

The Echocardiographic Assessment of Left Atrial and Right Ventricular Function Before and After Percutaneous Balloon Mitral Valvuloplasty: An Observational Study

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Abstract

Background: Rheumatic mitral stenosis causes progressive impairment of left atrial (LA) and right ventricular (RV) function due to chronic pressure overload. Percutaneous balloon mitral valvuloplasty (PBMV) relieves mitral obstruction and may lead to early improvement in cardiac chamber function. This study evaluated echocardiographic changes in LA and RV function before and after PBMV. The study aimed to assess left atrial and right ventricular function in patients with severe mitral stenosis and to evaluate the improvement in their function following percutaneous balloon mitral valvuloplasty. **Material and Methods:** A hospital-based prospective observational study was conducted in the Department of Cardiology, I.P.G.M.E. & R. and S.S.K.M. Hospital over 18 months following Institutional Ethics Committee approval. The study included 57 in patients with severe rheumatic mitral stenosis (RMS) undergoing successful percutaneous balloon mitral valvuloplasty (BMV), selected according to predefined inclusion and exclusion criteria. **Results:** Among 57 patients, mean age was 43.39 ± 9.60 years, with 71.9% females. Baseline MVA was 0.94 ± 0.10 cm² and RVGLS $-11.48 \pm 1.90\%$. After BMV, MVA increased and RVGLS improved significantly (both $p < 0.001$). At 3 months, RVGLS reached $-18.27 \pm 2.04\%$, while baseline RVGLS independently predicted improvement ($p = 0.034$). **Conclusion:** PBMV produces favorable early changes in both LA and RV function in patients with mitral stenosis. Echocardiographic assessment provides a useful non-invasive method for detecting these functional changes and may improve understanding of cardiac reverse remodeling following successful mitral valve intervention.

Keywords: Mitral stenosis; Percutaneous balloon mitral valvuloplasty; Left atrial function; Right ventricular function; Echocardiography.

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INTRODUCTION

Rheumatic heart disease (RHD) remains a major cause of cardiovascular morbidity and mortality worldwide, particularly in developing countries. It develops as a consequence of acute rheumatic fever following inadequately treated Group A streptococcal infection. Approximately 40 million people are affected globally, with India contributing substantially to this burden. Despite declining incidence in recent decades, rheumatic valvular disease continues to affect socioeconomically disadvantaged populations and remains an important public health concern in India.^[1-4] Mitral stenosis (MS) is the most common valvular manifestation of chronic RHD and often presents at a younger age in the Indian population. Rheumatic MS is characterized by commissural fusion, leaflet thickening, calcification, and subvalvular fibrosis, resulting in progressive narrowing of the mitral valve orifice. The

consequent obstruction to left ventricular inflow causes elevation of left atrial pressure, which is transmitted to the pulmonary circulation and may ultimately lead to pulmonary hypertension and pulmonary vascular remodelling.^[5-7] Chronic pressure overload in MS results in progressive left atrial enlargement, fibrosis, reduced compliance, and impaired mechanical function.

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Left atrial enlargement is clinically important because it is associated with atrial fibrillation, thromboembolism, worsening symptoms, and adverse cardiovascular outcomes. Persistent pulmonary hypertension also increases right ventricular afterload, leading to right ventricular hypertrophy, dilatation, altered geometry, and eventually systolic dysfunction. Right ventricular dysfunction is an important determinant of functional limitation and prognosis in advanced MS.^[8–10] Transthoracic echocardiography remains the primary modality for assessment and follow-up of rheumatic MS. Conventional parameters such as mitral valve area, mean mitral valve gradient, pulmonary artery systolic pressure, TAPSE, FAC, RV S' velocity, and RIMP provide valuable information regarding valvular and right ventricular function. However, these measures may fail to identify subtle or early myocardial dysfunction. Speckle-tracking echocardiography permits quantitative assessment of myocardial deformation, and right ventricular global longitudinal strain (RVGLS) has emerged as a sensitive marker for detecting subclinical RV dysfunction.^[11–13] Percutaneous balloon mitral valvuloplasty (BMV), introduced by Inoue and colleagues, is an established treatment for symptomatic severe rheumatic MS with suitable valve morphology. By relieving commissural fusion and increasing mitral valve area, BMV produces rapid haemodynamic improvement, including reduction in left atrial and pulmonary pressures. Improvement in RV function may subsequently occur following reduction of right ventricular afterload.^[14] The study aimed to assess left atrial and right ventricular function in patients with severe mitral stenosis and to evaluate the improvement in their function following percutaneous balloon mitral valvuloplasty.

