Mitral Valve Surgery for Non-ischemic Functional Mitral Regurgitation In Patients With Severe Left Ventricular Dysfunction and Five Years Follow-up

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Abstract

Background: To assess the effects of mitral valve (MV) replacement for functional mitral regurgitation (FMR) in patients with severe left ventricular (LV) dysfunction. Methods: 48 patients with secondary non-ischemic severe mitral regurgitation (MR) and left ventricle eject fraction (LVEF) less than 35% were underwent MV replacement. All surgeries were finished by one surgical team from January 2010 to December 2015. Twenty-three patients were females and the mean age was 60.21 ± 10.69 years (range, 29 75 years). The preoperative cardiac function classification was III˜IV (NYHA) in 40 patients. The mean follow-up time was five years. Results: Three patients (6.3%) died in hospital: 2 from low output syndrome and 1 from multi-organ failure induced by pulmonary infection. The mean postoperative intensive care unit (ICU) stay time was 4 days. The mean cardiopulmonary bypass time was 131.50 +- 3.92 min, and the mean aortic cross-clamping time was 85.39 +- 24.16 min. The left atrium diameter and the systolic pulmonary artery pressure (PAP) decreased significantly after surgery. The survival rates at 1 and 5 years were 83.3% and 54.6%, and 29 patients (60.4 %) were in NYHA class I/II during the follow-up time. Conclusions: Mitral valve replacement maybe offers symptomatic improvement and mid-term survival benefit for non-ischemic FMR in some patients with severe LV dysfunction.

Introduction

In idiopathic dilated cardiomyopathy (DCM), left ventricular (LV) dysfunction is frequently complicated by functional mitral regurgitation (FMR). Because of high surgical risk, mitral valve surgery for FMR in patients with severe left ventricular dysfunction is still under controversial. Due to various reasons, massive heart transplantation and left ventricular assist device cannot be well developed in most cardiac institutions in China. So we need a further consideration whether conventional mitral valve surgery is effective enough for these patients. Murakamiet al. (1) reported a group of patients with severe mitral valve regurgitation and LVEF <35% and concluded that conventional mitral valve repair could improve the long-term outcomes of these patients. In another report, Fino et al. concluded that mitral valve replacement was better than mitral valve repair for chronic ischemic mitral regurgitation (2). We reported the results of mitral valve replacement for the 48 non-ischemic FMR patients and analyzed the long-time follow-up results.

Material and Methods

Patients

The retrospective review of the records for publication was approved by the Institutional Review Board of our hospital. From January 2010 to December 2015, 48 patients with non-ischemic FMR and severe left ventricular systolic dysfunction (LVEF[?]35%) underwent mitral valve replacement in our institution. And 23 were female patients. All the surgeries were finished by same surgical group. The mean patient age was

60.21 ± 10.69 years (range, 29 75years). The selection criterion was non-ischemic significant functional mitral regurgitation with severe left ventricular systolic dysfunction. For emergency or urgent surgeries were excluded. The preoperative atrial fibrillation was observed in 19 (39.6%) patients. The cardiac magnetic resonance imaging was a routine examination to exclude the ischemic mitral regurgitation and we found mild left ventricular endocardium fibrosis in 2 patients. The mean preoperative LVEF for the 48 patients was 30.25+-2.96% (range 23% 35%). 13 patients had one or two-vessel coronary artery disease. 11 patients had moderate tricuspid regurgitation and 36 with severe tricuspid regurgitation. All preoperative clinical data is listed in Table 1.

Surgical techniques

All patients were performed used a standard median sternotomy. An arterial cannula (Ningbo Fly Medical Healthcare Corp Ltd, Ningbo, China) was inserted into the ascending aorta, and venous cannulas (Ningbo Fly Medical Healthcare Corp Ltd, Ningbo, China) were placed into the superior vena cava and inferior vena cava. The CPB flow was maintained between 2.2 and 2.4 L/min.m^2, and patients were cooled to a bladder temperature of 32. Cold blood cardioplegia was routinely administered for myocardial protection. Both antegrade and retrograde cardioplegia were used. The mitral valve was exposed through the right atrium and interatrial septum incision. Mitral valve was replaced using the chordae tendineae sparing technique. Tricuspid annuloplasty used MC3 ring (Edwards Lifesciences Medical Inc., Irvine, California, USA) for patients with tricuspid annulus enlarged. Bipolar radiofrequency (Medtronic, Minneapolis, Minn) and Cox-maze IV procedure was performed for atrial fibrillation ablation.

