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Immediat and Long Term Results of Mitral Valve Replacement in Patients with Rheumatic Mitral Stenosis and Left Ventricular Dysfunction

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Summary:

-Objective: The aim of this study was to assess the reversibility of left ventricular dysfunction in patients with rheumatic valve stenosis mitral stenosis after mitral valve surgery.

-Patients and methods: We retrospectively collected 565 patients who underwent mitral valve replacement for mitral stenosis. patients who had moderate tricuspid regurgitation (I-II) were included. Patients were studied under two groups: group with LVFE > 45% (n=535) and group with LVEF≤ 45% (n=30).

All patients underwent mitral valve surgery under cardiopulmonary bypass (CPB). Follow up evaluated the NYHA functional class and LVEF and survival rate.

-Results: The groups were similar for most preoperative characteristics. No statistical difference was observed between groups in term of CPB time and aortic cross clamp time. But 30 days mortality rate was higher in patients with LV dysfunction (13.3%, vs 4.5%, p=0.03). Low output syndrome was more frequent also (p=0.028) in group with MS and poor LVEF. Mean follow up time was 69.6± 29.2 months. Preoperative NYHA class was 2.83± 0.04 vs 1.27±0.04 after surgery p=0.001. LVEF increased from 39.8±45% to 52.8±86% p= 0.017.

No change was seen in LV diameters.

-Conclusion: Despite higher perioperative mortality in patients with MS and poor LV dysfunction, MVR provides excellent outcome and LVEF recovery.

Key words: Rheumatic mitral stenosis, poor left ventricular function, mitral valve surgery.

INTRODUCTION

In developing countries, rheumatic heart valve disease remains a common public healt problem 1-2- 3. The world health organisation (WHO) estimates that acute rheumatic fever (ARF) and subsequent rheumatic heart disease (RHD) affect about 15.6 million people worldwide 4-5. About 25% of all patients with RHD have isolated mitral stenosis. Although it is generally believed that left ventricular contractility is normal in most cases of MS 6-7 some studies have suggested otherwise 8-9. Impaired LV function in pure MS has been variously attributed to many factors 10-11-12 contrary to severe aortic stenosis with poor left ventricular function that can be stralified by

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investigating the contractile reserve using dobutamine stress echocardiography (DSE), we lack the tool to explore to possible reversibility of left ventricular dysfunction after surgery in patients with mitral stenosis. Few papers have been published about the influence of rduced LVEF on the short and long term prognosis. The present study reported the immediate and long term results in patients who underwent mitral valve surgery for MS with LV dysfunction.

PATIENTS AND METHODS

Between January 1994 and december 2012, 565 consecutive patients underwent mitral valve surgery at the present author's department. Of this population, 30 patients (5.3%), who had mitral stenosis associated to poor left ventricular systolic function (LVEF≤45%) were included.

Rheumatic mitral stenosis was diagnosed on the basis of a medical history of acute rheumatic fever (ARF) and / or precordial abnormalities including presence of a cardiac murmur plus standard echocardiographic criteria 13. All patients underwent transthoracic echocardiography (TTE) at the admission to the hospital by an experienced cardiologist.

Measurements of left atrium (LA), and left ventricular dimensions were made from 2D TTE images in the parasternal long axis view and ejection fraction (EF) was calculated by modification of Simpson's method with two apical views.

Peak and mean transmitral gradients were measured via doppler. Mitral valve area (MVA) was measured by planimitry in 2D images from the parasternal short axis and using the pressure half time (PHT) method by applying continuous wave. The valvular regurgitation was evaluated by flow doppler color imaging. Pulmonary artery systolic pressure (PASP) was measured by adding 10 mmhg to the value measured by evaluating Bernouilli equation, which is simplified from tricuspid insufficiency velocities.

Operative procedure: In order to reduce the anxiety, all patients received hydroxyin 1mg/kg as a premedicant. The choise of the anesthetic method depends mainly on left ventricular function and wether early extubation was suitable. Anesthetic induction used fentanyl 5mg/kg and propofol 3mg/kg and cisatracurium 0.15ng/kg.

The mmaintenance of anesthesia was performed of propofol 6-12mg/kg/h combined with sevoflurane 1-2%.

CPB was conducted with membran oxygenator under moderate hypothermia (32C). From 1994 until 2002, we employed antegrade intermittent crystaloid cardioplegia (Cold Saint Thomas), but since 2003, intermittent cold blood potassium cardioplegia was used.

pathients with the following diseases were excluded from the study: mitral insufficiency >1+, tricuspid regurgitation >3+, coronary artery disease. patients with tricuspid regurgitation 1-2 which underwent repair by Devega technic were included.

Preoperative and post operative data were obtained from hospital records.

Follow up data were investigated by a visit or phone interview, including physical examination chest X radiogram and echocardiogram.

statistical analysis was perfomed using the statistical soft ware package of social science (SPSS 19.0, chicago, Illinois, USA).

