-valve therapy because of a shorter and non-circular landing zone and difficulty in achieving optimal coaxiality. In addition, the risk of left ventricular outflow tract (LVOT) obstruction is higher as the anterior mitral leaflet could cover the transcatheter heart valve and obstruct the LVOT.

Clinical vignette

A 47-year-old female patient was referred for evaluation of severe mitral regurgitation after aortic valve replacement [Freestyle 23 mm (Medtronic, Medtronic Parkway, MN, USA)] and mitral valve repair with a surgical ring [Edwards Cosgrove Band 28 mm (Edwards Lifesciences, Irvine, CA, USA)] in 2006. She also had a history of mantle radiation for non-Hodgkin's lymphoma, stroke and surgical tricuspid valve replacement in 2015, followed by transcatheter tricuspid valve replacement in 2016. Considering the patient's comorbidities, the heart team decided to plan transcatheter mitral valve replacement (TMVR) for the patient. Pre-procedural echocardiography showed severe mitral regurgitation with an ejection fraction of 40%. Pre-procedural CT revealed a risk of LVOT obstruction after TMVR due to a large native anterior mitral leaflet.

Surgical technique

The procedure was performed under general anesthesia guided by fluoroscopy and transesophageal echocardiography. With micropuncture catheters, bilateral common femoral arterial and venous accesses were obtained under fluoroscopy and ultrasound guidance. The right common femoral vein was pre-closed using a double Perclose technique. Transseptal puncture was then performed using a transseptal deflectable catheter (Agilis NxT medium curve, St. Jude Medical, St. Paul, MN, USA) and an electrified Astato XS20 wire (Asahi Intecc, Nagoya, Japan). The septum was crossed approximately 4 cm above the mitral ring and the wire advanced into the right atrium. The Agilis catheter was then advanced into the left atrium over the wire. A Swan-Ganz catheter passed through the Agilis catheter was able to cross the mitral valve and aortic valve without getting caught in any chordae. A hydrophilic wire passed antegrade through the Swan-Ganz catheter and was then snared by a retrograde catheter in the ascending aorta and externalized. We used this wire as a rail and retrogradely advanced a JL-3.5 guiding catheter through the aortic valve and left ventricle to the left atrium. A snare was then passed through the tip of the JL-3.5 guider and opened in the left atrium. A second JL-3.5 guider was then passed retrograde through the aortic valve into the LVOT, with its tip pointing toward the base of the midportion of the anterior leaflet of the mitral valve. This position was confirmed with fluoroscopy and transesophageal echocardiography. An electrified wire was then used again to puncture through the anterior leaflet of the mitral valve and advanced into the left atrium. The wire tip was grasped by the left atrial snare and catheters were positioned such that a bare portion of the wire was exactly where it crossed the anterior leaflet. The wire was electrified while both catheters were withdrawn. This resulted in the anterior mitral leaflet being split in two. The transseptal Swan-Ganz catheter was used to place a

Confida wire (Medtronic) into the ventricle and the Swan and septal catheter were removed. A 16-French E-sheath (Edwards Lifesciences) was utilized for antegrade Sapien-3 valve (Edwards Lifesciences) deployment. Before the valve deployment, we made a septostomy with a 14 mm balloon and then used that to dilate the valve. Because the valve ruptured the balloon, we went back and dilated the mitral valve again with an 18 mm True balloon (Bard Peripheral Vascular, Tempe, AZ, USA). The Sapien-3 valve was loaded onto the wire, advanced into the inferior vena cava, where the valve was loaded onto the balloon. We carefully crossed the atrial septum and positioned the valve in the previously placed mitral ring. The valve was deployed under rapid pacing in an 80/20 orientation. There was no leak or LVOT obstruction and the final results were excellent. All catheters and wires were removed and the septum was closed with a 30-mm Cardioform Septal Occluder (Gore, Flagstaff, AZ, USA). All Percloses were closed in both femoral arteries and vein and the patient was sent back to the ICU in a stable condition.

