DISCUSSION

MAC can pose a significant challenge for even the most experienced surgeons and multiple techniques have been proposed to address this challenging problem. Novel atrial sliding plasties, anterior leaflet transposition, and autologous or xenograft patch plasty have been reported.^{2,3} These extensive procedures require prolonged myocardial ischemic and cardiopulmonary bypass times, however, and they are associated with a not insignificant risk of circumflex artery injury, atrioventricular dissociation, and calcific embolization.

The patient had severe MAC with a severely narrowed mitral orifice, limiting surgical options. Because of the patient's advanced age, concomitant severe aortic stenosis,

and MAC, we decided to perform a direct-vision deployment of a Sapien XT valve with an improvised sewing cuff to minimize paravalvular leak and prevent valve migration. This novel technique may serve as a useful treatment option for patients with severe MAC.

References

1. Izzat MB, Smith GH. Rupture of left ventricle after mitral valve repair: case report and new technique of repair. *Br Heart J*. 1993;69:366-7.
2. Carpentier AF, Pellerin M, Fuzellier JF, Relland JM. Extensive calcification of the mitral valve annulus: pathology and surgical management. *J Thoracic Cardiovasc Surg*. 1996;111:718-29; discussion 729-30.
3. Feindel CM, Tufail Z, David TE, Ivanov J, Armstrong S. Mitral valve surgery in patients with extensive calcification of the mitral annulus. *J Thoracic Cardiovasc Surg*. 2003;126:777-82.

EDITORIAL COMMENTARY

A very elegant transcatheter strategy for complicated mitral valve replacement associated with severe mitral annular calcification

Jessica Forcillo, MD, MSc, FRCSC,^a Vasilis Babaliaros, MD,^b and Vinod H. Thourani, MD^a

From the ^aDivision of Cardiothoracic Surgery, Joseph B. Whitehead Department of Surgery, and ^bDivision of Cardiology, Department of Medicine, Structural Heart and Valve Center, Emory University School of Medicine, Atlanta, Ga.

Disclosures: Drs Babaliaros and Thourani are members of the Edwards Lifesciences Advisory Board and have conducted paid research for Edwards Lifesciences. The other author has nothing to disclose with regard to commercial support.

Received for publication Nov 2, 2015; accepted for publication Nov 4, 2015; available ahead of print Dec 11, 2015.

Address for reprints: Vinod H. Thourani, MD, Emory University Hospital Midtown, 550 Peachtree St, NE, 6th Fl Medical Office Tower, Atlanta, GA 30308 (E-mail: vthoura@emory.edu).

J Thorac Cardiovasc Surg 2016;151:e49-50

0022-5223/\$36.00

Copyright © 2016 by The American Association for Thoracic Surgery

<http://dx.doi.org/10.1016/j.jtcvs.2015.11.005>

Mitral annular calcification (MAC) is a chronic and degenerative process of the mitral annulus that could lead to fatal outcomes in the context of mitral valve replacement during cardiac surgery due to atrioventricular disruption, circumflex artery injury, and calcific embolization.^{1,2} The reported prevalence of MAC in the general surgical population is between 8% and 15%, but it can significantly increase with age.³ A study done by Gondrie and colleagues⁴ showed the association between incidentally detected mitral valve calcifications and future cardiovascular events. They found that mitral valve leaflet calcification and MAC had an odds ratio 2.08 and 1.53 increased risk, respectively, of experiencing an event during the perioperative period.⁴ Several techniques for the intraoperative management of MAC have been described in the literature,

ranging from careful incomplete debridement of the annulus, atrial sliding plasty, anterior leaflet transposition, implantation of the mitral valve on a polytetrafluoroethylene or polyethylene terephthalate felt protruding into the left atrium, to complete debridement MAC with atrioventricular patch repair followed by valve replacement. Some have also published reports on implantation of the mitral valve inside the atrium and sutured around the pulmonary veins.^{5,6}

Jessica Forcillo, MD, MSc, FRCSC

Central Message

A unique strategy using transcatheter aortic valve in the mitral position for severe mitral annular calcification.

See Article page e47.