MATERIALS AND METHODS

Study design: Hospital-based, prospective observational study.

Place of study: Department of Cardiology, I.P.G.M.E. & R. and S.S.K.M. Hospital.

Study period: 18 Months (after approval from Institutional Ethics Committee)

Study population: Inpatients admitted in Cardiology department with Severe Mitral Stenosis after taking inclusion and exclusion criteria into consideration.

Sample size: A total of 57 Patients with severe rheumatic mitral stenosis (RMS) undergoing successful percutaneous balloon mitral valvuloplasty (BMV).

Inclusion Criteria:

- Patients were undergoing percutaneous mitral balloon valvuloplasty due to severe Mitral Stenosis
- Patients in sinus rhythm
- All the patients were in New York Heart class II -III
- Ready to give informed consent
- Absence of concomitant cardiovascular disease requiring surgical correction.

Exclusion Criteria:

- Concomitant Aortic valve disease
- Coronary Artery Disease and any other structural heart diseases

- COPD, Primary Pulmonary Arterial Hypertension
- Atrial Fibrillation
- Moderate to Severe Mitral Regurgitation after BMV
- Any contraindication of BMV

Study Variable:

- LA Volume Index (LAVI)
- Mitral Valve Area (MVA)
- Mean Mitral Valve Pressure Gradient
- Pulmonary Artery Systolic Pressure (PASP)
- RV Global Longitudinal Strain (RVGLS)

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS version 27.0 and GraphPad Prism version 5. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequency and percentage. Independent and paired t-tests were used for comparison of numerical variables. One-way ANOVA was applied for comparison among multiple groups. Categorical variables were analyzed using Chi-square test or Fisher's exact test. Non-parametric data were analyzed using Mann–Whitney U test. Pearson correlation analysis was used to assess relationships between variables, and logistic regression was performed to identify associated risk factors. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

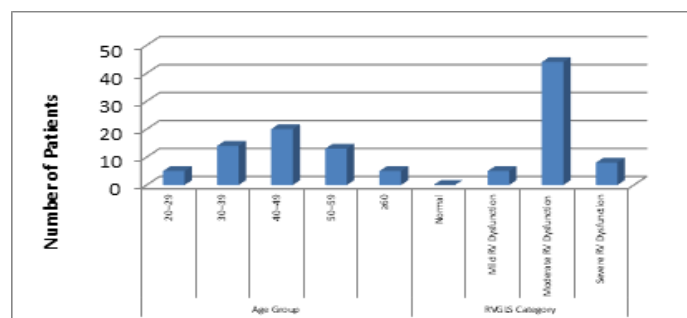


Figure 1: Distribution of Study Participants According to Age Group and Baseline RVGLS Category

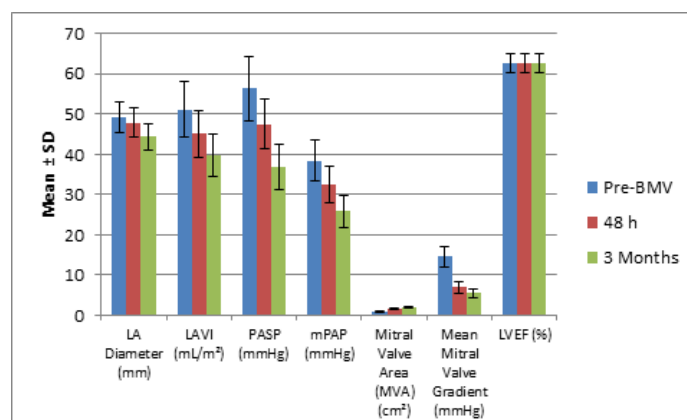


Figure 2: Comparison of Echocardiographic Parameters at Baseline, 48 Hours, and 3 Months After BMV

Baseline Demographic and Clinical Characteristics of Study Participants.

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants

		Value
Age (years)	Mean $\pm$ SD	43.39 $\pm$ 9.60
Sex, n (%)	Female	41 (71.9%)
	Male	16 (28.1%)
NYHA Functional Class, n (%)	Class II	29 (50.9%)
	Class III	28 (49.1%)
Wilkins Score	Mean $\pm$ SD	8.61 $\pm$ 0.90

Table 2: Distribution of Study Participants According to Age Group and Baseline RVGLS Category

		Frequency, n (%)
Age Group (Years)	20–29	5 (8.8%)
	30–39	14 (24.6%)
	40–49	20 (35.1%)
	50–59	13 (22.8%)
	≥ 60	5 (8.8%)
RVGLS Category	Normal	0 (0.0%)
	Mild RV Dysfunction	5 (8.8%)
	Moderate RV Dysfunction	44 (77.2%)
	Severe RV Dysfunction	8 (14.0%)

