Redo Mitral Valve Operation via Right Minithoracotomy- “No Touch” Technique

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Summary

Five patients who had had previous cardiac operations underwent minimally invasive beating heart mitral valve operations via a right minithoracotomy between November 2006 and February 2009. The mean age was 64 ± 10 years and 4 were female. Under general anesthesia with single-lumen ventilation, cardiopulmonary bypass was established using the right femoral artery and vein. Through right minithoracotomy, the left atrium was opened without dissection of pericardial adhesion. The aorta was not cannulated or clamped, using a so-called “No Touch” technique. Four patients had mitral valve replacement and one had mitral ring annuloplasty with the heart beating. Mean cardiopulmonary bypass time was 118 ± 38 minutes. There was no early mortality or confirmed stroke. One patient who underwent mitral ring annuloplasty for ischemic mitral regurgitation died 3 months after surgery due to renal failure. In conclusion, in our initial series, minimally invasive beating heart redo mitral valve surgery through right minithoracotomy was safely performed with no early mortality. (Int Heart J 2011; 52: 107-109)

Key words: Minimally invasive surgery, Reoperation, Mitral valve, Outcomes

Redo mitral valve surgery after a previous cardiac operation is often a major challenge especially when it is a multiple-time redo1 or there are patent coronary grafts.2 However, even with previous cardiac operations, right pleural space is normally an untouched area. Looking back in the history of cardiac surgery, mitral valve surgery was initially performed through a right thoracotomy.3 This approach became less common after the advent of coronary artery surgery through a median sternotomy but it has recently been resurfacing with a minimally invasive technique and redo mitral valve surgery has been performed through right thoracotomy more often.2,4-6 Although the right pleural space is virgin, there still is adhesion in the pericardial space in a redo surgery and dissection related bleeding is an issue. The efficacy of fibrillatory arrest without aortic clamping for mitral valve surgery with a favourable stroke rate of 2-3%, even without aortic vent cannulation for deairing, has been reported.7,8 On the other hand, beating heart mitral valve surgery has been performed successfully for appropriately selected patients.19 We simplified the technique for redo cases and mitral valve replacement or annuloplasty was carried out on the beating heart without an aortic clamp or fibrillatory arrest where there was no need to dissect pericardial adhesion at all. In the present study, we review the results of our initial series of minimally invasive beating heart redo mitral valve surgery.

Methods

Patients: Between November 2006 and February 2009, 57 patients underwent minimally invasive mitral valve plasty or replacement through right minithoracotomy at Royal Adelaide Hospital. Among these, 5 patients who had undergone previous cardiac surgery were selected out for detailed analysis, consisting of the cohort of this study. The medical records of subjects were reviewed for patient preoperative demographics, diagnosis, surgical procedural data, and outcomes. Operative techniques: Under general anesthesia with single-lumen intubation, patients were positioned with the right side of the chest slightly elevated. External defibrillation pads were placed. The right femoral artery and vein were surgically exposed and, after systemic heparinization, cannulated with a 28Fr venous cannula and a 21Fr arterial cannula (Edwards Lifesciences, Irvine, CA, USA) under transesophageal echocardiography (TEE) guidance. The venous cannula was inserted well into the superior vena cava (SVC) in order to avoid dislocation of the tip out of the SVC after left atrial retraction. Cardiopulmonary bypass (CPB) was established with vacuum assisted venous drainage with 30 mmHg negative pressure followed by a right minithoracotomy through a 6 to 8 cm incision on the anterior axillary line via the fourth intercostal space. After a soft tissue retractor (Edwards Lifesciences) was inserted, a rib spreader (Geister Medizintechnik, Tuttingen, Germany) was placed. A videoscope was inserted through a port placed in the third intercostal space on the anterior axillary line. Dissection of the pericardium was not attempted. The
right thoracic cavity was filled with carbon dioxide at 5 liters per minute throughout the procedure. With the heart perfused and beating, the left atrium was opened in a mass opening posterior to the right phrenic nerve without dissecting any pericardium. The aorta was not cannulated or clamped. An atrial retractor (Geister) was placed through the fifth or sixth intercostal space parasternally and the left atriotomy was retracted anteriorly as a mass retraction. The position of the venous drainage cannula was readjusted if the tip was dislocated into the right atrial appendage due to left atrial retraction. Too much atrial retraction can cause significant aortic regurgitation, leading to poor operative vision; therefore, a satisfactory surgical view was obtained with modest atrial retraction and rotation of the operation table. Mitral valve replacement or ring annuloplasty was performed with interrupted pledgetted 2-0 braided polyester (Ethibond, Ethicon, Somerville, NJ, USA) mattress sutures under direct vision with videoscopic assistance using specially designed long instruments (ValveGate, Geister Medizintechnik). The left atrium was filled to capacity by backflow of blood keeping the prostatic or native valve open before closing the atriotomy. The patient remained normothermic throughout the procedure. TEE was used to evaluate the valve and ventricular function. The patient was disconnected from CPB after appropriate reperfusion and was decannulated. The chest wound was closed with a 28 Fr pleural drain and catheters for a local surgical site anesthetic system (On-Q PainBuster, I-Flow Corp, Lake Forrest, CA, USA).