Lee and colleagues⁷ describe the case of an 84-year-old man with severe aortic and mitral stenosis who underwent surgical aortic valve replacement combined with the implantation of a transcatheter valve (Sapien XT, Edwards Lifesciences, Irvine, Calif) in the mitral position under direct vision. They describe an innovative and elegant strategy in a very complex scenario where surgeons have feared intraoperative complications such as atrioventricular separation.⁷ Transcatheter aortic valves have rarely been used in the mitral position as a bailout strategy for patients with severe MAC. A group from Portugal⁸ published the first report in human beings of implantation of an inverted transcatheter aortic valve in the mitral position using a 29-mm balloon-expandable transcatheter valve.⁸ They noted good results despite 2 moderate paravalvular leaks with a functional class improvement from New York Heart Association functional class IV to class II at 1 month postprocedure.⁸ A small series of 4 patients published that same year showed the feasibility of this technique in patients with severe MAC.⁹

This new hybrid technique is not without concern for specific complications, including left ventricular outflow obstruction, paravalvular leak, valve embolization, and thrombosis. Obstruction of the left ventricular outflow tract by the struts of the prosthesis or from the apposition of the anterior leaflet to the left ventricular septum should be evaluated with preoperative planning. One could extrapolate from the newer transcatheter mitral valve devices that the distance from the tip of the anterior leaflet of the mitral valve in systole to the interventricular septum should be at least 2.5 cm to prevent left ventricular outflow tract obstruction. It may be advisable to consider these same measurements when considering the implantation of a transcatheter aortic valve in the mitral position for MAC. Another concern for this hybrid procedure is the degree of residual paravalvular leak due to incomplete debridement of the mitral annulus sealing of the transcatheter aortic valve. In the report by Lee and colleagues,⁷ the team secured a soft felt strip to the Sapien XT valve frame using a running prolene suture. This is a very pertinent and innovative strategy to prevent paravalvular leaks. With the subsequent approval of the Sapien 3 valve, this new-generation transcatheter aortic valve already has a skirt that may provide a

more adaptive seal that prevents paravalvular leaks. To prevent valve embolization, thorough preoperative planning is necessary. A 3-dimensional reconstruction of the mitral valve is necessary for ensuring concentric, circumferential MAC and measurement of the mitral valve area required for the oversizing of the balloon-expandable valve. Lastly, the anticoagulation regimen for this prosthesis remains undetermined. It may be judicious to administer antiplatelet and warfarin therapy to minimize this complication.

There has been an explosion of new technology for transcatheter mitral valve replacement. Although there is no available device approved for this specific procedure, there are multiple early feasibility trials ongoing in the United States, Canada, Australia, and Europe. The majority are specific to patients with mitral regurgitation, but conceivably applicable for use in those patients with MAC. Until these trials move into patients with mitral stenosis and/or mitral annular calcification, the ideal solution for these high-risk patients may be the use of transcatheter aortic valve or sutureless valves.

References

1. Korn D, Desanctis RW, Sell S. Massive calcification of the mitral annulus. A clinicopathological study of fourteen cases. *N Engl J Med*. 1962; 267:900-9.
2. Okada Y. Surgical management of mitral annular calcification. *Gen Thorac Cardiovasc Surg*. 2013;61:619-25.
3. Fox CS, Vasan RS, Parise H, Levy D, O'Donnell CJ, D'Agostino RB, et al. Mitral annular calcification predicts cardiovascular morbidity and mortality: the Framingham Heart Study. *Circulation*. 2003;107:1492-6.
4. Gondrie MJ, van der Graaf Y, Jacobs PC, Oen AL, Mali WP, Group PS. The association of incidentally detected heart valve calcification with future cardiovascular events. *Eur Radiol*. 2011;21:963-73.
5. Feindel CM, Tufail Z, David TE, Ivanov J, Armstrong S. Mitral valve surgery in patients with extensive calcification of the mitral annulus. *J Thorac Cardiovasc Surg*. 2003;126:777-82.
6. Machler H, Anelli-Monti M. Complete intra-atrial implantation of a mitral-valve prosthesis in a severely calcified mitral annulus. *Eur J Cardiothorac Surg*. 2011; 40:1547.
7. Lee R, Fukuhara S, George I, Borger M. Mitral valve replacement with severe mitral annular calcification using transcatheter valve. *J Thorac Cardiovasc Surg*. 2016;151:e47-9.
8. Ladeiras-Lopes R, Vouga L, Braga P, Paulo N, Azevedo AI, Neves P, et al. Simultaneous transapical implantation of an inverted transcatheter aortic valve-in-ring in the mitral position and transcatheter aortic valve replacement: first-in-human report. *J Am Coll Cardiol*. 2014;63:e25.
9. Himbert D, Bouleti C, Iung B, Nejari M, Brochet E, Depoix JP, et al. Transcatheter valve replacement in patients with severe mitral valve disease and annular calcification. *J Am Coll Cardiol*. 2014;64:2557-8.