Data are presented as the mean standard derivation (SD) of normally distributed continuous variables or median and as numbers and percentages for categorical variables. Continuous variables were compared using independent samples T-test or the Mann Whitney U-test and qualitative variables were compared by the chi-square test and Fisher's exact test when the

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expected frequency was <5.
The results were considered significant, when the p value was less than 0.05.

Definitions: Hospital mortality was defined as death at any time before discharge from the hospital.
Postoperative morbidity was defined as any complication. leading to prolonged ICU stay.

RESULTS

Preoperative patient's characteristics are presented in table 1. Five hundred and sexty five (565) underwent mitral valve surgery at our institution over the period of the study. 30 patients of them had LVEF<40%, that represents 5.3%. Age, gender, prevalence of atrial fibrillation were very similar for the two groups. There were more patients with advanced NYHA functional class in group with MS and LV dysfunction compared to the control group, but it didn't reach statistical significance. The prevalence of preoperative comorbidities such as diabeter millitus, HTA, tobacco, previous cerebro vascular accident (CVA), renal dysfunction was similar in the two groups. There was a higher number of previous mitral commissurotomy in control group (19.8 vs 6.6% ps 0.07) but it failed to be statistically significant. Mean mitral valve area and mean mitral valve gradient were similar for the two groups. LV and systolic diameter was large in group with MS and impaired LV function (p=0.001), but left atrial diameter, LV and diastolic diameter and mean systolic pulmonary arterial pressure were similar in the two groups. Opened mitral valve commissurotomy was perfomed in four patients with LV dysfunction and all other patients received mitral valve prothesis. Mean CPB term mean aortic cross clamp were similar in the two groups p=0.93 and p= 0.89 respectively. No difference was observed in mechanical ventilation time and ICU stay p= 0.73 and p= 0.07 respectively. In hospital mortality rate was higher in the group with MS and LV dysfunction 13.3% vs 4.5%, p= 0.03.
Low output syndrom occured in six patients (20%) with MS and LV dysfunction vs fourthy (7.4) in control group p= 0.028.
seven patients (23.3%) with MS and LV dysfunction required the use of intravenous inotropic drugs and 60 patients (11.2%) in control group p= 0.046.
There was no difference between the two groups in term of renal failure, postoperative, cerebrovascular accident (CVA), reexploration for bleeding and infection.
Symptomatic improvement was noted in most of the survivors with MS and LV dysfunction (table 3). NYHA functional class was 2.83± 0.4 before surgery and 1.27± 0.4 after surgery p=0.001. There is also significant change in LV function in patients with MS and LV dysfunction. LVEF was 39.8± 4.5% before surgery and improved to 52.8± 8.6% after surgery p= 0.017 (Figure 1), but LV diameters did not decrease despite surgical correction of mitral stenosis.

DISCUSSION

The present study shows that mitral valve surgery in patients with pure rheumatic mitral stenosis (MS) and poor left ventricular function is associated with high mortality rate compared to those with conservative LV function (p= 0.03). However, we noted real improvement in functional status and LV function recovery. Preoperative left ventricular myocardial function is generally accepted as a major determinant of post operative survival and left ventricular function after mitral valve surgery. Until today, there is no tool to elucidate the post operative reversibility of LV contractility following mitral

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valve surgery. There is still continuing dilemmas concerning the exact mechanism of LV dysfunction.

Generally LV systolic function is well preserved in pure MS. However, there are some studies pointing out poor LV systolic function in isolated MS 8-14. LV systolic dysfunction in patients with MS was defined first by Heller in 1970, 15. LV function in patients with MS has been extensively investigated during the last decades 16. Earlier angiographic studies found lower ejection fraction in patients with MS than in controls 17, 18. Myocardial performance has critical importance on results after cardiac surgery. There are a few studies about mitral valve surgery in patients with MS and impaired LV function. The physiopathology of LV dysfunction in those cases remains controverssial and isn't clear. The essential mechanism to be suggested was the pan cardiac inflammation that occurs during acute rheumatic fever and the effects of potential chronic inflammation on the myocardium. Others suggested that this physiopathology is multifactorial. In addition to the myocardial effects of rheumatic fever, the long term homodynamic effect of MS are also documanted Andrew JP Klein. Patients with MS often have an elevated left atrial pressure, that's primarily due to the stenotic mitral valve. The left ventricular stroke volume is often reduced as a result of decreased LV filling and end diastolic volume. In most patients, LV systolic and diastolic functions are normal. However, there're reports of abnormal LV function 19-20. Varying degrees of LV systolic dysfunction may be observed in patients experiencing pure MS 14-21. Previous pathological studies demonstrated ultrastructural alterations at different levels, independent from LV systolic function, and the severity of MS 22-23. Other studies suggested that LV systolic dysfunction was due to abnormal function of the myocardium in the region of the mitral valve. The posterior wall or miflow tract of the LV is markedly shortened in many patients with MS due to atrophy of the myocardium 24. Decrease in LV myocardial performance in patients with MS is possibly caused by hemodynamic disorder.Right ventricular enlargement has been blamed for regional abnormalities of LV contraction 25. 10 patients (33%) in our serie underwent tricuspid valve repair that explained as a result of right ventricular dilatation. Currently, LV function in patients with rheumatic mitral stenosis is evaluated by echocardiography doppler. But conventional echocardiographic parameters aren't able to demonstrate subclinical LV dysfunction, particulary orly phase in patients with MS 16. Recently some studies demonstrate that tissue doppler imaging (TDI) 26- 27, two dimentional (2D) strain and srain rate imaging Ziya, velocity vector imaging (VVI) 22-28 are a novel techniques used for the quantitative assessment of segmental and global LV function. Murate Yuce found that fragmented QRS is predictive of myocardial dysfunction pulmonary arterial hypertension and severity in mitral stenosis Murate Yuce. Our results demonstrate a negative impact of preoperative systolic dysfunction on mortality after mitral valve replacement. Our data were in agreement with some previous reports 11-29.

