

CASE REPORT

Minimally Invasive Ascending Aortic Replacement with Concomitant Aortic Valve Replacement, A Case Report

SAIKAT DAS GUPTA¹, ALI HAIDER², PRASANTA K CHANDA¹, DIPAL K ADKIKARY³

¹Department of Cardiac Surgery, Square Hospitals Ltd, Dhaka, Bangladesh, ²Department of Cardiac Anesthesia, Square Hospitals Ltd, Dhaka, Bangladesh, ³Department of Cardiology, Bangabandhu Sheikh Mujib Medical University

Address of Correspondence: Dr. Saikat Das Gupta, Department of Cardiac Surgery, Square Hospitals Ltd, Dhaka, Bangladesh.
E-mail: saikatdasgupta@ymail.com

Abstract

Aortic valve stenosis or aortic stenosis is a type of heart valve disease (valvular heart disease). The valve between the lower left heart chamber and the body's main artery (aorta) is narrowed and doesn't open fully. This reduces or blocks blood flow from the heart to the aorta and to the rest of the body. Here we will discuss the care of a young male who presented with exertional dyspnea with palpitation and after detailed examination and investigation he was diagnosed as a case of severe aortic stenosis with moderate aortic regurgitation with bicuspid aortic valve and ascending aortic dilatation.

University Heart Journal 2023; 19(2): 71-73

DOI: <https://doi.org/10.3329/uhj.v19i2.73756>

Introduction:

Aortic valve disease, mainly aortic stenosis, is associated with ascending aortic aneurysm (Silva IA, 2019). Both aortic stenosis and ascending aortic aneurysms are now frequently treated simultaneously depending on whether the lesion may be repaired or requires replacement (Vendramin I, 2021). In modern era, reduction of surgical trauma to achieve faster recovery is the goal for every cardiac surgeon. Consequently, the journey of minimally invasive aortic valve replacement is more preferred than the standard open procedure (Staromlynski J, 2020). Minimal invasive procedure provides better thoracic stability and improves cosmetic purposes (Kaczmarczyk M, 2015). We hereby report a patient, who successfully underwent surgical replacement of ascending aorta and aortic valve replacement, through minimal invasive approach; and to best of our knowledge this is the first reported case of its kind in our country.

Case Report:

A 33 year's old, young male patient was admitted into our hospital as a known case of severe aortic stenosis with moderate aortic regurgitation with bicuspid aortic valve and ascending aortic dilatation. He complained of exertional dyspnoea with palpitation for last 3 years. On

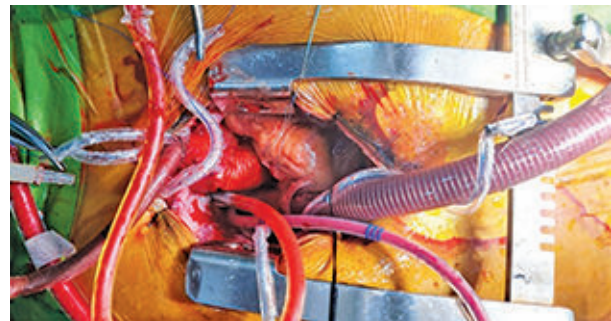


Figure 1: Completed aortic replacement through upper-mini "J" with cannulas in-situ

examination, he was having an ejection systolic murmur over the aortic area. No biochemical abnormality was detected. Doppler echocardiogram showed bicuspid aortic valve with severe aortic stenosis (PPG/MPG 84/54 mm of hg) with moderate aortic regurgitation along with dilated ascending aorta (Aortic annulus 22, sinus 36 mm, STJ 37mm, ascending aorta 46mm, arch 34 mm), normal ventricular functions. CT aortogram also showed dilated ascending aorta (48mm), severely calcified aortic valve with severe aortic stenosis and an otherwise normal aortic root, arch and descending aorta.

