Case report - Valves
Triple heart valve surgery through a right antero-lateral minithoracotomy

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Abstract

Triple valve surgery remains a complex intervention, with prolonged cardiopulmonary bypass (CPB) and cross-clamp times. A median sternotomy is the standard approach in the surgical treatment of multiple valve disease. In this report, we attempt to describe our approach for the correction of the triple heart valve disease through a right antero-lateral minithoracotomy, because avoiding sternotomy can bring less wound infections, faster recovery and a shorter hospital stay. The right minithoracotomy in the 3rd intercostal space was applied in two patients and a feasibility of either repair or replacement with a good field exposure to access the aortic, mitral and tricuspid valves without any particular difficulties was verified.

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1. Introduction

Minimally invasive cardiac surgery has been introduced during recent years [1–4]. It has been developed to offer patients the benefit of open heart surgery with less postoperative pain, lower morbidity and mortality, earlier recovery, shorter operation time, limited skin incision and lower hospital costs [3–6].

While the single and double valve procedure through a right minithoracotomy has been previously popularized, the surgery of the triple heart valve disease using a minimally invasive approach via right antero-lateral minithoracotomy is still uncommon [1, 2, 4]. We report the treatment of multiple valve disease through a right antero-lateral minithoracotomy, which has been recently implemented in our institution.

2. Case report

The procedure was carried out through an 8–10-cm incision in the 3rd intercostal space (Fig. 1a), at the left thoracic edge. The right internal mammary artery was preserved in both cases. After minithoracotomy is made, a 5.5-mm working port was established in the 3rd intercostal space, on the anterior axillary line for video assistance. Second, a 10.5-mm port was placed in the 5–7th intercostal space in the mid-axillary line for cardiotomy vent, CO₂ insufflation and pericardial stay sutures. Dedicated surgical instruments and equipment are described in the literature [4, 7, 8].

The pericardium is opened at 3–4 cm along to the phrenic nerve and held by stay sutures. After heparinization, two snares are placed over the superior and inferior vena cava. Using a Seldinger technique, a 22-Fr double-stage venous return cannula (Estech, San Ramon, CA) is placed percutaneously into the right femoral vein, under the TEE guidance, and the cannula tip is advanced in the superior vena cava. The ascending aorta is cannulated with a 23-F Straight Tip tip-mounted blade aortic cannula (Cardiovations; Edwards Lifesciences, Irvine, CA) and secured with tourniquets (Fig. 1b).

After placement of the cardioplegia catheter into the ascending aorta, it is directly cross-clamped with a Cygnet® flexible clamp (Novare Surgical Systems, Inc, Cupertino, CA) and antegrade cardioplegia is delivered as a single dose/shot (20 ml/kg) of crystalloid solution. The patient is cooled and maintained around 34 °C.

The CO₂ flow is kept at 0.5–1 l/min for minimizing the risk of air embolism. The myocardial standstill is achieved and aorta is opened transversely; native valve is excised, 12–16 double-needle 2-0 synthetic pledgeted sutures are passed through the annulus. Following that, the dissection is made in Sondergaard’s groove and an atrial retractor is placed through the left 3rd intercostal space stab incision. The mitral valve is replaced or repaired and a left ventricular vent is positioned through the mitral valve. Left atriotomy is closed in one layer with two 3-0 polypropylene sutures.
Subsequently, the aortic valve is approached; prosthesis is lowered and sutures are knotted. The aorta is closed with a single layer of 5-0 polypropylene suture. The two caval snares/tourniquets are secured over the double-stage cannula; after the right atriotomy is made, the tricuspid valve is exposed and the tricuspid annuloplasty ring implanted in a standard fashion. Right atriotomy is closed in two layers of 4-0 polypropylene suture. The residual air is aspirated by the aortic and ventricular vents. The lungs are inflated and the heart is filled by blood. The cross-clamp is removed once complete de-airing is confirmed by TEE. Eventually, aortic and ventricular vents are removed; aortic purse-string and left atriotomy suture are tied and checked for competence.

The patient is rewarmed and weaned from cardiopulmonary bypass (CPB). The aortic cannula is removed first and the insertion site is controlled for bleeding. The venous cannula is removed after heparin has been reversed with protamine; the femoral vein is temporarily placed under cannula; after the right atriotomy is made, the tricuspid annuloplasty ring may be inflated and the heart is filled by blood. The cross-clamp is removed once complete de-airing is confirmed by TEE. Eventually, aortic and ventricular vents are removed; aortic purse-string and left atriotomy suture are tied and checked for competence.

Hemostasis is secured; two 24-Fr chest drains (Blake; Ethicon, Inc, Sommerville, NJ) are placed through established ports. The pericardium is closed with 2–3 single polypropylene sutures. The minithoracotomy is closed in anatomical layers.

Using this technique, two female patients were operated on in our department. The first patient, a 72-year-old woman who had also undergone a concomitant bipolar radiofrequency ablation for the treatment of chronic atrial fibrillation. The other patient, a 63-year-old female underwent an aortic valve replacement with stentless bioprosthesis with repair of mitral and tricuspid valves.

Operative data are shown in Table 1. We delivered a cold Custodiol® crystalloid solution (Dr Franz Köhler Chemie GMBH, Alsbach-Hähnlein, Germany) antegrade in both patients, which was enough to successfully complete both procedures. This approach required a relatively long CPB and cross-clamp time in these first two cases.

3. Discussion

The minimally invasive approach used in triple heart valve disease is still an uncommon practice in high-risk patients. A conventional sternotomy approach may alter significantly postoperative recovery; therefore, the right minithoracotomy could be a method of preference. The valve repair or replacement technique and valve prosthesis choice are similar to those in the median sternotomy operation.

In our institution we commenced double valve surgery after about 850 mitral and 140 aortic valve procedures through minithoracotomy. We performed 14 double valve (12 mitral-tricuspid and 2 mitral-aortic) cases until now. In the two patients presented in this report, we found triple valve surgery to be a technically feasible approach. The key criteria for indication and patient selection are yet to be established, but without a doubt it could serve as an alternative treatment in multiple heart valve surgery, when avoiding sternotomy is an advantage.

References

