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ORIGINAL PAPER

The Influence of Aortic Valve Replacement on Functional Moderate - To-Severe Mitral Regurgitation in Patients with Aortic Valve Stenosis

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ABSTRACT

Goal: The aim of this study was to show whether the concomitant functional mitral regurgitation in patients undergoing aortic valve replacement improves after this surgical procedure and to identify preoperative echocardiographic parameters that may influence the lack of improvement in mitral regurgitation (MR) after aortic valve replacement (AVR). **Material and methods:** The study included 45 patients with severe aortic stenosis and concomitant moderate to severe (+2/+3) mitral regurgitation. **Results:** The results of our study indicated an improvement in the degree of mitral regurgitation in 24 patients. The most prominent parameters responsible for the lack of improvement of mitral regurgitation in our study were LVIDd, ERO, RVol, pulmonary artery systolic pressure and left atrial diameter. Identification of echocardiographic predictors may assist in selection of patients for whom more aggressive surgical treatment is advised. **Conclusion:** Concomitant moderate to severe functional MR indicates that MV should be repaired or replaced at the time of aortic valve surgery where at least two of indicated predicted preoperative echocardiographic parameters are present.

Key words: Cardiac surgery, aortic valve, mitral regurgitation, echocardiography.

1. INTRODUCTION

Patients with aortic valve stenosis very often have functional mitral regurgitation of varying degree (1-10). The underlying mechanism of mitral regurgitation in aortic valve stenosis is probably multifactorial/ LV remodeling, increased afterload / and often functional in nature, although organic mitral disease may coexist (1). It is expected that, after aortic valve replacement alone the degree of mitral regurgitation decreases and some previous studies have shown an improvement in mitral regurgitation after AVR (4). Still, there are many authors who showed in their studies lack of amelioration in case of moderate to severe mitral regurgitation after aortic valve replacement (11). Although additional mitral intervention is required in severe, symptomatic MR concomitant to AS, surgical treatment of moderate to severe mitral regurgitation at the time of aortic valve replacement remains uncertain (2). The replacement of both valves is however associated with increased mortality and morbidity and therefore surgical intervention must be carefully selected (6, 9).

2. GOAL

The aim of this study was to examine whether the aortic valve replacement alone influences the degree of mitral regurgitation and to try to identify echocardiographic and clinical factors which might influence the lack of improvement of mitral regurgitation after AVR.

3. MATERIAL AND METHODS

In this retrospective study patients included had aortic valve replacement and coexisting functional moderate-to-severe mitral regurgitation (MR+2/+3) on preoperative 2-dimensional echo examination. The study was conducted from January 2011 to January 2013 at the Heart Centre, Clinical Centre University of Sarajevo. The number of patient enrolled in this study was 45; they were of both sexes and they were 55 to 65 years old. Data were collected retrospectively through our institution database. In every patient the following characteristics were determined: comorbidity, age, sex, hypertension, diabetes mellitus, dyslipidemia, NYHA and cardiac arrhythmias such as atrial fibrillation. The patients who had ischemic mitral regur-

Figure 1. Echocardiographic assessment of MR severity by PISA. PISA radius measurement.

gitation, organic mitral valve disease, mitral valve replacement, coronary artery disease or had pacing rhythm were excluded from this study. All patients were subjected to qualitative and quantitative echocardiographic assessment. Echocardiographic assessment was performed preoperatively and 120 days postoperatively. MR grade +2/+3 was assessed by a high continuous Doppler intensity, a large color Doppler area, blunted or reversed systolic pulmonary vein flow pattern, PISA measurement, Regurgitant volume- Rvol /45-59ml/beat/, Regurgitation fraction RF /40-49%/ and Mitral effective regurgitant orifice ERO /30-39/mm² (Figure 1).

Statistical analysis

Data are presented as absolute and relative numbers, mean, standard deviation and range. In our data comparison and detection of possible factors, Student t-test and chi-square test were used with the level of significance set to $p < 0.05$.

4. RESULTS

Clinical characteristics of patients

This study included 45 patients (28 male and 17 female, aged 56.25 ± 7.24 years) who underwent AVR due to aortic stenosis and had moderate-to-severe mitral regurgitation on preoperative 2D echocardiography. Table 1 present the preoperative clinical characteristics. Nine patients of the total sample size had diabetes mellitus, 34 patients had hypertension and 30 patients had dyslipidemia. In addition, 5 patients had atrial fibrillation prior AVR. After 120 days, respectively, MR2/+3+ was improved in 46.7% ($n=21$) of patients, and remained unchanged in more than a half patients, 53.3% ($n=24$) postopera-

Patients characteristics	(n)
Number of patients	45
Male/female	28/17
Age (years)	56.25 ± 7.24
Diabetes mellitus	9
Dyslipidemia	30
Hypertension	34
Atrial fibrillation before AVR	5
NYHA II	17
NYHA III	1
NYHA II/III	5
NYHA III/IV	1

Table 1. Clinical characteristics of patients

	Group of patient without improvement in MR (n=21)		Group of patient with improvement in MR (n=24)		t	p
	M	SD	M	SD		
Septum(mm)	14.23	1.30	14.48	1.34	-0.62	0.540
LVIDd (mm)	54.46	2.99	50.33	1.91	4.11	0.001
Lad (mm)	49.33	2.28	41.76	2.02	11.72	0.001
PAP(mmHg)	41.42	5.94	27.14	4.17	9.20	0.001
LV EF (%)	49.29	1.63	51.29	1.42	-4.35	0.056
AVPG mean (mmHg)	51.81	5.89	20.96	6.56	-1.54	0.001
RF (%)	44.58	2.95	44.10	3.08	0.543	0.590
Regurgitation volume (ml)	52.79	3.90	30.05	5.25	1.275	0.001
ERO(mm ²)	34.29	3.86	25.76	2.57	-0.474	0.001
Vena contracta (cm)	0.76	0.10	0.49	0.17	-6.233	0.001

Table 2. Echocardiographic changes before and after aortic valve replacement (AVR) and indicators.

