Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/67ejq005

REDUCING THE SIZE OF LEFT ATRIUM LARGE LA DURING MIRAL VALVE SURGERY WITH OR WITH OUT MAZE PROCEDURE REDUCES ATRIAL FIBRILLATION.

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ABSTRACT

Background: Atrial fibrillation (AF) is a common arrhythmia that significantly impacts quality of life and increases the risk of stroke and heart failure. Chronic atrial fibrillation, in particular, is often associated with left atrial (LA) dilatation. LA enlargement induced by pressure and/or volume overload, and causes various associated factors with specifically to cardiovascular diseases. There is need of new advance technique which can be relatively simple and easy to utilised during mitral valve surgery

Methods: Between May 2021 and February 2023, 40 patients (15 males, 25 females; mean age 35±10 years; range 30 to 65) underwent mitral valve surgery with left atrial reduction by posterior wall plication. Neither bipolar nor unipolar catheter ablation therapy for chronic atrial fibrillation (AF) was performed in this study. We also did not include patients in this study who had undergone radiofrequency ablation therapy for chronic AF. We include left atrial size more than 5 cm(range 5- 8 cm) and reduces 4cm to 4.5 cm

Results: At discharge, 31 patients (77.5%) were in sinus rhythm. During follow-up After 6 Months, sinus rhythm was restored in 28 patients (70%). two patient were died (5). 10 patients came for follow up with AF.Left atrium diameter was significantly reduced from 6.5±1.4 cm preoperatively to 4.6±0.5 cm at six months after surgery.

Conclusion: On the basis of our findings we can conclude that left atrial size reduction is simple, takes less time, and is also effective in maintaining sinus rhythm without adding any additional mortality or morbidity compared to mitral valve surgery alone.

Keywords: atrial fibrillation, left atrial dilatation, rheumatic heart disease

Introduction

The left atrium (LA) is an asymmetrical cavity. The walls of the left atrium can be described as superior (roof), posterior (inferoposterior), left lateral, septal, anterior and it is relatively smooth, whereas the appendage is rough with pectinate muscles. The walls are composed of overlapping layers of myocardial fibers with varying thickness; the circular fibers run parallel; the longitudinal fibers perpendicular and the oblique fibers arranged between the two axes to the atrioventricular valve plane [1]. LA enlargement is usually induced by pressure and/or volume overload, and various factors and cardiovascular diseases are associated with LA size [2].

Rheumatic heart disease is associated with mitral stenosis, mitral regurgitation or mixed lesion. When the disease progresses with time, left atrium is getting enlarge in size, concomitant atrial fibrillation would be responsible for the gross LA enlargement [3] as associated with stretched fibres. So keep view of above insights, it was endeavour to evaluate the specific reason for the treatment as well as need to be readdress the key aspect to resolve the issue in nearer future.

Material And Methods

Forty patients (25 females, 15males; mean age 35±10 years; range 30 to 65 years) who underwent elective MV replacement along with a LA volume reduction operation in our clinic between May 2021 and february 2023 were enrolled in this study. Neither bipolar nor unipolar catheter ablation therapy for chronic AF was performed in this study. We also did not include patients who had undergone radiofrequency ablation therapy for chronic AF.

The etiology of the MV disease was rheumatic in 30 patients (75%) and degenerative in nine (25%). Nineteen (47.5%) of the patients had mitral stenosis, 6 (15%) had mitral insufficiency, and 15 (37.5%) had mitral insufficiency and stenosis. All the patients were in chronic AF except one who was in sinus rhythm with paroxysmal atrial tachycardia. A total of 10 patients (25%) were in New York Heart Association (NYHA) class II, 19 (47.5%) were in class III, and 11 (27.5%) were in class IV.

The echocardiographic imaging was performed in each patient pre- and postoperatively at six days and six months after surgery, during which MV function and LA diameters were evaluated. The echocardiographic data obtained in each patient was the anterior-posterior diameter in the parasternal axis view. Preoperative transesophageal echocardiography (TEE) was done in all patients in order to assess the MV reparability, except in one patient who did not tolerate it due to orthopnea. On the other hand, all of the patients underwent intraoperative TEE. No reoperation was performed for bleeding, pericardial tamponade, or valvular issues.

Surgical technique

After the classical left atriotomy, we occluded the LAA and plicated the inferior (or posterior) wall of the left atrium. Following atriotomy along the interatrial groove, para-annular plication parallel to the posterior mitral annulus of approximately 10-20 mm was performed (**Figure 1**). The posteroinferior wall of the left atrium between the ostia of inferior pulmonary veins and the posterior mitral annulus were plicated in a semilunar fashion. In the first stage, the LAA was occluded with continuous 4/0 prolene sutures. In the second stage, with the same suture, the LA posterior wall was plicated with stay-sutures at a distance 20-30 mm from each other, 15-20 mm from the ostia, and 10 mm from the annulus. Then a second row of continuous sutures (over-and-over) was fashioned (**Figures 2a-2b**).

