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Natural Evolution of Aortic Valve Regurgitation Following Surgery for Rheumatic Mitral Valve Disease

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Abstract: ***Objective: The aim of this study was to assess natural course of rheumatic aortic regurgitation (AR) in patients who underwent mitral valve surgery. Patients and methods: A total of 125 patients (84 women and 41 men, mean age 39.7±9.6 years) with mild AR at the time of mitral valve surgery were followed for a mean period of 8.42±5.8 years. AR was assessed preoperatively and during follow-up by transthoracic echocardiography Doppler. Mild aortic stenosis and mixed aortic disease were excluded. Results: At the last follow-up control, 118 patients 94.4% were in NYHA functional class I or II. Mean cardio-thoracic index (CTI) decreased significantly (p= 0,002). Left atrium diameter also decreased (p= 0,001) but no change was observed in left ventricular diameters. Of the 125 patients, 7 (5,6%) underwent reoperation for aortic valve replacement . 5 of them had AR grade I that progressed to AR grade III in 4 cases and to AR grade IV in one case. 2 patients had AR grade II developed AR grade III. Conclusion: Our findings showed that concomitant mild AR after mitral valve surgery rarely progressed to significant AR over a long follow-up period.***

Keywords: Rheumatic heart disease, mitral valve surgery, aortic regurgitation

1. Introduction

Although the rate of coronary artery disease has been increased in the major populous countries of the developing world over the last decade, rheumatic heart disease (RHD) remains prevalent and important causes of cardiovascular morbidity and mortality [1, 2].

The most common heart valve affected by RHD is the mitral valve, but it is well known that about one-third of patients have simultaneous involvement of mitral and aortic valve [3,4]. In other hand, the majority of rheumatic valve disease cases are only mildly affected and a minority progress to more severe disease requiring valve surgery [1-5].

The frequent clinical situation is the coexisting mild to moderate aortic valve regurgitation in patients referred for mitral valve surgery. They are limited data available about natural history of aortic valve regurgitation after mitral valve surgery. And some studies suggest that outcome of patients undergoing mitral valve surgery alone is better than those undergoing prophylactic aortic valve replacement [6,7].

The purpose of the present study was to assess the natural course of untreated mild rheumatic aortic valve regurgitation at the time of mitral valve surgery.

2. Patients and Methods

This retrospective study was conducted in our cardiovascular surgery division and approved by local medical ethic committer between January 1997 and December 2014, 595 patients under went isolated mitral valve surgery. 470 of them were excluded from the study because of non-rheumatic valvular disease, concomitant mild aortic stenosis or aortic mixed valve disease, follow-up<2 years or inadequate follow-up, patients who died during follow-up.

Finally 125 patients were entered into the study. Before the mitral valve surgery, all patients underwent detailed transthoracic echocardiography (TTE) investigating all valves. The clinical data detained from hospital records included demographic characteristics, operative data of the mitral valve procedure.

Follow-up:
Follow-up data were obtained by hospital chart review or telephone interview.

Those patients we evaluated clinically based on New-York Heart Association (NYHA) functional class, chest radiogram and by echocardiography.

Echocardiographic analysis was performed in a standard manner and included prosthetic mitral valve study, left ventricular ejection fraction (LVEF) and pulmonary artery pressure measurements.

Aortic regurgitation (AR) grade was estimated by integrating the continuous wave doppler signal [8]and the color flow mapping as previously described [9,10].

Left ventricular diameters were measured by 2D method. Color Doppler assessed effective regurgitation orifice area, vena contraction and pressure half time (PHT) methods were used to define the quality and quantity of AR and based on these findings, AR was classified into four groups: none, mild, moderated and severe AR [7].

Statistical analysis:
Data were analyzed using IBM SPSS statistics 19.0. The continuous variables are expressed as Mean ± SD or

medians with interquartile range (IQR) depending on the data format and distribution and categorical variables as percentages. Comparison between groups were undertaken using chi-square or fisher's exact test for categorical variables; and student's test or Mann-Whitney U test for continuous normally distributed or non-Normally distributed data respectively. A p valve less than 0,05 was taken to indicate statistical significance.

3. Results

A total of 125 patients who underwent mitral valve surgery for rheumatic valve disease had concurrent aortic regurgitation assessed grade I in 113 cases (90.4%) and grade II in 12 cases (9.6%). Baseline characteristics are outlined in table I. The study population consisted of 84 (67.2%) women and 41 (32.8%) man. The mean age of our patients was 39.7±9.6 years. At the time of mitral valve surgery, most patients were in advanced functional class NYHA II-IV: 63.2% and the majority of them had developed atrial fibrillation (AF) (68.8%). The indications for mitral valve surgery were pure rheumatic mitral stenosis (MS) in 81 cases (64.8%), pure mitral regurgitation (MR) in 24 cases (19.2%) and mixed mitral valve disease in 20 cases (16%).