Table 3: Baseline Echocardiographic and Catheterization Parameters of Study Participants

	Mean $\pm$ SD
LA Diameter (mm)	49.25 $\pm$ 3.78
LA Volume Index (LAVI) (mL/m ²)	51.10 $\pm$ 6.86
Left Ventricular Ejection Fraction (LVEF) (%)	62.65 $\pm$ 2.45
Mitral Valve Area (MVA) (cm ²)	0.94 $\pm$ 0.10
Mean Mitral Valve Gradient (mmHg)	14.57 $\pm$ 2.59
Pulmonary Artery Systolic Pressure (PASP) (mmHg)	56.32 $\pm$ 8.07
Mean Pulmonary Artery Pressure (mmHg)	38.40 $\pm$ 5.05
Tricuspid Annular Plane Systolic Excursion (TAPSE) (mm)	19.46 $\pm$ 1.47
Fractional Area Change (FAC) (%)	39.44 $\pm$ 3.99
RV S' Velocity (cm/s)	10.12 $\pm$ 1.07
Right Ventricular Myocardial Performance Index (RIMP/Tei Index)	0.57 $\pm$ 0.07
RV Basal Dimension (mm)	37.94 $\pm$ 3.20
RV Wall Thickness (mm)	5.88 $\pm$ 1.05
RV Global Longitudinal Strain (RVGLS) (%)	–11.48 $\pm$ 1.90
Left Atrial Pressure (mmHg)	27.69 $\pm$ 5.76
Left Ventricular End-Diastolic Pressure (LVEDP) (mmHg)	10.65 $\pm$ 3.01

Table 4: Comparison of Echocardiographic and Catheterization Parameters Before and 48 Hours After BMV

	Pre-BMV Mean $\pm$ SD	48 h Post-BMV Mean $\pm$ SD	Mean Difference	95% CI	p-value
Mitral Valve Area (MVA) (cm ²)	0.94 $\pm$ 0.10	1.79 $\pm$ 0.13	0.85	0.82 to 0.89	<0.001
Mean Mitral Valve Gradient (mmHg)	14.57 $\pm$ 2.59	6.97 $\pm$ 1.47	–7.60	–8.11 to –7.09	<0.001
PASP (mmHg)	56.32 $\pm$ 8.07	47.55 $\pm$ 6.24	–8.77	–9.87 to –7.67	<0.001
mPAP (mmHg)	38.40 $\pm$ 5.05	32.48 $\pm$ 4.50	–5.92	–6.53 to –5.31	<0.001
LA Diameter (mm)	49.25 $\pm$ 3.78	47.82 $\pm$ 3.64	–1.43	–1.63 to –1.23	<0.001
LAVI (mL/m ²)	51.10 $\pm$ 6.86	45.13 $\pm$ 5.85	–5.97	–6.57 to –5.37	<0.001
LVEF (%)	62.65 $\pm$ 2.45	62.61 $\pm$ 2.34	–0.04	–0.21 to 0.14	0.687
TAPSE (mm)	19.46 $\pm$ 1.47	20.25 $\pm$ 1.63	0.79	0.55 to 1.03	<0.001
FAC (%)	39.44 $\pm$ 3.99	43.75 $\pm$ 3.99	4.3	3.75 to 4.86	<0.001
RV S' (cm/s)	10.12 $\pm$ 1.07	11.05 $\pm$ 1.12	0.93	0.78 to 1.08	<0.001
RIMP (Tei Index)	0.57 $\pm$ 0.07	0.52 $\pm$ 0.06	–0.05	–0.06 to –0.04	<0.001
RV Dimension (mm)	37.94 $\pm$ 3.20	36.27 $\pm$ 3.07	–1.67	–2.02 to –1.32	<0.001
RV Wall Thickness (mm)	5.88 $\pm$ 1.05	5.88 $\pm$ 1.05	0	–0.01 to 0.01	0.958
RVGLS (%)	–11.48 $\pm$ 1.90	–14.62 $\pm$ 1.98	–3.14	–3.44 to –2.84	<0.001
Left Atrial Pressure (mmHg)	27.69 $\pm$ 5.76	18.21 $\pm$ 3.87	–9.48	–10.62 to –8.34	<0.001
LVEDP (mmHg)	10.65 $\pm$ 3.01	10.41 $\pm$ 2.89	–0.24	–0.61 to 0.13	0.198

