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EFFECT OF BALLOON MITRAL VALVOTOMY ON MITRAL ANNULAR PLANE SYSTOLIC EXCURSION IN ISOLATED RHEUMATIC MITRAL STENOSIS

Cardiology

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ABSTRACT

BACKGROUND Mitral annular plane systolic excursion assessed by M mode echo is a validated parameter for indicating LV longitudinal function. Reduced MAPSE is mostly related to fibrosis in the context of rheumatic mitral stenosis. Our study is aimed at observing the effect of balloon mitral valvotomy on MAPSE in patients with isolated severe mitral stenosis

METHODS A total of 113 patients with mitral stenosis were screened and 30 patients according to inclusion criteria in all age groups with isolated rheumatic mitral stenosis in whom BMV was suitable were enrolled in the study. MAPSE was measured by M-mode images. All the parameters were assessed before BMV and 2 weeks after procedure.

RESULTS Pre BMV, MAPSE was lower in patients with Subvalvular disease which was statistically significant. Paradoxically MAPSE was higher in patients with very severe stenosis and severe pulmonary hypertension but was not statistically significant. Post BMV, EF remained more or less the same but there was statistically significant improvement in MAPSE. Improvement in MAPSE was significantly less in group with subvalvular disease

CONCLUSION MAPSE can be useful in detecting early longitudinal dysfunction even in cases of preserved global LV function in severe mitral stenosis patients and shows a significant improvement after successful BMV

KEYWORDS

Mitral Annular Plane Systolic Excursion, Balloon Mitral Valvotomy, Mitral Stenosis

INTRODUCTION

Left ventricular (LV) longitudinal shortening plays an important role in cardiac pump function[1-2] and can be evaluated by measuring long axis, M-mode-derived, mitral annular plane systolic excursion (MAPSE). Although newer modalities like strain imaging are now available, MAPSE is measurable in the majority of patients quite independent of imaging quality. Thus use of MAPSE is still helpful to evaluate LV systolic function in case of poor sonographic windows.

MAPSE has been proposed as a well-established clinically useful echocardiographic parameter for the assessment of LV longitudinal function and correlates with global systolic function of the LV.[3] The average normal value of MAPSE derived from previous studies for the four annular regions (septal, anterior, lateral, and posterior) ranged between 12 and 15 mm[4] and a value of MAPSE 8 mm was associated with a depressed LV EF (50%) with a specificity of 82% and a sensitivity of 98%.

Left ventricular (LV) dysfunction has been described in mitral stenosis (MS)[5] which may be a due to change in interaction between right and left ventricles, myocardial fibrosis or a chronic decrease in preload. Even with normal ejection fraction (EF) (indicating preserved global left ventricular function), there can be impairment in long-axis function (measured by tissue Doppler echocardiography).Altered LV long-axis movement has been shown to be a sensitive indicator of early myocardial dysfunction. We sought to study MAPSE as a marker of LV function in rheumatic mitral stenosis and effect of BMV on this parameter.

MATERIALS AND METHODS

The study was done in a Rajiv Gandhi government general hospital Chennai from March 2019 to January 2020. A total of 113 patients with mitral stenosis were screened and 30 patients according to inclusion criteria in all age groups with isolated rheumatic mitral stenosis in whom BMV was suitable were enrolled in the study. All studies were obtained using Aloka ultra sonographic machine equipped with 3.5 MHz transducer. All echo-cardiographic measurements were taken as mean of 3 consecutive cycles. Modified Simpson's method was used to assess ejection fraction (after measuring end diastolic and end systolic volumes). Mitral valve area was calculated by planimetry (measurement obtained by direct tracing of the mitral orifice at the leaflet tip, on a parasternal short-axis MAPSE was measured by M-mode images obtained at the LV septal, lateral, anterior, and posterior borders of the mitral ring in the apical 2-chamber and 4-chamber views, and an average MAPSE value was calculated. Transmitral gradients were measured using Bernoulli principle from continuous wave Doppler recordings through mitral inflow. Suitability for BMV was assessed using Wilkins score and commissural calcium score. Systolic pulmonary artery pressures were derived from tricuspid regurgitant jet velocity. Right atrial pressure is calculated by estimating the inferior vena caval size and its variation with respiration. An experienced team performed BMV monitoring of conventional hemodynamic parameters. Balloon size was chosen according to height. Percutaneous BMV was regarded as successful if the mitral valve area post-percutaneous BMV was >1.5 cm^2 or the gain was >50% of baseline with no significant mitral regurgitation. All the parameters were assessed before BMV and 2 week after procedure.

