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Research Article

Limitations of Indication for Left Atrial Plication

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Abstract
Introduction: *Patients with Rheumatic mitral valve disease with mitral stenosis, mitral regurgitation, or a combination of both can have enlargement of the left atrium (LA) with atrial fibrillation, hemodynamic complications and even atrial thrombus formation in LA. Currently, there is no consensus regarding the management of dilated LA based on its size.*
Materials and Methods: *Patients who met Piccoli criteria, that is anteroposterior diameter of left atrium of over 65 mm on echocardiography with mitral valve disease of rheumatic etiology were divided into 2 groups prospectively : 37 patients underwent LA plication (group 1) and 46 patients without LA plication (group 2). Pre operative and postoperative functional and hemodynamic parameters data was collected of both the groups. Mean follow-up period was 10.33 months. Mean left atrial diameter was 8.77 +/- 1.62 cms preoperatively and 6.05 +/- 1.21 cm postoperatively in group 1. In group 2, the mean values were 7.88 +/- 0.81 and 6.28 +/- 1.14 cms respectively. Postoperatively patients were followed up with echocardiography and ECG to see for conversion to sinus rhythm*
Results: *Postoperatively no differences were observed in ejection fraction and left ventricular end-diastolic diameter between the 2 groups. The postoperative decreases in pulmonary arterial pressure and the left atrial plication were not significantly different. Aortic cross clamp time was significantly less in group 2. In group 1, 23 patients with LA size > 8 cms were in AF preoperatively of which 20 patients attained sinus rhythm. In group 2, 22 patients with LA size > 8 cms were in AF preoperatively of which 8 patients attained sinus rhythm (p <0.05), where as 8 patients out of 11 patients in group 2 with LA size of <8 cms attained normal sinus rhythm. In group 1, 30 patients with preoperatively LA size > 8 cms, 25 patients attained LA size <6.5 cms. In group 2, 22 patients with preoperatively LA size > 8 cms, 8 patients attained LA size <6.5 cms (p<0.05). There is no added advantage of left atrial plication if the left atrial diameter is below 8 cms*
Keywords: *Left atrial reduction, giant left atrium, atrial fibrillation.*

Introduction

Patients with Rheumatic mitral valve disease with mitral stenosis, mitral regurgitation, or a combination of both with associated left atrium (LA) enlargement of anteroposterior diameter of over 65 mm on echocardiography were selected for study. Piccoli criteria for giant left atrium (GLA) is defined as anteroposterior diameter of left atrium of more than 65mm on echocardiography[1] . According to Di Eusanio et al.[3], about 19% of patients requiring an operation for a mitral valve disease had GLA. GLA patients always have a long history of mitral valve disease and atrial fibrillation, and very often present with hemodynamic and/or respiratory complications, as well as atrial thrombus formation[2]. Currently, there is no consensus regarding the management of GLA during mitral valve surgery. Most surgeons fix the mitral valve, and do little to an oversized left atrium. Others occlude the left atrial appendage[4,5]. A good proportion of surgeons think that successful mitral valve surgery alone will result in the eventual remodeling of the left atrium and size reduction. Several techniques of left atrial size plication during mitral valve replacement have been developed to eliminate symptoms of left atrial compression, enlargement, and potential postoperative complications[2,6]. This study compared patients with giant LA who underwent mitral valve replacement or repair with LA plication and those who underwent mitral valve replacement or repair without LA plication.

