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Case Report

Simultaneous Aortic and Mitral Valve Replacement through a Minimally Invasive 3D Videoassisted Approach

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Abstract

During the last decade, minimally invasive cardiac surgery (MICS) has gained increasing acceptance. Although published evidence and experience available is broad, there are still further areas to explore, including the surgical technique in patients undergoing simultaneous mitral-aortic bivalvular minimally invasive surgery.

In high volume centers, a right lateral minithoracotomy for valvular surgery is preferred, establishing this procedure as a safe and effective approach, leading to better recovery due to a reduction of surgical trauma with all the known benefits of MICS. This approach is most commonly used in mitral valve surgery. In aortic valves, an anterior lateral accesses as well as an upper minithoracotomy are used. However, few centers combine a common access through a minithoracotomy for aortic and mitral valve surgery.

In this case, we present a patient operated simultaneously on the mitral and aortic valve through a minithoracotomy with 3D video assistance and peripheral cannulation guided by fluoroscopy.

Keywords: *Mini Thoracotomy; Mitral Valve; Aortic Valve; 3D Video Assisted*

Introduction

The pioneers of minimally invasive valve surgery, Navia., *et al.* in 1996 and Cohn., *et al.* in 1997, have shown that this approach provides numerous benefits compared to the conventional sternotomy technique [1]. These benefits include reduction in total surgical bleeding, less pain, lower morbidity, a decrease in transfusion requirements, early recovery in an intensive care unit, and therefore shorter in-hospital stay.

These benefits have shown an even greater favorable impact when dealing with patients with chronic kidney disease [2], obstructive pulmonary disease [3], in patients requiring mitral valve surgery [4] and aortic valve surgery [5]. Mortality is also reduced in elderly [6] and obese patients [7]. Therefore, high-risk patients, who require concomitant aortic and mitral surgery, are ideal candidates for this type of procedure.

The approach with a lateral mini-thoracotomy offers a very good exposure for both, the mitral valve and the aortic valve, comparable to or even better than a median sternotomy. In addition, a sternal preservation approach reduces the risk of infection, manifested as sternal wound dehiscence or mediastinitis [1].

When using these procedures, older patients with physical disabilities as well as patients with chronic obstructive pulmonary disease (COPD) may be offered more aggressive physical therapy post operatively, as there is no fear of sternal dehiscence. In addition, hybrid approaches can be offered to selected patients with a potential to decrease the mortality rates of combined coronary and valve disease [1].

Minimally invasive mitral and aortic valve surgery are a standard in many centers. This approach is usually performed through an anterior minithoracotomy in the second intercostal space for the aortic valve and a lateral minithoracotomy in the fourth or fifth intercostals space for the mitral valve. Few centers perform this minimally invasive approach to simultaneously treat both valves.

Case Presentation

A 71-year-old male patient diagnosed with a symptomatic severe mitral regurgitation and severe aortic insufficiency was referred to our center. The patient was under medical treatment for chronic pulmonary thromboembolism for which an inferior vena cava filter was placed 10 years ago (Figure 1). The transesophageal echocardiography demonstrated the presence of a bivalvular aortic valve with annular dilation and a mitral regurgitation due to rheumatic degeneration characterized with calcification and retraction of the posterior leaflet and bicommisural fusion.

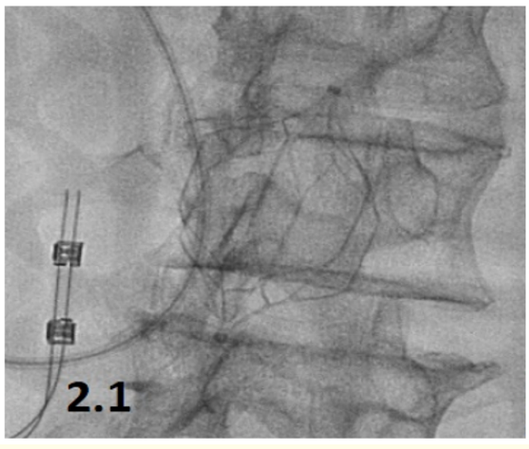

Figure 1: *Visualization of vena cava filter during cannulation.*

A preoperative CT scan was performed (Figure 2) showing an optimal angulation of the ascending aorta for lateral access, which is recommended to be more than 45 degrees off the midline [13].

Figure 2: *Preoperative CAT scan.*

Surgical technique

The patient was placed on the operating table, the right thorax elevated to 30 degrees and the right arm placed laterally with a posterior fixation (Figure 3).

Figure 3: *Positioning of the patient.*

Cannulation for cardiopulmonary bypass was performed peripherally via a femoral access guided by fluoroscopy due to the presence of an inferior vena cava filter (Figure 4), as well as visualization with trans-esophageal echocardiography. A second venous cannula in the jugular vein was placed via linear ultrasound-guided puncture. The surgical approach was achieved through a 5 centimeter incision in the 3rd inter-costal space on the right hemithorax, respecting the pectoral muscle. A port was placed in the 2nd intercostal space superiorly for video assistance with a 3D camera and CO_2 infusion of the surgical field.

