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# Alternative to Sternotomy: Aortic Valve Replacement through Right Thoracotomy

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## ABSTRACT

Many minimally invasive alternatives to aortic valve replacement through full sternotomy have been described. We report an approach through a right thoracotomy that has been planified in 2 patients with contraindication to standard thoracotomy. Exposure was excellent, and valve replacement could be performed safely.

## INTRODUCTION

Several approaches have been explored to avoid a standard midsternotomy and the drawbacks related to it. Among them, several types of partial sternotomy were proposed [Estrera 2000]. Although they provided comfortable access to the aortic root, they still required a sternal or parasternal incision. Nevertheless, for a majority of surgeons the gold standard has remained the full sternotomy for aortic valve surgery.

We herein describe 2 patients upon whom an aortic valve replacement was carried out through a right thoracic approach due to contraindication to standard sternotomy.

## FIRST PATIENT

A 59-year-old woman was referred with a recent history of heart failure and severe aortic stenosis. Twenty-six years ago, she had bilateral mastectomy and chest radiotherapy for bilateral breast cancer, and a year prior to the current admission she had a cutaneo-dorsalis muscular flap for a radio-osteonecrosis of the lower sternum. By transthoracic echocardiography, the valve surface area was 0.7 $cm^2$ and the mean gradient was 56 mmHg. She had no coronary disease and the left ventricular ejection fraction was 35%.

Considering the recent reconstructive surgery, she was initially referred for percutaneous aortic valvuloplasty. Owing to her young age, we felt that a surgical approach was better indicated. We elected to proceed through a right thoracotomy.

Under general anesthesia using a double lumen endotracheal tube, the patient was placed in a supine position with a 20° leftward chest rotation. Cardiopulmonary bypass was established through right femoro-femoral cannulations completed by superior vena cava cannulation through the chest incision. The skin incision was made in regard to the scar of the muscular flap harvest. The third intercostal space was opened and the fourth rib cartilage sectioned proximal to the sternum (Figure 1). The pericardium was entered and the right atrium retracted downward. Access to the ascending aorta was immediate and spectacular. The ascending aorta was cross clamped and cold blood retrograde cardioplegia was infused to arrest the heart. A left ventricle vent was inserted through the right upper pulmonary vein. A transversal supracoronary incision was made on the great curvature more posterior than usual. The aortic valve exposure was excellent (Figure 2). A CarboMedics 23-mm aortic mechanical valve (Austin, TX, USA) was implanted. De-airing was done through the ascending aorta under transesophageal echocardiography control (TEE). Bypass time was 167 minutes and the cross-clamp time was 106 minutes.

The patient was extubated after 17 hours, transferred to the general ward on day 4, and discharged for convalescent home on day 7. Postoperative transthoracic echocardiography confirmed normal prosthetic function, and 6 months later the patient had resumed normal daily activities.

## SECOND PATIENT

A 74-year-old man was admitted to our institution with severe dyspnea and a recent episode of heart failure due to an aortic stenosis (valve surface area: 0.9 $cm^2$; mean gradient: 31 mmHg). Left ventricular ejection fraction was evaluated at 30%. The patient had 2 previous coronary bypass surgeries. The last one, carried out 7 years ago, consisted of 3 coronary bypasses: the left internal mammary artery to the first marginal coronary, the right internal mammary artery (RIMA) to the left anterior descending artery, and a radial artery branching off the RIMA to the posterior descending artery.

All grafts were patent, and the RIMA and the radial artery were caught behind the posterior table of the sternum. The right thoracotomy was chosen to avoid injuring the grafts.

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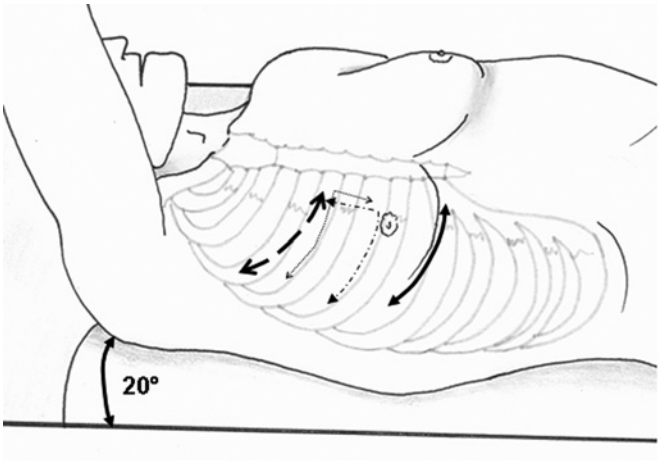


Figure 1. For case 1, dashed line and arrows indicate skin incision; dotted line and arrows indicate the intercostal space thoracotomy. For case 2, solid line and arrows indicate skin incision; dotted/dashed line and arrows indicate fourth intercostal space thoracotomy.