Methods

Eighty three Patients who met Piccoli criteria for giant LA (anteroposterior LA diameter over 65 mm by echo assessment) who were operated upon for mitral valve disease, with MS, MR, MS / MR with rheumatic etiology between January 2015 and March 2017. Patients were divided into 2 groups prospectively inot two groups. 37 patients underwent mitral surgery with LA plication (group 1) and 46 patients underwent mitral surgery without LA plication (group 2). Ten patients who had left atrial compression symptoms were all included in the group 1. Patients with aortic valve disease or coronary artery disease were not included in the study. In group 1, 8 patients had pure mitral valve stenosis, 18 had pure mitral insufficiency, and 11 had mitral stenosis and insufficiency. In group 2, 9 patients had mitral stenosis, 21 had mitral insufficiency, and 16 had mitral stenosis and insufficiency. Most of the patients had a history of rheumatic fever. 8 patients in group 1, and 6 in group 2 had tricuspid insufficiency which required tricuspid surgery, these cases were treated by tricuspid ring annulopasty. In group 1, 31 patients were in New York Heart Association (NYHA) functional class III, and 6 were in NYHA class IV. In group 2, 4 patients were in NYHA class II, 33 were in class III, and 9 were in class IV. In group 1, 31 patients were in AF and 6 were in NSR. Of these 31 patients who were in AF, 23 patients had left atrial diameter of >8 cms and 8 patients had left atrial diameter of <8 cms. In group 2, 33 patients were in AF and 13 were in NSR. Of these 33 patients were in AF, 22 patients had left atrial diameter of >8 cms and 11 patients had left atrial diameter of <8 cms. None had experienced a thromboembolic event. Mean age in group 1 was 27 +/- 12 years; there were 24 female and 13 male. Mean age in group 2 was 30 +/- 9 years; there were 28 female and 18 male. In group 1, 33 patients underwent mitral valve replacement and 4 patients underwent mitral valve repair. In group 2, 41 patients underwent mitral valve replacement and 5 patients underwent mitral valve repair. Cardiopulmonary bypass was established by aortic and bicaval cannulation after induction of general anesthesia. Diastolic arrest was achieved with antegrade potassium cold blood cardioplegia after cross clamping. Mitral valve replacement or mitral valve repair was done. Electrocautery maize was done in all patients who were in AF, in both the groups. The Electrocautery maize was done with a diathermy machine set at 30-40 watts and using the coagulation-spray setting. Maize was done circumferentially at all pulmonary vein orifices and all were connected[3]. In group 1, Kawazoe

plication technique[2] was used in addition to mitral valve replacement or repair. Plication was made with 3/0 polypropylene continuous suture technique on the left atrial posteroinferior wall (area between the mitral valve ring and the right and left pulmonary vein orifices) in a semilunar shape between the upper edge of the left atrial appendage and the posteromedial area of the mitral valve. The plication was completed from the caudal edge of the left atrial appendage lengthways along the atrial cranial side to the right and left pulmonary vein orifices, in a horseshoe shape. The width of the plication was between 35 and 50 cms, as in Kawazoe's technique[2]. Patients who were in AF pre-operatively were on antiarrhythmic drugs and all patients were on oral anticoagulation postoperatively. Pre-operative, post-operative and follow-up, functional and hemodynamic parameters data was collected of both the groups. Values are expressed as percentages and the mean and standard deviation. Pre and postoperative LA values were compared with the Student t test for quantitative variables. A difference was considered statistically significant if P<.01. SPSS software was used in data analysis, and $p < 0.05$ was considered statistically significant.

