Masters of Cardiothoracic Surgery

Direct access hybrid transatrial implantation of a Sapien 3 valve inside a bioprosthetic mitral valve with concomitant tricuspid valve replacement and cryoablation

Sophia L. Alexis, Gilbert H. L. Tang, Dimosthenis Pandis, David H. Adams, Ahmed El-Eshmawi

Department of Cardiovascular Surgery, Mount Sinai Medical Center, New York, NY, USA

Correspondence to: Ahmed El-Eshmawi, MD. Department of Cardiovascular Surgery, Mount Sinai Health System, 1190 Fifth Avenue, GP2W, Box 1028, New York, NY 10029, USA. Email: ahmed.el-eshmawi@mountsinai.org.

Submitted Apr 28, 2021. Accepted for publication Aug 11, 2021.
doi: 10.21037/acs-2021-tviv-17
View this article at: https://dx.doi.org/10.21037/acs-2021-tviv-17

Clinical vignette

We present the case of a 64-year-old high-risk male with a history of mitral valve (MV) endocarditis post-MV replacement (MVR) in 2005, complicated by MV prosthesis dehiscence due to recurrent endocarditis that required MV re-replacement one year later. Additional co-morbidities include atrial flutter, gastrointestinal bleeding, anemia, chronic kidney disease, and metastatic pancreatic islet cell tumor. In 2018, he represented with class IV congestive heart failure despite maximal medical therapy. An echocardiogram showed severe tricuspid regurgitation (TR), a significantly dilated and dysfunctional right ventricle (RV), and structural MV prosthesis degeneration with severe mitral regurgitation (MR). He was subsequently transferred to our reference center for definitive management.

The patient was screened for percuatneous transcatheter therapy based on his high-risk profile but was deemed an inappropriate candidate due to the presence of concomitant prosthetic mitral disease and suboptimal transesophageal echocardiographic windows. We decided to proceed with a third-time reoperation. Due to the anticipated operative complexity, we screened for direct-access Sapien 3 transatrial mitral valve-in-valve to shorten the bypass and ischemic times given his RV dysfunction. Multi-detector computed tomography (MDCT) revealed an *in situ* 35 mm Carpentier-Edwards Standard (Model #6625) porcine bioprosthesis (Edwards Lifesciences LLC, Irvine, CA) with an internal diameter of 31 mm and a generous neo-left ventricular outflow tract (LVOT).

The patient was medically optimized by our multidisciplinary team prior to surgery with intravenous milrinone, diuresis, correction of anemia, and octreotide infusion for his carcinoid disease.

Surgical techniques

The patient was brought to the operating room and after an uneventful third-time sternotomy, was centrally cannulated for cardiopulmonary bypass. Myocardial protection was achieved via antegrade and retrograde cold blood cardioplegia with moderate systemic hypothermia. The MV was exposed via a transseptal approach due to dense adhesions at the Sondergaard's groove. The existing mitral bioprosthesis was cemented into a calcified annulus, with extensive pannus overgrowth and leaflet perforations. Explanting this prosthesis would risk injury to the atrioventricular groove, circumflex coronary artery and the aortic valve. We elected to solely excise the bioprosthetic leaflets and perform a valve-in-valve mitral replacement with a 29-mm Edwards Sapien 3 (Edwards Lifesciences LLC, Irvine, CA, USA) in the existing 35 mm porcine prosthesis. Deployment of the Sapien 3 valve was performed using the Edwards Certitude system, with one operator using forceps to guide the deployment with a commissural orientation similar to the prior bioprosthetic MV, confirmed by marking the inflow cuff of the transcatheter valve frame. The co-surgeon slowly inflated the Sapien 3 valve 2 cc above nominal pressure, to ensure ideal placement.

After saline-testing the Sapien 3 valve to confirm optimal function, the transseptal incision was closed and the atrial flutter was treated with cavotricuspid isthmic cryoablation. Inspection of the tricuspid valve demonstrated that it was non-repairable with severely retracted leaflets. It was replaced with a 29-mm Hancock II porcine prosthesis (Medtronic Inc, Minneapolis, MN). The post-operative course was uneventful, and the patient was discharged on post-operative day 23 with a mean MV gradient of 6 mmHg, minimal MR/TR, and no LVOT obstruction (LVOTO) on pre-discharge echocardiogram. Transthoracic echocardiogram 9 months later showed no MR and trace TR.