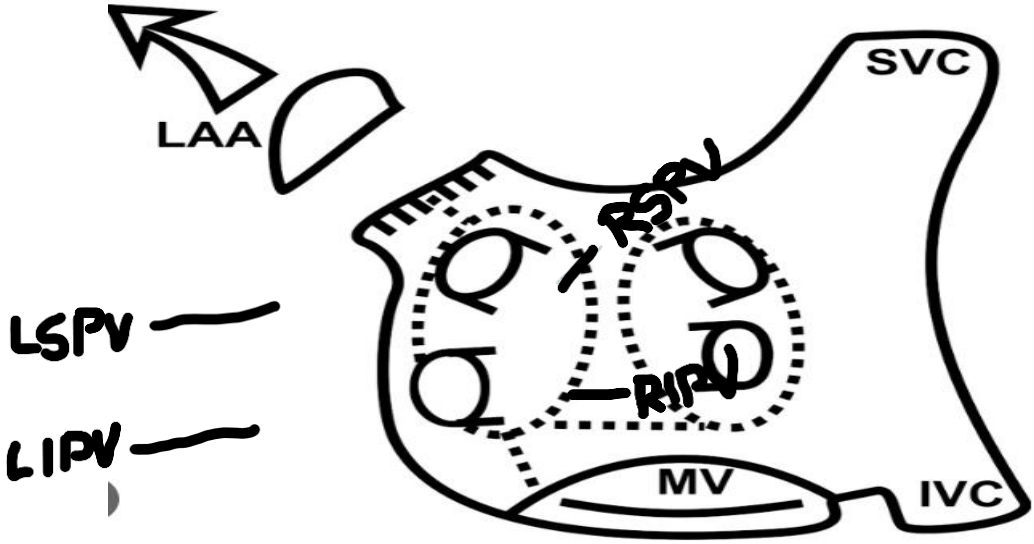

Figure 1: Schematic representation of surgical technique performed to reduce left atrial. MV: Mitral valve; LAA: Left atrial appendage; LSPV: Left superior pulmonary vein; LIPV: Left inferior pulmonary vein; RSPV: Right superior pulmonary vein; RIPV: Right inferior pulmonary vein.

