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Original Article

Long-term results of surgical treatment of aortic and mitral regurgitation with enlarged left ventricle

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Abstract: Mitral valve and aortic valve regurgitation associated with enlarged left ventricle remains difficult to manage and the long-term results following surgical treatment is uncertain. Between April 1988 and September 2000, 82 patients with aortic and mitral regurgitation associated with enlarged left ventricle underwent valve replacement at Anzhen Hospital. The valve disease was rheumatic in origin in 75 patients (91.5%) and congenital in 7 (8.5%). Twenty-eight patients were in New York heart Association Functional (NYHA) class II and 39 in class III and 15 in class IV. Echocardiogram showed severe aortic insufficiency associated with mild to moderate mitral regurgitation in 66 patients and severe mitral regurgitation associated with mild to moderate AI in 16 patients. The mean left ventricular diastole diameter (LVDD) was 77.8 ± 5.2 mm. Valve replacement was performed under hypothermic cardiopulmonary bypass (CPB). Early hospital mortality was 7.3%. Two weeks after surgery the echocardiogram showed a reduction of LVDD. Follow up was completed in 69 patients with mean of 13.5 years. 20 patients were in NYHA class I; 26 in Class II and 3 in Class III and 2 in class IV. The follow-up survival rate was 73.9%, and follow-up mortality was 26.1%. LVDD reduced from 77.8 ± 5.2 mm to 58.3 ± 4.5 mm ($P < 0.001$). In 24 patients, the LVDD was less than 50 mm. Double valve replacement and/or repair carried out an acceptable early and Long-term clinical outcomes in patients with MR and AI with associated LV great enlargement. Both LVDD and NYHA improved following surgical treatment in survival patients.

Keywords: Surgical treatment, aortic insufficiency, mitral regurgitation, enlarged left ventricular

Introduction

Mitral regurgitation (MR) associated with aortic insufficiency (AI) is a common heart disease in China. In Beijing Anzhen hospital the proportion of valve surgery for MR and AI disease was 7.07% among open heart operations. Long term results of double valve replacement (DVR) in patients associated with severely enlarged left ventricle (LV) are not well known yet.

Material and methods

Subject

Between April 1988 and September 2000, 248 patients with MR and AI underwent DVR. Among them, 82 patients had severely enlarged left ventricular diastolic dimension (LVDD) (> 70 mm) with normal posterior free wall thickness of left ventricle (LV). There were 64 male and 18 female with a mean age of 42.8 ± 8.2 years (range: 15-67 years). The preoperative data of patients were detailed in **Table 1**.

Surgical treatment

The indications for operation were 1) moderate to severe MR and AI; 2) heart function (NYHA) improved by medications including Digoxin, diuretics and vasodilator. The operation was performed under standard cardiopulmonary bypass (CPB), moderate hypothermia, using cold cardioplegia for myocardial protection. Surgical approach either through left atrium or right atrium via atrial septum. For mitral valve

Table 1. Preoperative patients' data

Items	Value
Total cases	82
Diagnosis	
Rheumatic heart disease	75 (91.5%)
Congenital heart disease	7 (8.5%)
With tricuspid insufficiency	68 (82.9%)
Main symptoms	
Dyspnea	82 (100%)
Palpitation	75 (91.5%)
Peripheral edema	58 (70.7%)
Signs of congestive heart failure	71 (86.5%)
Years of symptoms	8.4 ± 3.2
Heart function (NYHA)	
Class II	11 (13.4%)
Class III-IV	71 (86.6%)
C/T	0.68 ± 0.14
Atrial fibrillation	76 (92.7%)
UCG	
LAD	64.4 ± 5.5 mm
LVDD	77.8 ± 3.7 mm
LVPW	8 ± 1.0 mm
EF (%)	44.6 ± 5.3%

LAD: Left Atrium Diameter; LVDD: Left Ventricular Diastole Diameter; LVPW: Left Ventricular Posterior Wall Thickness; EF: Eject Fraction; C/T: cardio-thoracic ratio.

replacement (MVR) or aortic valve replacement (AVR), all components of mitral or aortic valve were removed. For mitral valvuloplasty (MVP), the Kay's technique was used and all mitral valve components preserved. Continuing suture with 2/0 Prolene was employed in 78 cases of mechanical mitral prosthetic valves and 2 cases of mitral tissue prosthetic valves, and interrupted suture in 78 cases of mechanical aortic prosthetic valves and 2 cases of aortic tissue prosthetic valves. Tricuspid valvuloplasty (TVP) was applied in 46 cases (56.1%) with De Vega's and Kay's technique. The numbers of patients received repair or replacement and the types of prosthesis used are listed in **Tables 2** and **3**. The mean aortic cross-clamping time was 83.3 ± 9.3 min (range: 54-153 min). Digoxin and/or diuretics, vasodilators were used postoperatively and continued for 6 to 12 months.