INCLUSION CRITERIA	EXCLUSION CRITERIA
All age group	Diabetes
Both male & female	Hypertension
Rheumatic severe and very severe Mitral stenosis suitable for BMV	Chronic kidney disease
Normal LV function	Previous mitral valve procedures
	Non-rheumatic mitral valve disease
	Atrial Fibrillation
	More than mild MR
	Associated other valve lesions
	LV dysfunction
	RV Dysfunction

STATISTICAL ANALYSIS

Statistical analysis was performed with Graph Pad Prism version 5.0. Data was presented as mean ± SD for continuous variables. Qualitative variables, expressed as numbers and percentages were compared by the Chi-square test. Quantitative variables among study group and control group were compared by T test. A p value less than 0.05 was considered as significant

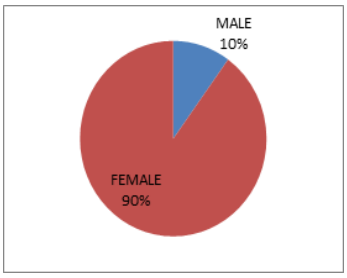
RESULTS

Out of the 30 patients, 27 were females and 3 were males. Mean age was 34.7 years. Mean height was 154+8.4cm. BMV done via femoral approach using appropriately sized Accura balloon. Mean MVOA 0.87+0.16.A total of 22 patients had tight mitral stenosis with MVOA less than 1cm^2.

Mean MAPSE was lower in patients with Subvalvular disease which was statistically significant. Paradoxically MAPSE was higher in patients with very severe stenosis and severe pulmonary hypertension

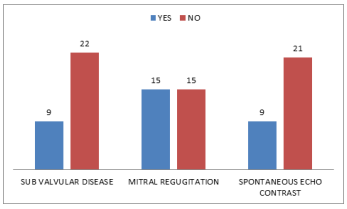
but was not statistically significant.

Graph 1 Sex Distribution Among Patients



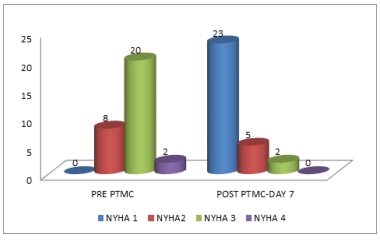
Out of the 30 patients, 27 were females and 3 were males

Graph 2 Co Factors Distributon



Out of 30 ,9 patients had spontaneous echo contrast in LA. Subvalvular disease was present in 9 patients.9 patients had trivial MR and 6 had mild MR

Graph 3 Functonal Class Comparison Between PRE BMV And Post BMV



Most of the patients were in NYHA Functional class III preoperatively and improved to functional class I at the end of 2 week post BMV

Table 1 Comparison Of Mapse In Different Sub Groups

SUB GROUP		MEAN MAPSE	P VALUE
SUB VALVULAR DISEASE	PRESENT	10.22±0.22	0.001
	ABSENT	11.24±0.16	
VERY SEVERE STENOSIS	PRESENT	11.00±0.17	0.495
	ABSENT	10.75±0.36	
SEVERE PHT	PRESENT	11.14±0.26	0.475
	ABSENT	10.87±0.19	