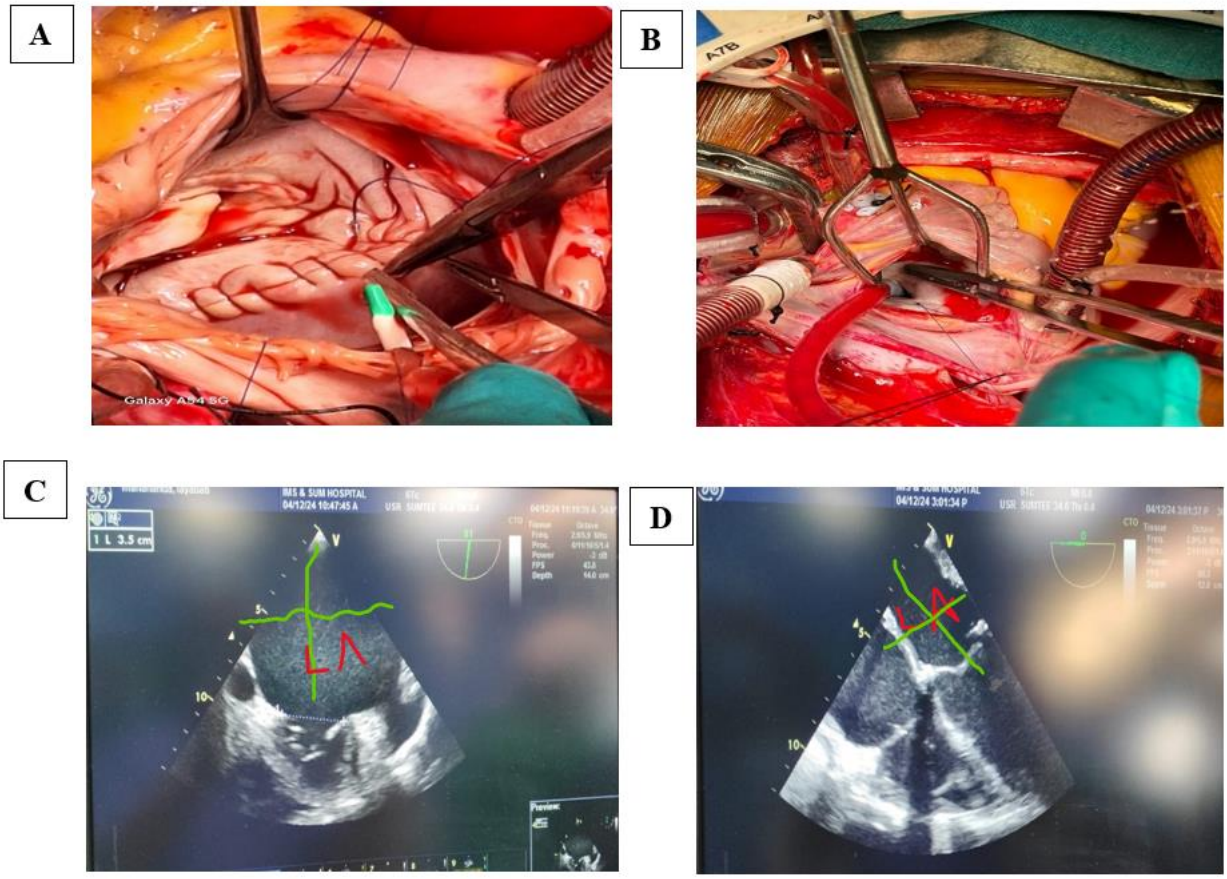

Figure 2: (a) A view of giant left atrial annular plication. (b) Lateral wall of giant left atrial plication. (c) preoperative echo finding. (d) Post procedure LA reduction view of left atrial reduction surgery**.**

Statistical analysis

Statistical analysis was performed using the commercially available statistics software SPSS 11.5 version for Windows 11. A p value of less than 0.05 was considered to be statistically significant. All the quantitative data was expressed as mean ± standard deviation (SD), and categorical data as n (%)

unless specified otherwise. Paired samples t-tests were used to compare the pre and postoperative six-month values.

Results

There was two post operative mortality, and none of the patient's required re-intervention for bleeding. Twenty-eight patients had sinus rhythm after their operations, and one of them developed AF in the first hour after surgery. Although medical treatment was given, this patient remained in AF at the time of discharge. Except for temporary atrial premature systoles, there were no other arrhythmic problems observed. After 6 months 10 patients were found to AF.Antiarrhythmic treatments (amiodarone, calcium channel blocker, and beta blocker) were eliminated after six postoperative months. Oral anticoagulant treatment was continued in all the patients who had a mechanical MVR and/or had AF. Oral anticoagulant treatment of patients who had sinus rhythm and underwent mitral repair surgery was stopped at six months during the follow-up. In our follow-up, only one patient had a transient ischemic attack without any neurological sequela. Echocardiography of both pre operative and post operative ejection fraction improved significantly (p =0.034) (**Table 1-4)**

Table 1: Statical analysis between PEF, POEF, PLA and POLA

	MEAN	N	STD DEVIATION	EROR STD DEVIATION
	43.78	40	6.926	1.095
Pair P EF	45.73	40	6.000	.949
PO EF Pair PLA size	6.13	40	.617	.098
PO LA size	4.09	40	.701	.111

P EF: PREOP EF; PO EF: POST OP EF; P LA SIZE:PREOP LA SIZE; PO LA SIZE: POST OP LA SIZE.

Table 2: Paired sample corelation analysis

	N	CORALLATION	SIG
Pair PEF AND POEF	40	0.772	.000
Pair PLA SIZE AND POLA SIZE	40	-0.169	.296

Table 3: Paired sample test analysis

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PEF - POEF	-1.950	4.455	.704	-3.375	-.525	-2.769	39	.009
Pair 2	PLASIZE - POLASIZE	2.040	1.009	.160	1.717	2.363	12.782	39	.000

Table 4: Chi-Square Tests analysis

	Value	df	Asymp. Sig.(2-sided)
Pearson Chi-Square	32.929	20	0,34
Likelihood Ratio	29.179	20	0.84
Linear-by-Linear Association	0.781	1	0.377
N of Valid Cases	40		

The procedure that we used in our study is a simple technique and effectively reduces the LA size. We used this technique in 40 patients and 28 of them (70%) remained in sinus rhythm at discharge. Ten cases (25%) had AF postoperatively, although they were treated with pharmacological agents in the first postoperative days (**Figure 3**).