The following surgical procedures were performed in our patients: Opened mitral commissurotomy (OMC) in 3 cases, mitral valve repair in one patient, mitral valve replacement in 83 patients (66.4%) and mitral valve replacement+ tricuspid valve repair in 39 patients (31.2%).

At follow-up: the mean follow-up period after mitral valve surgery was 8.42±5.8 years. Ranged from 2 to 20 years.

At the last follow-up examination, the majority of patients (118; 94,4%) was in either NYHA functional class I or II. Mean cardio thoracic index (CTI) decreased significantly (0.58±0.08 vs 0.5±0.07, p=0.002) Echocardiographic investigations showed that left atrial (LA) diameter had decreased also significantly (57.2± 10.2 mm vs 50.4±8.9 mm, p< 0.001). Pulmonary hypertension has draped dramatically (p=0.001). But no change was observed in left ventricular diameters and function.

Of the 125 patients, 7 (5.6%) underwent reintervention for aortic valve replacement. 5 of them had AR grade I that progressed to grade III in 4 cases and to AR grade IV in one. 2 patients had AR grade II developed AR grade III. Among 118 remaining patients, AR grade I remains stable in 96 patients during follow-up period and progressed to AR grade II in 12 patients (Figure 1). In patients with AR grade II at the time of mitral surgery, 8(66%) remained the same and 2 (16.6%) decreased to grade I.

Also, during follow-up, 5 patients developed severe tricuspid regurgitation that necessitates surgery: 2 tricuspid valve repair (ring annuloplasty) and 3 tricuspid valve replacements. During follow-up period, Atrial fibrillation(AF) remained predominant in 64% of patients and a few patients 6 (4.8%) who had AF before mitral valve surgery had converted sinus rhythm during follow-up. In other hand, 7 patients (5.6%) who had sinus rhythm before surgery developed AF during follow-up (Table 2).

4. Discussion

Rheumatic heart disease (RHD) remains a significant health problem in the developing world [11,12]. Young adults and children are the predominantly affected populations rather than the elderly [13,14].

Currently, the most common treatment for advanced stages of RHD is valve replacement. Coexisting involvement of both mitral (MV) valve and aortic valve (AV) has been reported in one third to one half of patients who experienced RHD [7,15,16].

Dilemma exists when one valve required clearly indication for surgery but the other concurrent one is affected mildly. This situation is quiet frequent during mitral valve surgery associated with mild aortic regurgitation.

Theoretically, after mitral valve surgery, change in blood flow throught aortic valve increase hemodynamic stress and damage in aortic leaflets. In this condition, it might be expected that AR would progress rapidly. However, various studies found that patients with mild AR at the time of mitral valve procedures (Surgery or mitral balloon valvuloplasty) rarely develop severe AR [17-23]

In recent study, Namboodiri and colleagues [16] found that mild AR progressed very slowly and less frequently required reintervention ,but mild aortic stenosis (AS) progressed more often and more rapidly. In Chaouch's study [17] 38% of patients who had mild AS required aortic valve replacement during mean follow-up of 5 years.

These observations had been reported by other investigations [24-26] Otto and al [27] found that 75% of patients with mild AS develop symptoms 5 years after mitral valve surgery.

During the course of our study the slow progression of AR was in accordance with available natural history studies on the same condition [16,18,23,33].

The option of replacing affected aortic valve in patients with mitral valve surgery puts a premium on detailed knowledge of the natural history of AR, and the important issues to be considered in those patients include following:

- Physicians have long known that patients with rheumatic AR may remain asymptomatic for years.
- The decision is likely to be influenced by many factors such: age, gander, geography, medication access and use, timing of diagnosis and referral, access to ongoing care and follow-up.
- The possibility of others alternatives therapies (closure mitral commissurotomy (CMC) or mitral balloon valvuloplasty (MBV)). This option seems to be an effective treatment for patients with MS until both valves accomplished the indication for surgery [22,23,28].
- Another particular challenge in developing countries includes low budgets for health. The low socio-economic

level limits access to surgery because it costs very expensive [29,30].

- It is well known that a multiple prosthetic valves increases the immediate surgical risk, and have a higher long-term complicationrate than single prostheses [31].
- Some investigators suggested that the presence of LV dysfunction justify aortic replacement [28-32].

Study limitation of this study is its retrospective design. Echocardiography doppler is the main tool to assess AR during follow-up, but the lack of this exam exclude some patients and reduce the number of patients enrolled in the study. Also the high number of lost sight of patients might be another problem that limits statistical power.

5. Conclusion

The results of our study showed that the presence of a mild aortic regurgitation in the primary mitral valve surgery progress very slowly and few patients required reintervention. However, a regular follow-up of these patients is justified despite this favorable outcome.