Figure 4: *Surgical team performing cannulation procedure by fluoroscopic guidance with a C Arm.*

The aorta was cross clamped with a regular MICS Chitwood clamp, introduced superiorly to the surgical wound through the second intercostal space in the midaxillary line. The myocardium was protected using a single dose of antegrade cardioplegia (Custodiol®).

Excellent exposure was obtained for the aortic valve, facilitating its manipulation with the subtotal circumferential transection of the ascending aorta, which allowed a complete visualization of the aortic annulus, with anatomic magnification with the 3D camera (Figure 5). The vision of the mitral valve was not compromised by this approach (Figure 6).

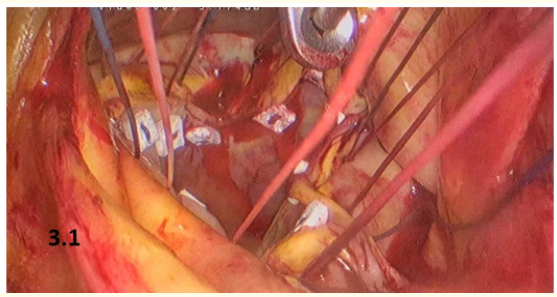

Figure 5: *Aortic ring.*

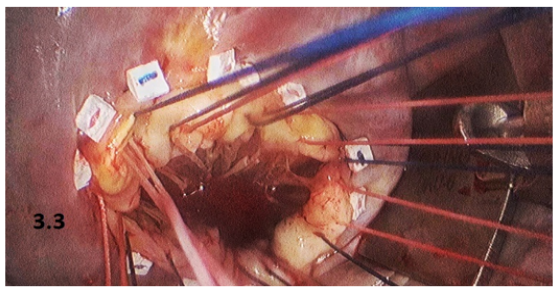

Figure 6: *Mitral valve.*

The native aortic valve was first removed. Then, the mitral valve was approached through the left atrium, resecting the body of the anterior leaflet and replacing the valve with a 33 mm Medtronic Mosaic biological prosthetic valve (Figure 7), preserving the whole subvalvular apparatus. Commissural fusion and posterior valve retraction avoided a mitral valve reconstruction. Subsequently, a 27 mm biological aortic prosthesis type Inspiris Resilia (Edwards Lifesciences) was implanted (Figure 8). Cardio-pulmonary bypass time was 206 minutes and aortic clamping time 181 minutes. The total surgical bleeding was 150 ml. Removal of endotraqueal tube was achieved in the surgical room. Hospitalization in the Intensive Care Unit (UCI) was 36 hours, with the patient beginning to walk in the first 24 hours after ICU admission.

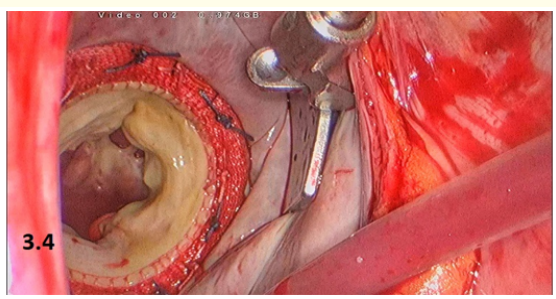

Figure 7: *Medtronic Mosaic biological mitral prosthetic # 33 mm.*

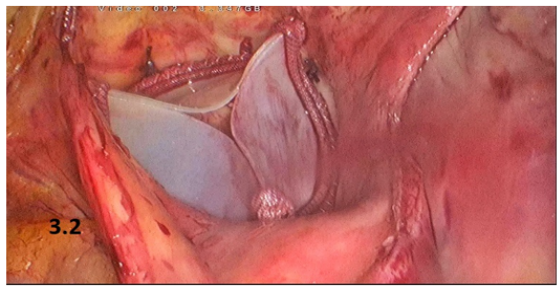

Figure 8: *Biological aortic prosthetic 27 mm Inspiris Resilia (Edwards Lifesciences).*

The pleural tube shed 350 ml of postoperative bleeding and was withdrawn after 24 hours. No transfusions were required. The patient was discharged on the fifth postoperative day. Reincorporation with normal daily activities was achieved after two weeks of the surgical procedure.

Discussion

There is still a very low frequency of bivalvular surgery (aortic and mitral) through a single minimal invasive approach, with an incidence of 3 - 14% of all valvular surgeries accounting for bivalvular (aortic and mitral) pathology requiring surgical repair [8,9]. Mortality ranges in early reports between 9.6 - 15.6% [8-10]. In an observational study by Karimov., *et al.* [11] of 48 double-valve procedures performed by right antero-lateral minithoracotomy, no postoperative mortality and no conversions to median sternotomy was observed, proving evidence that this approach is both safe and feasible [1].

Some authors recommend placement of the arm on the head facilitating exposure, especially in patients with large breasts and patients with a raised right hemi- diaphragm [13]. In the absence of these, a posterior fixation and elevation of the right thorax is adequate for a good exposure, allowing appropriate placement of the Chitwood clamp.

It is important to determine the specific reference points defining the correct access for entry into the thorax. A minithoracotomy, using the middle of the sternum, as a reference point, will allow any type of complex mitral repair, as well as the replacement of the aortic valve and even the concomitant replacement of the ascending aorta and hemiarch procedures [1].