Extracorporeal circulation was established again through femoro-femoral bypass and the patient was cooled to 22°C (bladder temperature) to optimize myocardial protection and induce sustained ventricular fibrillation (grafts were not occluded during surgery). Retrograde cold blood cardioplegia was added to further enhance myocardial protection.

Skin incision was performed under the breast, and the chest was entered at the fourth intercostal space; the fourth rib was sectioned at the sternal edge. Lung adhesions were dissected out. Again, aortic exposure was excellent. A Carpentier Edwards 23-mm bioprosthesis (Edwards Lifesciences, Irvine, CA, USA) was implanted. Aortic cross-clamping time was 67 minutes and bypass time was 134 minutes (including rewarming period). The patient was extubated 7 hours after. On day 5, while on intravenous heparin for atrial fibrillation, the patient developed a chest hematoma at the surgical site that was treated conservatively. He was discharged on day 12 with normal prosthetic function on transthoracic echocardiography.

## DISCUSSION

Very few authors have described the right thoracic approach for aortic valve surgery. Rao [1993] described first the right anterior thoracotomy for cosmetic reasons in 2 young women using a sub-mammary incision and the fourth intercostal space. The aortic root exposure was excellent as reported by others [Gersak 2003; Folliguet 2005]. Benetti [1999] chose the second intercostal space in 3 patients (but 4 patients in the third) with success. Few details were given in these surgical reports. To improve the surgical view, we used a generous skin incision; to avoid a rib fracture, the proximal segment of the third rib was divided. This method allowed us to significantly improve the working space, and our patients did not seem to suffer. Full access to all the ascending aorta was provided, but the view on the myocardium was restrained. De-airing maneuvers were guided with TEE to overcome this technical hitch.

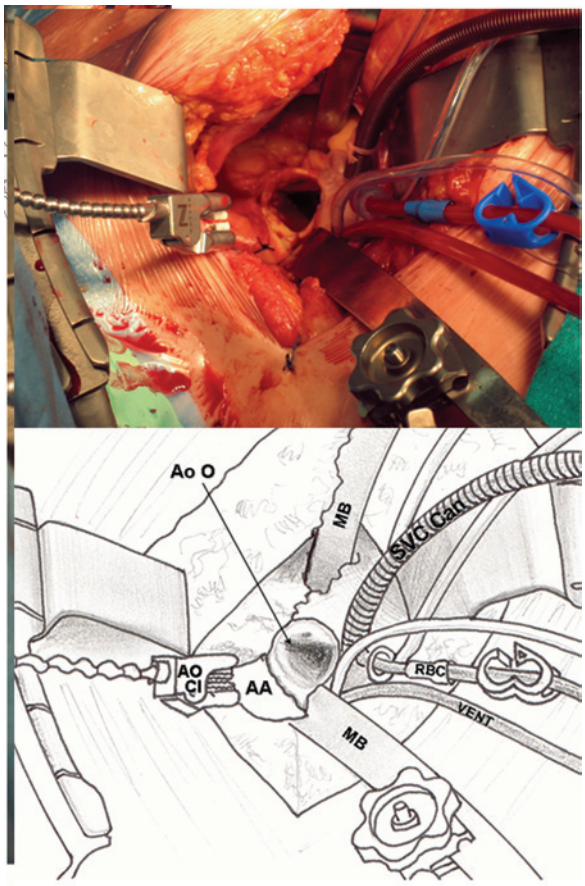


Figure 2. Ao Cl indicates aortic clamp; AA, ascending aorta; Ao O, aortic orifice; MB, malleable blade; SVC Can, superior vena cava cannula; RBC, retro blood cardioplegia; VENT, aortic vent.

Others have described a less invasive approach through the right chest mainly derived from the open technique. Benetti [1999] and Gersak [2003] have described a videoscopic approach, and more recently Folliguet [2005] published his experience with the combination of robotic assistance and a minithoracotomy for a "nonsternotomy" aortic valve replacement. The principal advantage of the use of video or robotic technology was to limit the skin incision (4 cm) [Gersak 2003; Folliguet 2005] with a good visualization of the aortic root. Although interesting, the main drawbacks of these techniques remain the accessibility and the high cost, especially in the case of the robotic set up. The endoscopic technology is generally more accessible and can significantly limit the skin incision for cosmetic purposes.

## CONCLUSION

We believe that the right anterior thoracotomy is a good and safe alternative to standard sternotomy for aortic valve replacement. An excellent access to the aortic valve was provided without jeopardizing the success of the procedure. This technique should be considered whenever a standard sternotomy is contraindicated.

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