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Table 1: demographic data

Variables	n=125 Mean ± SD / n(%)
Age (years)	39.7±9.6
Sex Male/Female	41/84
BMI (kg/m²)	24 ± 4.2
CTI (%)	0.58 ± 0.08
Atrial Fibrillation (%)	86 (68.8%)
Diabetes Mellitus	4 (3.2%)
HTA	3 (2.4%)
Smoking	22 (17.6%)
NYHA III-IV	79 (63.2%)
LA diameter (mm)	57.2 ± 10.2
LVESD mm	35 ± 6.8
LV EDD mm	51.4 ± 8.5
Ejection Fraction	60 ± 9.3
SPAP mmHg	54.9 ± 20.3
AR grade I	113 (90.4%)
AR grade II	12 (9.6%)
Euroscore	2.5 ± 2.3
Indication for intervention:	
• MS alone	81 (64.8%)
• MR alone	24 (19.2%)
• Mixed mitral lesion	20 (16%)
Surgical procedure:	
• Opened mitral commissurotomy	3 (2.4%)
• MV repair	1 (0.8%)
• MV replacement	83 (66,4%)
• MV replacement + TV repair	39 (31.2%)

AR: aortic regurgitation, **BMI**: body mass index, **CTI**: cardio-thoracic index, **LA**: left atrium, **LVEDD**: left ventricular end diastolic diameter, **LVESD**: left ventricular end systolic diameter, **MR**: mitral regurgitation, **MS**: mitral stenosis, **MV**: mitral valve, **SPAP**: systolic pulmonary artery pressure, **TV**: tricuspid valve.

Table 2: follow-up of the patients (before and after MVS: Mitral valve surgery)

Variable	*Before MVS N=125*	*After MVS N=125*	*P*
Mean follow-up period (year)	-	8.44±5.8	-
NYHA	2.7±0.59	1.45±0.81	**<0.001**
CTI	0.58 ± 0.08	0.50 ± 0.07	**0.002**
LA diameter (mm)	57.2 ± 10.2	50.4 ± 8.9	**<0.001**
LV ESD (mm)	35 ± 6.8	34.5 ± 9.5	0.83
LV EDD (mm)	51.4 ± 8.5	50.8 ± 8.3	0.82
Ejection Faction (%)	60 ± 9.3	58.4 ± 11	0.12
SPAP (mmHg)	54.9 ± 20.3	32.9 ± 11.4	**<0.001**

CTI: cardio-thoracic index, LA: left atrium, LVEDD: left ventricular end diastolic diameter, LVESD: left ventricular end systolic diameter, SPAP: systolic pulmonary artery pressure.

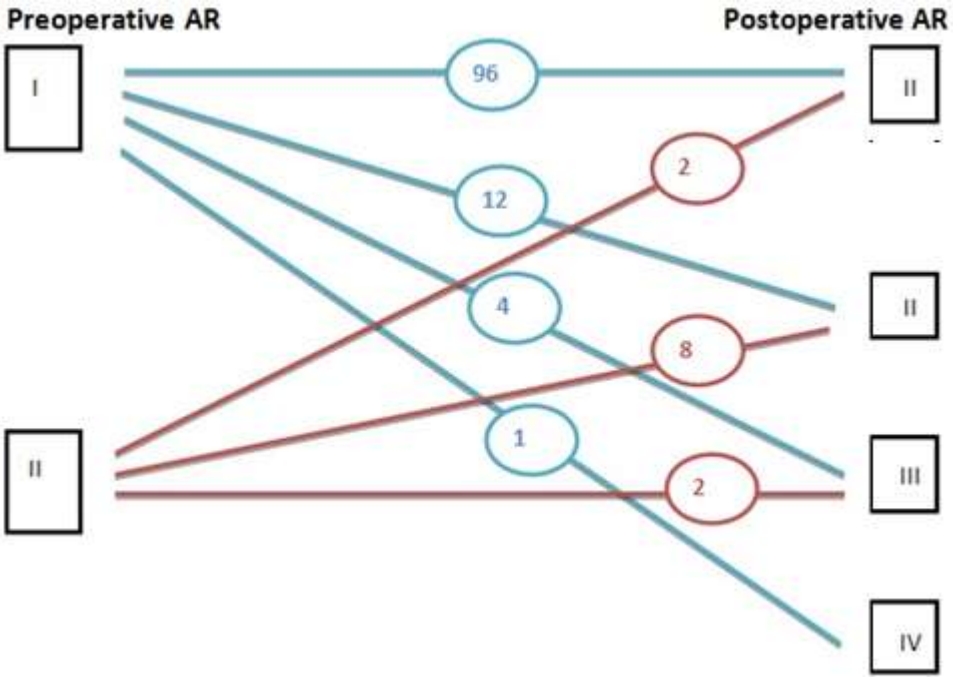

Figure 1: Evolution of the AR (aortic regurgitation) after mitral valve surgery