
Case report - Valves

On-pump beating heart mitral valve repair in patients with patent bypass grafts and severe ischemic cardiomyopathy

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Abstract

Re-operative mitral valve surgery in patients with poor ventricular function can be challenging especially in the presence of patent bypass grafts. We report the case of 11 patients with severe ischemic cardiomyopathy who underwent reoperative mitral valve repair through a limited right thoracotomy approach, on a non-fibrillating beating heart. All patients had their valves successfully repaired with no operative mortality and minimal morbidity. The technical aspects of the procedure are discussed, and the pertinent literature reviewed.

Keywords: Mitral valve repair; Beating heart; Ischemic cardiomyopathy; Thoracotomy; Re-operative

1. Introduction

Re-operation in cardiac surgery poses an increased risk of mortality and major complications, especially in the setting of depressed myocardial function [1]. The present study reports the case of 11 patients with severe cardiomyopathy and previous sternotomy who underwent successful mitral valve repair through a right thoracotomy approach on a normothermic, non-fibrillating, beating heart.

In patients with advanced ischemic cardiomyopathy who have undergone previous surgical revascularization, mitral regurgitation often becomes a symptomatic problem that comes to surgical attention [2]. Although repair of mitral regurgitation has resulted in survival benefit and marked improvement in symptoms and quality of life in these patients, careful strategies must be employed intraoperatively in order to ensure a safe outcome [2–4].

Eleven patients underwent a limited right anterolateral thoracotomy approach for re-operation for symptomatic severe mitral regurgitation, using the on-pump beating heart technique. All patients had a previous surgical revascularization and were known for advanced ischemic cardiomyopathy. Echocardiography confirmed the presence of moderate to severe mitral regurgitation as well as increased left ventricular volumes with mean left ventricular end-diastolic and end-systolic diameters of 67.5 ± 7.4 mm and 53.2 ± 8.6 mm, respectively. There was at most mild aortic insufficiency and preoperative cardiac catheterization showed patent veins and/or LIMA (Table 1). None of the patients required additional bypasses or PCI interventions.

Patients were placed in a left lateral and Trendelenberg position and rotated to elevate the left atrium relative to the left ventricle. Transcutaneous defibrillator pads were used and a right-sided transvenous ventricular pacemaker lead (Chander Transluminal V-Pacing Probe, Edwards-Lifesciences) was inserted via a 7.5 Fr pulmonary artery catheter port (Edwards-Lifesciences Swan–Ganz). After heparinization, the right femoral artery and vein were cannulated with a 21 Fr Biomedicus cannula (Medtronic, Minneapolis, MN) and a 24 Fr two-stage venous cannula. A right anterolateral thoracotomy of ~10 cm was then performed and the right cavity was entered in the 4th intercostal space. After incising the pericardium, a right angle 28 Fr venous cannula (DLP, Medtronic) was inserted into the superior vena cava, and an active vent was placed in the ascending aorta. Once cardiopulmonary bypass was started, the patients were kept normothermic with the mean systemic perfusion pressure between 70 and 90 mmHg. There was no aortic clamping or administration of cardioplegia. A linear incision was then made through the Sondergaard’s groove to expose the mitral valve. The valve was then inspected systematically to determine the mechanism of mitral regurgitation according to Carpentier’s classification. For Type I mitral regurgitation, a reduction anuloplasty was performed with a Cosgrove–Edwards #26 anuloplasty band (n = 8), or with a Carpentier Physio #26 anuloplasty ring (n = 1). For Type IIIb mitral regurgitation, a Adams–McCarthy–Carpentier ET Logix #26 annuloplasty ring was employed (n = 2). At times, it was helpful to intermittently decrease the flows when the surgical field was flooded with blood. At the end of the procedure, CO2...
was used and the heart filled with blood in order to facilitate de-airing. After confirming successful repair by saline test and by transesophageal echocardiogram, the vent in the aorta was closed and the remainder of the closure was routine.

There were no deaths, myocardial infarctions, or strokes and none of the patients required re-operation for failed repair, bleeding or tamponade (Table 2). Patients were discharged home from the hospital with follow-up in the heart failure clinic. At three months following their surgery, all patients were in NYHA class I or II and repeat echocardiograms revealed at most trivial mitral regurgitation.

2. Comment

Re-operation for mitral valve repair following previous CAGB with patent grafts presents a unique challenge in patients with severe left ventricular dysfunction. In fact, many of these patients are deemed inoperable due to prohibitive surgical risk, not only because of advanced patient morbidity, but also because of technical issues including extensive dissection, bleeding and injury to the underlying cardiac structures or grafts [4]. Several investigators have approached these challenging issues by using a right thoracotomy approach. However, most methods of myocardial protection with this approach have involved moderate to deep hypothermia with fibrillatory arrest [4, 5] or aortic cross-clamping with cardioplegic arrest [6, 7]. While systemic hypothermia does not require aortic cross-clamping or interruption of the IMA graft flow, its ability to provide adequate myocardial protection is still a concern. We believe that severely compromised ventricles better tolerate mitral valve repair in a normothermic, well-perfused heart, leading to minimal reperfusion injury or myocardial stunning postoperatively [8]. The technique described in this report maintains continuous normothermic perfusion of the beating heart while avoiding fibrillatory or cardioplegic arrest. There is minimal aortic manipulation, and the potential for injury to the right ventricle and patent grafts is low.

Recently, Svensson and colleagues reported their outcome with mitral valve re-operation through median sternotomy or right thoracotomy approach using hypothermic ventricular fibrillation. Stroke occurred in 7.5% and hospital mortality was 6.3% in the thoracotomy group [2]. A lower stroke rate of 3% was recently reported by Byrne and colleagues who used hypothermic fibrillatory arrest at all times [3]. Although induced ventricular fibrillation avoids the need to cross-clamp the aorta, it may not provide optimal cardiac protection. Oxygen delivery to the left myocardium is markedly reduced and coronary flow is re-distributed away from the subendocardium. We believe that allowing the myocardium to beat at normothermia while maintaining normal coronary perfusion offers optimal myocardial protection and reduces the risk of induced hypothermic coagulopathy and blood loss. Compared to these reports, our initial experience showed that a similar approach using the on-pump beating heart technique can be performed with an acceptable morbidity and mortality in carefully selected patients, even with poor ventricular function. By offering these patients a normothermic, beating heart operation, we have removed the potential complications related to aortic cross-clamping and cardioplegic arrest, while optimizing the quality of the mitral valve repair. Another unique and distinct advantage of this beating heart technique is the ability to directly assess the mitral valvular dysfunction dynamically. Furthermore, this approach eliminates the additional rewarming time necessary when fibrillatory or hypothermic arrest is used. We have also applied this technique in patients with degenerative mitral valve disease and it is likely that this approach may have further application in the field of minimally invasive mitral surgery.

In summary, re-operative mitral valve repair via a right anterolateral thoracotomy on a normothermic, non-fibrillating, beating heart appears to be a simple, safe, and effective alternative to conventional techniques in patients with symptomatic mitral valve regurgitation and severe ischemic cardiomyopathy. For patients without significant pulmonary dysfunction contraindicating thoracotomy, and in the absence of significant aortic insufficiency, this technique decreases the risk of injury to underlying cardiac struc-
tures, and allows successful mitral valve repair with a good operative exposure and low perioperative morbidity.

References