As to relative disadvantages, we face longer aortic cross clamp and cardio- pulmonary bypass times. The learning curve becomes longer due to the complexity of the technique compared to isolated minimally invasive surgery of the aortic or mitral valve independently. The conversion rate to a median sternotomy is approximately 2.6 to 4.0% [12] and is generally attributed to an inadequate exposure [1].

Visual assistance with a 3D camera allows for a rapid and precise intervention, aiding specifically in maneuverability of instrumental depth during the manipulation of the aortic annular portion of the surgery. Fluoroscopic guidance during peripheral cannulation, specifically in this type of cases with known vascular risk factors, allows for a secure placement of femoral cannulas.

In a series of 169 cases with bivalvular replacement procedures performed at the Mount Sinai Medical Center, a mean 116-minute aortic cross-clamp was reported [interquartile range (IQR), 91-138] and a cardiopulmonary bypass time of 145 minutes (IQR) (121-178). There were four (2.36%) patients who required a second operative time due to hemorrhage and two patients (1.18%) suffered from stroke. The average length of hospital stay was seven days (RIC, 6-12) and mortality at 30 days was reported at six (3.55%) [1].

In another series of 69 patients carried out at the Snt'Ambrogio Clinical Institute, patients were considered suitable for minimally invasive bivalvular replacement if the following CAT scan criteria were met: (i) ascending aorta to the right at the level of the main pulmonary artery, (ii) distance from the ascending aorta to the sternum < 10 cm, (iii) angle between the ascending aorta and the patient's median line > 45°. In this study, the mean times of cardiopulmonary bypass and aortic clamping were 135 ± 41 and 95 ± 32 min, respectively, achieving this surgical times with the aid of a sutureless aortic valve. A low conversion rate to a complete sternotomy was observed, being necessary in one case due to hemorrhage in the ascending aorta [13].

Conclusion

Although there are few publications on this minimal invasive approach to two valve lesion repaired, we can say that minimally invasive mitro-aortic valve surgery through a right minithoracotomy can be simultaneously performed with low postoperative morbidity and mortality [1]. Reaffirming that minimally invasive surgery continues to revolutionize and innovate the surgical field. However, more evidence of its feasibility and reproducibility in appropriate studies is necessary.

Bibliography

1. Joseph Lamelas. "Minimally invasive concomitant aortic and mitral valve surgery: the "Miami Method"". *Annals of Cardiothoracic Surgery* 4.1 (2015): 33-37.

2. Valdez GD., *et al*. "Incidence of post-operative acute kidney injury in patients with chronic kidney disease undergoing minimally invasive valve surgery". *Journal of Thoracic and Cardiovascular Surgery* 146.6 (2013): 1488-1493.

3. Santana O., *et al*. "Outcomes of 19. minimally invasive valve surgery in patients with chronic obstructive pulmonary disease". *European Journal of Cardio-Thoracic Surgery* 42.4 (2012): 648-652.

4. Mihos CG., *et al*. "Outcomes of right mini-thoracotomy mitral valve surgery in patients with previous sternotomy". *Annals of Thoracic Surgery* 91.6 (2011): 1824-1827.

5. Pineda AM., *et al*. "Outcomes of aortic valve replacement via right mini-thoracotomy versus median sternotomy in patients with previous cardiac surgery". *Journal of Heart Valve Disease* 22.1 (2013): 50-55.

6. Lamelas J., *et al*. "Outcomes of minimally invasive valve surgery versus median sternotomy in patients 75 years or greater". *Annals of Thoracic Surgery* 91.1 (2011): 79-84.

7. Santana O., *et al*. "Outcomes of minimally invasive valve surgery versus standard sternotomy in obese patients undergoing isolated valve surgery". *Annals of Thoracic Surgery* 91.2 (2011): 406-410.

8. Hellgren L., *et al*. "Improved early results after heart valve surgery over the last decade". *European Journal of Cardio-Thoracic Surgery* 22.6 (2002): 904-911.

9. Jamieson WR., *et al*. "Risk stratification for cardiac valve replacement. National Cardiac Surgery Database. Database Committee of The Society of Thoracic Surgeons". *Annals of Thoracic Surgery* 67.4 (1999): 943-951.

10. Sheikh AM., *et al*. "Outcomes of double valve surgery for active infective endocarditis". *Journal of Thoracic and Cardiovascular Surgery* 138.1 (2009): 69-75.

11. Karimov JH., *et al*. "Surgical treatment of double and triple heart valve disease through a limited single-access right minithoracotomy". *Multimedia Manual of Cardiothoracic Surgery* (2010): mmcts.2009.004036.

12. Tabata M., *et al*. "Conversion to full sternotomy during minimal-access cardiac surgery: reasons and results during a 9.5 year experience". *Journal of Thoracic and Cardiovascular Surgery* 134.1 (2007): 165-169.

13. Antonio Lio., *et al*. "Minimally invasive approach for aortic mitral valve surgery". *European Journal of Cardio-Thoracic Surgery* 50.6 (2016): 1024-1205.

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