RESULTS

Preoperative patient characteristics are shown in the Table. The average age of the patients was 64 ± 10 years and 4 were women. The mean interval from the last cardiac operation was 12 ± 14 years. Two patients had patent coronary grafts. Preoperative echocardiography showed mild or less aortic regurgitation in all the patients.

Four patients underwent mitral valve replacement and one had ring annuloplasty. Before left atriotomy, TEE revealed that, with full flow of cardiopulmonary bypass with vacuum assisted venous drainage, the aortic valve hardly opened even in systolic phase in each case. The mean CPB time was 118 ± 38 minutes. The left atrium could be emptied quite readily with a sump sucker in all the cases. One patient developed ST elevation in the inferior leads after closing the left atriotomy but it improved in 4 minutes during reperfusion. The mean ventilation time and hospital stay were 18 ± 18 hours and 12 ± 7 days, respectively. Three patients received a blood transfusion. There was no hospital mortality. Although one patient with a history of previous stroke developed mild left hemiparesis postoperatively, it recovered completely during admission without any acute CT findings. One patient had deep vein thrombosis and pulmonary embolism on the sixth postoperative day in spite of therapeutic anticoagulation.

One patient who underwent ring annuloplasty for ischemic mitral regurgitation died 3 months after surgery due to renal failure. At a mean follow-up of 33 months (range, 21 to 43 months), New York Heart Association functional class had improved in 3 patients.

DISCUSSION

Reoperative mitral valve surgery carries a greater mortality and morbidity than primary mitral surgery. The features of this simple and reproducible technique presented in this study include single lumen ventilation, no dissection of pericardial adhesion, and no aortic cannulation, clamping or balloon occlusion, that is, “No Touch” technique. We introduced this technique with the idea that a more simplified operation in which there is no need for adhesion dissection or cardiac arrest would shorten the CPB time and operation times, minimize cardiac trauma, and decrease risk of ischemia-reperfusion injury, leading to a better outcome for redo mitral valve surgery. In addition, a right thoracotomy approach has the potential advantage of absence of sternal infection. In the study period, 10 other patients without previous cardiac surgery underwent mitral valve replacement or simple mitral ring annuloplasty through right minithoracotomy in our hospital. The mean CPB time was 121 ± 36 minutes. The fact that there was no significant difference between the mean CPB times of these groups (P = 0.8519) suggests a considerable advantage of this technique for redo cases.