Results

In group 1, 33 patients underwent mitral valve replacement and 4 patients underwent mitral valve repair. In group 2, 41 patients underwent mitral valve replacement and 5 patients underwent mitral valve repair. In group 1 Mean left atrial diameter was 8.77 cms preoperatively and 6.0 cms postoperatively. In group 2, the mean values were 7.88 and 6.28 cms respectively. Left atrial diameters showed significant reduction of size after surgery in both groups. Postoperatively no differences were observed in ejection fraction or left ventricular end-diastolic diameter between the 2 groups. The postoperative decreases in pulmonary arterial pressure and the left atrial plication were not significantly different. Pulmonary artery pressure dropped significantly in both groups postoperatively (Table 1 and Table 2). Extubation times were also similar for both groups. The aortic cross clamp time was 59.18 +/- 8.78 minutes in group 1, and 49.0 +/- 8.07 minutes in group 2 ($p < 0.05$). Ten patients had left atrial compression symptoms and all had left atrial reduction procedure, and all ten of these patients had relived of those symptoms postoperatively. In group 1, 23 patients with LA size > 8 cms were in AF preoperatively of which 20 patients (86.95%) attained sinus rhythm. In group 2, 22 patients with LA size > 8 cms were in AF preoperatively of which 8 patients (36.30%) attained sinus rhythm ($p <0.05$). In group 1, 8 patients with LA size < 8 cms were in AF preoperatively of which 6 patients (75%) attained sinus rhythm where as in group 2, 11 patients with LA size <8 cms were in AF preoperatively of which 6 patients (63.30%) attained sinus rhythm ($p <0.05$). In group 1, of 30 patients with preoperatively LA size> 8 cms, 25 patients (83.33%) attained LA size <6.5 cms and of 7 patients with preoperative LA size <8 cms, 6 patients (85.71%) attained LA size <6.5 cms. In group 2, 22 patients with preoperatively LA size > 8 cms, 8 patients attained LA size <6.5 cms ($p<0.05$) and of 24 patients with preoperative LA size <8 cms, 18 patients (75%) attained LA size <6.5 cms. In group-1, no patient had LA thrombus on follow-up and one patient had thromboembolism who was in AF at 6 months post-op. In group-2 patients one patient had LA thrombus at 6 months follow-up and one patient had thromboembolism at 9 months post-op. hospital stay duration was not significantly different in both groups. There was no immediate post-op mortality. In group-1 there was one mortality due to non cardiac cause and in group-2 there was one mortality due to valve thrombosis at 7 months post-op period. In the postoperative period, most of the patients were in NYHA functional class I. The mean duration of follow-up was 10.33 months.

Table-1 Echocardiography Data (pre and postoperative)			
Parameters	**Group 1**	**Group 2**	***p* Value**
LVEDD (cms)			
Preoperative	5.89 ± 0.81	5.98 ± 0.94	NS
Postoperative	5.31± 0.77	5.38 ± 0.91	NS
p value	NS	NS	
LVESD (cms)			
Preoperative	3.93 ± 0.74	4.06 ± 0.87	NS
Postoperative	3.65 ± 0.79	3.89 ± 0.99	NS
p value	NS	NS	
LVEF (%)			
Preoperative	52 ± 8.31	53.43 ± 8.88	NS
Postoperative	50.51 ± 7.58	48 .5 ± 8.84	NS
p value	NS	NS	
LA Diameter (cms)			
Preoperative	8.77 ± 1.62	7.88± 0.82	NS
Postoperative	6.05 ± 1.21	6.28 ± 1.14	NS
p value	< 0.05	< 0.05	
PAP (cms Hg)			
Preoperative	40 ± 9.9	39.9 ± 10.5	NS
Postoperative	27.9 ± 8.16	31.6 ± 7.47	NS
p value	< 0.05	< 0.05	

Table-2 Postoperative and follow-ups data. (in centimeters) Group-1(37), group-2(46), total-83

		Postoperative	3 months	6 months	9 months
LVEDD (cms)	Group-1	5.31± 0.77	4.99± 0.78	4.70± 0.82	4.23± 0.92
	Group-2	5.38 ± 0.91	5.08± 0.89	4.85± 0.62	4.51± 0.31
LVESD (cms)	Group-1	3.65± 0.79	3.38± 0.76	3.12 ±0.61	3.02 ±0.28
	Group-2	3.89± 0.99	3.67± 0.87	3.41± 0.59	3.15± 0.62
LVEF (%)	Group-1	50.51± 7.89	50.83 ±6.67	51.41± 5.71	52.33± 2.84
	Group-2	48.8± 8.84	49.02 ±7.20	50.38 ±3.85	50.12 ±5.72
LA size (cms)	Group-1	6.05± 1.21	5.39 ±1.37	4.82± 1.55	4.5± 0.84
	Group-2	6.28± 1.14	5.76 ±0.99	5.13± 0.74	4.7± 0.71
PAP (cms Hg)	Group-1	27.9 ± 8.16	26.70 5.9	21.35± 2.54	18.26 ±1.56
	Group-2	31.6 ± 7.47	32.21± 7.20	25.23± 5.62	20.79± 6.45