Comments

Recent advances in transcatheter valve-in-valve interventions have led to an expansion in the use of bioprosthetic valves in younger patients, with subsequent increase in the number of patients presenting with structural valve degeneration. Despite the increasing anatomic complexity and/or associated co-morbidities, advances in surgical techniques, cardiac anesthesia, perfusion, imaging and cardiothoracic intensive care have allowed valve reoperations to be performed with reasonably low peri-operative morbidity and mortality in reference centers. Surgical valve re-replacement remains the standard of care for most patients with structural valve degeneration, while percutaneous transcatheter valve-in-valve procedures remain a valid alternative for high-risk patients where anatomically feasible (1). Direct access transatrial mitral valve-in-valve with leaflet resection affords the advantage of avoiding en bloc explantation and annular debridement of a mitral bioprosthesis, while significantly reducing the ischemic and bypass times to minimize the peri-operative risks. With the hybrid approach, one can also perform concomitant valve, coronary, septal myectomy, and ablation procedures.

At our institution, we begin by assessing a patient's surgical risk and anatomical feasibility. A percutaneous transseptal approach may be considered if they are of prohibitive surgical risk, without concomitant cardiac lesions, and with a low likelihood of LVOTO. However, for patients who are not of prohibitive risk for surgery, especially patients with risk of LVOTO and difficult prosthesis explant, we consider hybrid valve-in-valve as a bailout strategy.

As demonstrated in our video, we perform MDCT to analyze the patient's prosthetic valve and LVOT anatomy in systolic phase using 3mensio Valves software (Version 10.0, Pie Medical Imaging, Maastricht, the Netherlands). This technology allows us to implant a virtual Sapien 3 valve to evaluate the risk of LVOTO (2). From the aortic root view, the neo-LVOT can be measured to determine the risk of obstruction based on a cutoff of 170 mm (3). This cutoff has 96.2% and 92.3% sensitivity and specificity, respectively, for LVOTO (2).

In this particular patient, we had the ability to excise the existing bioprosthetic mitral leaflets to prevent paravalvular leak/LVOTO from remaining leaflet calcium. The annulus of the former prosthetic valve also provided a perfect circle for transcatheter valve apposition. Removal of the surgical bioprosthetic leaflets and the ability to align the Sapien 3 valve commissures with the surgical bioprosthetic commissural posts, allowed for optimization of the washout effect on the Sapien 3 valve during the cardiac cycle, in order to avoid potential stasis between the Sapien 3 valve and propped-open surgical bioprosthetic leaflets, which can subsequently cause leaflet thrombosis. Pagnesi *et al.* found that stented porcine surgical valves more frequently developed transcatheter valve thrombosis in mitral valve-in-valve cases, as compared to pericardial valves (4).

In our experience as a reference mitral center, a direct access valve-in-valve hybrid procedure is considered in high-risk patients who are: elderly or frail, susceptible to complications of en bloc prosthesis debridement, in need of concomitant procedures, multiple reoperations, with underlying mitral annular calcification, or with poor ventricular function.

In summary, direct access transatrial mitral valve-in-valve replacement is a reasonable alternative to conventional re-operative MVR in selected high-risk patients with multifaceted cardiac disease, in order to decrease peri-operative morbidity and mortality.

Acknowledgments

Funding: None.

Footnote

Conflicts of Interest: David H. Adams, MD: The Icahn School of Medicine at Mount Sinai receives royalty payments from Edwards Lifesciences and Medtronic for intellectual property related to development of valve repair rings. National Co-PI of the Medtronic APOLLO FDA Pivotal Trial, the NeoChord ReChord FDA Pivotal Trial, The Medtronic CoreValve US Pivotal Trial and the

Abbott TRILUMINATE Pivotal Trial. Dr. Gilbert H. L. Tang: A physician proctor and consultant for Medtronic, a consultant for Abbott Structural Heart and NeoChord, and a physician advisory board member for Abbott Structural Heart and JenaValve. The other authors have no conflicts of interest to declare.

Cite this article as: Alexis SL, Tang GHL, Pandis D, Adams DH, El-Eshmawi A. Direct access hybrid transatrial implantation of a Sapien 3 valve inside a bioprosthetic mitral valve with concomitant tricuspid valve replacement and cryoablation. Ann Cardiothorac Surg 2021;10(5):714-716. doi: 10.21037/acs-2021-tviv-17

References

1. Sengupta A, Yazdchi F, Alexis SL, et al. Reoperative Mitral Surgery Versus Transcatheter Mitral Valve Replacement: A Systematic Review. J Am Heart Assoc 2021;10:e019854.
2. Yoon SH, Bleiziffer S, Latib A, et al. Predictors of Left Ventricular Outflow Tract Obstruction After Transcatheter Mitral Valve Replacement. JACC Cardiovasc Interv 2019;12:182-93.
3. Alexis SL, Alzahrani TS, Akkoc D, et al. Anatomic classification of mitral annular calcification for surgical and transcatheter mitral valve replacement. J Card Surg 2021;36:2410-8.
4. Pagnesi M, Moroni F, Beneduce A, et al. Thrombotic Risk and Antithrombotic Strategies After Transcatheter Mitral Valve Replacement. JACC Cardiovasc Interv 2019;12:2388-401.