We have not encountered a case requiring complex mitral valve plasty but only mitral valve replacement or simple ring annuloplasty thus far. Replacement of neochoordae or quadrangular resection and resuture should be technically feasible with a beating heart but fibrillatory arrest might be preferable if a water-leaking test is required to check the repaired valve with saline injection into the left ventricle because a pressurised left ventricle might eject air into the aorta with the heart beating, causing air embolism. Stroke including air embolism had

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>Diagnosis</th>
<th>Previous cardiac operation (s)</th>
<th>Interval from last operation</th>
<th>NYHA</th>
<th>AR</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>F</td>
<td>MS</td>
<td>OMC</td>
<td>15 years</td>
<td>4</td>
<td>mild</td>
<td>MVR</td>
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<td>72</td>
<td>M</td>
<td>MR, Hemolysis</td>
<td>CABG + MAP</td>
<td>2 months</td>
<td>3</td>
<td>trivial</td>
<td>MVR</td>
</tr>
<tr>
<td>3</td>
<td>76</td>
<td>F</td>
<td>MR</td>
<td>CABG</td>
<td>7 years</td>
<td>4</td>
<td>trivial</td>
<td>MAP</td>
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<tr>
<td>4</td>
<td>51</td>
<td>F</td>
<td>Stuck leaflet of prosthetic valve, LA myxoma resection</td>
<td>CMC</td>
<td>3 years</td>
<td>4</td>
<td>0</td>
<td>MVR</td>
</tr>
<tr>
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<td>59</td>
<td>F</td>
<td>MS</td>
<td>Redo MVR</td>
<td>36 years</td>
<td>2</td>
<td>0</td>
<td>MVR</td>
</tr>
</tbody>
</table>

AR indicates aortic regurgitation; CABG, coronary artery bypass grafting; CMC, closed mitral commissurotomy; LA, left atrium; MAP, mitral annuloplasty; MR, mitral regurgitation; MS, mitral stenosis; MVR, mitral valve replacement; NYHA, New York Heart Association functional class; and OMC, open mitral commissurotomy.
been one of our concerns. It of course is desirable to perform aortic root venting unless dissection around the aorta carries significant risk. It has been reported that Port-Access minimally invasive redo mitral surgery using an endoclamp or ventricular fibrillation was associated with a higher stroke rate than redo sternotomy or right thoracotomy despite lower mortality. In our series, TEE revealed that, with full flow of CPB with vacuum assisted venous drainage, the aortic valve hardly opened even in systolic phase (data not shown), allowing less chance for air to get sucked into the aorta on left atriotomy. Carbon dioxide gas was used throughout the procedure and the left ventricle was filled completely by backflow of blood keeping the prosthetic or native valve open before closing the atriotomy. The ascending aorta was not manipulated for cannulation or clamping. Thus, we tried to minimize the chance of embolism. No patient had significant aortic regurgitation and operative vision was satisfactory for all the cases. The descending aorta was also examined by TEE. Axillary cannulation should be considered in cases of atherosclerotic aortic disease or aortoiliac occlusive disease.

Mitral valve surgery is a repair-oriented surgery even for redo cases and this technique may not be indicated for the cases in which complex valve plasty is likely. However, it is useful for redo cases with Carpentier’s type I mitral regurgitation requiring ring annuloplasty, severe rheumatic mitral stenosis with previous commissurotomy requiring valve replacement, or revisional mitral valve replacement.

This “No Touch” technique can also be indicated for patients with patent coronary bypass grafts or those who had previous sternal infection, unless there is significant aortic regurgitation or severe right pleural adhesion due to previous right pleural disease or surgery.

This review has, of course, certain limitations. It is only a small number retrospective study and lacks a control group of conventional redo mitral operations for comparison. However, of particular note is that we had no early mortality or confirmed perioperative stroke. To further prove its safety and advantages, more cases will be needed.

In conclusion, in our initial series, minimally invasive beating heart redo mitral valve surgery through right minithoracotomy was safely performed with no early mortality.

REFERENCES