LA = Left atrial, LVEDD = left ventricular end-diastolic diameter, LVEF = left ventricular ejection fraction, LVESD = left ventricular end systolic Diameter, NS = not significant, PAP = pulmonary artery pressure

Discussion

Previous studies have suggested that the status of the left atrium is an important determinant of the natural history in patients with MVR[7]. Chronic AF usually accompanies mitral valve disease at the time of surgery, especially when the LA is enlarged, which is the main determinant factor in the appearance and maintenance of chronic AF[8, 9]. Left atrial size appears to be as important a predictor of outcome as LV function. A review of the literature reveals that most GLA cases are managed at the time of mitral valve surgery. All authors agree that the main indication for its surgical management is the presence of intracardiac or extra cardiac compressive symptoms from neighboring organs [2,3,10]. They claim that by reducing the left atrial size, the pressure effect is reduced with a favorable effect on the postoperative course. A second indication in our opinion is the presence of thrombus and a history of thromboembolic events. Left atrial volume plication can in theory prevent recurrent thrombosis by reducing intra-arterial stasis. However, these can be difficult to perceive if such patients are on Acenocoumarol (Acitrom) from the beginning. Furthermore, a large atrial size

increases thromboembolic risk and reduces the success rate of cardioversion[11,12]. Some authors claim that there is an indication for size plication of GLA even in asymptomatic patients [11,13,14, 15]. This opinion is based mainly on observations made following the maze procedure. An important factor in plication of left atrial diameter is the effect of the rheumatic process on the elastic fibers of the tissue. This process causes strain and loss of tone, thus the LA does not become smaller[16] when LA plication is not done. In our study left atrial size plication was seen in more in group-1. Beppu and colleagues[2,17] noted paradoxical movement of the left ventricular posterobasal wall due to atrial compression in their Echocardiographic studies on giant LA, and concluded that this would negatively affect hemodynamics. There are two important pathophysiological processes in patients with giant LA. The first is respiratory dysfunction due to compression of the left main bronchus and/or right middle or lower lobes of the lung and the second is excessive enlargement of the LA and compression of the left ventricular posterobasal wall as a result of hemodynamic dysfunction[2]. In our study 10 patients had LA compression symptoms, which got relived after LA plication. However, others have found no correlation between left atrial diameter and surgical results [18,19,20]. In our study, there was no difference in mortality in patients with or without plication. There were also no significant differences between the two groups in respect of the need for positive inotropic support, postoperative ejection fraction, and long-term functional capacity. These results agree with the findings of Plaschkes and colleagues[16]. Plication did not cause any complications, but it prolonged the cross clamp time. With regard to hemodynamic changes and plication of left atrial diameter, there were no differences between plicated and non-plicated patients when pre operative LA size was <8 cms. Thus, mitral valve replacement without plication, reduced left atrial diameter as much as mitral valve replacement with plication when pre operative LA size was <8 cms. There was differences between plicated and non-plicated patients when pre-op LA size was >8 cms. Although thromboembolism was not seen in our patients, anticoagulation was considered to be more important than plication. Most patients with a preoperative left atrial diameter > 8 cms did not achieve a left atrial diameter below 6.5 cms after mitral valve replacement without plication, whereas most patients with preoperative LA diameter < 8 cms achieved a LA diameter < 6.5 cms without plication. Most patients with a preoperative left atrial diameter above 8 cms did not achieve a sinus rhythm after mitral valve replacement without plication, whereas most patients with preoperative LA diameter < 8 cms achieved sinus rhythm without plication. There is no added advantage of left atrial plication if the left atrial diameter is below 8 cms.

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