On X of Jan, 2023 after optimization of patient's condition, he was operated through upper-mini

sternotomy. Incision extended from 2nd to 4th space and a “J” sternotomy was done. Sternal spreader was used to apart sternum and thymus was dissected. After doing pericardiotomy, pericardial stay sutures were taken. Ascending Aorta was found grossly dilated. Central aortic cannulation, two stage venous and CP cannulation was done, while left ventricle (LV) was vented through right upper pulmonary vein. After arresting heart with del-Nido cardioplegia, aortotomy was done and aortic valve was checked. Aortic valve was found severely calcified, stenosed and was replaced with 21 mm On-X mechanical aortic valve. Ascending aorta (supra-coronary) was replaced with 24 mm tube graft. We placed the pacing wire at RVOT before releasing cross-clamp. Aortic cross-clamp was released after de-airing (CO₂ was used) and heart was gradually weaned from CPB to normal sinus rhythm. As TEE showed no residual air in the cardiac chambers, we decannulated and administered protamine. We did some hemostasis and closed the chest with sternal wires after putting a chest tube.

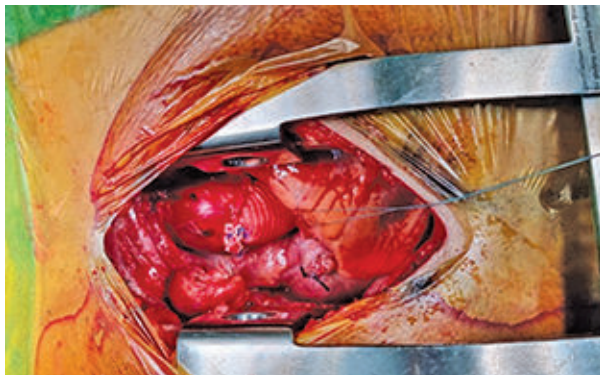


Figure 2: Completed aortic replacement through upper-mini “J”

Patient was then shifted to ICU with no inotropes and was ventilated electively for six hours. We extubated the patient on the night of surgery with very minimum drainage through chest tube drain. His ICU and hospital stay at square hospitals ltd were eventless and he was discharged at 5th post-operative day. Post-operative echocardiogram showed normally functioning prosthetic valve and a normal blood flow through the neo-aorta. Patient was followed-up at 1, 3 and 6 months after surgery and he showed excellent exercise capacity and no exertional dyspnea.



Figure 3: Completed chest closure with chest tube and pacing wire in-situ

Discussion:

Replacement of aortic valve during aortic surgery is typically time consuming (Silva IA, 2019) and minimizing surgical trauma for quicker recovery is a key goal in cardiovascular and thoracic surgery (Phan K, 2014). Early results of post-operative renal failure and cerebral complication showed no significant differences between upper-mini or complete sternotomy, but the respiratory function recovery was better in upper-mini group. Although the cross-clamp time was longer in the minimal invasive group the cardio-pulmonary bypass time was similar in both groups, (Wu, Y, 2020) and the outcomes were excellent.

Stroke rate is significantly reduced in minimal invasive procedure. Because, prior to the release of aortic cross-clamp and during the weaning from cardiopulmonary bypass, presence of air in the left ventricle can be precisely detected by intra-operative trans-esophageal echocardiography. Furthermore, filling the thoracic cavity with carbon-di-oxide lessen the risk of air embolism and its consequences by increasing gas solubility (Schroeyers P, 2001).

In the same way, minimally invasive aortic surgery leads to a much shorter ICU stays and hospital stays (Ram sharon, 2003). According to our experience, which is consistent with other published reports, mini-AVR naturally evolved into minimally invasive aortic surgery. Single stage aortic replacement was gradually added to the normal mini-AVR operation, and at present, single isolated aortic aneurysm is treated in this way (staromtynski J, 2020). Literatures support the observation that patient treated with minimally invasive method had a strong trend toward less wound problems and evidences showed patient received minimal invasive treatment have a lower incidence of postoperative wound infection and mediastinitis (Sebastian V. Rojas, 2013). MI-AVR (minimally invasive aortic valve replacement) is currently comparable to open sternotomy in terms of hospital morbidity and mortality as well as mid-term survival. (Ram sharon, 2003).

Limitations of this procedure are mainly diminished access to the heart and the distal arch of the aorta. Learning curve is absolutely important and gradual extension of techniques should be considered from ascending aorta replacement, hemi-arch replacement, to total arch replacement with or without aortic root repair.