Comments

Clinical results

The results of an early feasibility trial were reported, with 5 patients with severe mitral valve disease and prohibitive surgical risk (1). We performed intentional laceration of the anterior mitral leaflet to prevent LVOT obstruction (LAMPOON) for patients who had prior surgical mitral valve ring (n=3) or band annuloplasty (n=1) or MAC with stenosis (n=1).

All patients successfully underwent LAMPOON before valve implantation. Critical LVOT gradients were not observed after TMVR with LAMPOON though pre-procedural MDCT predicted hemodynamic collapse after TMVR without LAMPOON. Since the LAMPOON had split the AML, doppler blood flow was seen across the transcatheter heart valve struts that encroached the LVOT. The LAMPOON IDE trial showed the technical success of 70%, in-hospital survival rate of 93% and no stroke after the procedure (2).

Advantages

LVOT obstruction is a devastating complication of TMVR. In cases that had LVOT obstruction after TMVR, the 30-day mortality was 88.9% post-procedure (3). Several techniques have been applied to avoid this complication: preparatory alcohol septal ablation (4) and controlled laceration of the anterior mitral leaflet (1,5,6). Preparatory alcohol septal ablation sacrifices myocardium and risks conduction system injury and pacemaker-dependence in patients with cardiomyopathy and is unsuitable in patients with thin interventricular septa. Septal ablation also delays TMVR by 4 to 6 weeks to allow remodeling in highly symptomatic patients. Intentional laceration of the anterior mitral leaflet to prevent LVOT obstruction (LAMPOON) procedure is a transcatheter technique that allows us to perform TMVR safely for patients who are at risk of LVOT obstruction.

Caveats

Potential risks and limitations of LAMPOON are mainly related to incorrect positioning of the retrograde catheter through which the electrified wire traverses the anterior mitral leaflet. An incorrect transverse of the anterior mitral leaflet could result in a suboptimal split or unexpected sinus or myocardial injury. Entrapment of chordae by a catheter or a wire could cause chordal injury. Fluoroscopy and 3-dimensional transesophageal echocardiography minimize the risk of those complications.

Acknowledgements

Funding: Supported by intramural funds, Emory Structural Heart and Valve Center, and by NIH Z01-HL006040-7.

Footnote

Conflict of Interest: Dr. Babaliaros is a consultant for and received research grant support from Abbott Vascular and Edwards Lifesciences. Dr. Greenbaum is a proctor for Edwards Lifesciences and St Jude Medical. The other authors have no conflicts of interest to declare.

References

1. Babaliaros VC, Greenbaum AB, Khan JM, et al. Intentional Percutaneous Laceration of the Anterior Mitral Leaflet to Prevent Outflow Obstruction During Transcatheter Mitral Valve Replacement: First-in-Human Experience. JACC Cardiovasc Interv 2017;10:798-809.
2. Babaliaros V, Khan J, Greenbaum A, et al. LAMPOON IDE Trial: preliminary results. In: TCT.

San Diego, CA; 2018.
3. Guerrero M, Urena M, Himbert D, et al. 1-Year Outcomes of Transcatheter Mitral Valve Replacement in Patients With Severe Mitral Annular Calcification. J Am Coll Cardiol 2018;71:1841-53.
4. Guerrero M, Wang DD, Himbert D, et al. Short-term results of alcohol septal ablation as a bail-out strategy to treat severe left ventricular outflow tract obstruction after transcatheter mitral valve replacement in patients with severe mitral annular calcification. Catheter Cardiovasc Interv 2017;90:1220-6.
5. Lee R, Hui DS, Helmy TA, et al. Transapical mitral replacement with anterior leaflet splitting: A novel technique to avoid left ventricular outflow tract obstruction. J Thorac Cardiovasc Surg 2018;155:e95-8.
6. Esper E, Ferdinand FD, Aronson S, et al. Prosthetic mitral valve replacement: late complications after native valve preservation. Ann Thorac Surg 1997;63:541-3.

Cite this article as: Kamioka N, Khan JM, Lederman RJ, Block P, Babaliaros VC, Greenbaum AB. LAMPOON transseptal mitral valve in ring. Ann Cardiothorac Surg 2018;7(6):834-836. doi: 10.21037/acs.2018.10.04