Synder 30 and Morgoni found that preoperative LVEF didn't influence in hospital mortality, no recovery of LVEF and improved functional status was observed after surgical correction of mitral valve stenosis.

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Table 1: Preoperative characteristics of MS population with LV dysfunction compared to control group.

VARIABLE	MS LVEF<45%	MS LVEF>45%	p value
Age (years)	43.9 ± 9.7	41 ± 10.8	0.13
sex (F/M)	18/12	335/200	0.7
BMI	23.8 ± 3.7	23.5 ± 4	0.75
NYHA III, IV	24 (80%)	335 (62.6%)	0.054
DM	1 (3.3%)	16 (2.9%)	0.6
HTA	1 (3.3%)	21 (3.9%)	1.00
Smoking	9 (30%)	116 (21.7%)	0.28
Atrial fibril	23 (76.6%)	320 (59.8%)	0.066
CTI	0.57±0.07	0.57 ± 0.07	0.99
Previos stroke	3 (10%)	41 (7.6%)	0.72
Renal insuff	2 (6.6 %)	17 (3.2%)	0.26
LA diameter mm	57.5 ± 9.7	56.8 ± 10.4	0.71
LVED mm	52 ± 7.8	52.6 ± 9.4	0.68
LVES mm	40.3 ± 6.3	35.3 ± 7.6	0.001
SF mm%	20 ± 3	31.7 ± 5.3	0.001
EF mm%	39.8 ± 4.5	61.3 ± 7.8	0.001
SPAP mmHg	53.3 ± 15.9	54.8 ± 20.4	0.63
Mitral valve area	0,92 ± 0.28	0.99 ± 0.29	0.19
Mean TMG	12.2 ± 3.8	13.5 ± 5.5	0.2
Previous M commiss	2 (6.6%)	106 (19.8%)	0.07
Euro score	3.1 ± 2.9	2.4 ± 2.5	0.23

Table 2: Comparaison Of Operative Data Between MS With LV Dysfunction And Control Population.

VARIABLE	MS+LVEF≤45%(n=30)	MS+LVEF>45%(n=535)	P VALUE
No elective surgery	1(3.3%)	12(2.2%)	0.51
CPB time	82.2±33.7	81.6±31.7	0.93
X clamp time	54.2±25.7	53.5±22.5	0.89
Operative time	186.3±77	180±50	0.66
MV	9(6-18)	8(5-17)	0.73

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MV≥48Hours	4(13.3%)	30(5.6%)	0.099
ICU stay(Hours)	48(24-60)	24(24-48)	0.87
Postop Hospital stay(d)	11.8±4.2	12.8±9	0.32
Need for inotropic drug	7(23.3%)	60(11.2%)	0.046
LOS	6(20%)	40(7.4%)	0.028
Reoperative for bleeding	0(0%)	18(3.3%)	0.61
Infection	1(3.3%)	31(5.8%)	0.56
New renal insufficiency	2(6.6%)	26(4.8%)	0.65
Postoperative stroke	1(3.3%)	6(1.1%)	0.31
Transfusion	5(16.6%)	141(26.3%)	0.26
MV commissurotomy	4(13.3%)	0(0%)	---
MVreplacement	26(80%)	375(70%)	---
Tricuspid valve repair	10(33.3%)	160(30%)	---
30 day mortality	4(13.3%)	24(4.5%)	0.03
MOF	3(10%)	18(3.3%)	0.088

TABLE 3: Comparaison of preoperative and postoperative parameters in MS with LV dysfunction.

VARIABLE	PREOP	AFTER CONTROL	P VALUE
NYHA	2.83±0.4	1.27±0.4	0.001
CTI(%)	0.64±0.17	0.59±0.09	0.33
LA diameter mm	57.5±9.7	53.4±6.8	0.42
LVES diameter mm	40.2±6.3	42.8±14	0.51
LVED diameter mm	52±7.8	55.8±12.6	0.53
Short fraction(%)	20±3	27.2±6.3	0.015
Ejection fraction(%)	39.8±4.5	52.8±8.6	0.017
PAPS(mmHg)	53.3±15.9	25.7±3.7	0.075
Follow up time(montly)	---	69.6±29.2	---

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CONCLUSION

Despite excessive operative mortality, good results were observed after surgical correction of mitral barrier in patients with rheumatic mitral stenos is and poor left ventricular function.

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