

Balloon-expandable prosthesis for open mitral replacement with a calcified mitral annulus



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Disclosures: The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Received for publication Sept 25, 2020; accepted for publication Sept 28, 2020; available ahead of print Oct 2, 2020.

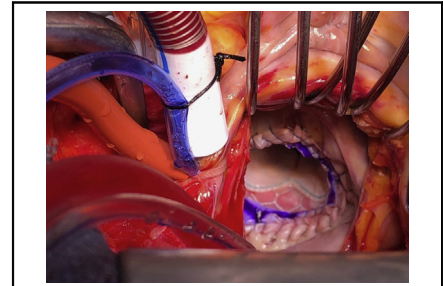
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JTCVS Techniques 2021;5:25-6

2666-2507

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<https://doi.org/10.1016/j.jtc.2020.09.036>



Expandable valve prosthesis with a pericardial skirt seen through the left atriotomy.

CENTRAL MESSAGE

The open use of a balloon-expandable prosthesis for mitral replacement may require adding a pericardial skirt for prevention of periprosthetic leakage, and a partial ventricular septal myectomy.

See Commentaries on pages 27 and 29.

▶ Video clip is available online.

In presence of a heavily calcified mitral apparatus, mitral valve replacement may represent a challenging surgical intervention. The risk of injury to the atrioventricular groove is high and the success rate of its consequent repair is very low. Nevertheless, a symptomatic patient affected by severe mitral stenosis, especially when balloon commissurotomy is not indicated, should not be left untreated. Mitral decalcification represents a risky option, but an apparently simpler and safer solution can be an open-heart positioning of an inverted aortic balloon-expandable aortic prosthesis. A surgical enhancement of the procedure is advisable to prevent both periprosthetic leakage and any obstruction of the left ventricular outflow tract.

CASE REPORT

A 74-year-old woman with severe post-rheumatic mitral pathology (severe stenosis and regurgitation), was symptomatic for dyspnea at rest. The preoperative computed tomography scan of the chest showed a prohibitive calcification of the entire mitral apparatus (Figure 1), contraindicating a standard mitral replacement. During heart team discussion, the possibility for an expandable prosthesis was mentioned. Computed tomography and transesophageal echocardiogram examinations were used to precisely size the prosthesis. The largest (29 mm) Sapien 3 valve (Edwards Lifesciences, Irvine, Calif) offered both a slight oversizing and just a minimal stress to the atrioventricular groove.

The operation was performed via standard sternotomy with moderate hypothermia and cardioplegic arrest. The prosthesis was deployed and expanded through a standard opening of the left atrium at the interatrial groove after removal of the anterior mitral leaflet, it was ballooned once with 33 mL reaching 7 atm pressure. There was nevertheless diffuse periprosthetic saline oozing after filling the

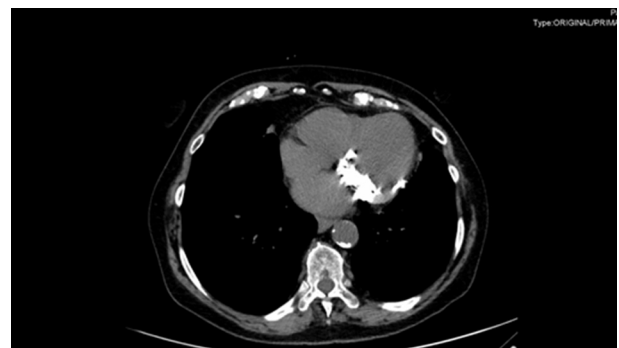


FIGURE 1. Preoperative computed tomography scan of the patient's chest showing calcification of the entire mitral apparatus, relatively contraindicating mitral removal followed by replacement.

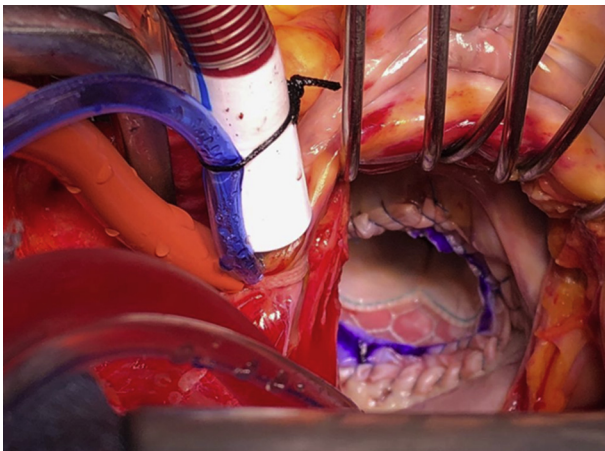


FIGURE 2. Intraoperative view of the mitral valve. A bovine pericardium skirt was sutured to the inner part to the base of the prosthesis and the outer part to the mitral annulus to improve sealing.