Table 2 Comparison Of Relavent Parameters Pre And Post BMV

PARAMETER	PRE BMV	POST BMV	P VALUE
AGE(years)	34.7±1.7	34.7±1.7	-
HEIGHT(cm)	154.2±8.40	154.2±8.40	-
MVOA(cm^2)	0.87±0.16	1.7±0.18	<0.00001
MPG(mmHg)	16.67±3.23	7.50±1.38	<0.00001
PASP(mmHg)	47.67±15.25	43.13±11.39	0.00010
TAPSE(mm)	18.30±1.30	19.03±1.06	0.003
MAPSE(mm)	10.93±0.86	11.83±2.01	0.0130
EF(%)	64.60±4.10	65.53±3.63	0.6903

Post BMV EF remained more or less the same but there was statistically significant improvement in MAPSE

Table 3 Post BMV Mapse In Subvalvur Disease Vs No Subvalvular Disease Group

Sub Group	Mean Mapse	P Value
Sub Valvular Disease	10.44±1.09	0.010
No Subvalvular Disease	12.43±0.13	

Improvement in MAPSE was less in group with subvalvular disease

DISCUSSION

In patients with MS, varying degrees of deterioration in LV function has been reported. The motion of posterobasal myocardium is restricted because of the extension of scarring process and inflammation in MS. The motion of interventricular septum is also impaired due to the right ventricular overload. Consequently, left ventricular systolic performance is reduced in these patients in the long run.[6]The study by Ozdemir et al.[7] showed that MS affects long axis left-ventricular performance. The myocardial velocities of the left ventricle indicating left-ventricular function were found to be significantly lower in patients with pure MS. EF is misleading when studying LV performance in patients with MS as a result of the elevated LV after load Our study showed lower pre BMV MAPSE in mitral stenosis patients who had normal ejection fraction. The higher prevalence of longitudinal LV dysfunction in our group may be due to the fact that we have taken only patients with severe MS. We observed pre BMV mean MAPSE was lower in patients with Subvalvular disease which was statistically significant. We also observed paradoxically higher values of MAPSE for patients with very severe stenosis and severe pulmonary hypertension but was not statistically significant.

Post BMV, EF did not show significant change with BMV (P=0.693), but there was a significant increase in MAPSE (P =0.013) suggesting improvement in longitudinal function. The improvement in MAPSE was significantly lower in subvalvular disease group (P=0.010) suggesting a higher prevalence of myocardial fibrosis. The improvement of LV long axis parameters may be due to mechanical effect of BMV. In a study by Lee and colleagues,[8]most patients with impaired LV ejection fraction showed improvement after mitral valvuloplasty. Reduced MAPSE is also related to poor outcomes in patients with various cardiovascular diseases. Some of the disadvantages of using MAPSE is that it is preload and after load dependent angle dependent ,inability to detect regional myocardial abnormalities, variation due to cardiac size (especially in children) Influenced by mobile apex (in case of moderate/large pericardial effusion)

Despite the availability of refined echocardiographic technologies, MAPSE measurement is still helpful to evaluate LV systolic function during daily routine echocardiography in case of poor sonographic windows as this measurement demands very little of image quality on account of the high echogenicity in the atrioventricular annulus

CONCLUSION

MAPSE, reflecting longitudinal myocardial shortening, is a simple and sensitive echocardiographic parameter for assessing global longitudinal LV wall function. MAPSE can be useful in detecting early longitudinal dysfunction even in cases of preserved global LV function in severe mitral stenosis patients and shows a significant improvement after successful BMV.

LIMITATIONS

Our study has a small sample size. Large scale studies are required to validate our findings. We have not measured other parameters of LV longitudinal function. Even though we have carefully selected the patient group without conventional cardiovascular risk factors, we have not done coronary angiogram to rule out CAD.A longer follow up would have given a better to assess the improvement in longitudinal function.

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