Data statistics

We did data statistics by using SPSS for Windows version 21.0 (SPSS Inc., Chicago, IL). Continuous data were presented as a mean +- standard deviation and t-test was used to analyze continuous variables.

Results

Concomitant tricuspid annuloplasty was done in 47 patients. 13 patients received CABG and 10 patients received only one graft, 3 patients received two grafts. The 18 patients received atrial fibrillation ablation and 10 patients converted to sinus rhythm after surgery. 3 patients had frequent ventricular premature beats before and after operation. Seven patients received mechanical valve prosthesis (St. Jude Medical Inc., St. Paul, Minnesota, USA) and the others used bioprosthesis (Edwards Lifesciences Medical Inc., Irvine, California, USA). Three patients (6.3%) died in hospital: 2 from low output syndrome and 1 from multi-organ failure induced by pulmonary infection. The mean postoperative ICU time was 4 days (range 2˜20 days) and the mean time of hospital stay was 28 days (range 13˜67 days). The mean cardiopulmonary bypass time was 131.50 +- 3.92 min (range 83˜446 min), and aortic cross-clamp time was 85.39 +- 24.16 min (range 54˜180 min). (Table 2) The 6 months postoperative echocardiography showed left ventricular end-diastolic and end-systolic diameters were decreased but without statistical significance. And the left atrium diameter and mean pulmonary artery pressure decreased significantly. (Table 3)

Follow-up outcomes

41 patients(85.4%)were followed up. The mean follow-up time was 36.16 +- 19.81 months (ranged 4˜ 94 months). 10 patients (20.8%) died during the follow-up and 4 of them died 45 months after surgery; 7 from heart failure, 1 from hemorrhage of digestive tract and 2 from cancer. 29 patients (60.4 %) were in NYHA class I/II during the follow up time. (Table 4) For patients with atrial fibrillation also received oral amiodarone for 3 months after surgery. 5 patients with sinus rhythm after ablation revert to atrial fibrillation. Patients with tissue valve and without atrial fibrillation received oral warfarin for 6 months after surgery. Figure 1 illustrates the survival rates at 1 and 5 years were 83.3% and 54.6%.

Discussion

About 35% 50% of patients with chronic congestive heart failure will have concomitant severe mitral regurgitation (3). Because progressive ventricular remodeling also results from chronic volume overload in severe

mitral regurgitation (4, 5), significant mitral regurgitation begets progressive ventricular remodeling, which in turn begets progressive mitral regurgitation (4).

Murakami (1) et al. reported a group of patients with advanced LV dysfunction underwent MV repair and the postoperative 30-day mortality was 9.6%. In another report from Italy, for the same kind of patients, the hospital mortality was 2.3% for MV repair and 12.5% for MV replacement (6). Michele reported 54 patients with functional mitral regurgitation caused by idiopathic DCM with only annuloplasty, and the hospital mortality was 5.6% (7). However, with current annuloplasty techniques, moderate or greater MR occurs in as many as 35% of patients within 1 year of surgery (8). And restrictive annuloplasty can increase posterior MV leaflet tethering when there is a mismatch between ring size and LV dimension (9). We chose MV replacement rather than MV repair mainly based on the following considerations: 1. Restrictive mitral valve annuloplasty for functional mitral regurgitation may result in mitral stenosis and elevate the postoperative pulmonary arterial pressure. 2. In case of recurrent mitral regurgitation, these patients may not tolerate the second re-open operation. In order to decrease the surgical risk, all patients underwent a long-time medicine therapy before surgery to result in a chronic stable state. An interesting finding was that after surgery the symptoms of heart failure and the grade of heart function(NYHA)were improved obviously in most of the patients during follow-up. Maybe it was associated with the decreased postoperatively pulmonary arterial pressure and a good exercise mitral hemodynamic performance. The specific mechanisms may require further analysis.

No increased morbidity and mortality were associated with the addition of the radiofrequency ablation. We believed that conversion to sinus rhythm may contribute to improve the ejection fraction. But 5 patients revert to atrial fibrillation during the follow-up time, the specific reason was not known, maybe because of the heart failure.

Functional MR remains a diagnostic and therapeutic challenge, and there are many issues unresolved. At least we may conclude from this study that for carefully selected patients with advanced chronic heart failure and non-ischemic mitral regurgitation, MV replacement maybe a safe and good option. The limitations of this study were the small number of the patient cases and the long-term results still need to be assessed.

Conflict of interest

None.

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