No. of values above cutoff	Without improvement in MR	With improvement in MR	Total
0	0 .0%	6 100.0%	6 13.3%
1	1 6.7%	14 93.3%	15 33.3%
2	10 90.9%	1 9.1%	11 24.4%
3	11 100.0%	0 .0%	11 24.4%
4	2 100.0%	0 .0%	2 4.4%
Total	24 100.0%	21 100.0%	45 100.0%

Table 3. Influence of possible parameters number above cut off value on grade change

tively. After aortic valve replacement surgery, we identified two groups of patients: with - and without the improvement in the degree of mitral regurgitation Persistent postoperative MR +2/+3 was associated with: male sex, atrial fibrillation, diabetes mellitus and dyslipidemia. Analysis of echocardiographic changes before and after aortic valve replacement indicates that mean values of all observed parameters was higher in the group of patients without improvement in MR. Changes that were statistically significant occurred in: LVIDd ($54.46:50.33$ mm), Lad ($49.33:41.76$ mm), PAP ($41.42:27.14$ mmHg), AVPG ($51.81:20.96$ mmHg), Regurgitation volume ($52.79:30.05$ ml), ERO ($34.29:25.76$ mm²) and Vena contracta ($0.76:0.49$ cm) (Table 2). The most prominent factors of persistent postoperative MR +2/+3 in our study were the following preoperative echocardiographic characteristics: LVIDd >54mm, ERO >25mm², RVol > 40ml/beat, pulmonary artery systolic pressure >40mmHg and left atrial diameter >45mm. These findings indicate that patients with two or more observed parameters above set cut of values will have a high probability to retain MR+2/+3 after AVR (Table 3).

5. DISCUSSION

In patients with severe aortic stenosis, mitral regurgitation can be caused by morphological changes, but also may be secondary due to the aortic stenosis (increased afterload, left ventricular remodelling). Publication results concerning both valve interventions in the setting of AVR and concomi-

Figure 2. Tricuspid regurgitant jet recorded using CW Doppler. Apical four chamber view. TR pressure gradient measurement- TRPGmax 36mmHG with estimated PAP 46mmHG

Figure 3. Echocardiographic measurement of LVIDd in parasternal long – axis view: 1.IVSd=17mm, 2.LVIDd 62mm, 3.LVPWd=13mm.

Figure 4. Color M mode Doppler pattern of functional MR

tant MR are controversial (16) In our study 46.7% patients with AVR had improvement in the mitral regurgitation from grade +2/+3 to grade +2 while 53.3% patients with AVR did not have any improvement in the mitral regurgitation. These results are similar to the results of Brasch et al and Adams et al. (2, 3), but are in contradiction with the results of Harris et al. and Tunick et al.(5, 8). None of our patients had mitral regurgitation grade IV or grade I after AVR. After AVR atrial fibrillation was present in eight patients and only one patient needed to repeat surgery intervention. In Christenson retrospective study of 60 patients undergoing isolated AVR, patients with MR / without CAD or organic origin/showed an improvement in MR degree (4) In another study from Moazami, fifteen of 35 patients identified with moderate to severe MR prior AVR retained the same MR degree after surgery and a survival was only 78% at 3 years versus 98% survival in patients with mild MR (10). The authors of this study, therefore, concluded that moderate-to-severe MR should be treated at the time of AVR.

Our study has identified the most prominent factors that might have influence on changes in mitral regurgitation. Some of these factors are: size of left atrium above 45mm, which is a significant predictor for the existence of postoperative mitral regurgitation. Left atrial enlargement is a chronic change and highly correlated with atrial fibrillation, and in later years is an important predictive factor of postoperative mortality (8). Also negative influence has sex as it was observed that women have shown the improvement of mi-

tral regurgitation after AVR. This can be explained by the fact that the women have a lower body weight, lower concentric hypertrophy, decreased LV volume and increased ejection fraction. Our study showed that the age of patients was not associated with the improvement in mitral regurgitation. Similar results have been found by Gaudino et al. (4). Pulmonary artery systolic pressure (PAP) was identified in our study as an indicator of persistent postoperative mitral regurgitation grade +2/+3. (Figure 2) Persistent postoperative +2/+3MR was associated with diabetes mellitus and dyslipidemia. End-diastolic left ventricular diameter (LVIDd) in our study had influence on the AVR outcome as all patients with LVIDd> 50 mm preoperatively retained postoperative mitral regurgitation grade +2/+3. (Figure 3 and 4).

6. CONCLUSION

Functional preoperative moderate to severe MR+2/+3 does not improve in majority of patients after isolated AVR. Identification of echocardiographic predictors may assist in selection of patients for whom more aggressive surgical treatment is advised. Moderate to severe concomitant functional MR indicates that MV should be repaired or replaced at the time of aortic valve surgery where at least two preoperative echocardiographic indicators are present.

Study limitation

The number of patients who had been in our study is relatively small, although significant differences were seen between preoperative parameters and their correlation with postoperative changes of MR. In order to more accurately assess this difference it is advisable to perform a larger multicentric study.

Abbreviations

MR – mitral regurgitation, AVR–aortic valve replacement, Lad – left atrium diameter, LVIDd – left ventricle end-diastolic diameter, PAP – pulmonary artery pressure, ERO–effective regurgitant orifice, Rvol – Regurgitation volume.

CONFLICT OF INTERESTS: NONE DECLARED.

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