Conclusion:

We have done a few aortic replacements along with aortic valve replacement through upper partial sternotomy and the short-term results are promising. Regardless of the degree of repair, from supra-coronary aortic replacements to sophisticated root surgery, minimally invasive aortic surgery conducted through partial upper sternotomy is a conceivable alternative to full median sternotomy and safe in appropriate patients.

References:

1. Kaczmarczyk, M., Pacholewicz, J., Kaczmarczyk, A., Filipiak, K., Hrapkiewicz, T., & Zembala, M. (2022). Ministernotomy for aortic valve replacement improves early recovery and facilitates proper wound healing - forced propensity score matching design with reference full sternotomy. *Kardiochirurgia i torakochirurgia polska* Polish journal of cardio-thoracic surgery, 19(1), 1–10. <https://doi.org/10.5114/kitp.2022.114548>
2. Phan K, Xie A, Di Eusanio M, Yan TD. A meta-analysis of minimally invasive versus conventional sternotomy for aortic valve replacement. *Ann Thorac Surg*. 2014 Oct;98(4):1499-511. Epub 2014 Jul 24. PMID: 25064516. <https://doi.org/10.1016/j.athoracsur.2014.05.060>
3. Ram Sharony, Eugene A. Grossi, Paul C. Saunders, Charles F. Schwartz, Greg H. Ribakove, Alfred T. Culliford, Patricia Ursomanno, F. Gregory Baumann, Aubrey C. Galloway and Stephen B. Colvin. Minimally Invasive Aortic Valve Surgery in the Elderly: A Case-Control Study. Originally published Sep 2003 *Circulation*. 2003;108:II-43–II-47. <https://doi.org/10.1161/01.cir.0000087446.53440.a3>
4. Schroevers P, Wellens F, De Geest R, Degrieck I, Van Praet F, Vermeulen Y, Vanermen H. Minimally invasive video-assisted mitral valve repair: short and mid-term results. *J Heart Valve Dis*. 2001 Sep;10(5):579-83. PMID: 11603596.
5. Silva, I. A., Corso, R. B., Santos, M. V. N., Souza, H. J. B., & Pina, G. K. S. (2019). First Two Brazilian Cases: Correction of Ascending Aortic Aneurysm and Aortic Valve Stenosis with Sutureless/Rapid Deployment Aortic Prosthesis. *Brazilian journal of cardiovascular surgery*, 34(3), 366–367. <https://doi.org/10.21470/1678-9741-2018-0148>
6. Starom³yñski J, Kowalewski M, Sarnowski W, Smoczyñski R, Witkowska A, Bartzak M, Drobiñski D, Wierzba W, Suwalski P. Midterm results of less invasive approach to ascending aorta and aortic root surgery. *J Thorac Dis*. 2020 Nov;12(11):6446-6457. <https://doi.org/10.21037/jtd-20-2165> PMID: 33282347; PMCID: PMC7711423.
7. Vendramin, I., Bortolotti, U., De Manna, D. N., Lechiancole, A., Sponga, S., & Livi, U. (2021). Combined Replacement of Aortic Valve and Ascending Aorta-A 70-Year Evolution of Surgical Techniques. *Aorta (Stamford, Conn.)*, 9(3), 118–123. <https://doi.org/10.1055/s-0041-1729913>
8. Sebastian V. Rojas, Axel Haverich, Minimally Invasive Cardiac Surgery: A Safe Alternative for Aortic Valve Replacement?, *Revista Española de Cardiología (English Edition)*, Volume 66, Issue 9, 2013, Pages 685-686, ISSN 1885-5857. <https://doi.org/10.1016/j.rec.2013.05.010> (<https://www.sciencedirect.com/science/article/pii/S1885585713001746>)
9. Wu, Y., Jiang, W., Li, D. et al. Surgery of ascending aorta with complex procedures for aortic dissection through upper ministernotomy versus conventional sternotomy. *J Cardiothorac Surg* 15, 57 (2020). <https://doi.org/10.1186/s13019-020-01095-1>.