ventricle was treated using a bovine pericardium skirt tailored and sutured (with 5-0 polypropylene) to the inner part to the base of the prosthesis and the outer part to the mitral annulus (Figure 2). The left atrial appendage was excluded from the inside of the left atrium. After clamp removal and refilling of the beating heart, the transesophageal echocardiography showed obstruction of the left ventricular outflow tract, so new crossclamping was needed. The aorta was opened and a partial septal myectomy was added to increase the distance between the prosthesis and the septum. The following echocardiography showed complete resolution of the systolic anterior motion. A temporary heart block required external pacing for a few days. The patient was discharged 9 days after the operation with a good left ventricular function, mean transprosthetic gradient was 4 mm Hg, and no obstruction of the left ventricular outflow tract was present (Video 1).

COMMENT

Positioning of a balloon-expandable prosthesis into the mitral apparatus represents an effective option for the treatment of otherwise inoperable patients.^{1,2} In this case, the positioning was useful for the treatment of a relatively young woman with a singularly severe calcification seen on the computed tomography scan, virtually contraindicating the use of a standard sutured prosthesis to avoid injury to the atrioventricular groove.

Although expansion with the balloon seemed to be sufficient for anchoring the prosthesis to the annulus, the advantage represented by the direct vision convinced us to add a pericardial skirt to abolish the risk of periprosthetic leakage.

The typical small ventricle seen in this patient affected by severe mitral stenosis requires a low-profile valve



VIDEO 1. Dr Codecasa explains how to perform a mitral valve replacement in a calcified annulus avoiding atrioventricular groove rupture and prosthesis leakage. Video available at: [https://www.jtcvs.org/article/S2666-2507\(20\)30559-9/fulltext](https://www.jtcvs.org/article/S2666-2507(20)30559-9/fulltext).

prosthesis, and a high-profile balloon-expandable prostheses can result in unsuitability for this reason. Hamdeh and colleagues³ described a ventricular perforation following open heart deployment of an inverted Sapien XT (Edwards Lifesciences) into the mitral valve, demonstrating the need for addressing the issue. In this patient, postoperative left ventricular outflow tract obstruction was noted immediately after the valve implantation, so a partial septal myectomy was added after a second crossclamping with complete resolution.

CONCLUSIONS

The use of a balloon-expandable prosthesis for open heart mitral replacement is feasible and effective.^{4,5} Key points include the opportunity to add a pericardial skirt for prevention of periprosthetic leakage and the possible need for a septal myectomy. Because of the need for opening the aorta (for septal myectomy), the ideal surgical approach is probably represented by midsternotomy instead of a less-invasive right minithoracotomy.

References

1. Ahmad T, Ludhani PM, Gurvitch R, Larobina M, Goldblatt J, Tatoulis J. Use of transcatheter valves for open surgical mitral valve replacement. Australian experience. *Heart Lung Circ.* 2019;28:464-70.
2. Alfonsi J, Murana G, Corsini A, Savini C, Di Bartolomeo R, Pacini D. Transcatheter mitral valve implantation in open heart surgery: an off-label technique. *Korean J Thorac Cardiovasc Surg.* 2017;50:467-70.
3. Hamdeh YM, Goldhammer JE, Ruggiero NJ, Entwistle JW. Ventricular perforation during open surgical balloon expandable mitral valve replacement: a case report. *A A Case Rep.* 2017;9:300-4.
4. Murashita T, Suri RM, Daly RC. Sapien XT transcatheter mitral valve replacement under direct vision in the setting of significant mitral annular calcification. *Ann Thorac Surg.* 2016;101:1171-4.
5. Puri R, Abdul-Jawad Altisent O, del Trigo M, Campelo-Parada F, Regueiro A, Barbosa Ribeiro H, et al. Transcatheter mitral valve implantation for inoperable severely calcified native mitral valve disease: a systematic review. *Catheter Cardiovasc Interv.* 2016;87:540-8.