Anticoagulation management

Oral anticoagulation was routinely used for all patients postoperatively, with mechanical prosthesis for life and tissue prosthesis for 3 months. The International Normalized Ratio (INR) target was 1.5-2.5 for mechanical prosthetic valves and 1.5-2.0 for tissue prosthetic valves.

Table 2. Details of the valves operation

Operation	No.
AVR+MVR	27
AVR+MVP	9
AVR+MVR+TVP	46

AVR: Aortic Valve Replacement; MVR: Mitral Valve Replacement; MVP: Mitral Valvuloplasty; TVP: Tricuspid Valvuloplasty.

Table 3. Details of types of prosthesis

Types	No.
Mitral mechanical prosthesis	69
Mitral tissue prosthesis	4
Aortic mechanical prosthesis	78
Aortic tissue prosthesis	4

Table 4. Perioperation complications

Complications	No.
Re-exploration	6 (7.3%)
Low output syndrome	18 (21.9%)
Ventricular premature beats	42 (51.2%)
Atrial fibrillation retained	76 (92.7%)

Follow up

Follow up data were obtained from the medical records and outpatients clinic with telephone or e-mail. The evaluation of prosthetic function, ventricular dimensions and contractility measured by echocardiogram study were collected.

Statistical analysis

Statistical analysis was performed with Student's t-test. All values are expressed as mean ± SD (standard deviation).

Results

The early hospital mortality was 7.3% (one due to heart failure and other five due to ventricular arrhythmias). Perioperative complications are specified in **Table 4**. None of patients had events induced by anticoagulation during hospitalization. The means hospital stay was 23 ±

Table 5. Comparison between pre- and post-operation

Items	Values	*P* Value
Pre-op LVDD (mm)	77.8 ± 3.7	
Post-op LVDD (mm)	67 ± 5.2	< 0.001
Follow-up LVDD (mm)	56.3 ± 5.8	< 0.001
Pre-op EF (%)	44.6 ± 5.3	
Post-op EF (%)	55.7 ± 4.2	< 0.01
Follow-up EF (%)	50.3 ± 2.3	< 0.001

LVDD: Left Ventricular Diastole Diameter; EF: Eject Fraction.

Table 6. Follow-up data

Items	Value
Cases of follow-up patients	69 (MP: 65; TP: 4)
Rate of follow-up	84.1%
Mean Follow-up time	13.3 years
Death	21 (30.4%, MP: 19, TP: 2)
Survival	48 (69.6%)
Anticoagulation events	36 (52.2%, MP: 35; TP: 1)
Heart function (NYHA)	
Class I	17 (35.4%)
Class II	24 (50.0%)
Class III	6 (12.5%)
Left Ventricular Diastole Diameter (mm)	56.3 ± 5.8

MP: Mechanical Prosthesis; TP: Tissue Prosthesis.

5.6 days. Two weeks after surgery the echocardiogram showed a significant reduction of LVDD and significant improvement in mean LV EF (**Table 5**). None of patients had periprosthetic leakage.

Follow up was completed in 69 patients with detailed information listed in **Table 6**. The mean follow-up time was 13.5 years. The follow-up survival rate was 73.9%, and follow-up mortality was 26.1%. Causes of late deaths were cerebral bleeding in 10 and cerebral infraction in 6, intractable ventricular failure in 2, and Freedom from valve-related mortality was 76.8%. Related to anticoagulation therapy, 30 cases had suffered with anticoagulation complication, 18 out of them had cerebral bleeding and infraction, and 12 out of them suffered from thrombosis in limb due to left atrium thrombus. 20 patients were in NYHA class I; 26 in Class II and 3 in Class III and 2 in class IV. LVDD reduced from 77.8 ± 5.2 mm to 58.3 ± 4.5 mm (P < 0.001). In 24 patients, the LVDD was less than 50 mm. 6 of the patients required re-operations of tricuspid valve replacement due to severely tricuspid regurgitation.

Discussion

Causes of chronic MR associated with AI

MR associated with AI is a common Valvular heart disease. The etiology of this disease includes rheumatic valve disease, degenerated disease, infective endocarditis, and etc. Rheumatic valve disease has been reported to be the commonest cause of surgically treated isolated MR in China [1-3], while in the United States the most common cause of this condition was congenital mitral valve prolapse [4]. In our group, MR and AI caused by rheumatic heart disease accounts for 91% of cases. Annular dilation appeared to be the major cause of either MR or AI. Other contributors to regurgitation includes leaflet thickening, fused commissure, calcification, and mitral valve chordae elongation.