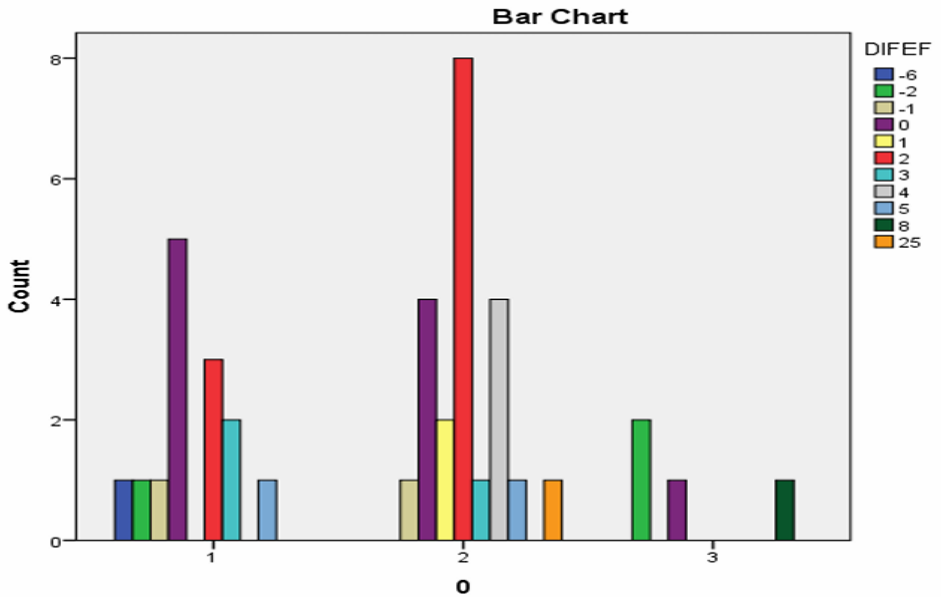

Figure 3: The bar graph represents the effectiveness of simple technique that reduces the LA size

Discussion

Giant left atrium (GLA) is closely related to rheumatic MV regurgitation or mixed mitral disease with predominant regurgitation. Giant left atrium is rare in patients with nonrheumatic MV regurgitation [4]. Most surgeons fix the MV and do little to an oversized left atrium. Others occlude the LA appendage [5-8]. According to Di Eusanio et al.[7] about 19% of patients requiring an operation for MV disease had GLA. Patients with GLA always have a long history of MV disease and atrial fibrillation, and very often they present with hemodynamic and/or respiratory complications as well as the formation of atrial thrombus.[7,9-11]Chronic AF usually accompanies MV disease at the time of surgery, especially when the LA is enlarged. This is the main determining factor in the occurrence and maintenance of chronic AF.[12] In many instances, MV surgery does not result in long term relief of AF. The restoration of atrial pump function and maintenance of an adequate heart rate during exercise are major advantages of treating AF in those cases with enlarged LA and MV disease. It is known that LA volume is one of the independent predictive factors for both occurrence and recurrence of AF, especially when the LA size is in excess of 45 mm.[12-14] After LA surgery, there was also a significant increase in vital capacity as well as an increased probability of regaining postoperative sinus rhythm.[4] Schrerer et al.[15] This was proportional to the LA size reduction (a from 6.5±1.4 cm preoperatively to 4.6±0.5 cm at six months after surgery.(P=0.165) and possible reduction of late thromboembolic complications due mainly to a significant reduction of the LA size as well as to the restoration of normal rhythm. However, this is difficult to understand when warfarin was in use.[16-18] In our follow-up, only one patient had a transient ischemic attack without any neurological sequela. In **table 1-4**, the echocardiography of both pre operative and post operative ejection fraction improved significantly (p =0.034) was collective determined and highlights the significance of our retrospective study.

Conclusion

It is well-known that most of the patients who undergo MV surgery also have LA enlargement and chronic AF, and this is closely related with LA dilatation. Also, stroke is the most feared complication of AF, and LAA obliteration could potentially be a highly valuable strategy for stroke prevention in

these patients. The procedure that we used in our study is a simple technique which effectively reduces LA. We believe that this technique is simple, time effective, and also successful in maintaining sinus rhythm without any additional mortality or morbidity compared to MV surgery alone.

Acknowledgement
We are grateful to the Dean, IMS, and SUM Hospital, Bhubaneswar for the extended research facility at SUM Hospital. The authors acknowledge Dr. Debasmita Dubey, MRL Lab, IMS and SUM hospital, Siksha 'O' Anusandhan University for providing necessary facilities and supports.

Author contributions
SKB, SM and DNS performed the study design, conceptualized data retrieval, wrote the original manuscript, and performed formal analysis, investigation, validated, reviewed, and edited the manuscript and supervision. All authors have read and agreed to the published version of the manuscript.

Data availability
The datasets generated during and/or analyzed are available from the corresponding author on reasonable request.

Declarations
Funding
Not applicable.

Ethics approval
The ethical approval was obtained from IMS and SUM Hospital with approval number: DMR/IMS/IEC-2021/054

Conflict of interest
The authors have declared no conflict of interest.

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