Mechanism of LV enlargement

LV enlargement is induced by volume overload following the development of MR and AI and it is the risk factor for sudden death and cardiac dysfunction [5]. The LV end-diastolic pressure increases rapidly once the LV loses its preload reserve following the increasing LV end-diastolic volume caused by MR and AI. LV hypertrophy also occurs following the development of LV enlargement. The combination of LV enlargement of LV hypertrophy significantly reduces the LV compliance and myocardial function. After operation, LV enlargement regresses, both end-diastolic and end-systolic dimensions returning to normal or near to normal. Previous studies showed that LVDD reduced during early postoperative period, but increased again 6 to 12 months after operation [6]. In this group, the early postoperative LVDD results were similar to that reported by Zile MR [5]. However, none of our patients had late increasing of LVDD during follow up. The difference between our data and the previous reports remain unclear. One explanation is that significant myocardiopathy had not yet been developed in our group as all our patients had normal preoperative posterior free wall thickness of LV.

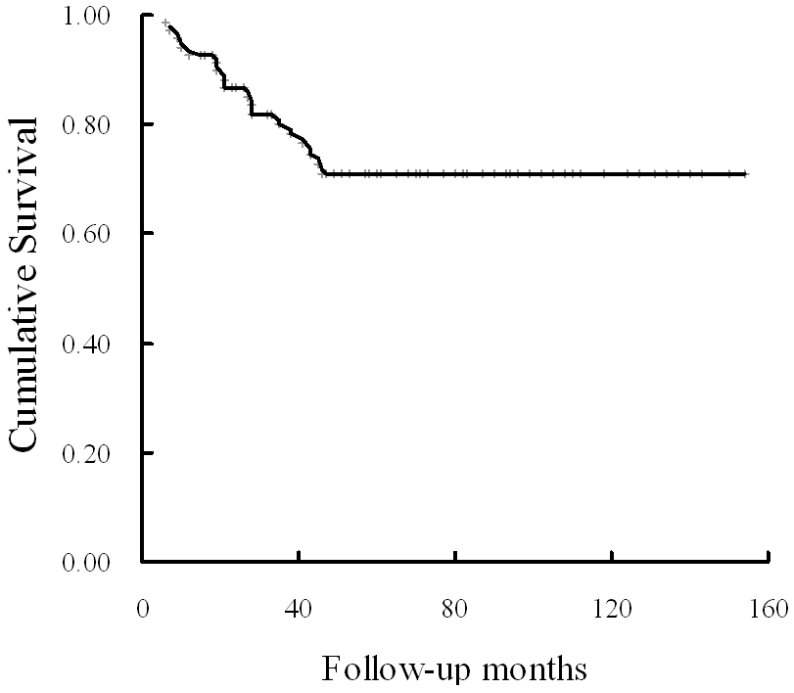

Figure 1. Cumulative overall survival.

Surgical treatment

Diuretics and vasodilator medicine may improve patient's symptoms at early stage, but as the disease develops patients eventually need surgical treatment. Valve repair or replacement reverts LV enlargement and improves LV function. At present, many type of operations had been introduced to treat MR and AI. We found double valve replacement is an effective way in treating this condition, and we have used continuous running suture during implantation of mechanical prosthesis to reduce the aortic cross-clamping time.

Prognosis

The 5- and 10-year survival for patients with MR and AI was 95% and 87%, respectively [7, 8]. However the natural history of MR and AI is difficult to determine due the following factors: (1) variable etiologies; (2) age difference at onset; (3) MR may be mild and non-progressive for many years; and (4) LV function, deteriorates at a variable rate. Few studies on postoperative survival associated with severe LV enlargement had been reported with variable results. Our Follow up study shows that long term survival and cardiac functions were acceptable in patients with MR and AI following double valve replacement and/or repair (**Figure 1**).

Analysis of results of follow-up

This group of patients after 13.5 year survival rate was 73.9%, the results were obviously lower than Zhang BR [9] reported the 10-year survival rate (86.50 ± 1.91)%, but similar to the survival rate of 15 years (67.86 ± 6.16)%. The possible reasons for this group of patients were associated with giant left ventricle, and left ventricle LVDD > 70 mm patients may have different degrees of myocardial damage, which was the independent risk factors of death in the patients with [5, 6]. In the group of death, death by anticoagulant complications accounted for 16 cases, indicating that postoperative anticoagulation is one of the risk factors for death after valve replacement in patients with postoperative patients [10, 11].

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Disclosure of conflict of interest

None.

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