Table 5: Comparison of Echocardiographic Parameters at Baseline, 48 Hours, and 3 Months After BMV

	Pre-BMV Mean $\pm$ SD	48 h Mean $\pm$ SD	3 Months Mean $\pm$ SD	Overall p-value
LA Diameter (mm)	49.25 $\pm$ 3.78	47.82 $\pm$ 3.64	44.36 $\pm$ 3.21	<0.001
LAVI (mL/m ²)	51.10 $\pm$ 6.86	45.13 $\pm$ 5.85	39.74 $\pm$ 5.12	<0.001
PASP (mmHg)	56.32 $\pm$ 8.07	47.55 $\pm$ 6.24	36.84 $\pm$ 5.56	<0.001
mPAP (mmHg)	38.40 $\pm$ 5.05	32.48 $\pm$ 4.50	25.86 $\pm$ 3.92	<0.001
Mitral Valve Area (MVA) (cm ²)	0.94 $\pm$ 0.10	1.79 $\pm$ 0.13	1.88 $\pm$ 0.14	<0.001
Mean Mitral Valve Gradient (mmHg)	14.57 $\pm$ 2.59	6.97 $\pm$ 1.47	5.50 $\pm$ 1.18	<0.001

LVEF (%)	62.65 ± 2.45	62.61 ± 2.34	62.72 ± 2.34	0.289
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Table 6: Multivariable Regression Analysis of Predictors of RVGLS Improvement Following BMV

Predictor	β Coefficient	95% CI	p-value
Age	0.033	-0.014 to 0.081	0.166
Wilkins Score	0.208	-0.304 to 0.720	0.42
Baseline MVA	-0.543	-5.053 to 3.966	0.81
Baseline PASP	0.028	-0.029 to 0.085	0.324
Baseline mPAP	0.031	-0.061 to 0.123	0.5
Baseline LA Pressure	0.044	-0.036 to 0.124	0.272
Baseline LAVI	0.052	-0.014 to 0.119	0.119
Baseline RVGLS	0.254	0.019 to 0.488	0.034

Among the 57 study participants, the mean age was 43.39 ± 9.60 years. Female patients constituted the majority, with 41 cases (71.9%), while 16 cases (28.1%) were male. Regarding NYHA functional status, 29 patients (50.9%) were in Class II and 28 patients (49.1%) were in Class III. The mean Wilkins score was 8.61 ± 0.90 .

Interpretation: The study comprised predominantly younger females, with substantial symptomatic burden and generally favourable mitral valve morphology for BMV.

Distribution of Study Participants According to Age Group and Baseline RVGLS Category

Results: The highest proportion of participants belonged to the 40–49 years age group, comprising 20 cases (35.1%), followed by the 30–39 years group with 14 cases (24.6%). The 50–59 years group included 13 cases (22.8%), while both the 20–29 years and ≥ 60 years groups included 5 cases (8.8%) each. Regarding baseline RVGLS, none of the participants had normal RV function. 5 patients (8.8%) had mild RV dysfunction, 44 (77.2%) had moderate RV dysfunction, and 8 (14.0%) had severe RV dysfunction.

Interpretation: Middle-aged patients predominated, with moderate RV dysfunction being common, indicating significant right ventricular impairment in severe rheumatic mitral stenosis.

Baseline Echocardiographic and Catheterization Parameters of Study Participants

Results: The mean LA diameter was 49.25 ± 3.78 mm and mean LAVI was 51.10 ± 6.86 mL/m². The mean LVEF was $62.65 \pm 2.45\%$. Mean MVA was 0.94 ± 0.10 cm², while the mean mitral valve gradient was 14.57 ± 2.59 mmHg. Mean PASP and mPAP were 56.32 ± 8.07 mmHg and 38.40 ± 5.05 mmHg, respectively. Baseline RV functional parameters showed a mean TAPSE of 19.46 ± 1.47 mm, FAC of $39.44 \pm 3.99\%$, RV S' velocity of 10.12 ± 1.07 cm/s, and RIMP of 0.57 ± 0.07 . The mean RV basal dimension was 37.94 ± 3.20 mm, RV wall thickness was 5.88 ± 1.05 mm, and RVGLS was $-11.48 \pm 1.90\%$. Mean LA pressure was 27.69 ± 5.76 mmHg, while LVEDP was 10.65 ± 3.01 mmHg.

Interpretation: Severe mitral stenosis showed left atrial enlargement, elevated pulmonary pressures, preserved LV function, and impaired RV function due to chronic pressure overload.

Comparison of Echocardiographic and Catheterization Parameters Before and 48 Hours After BMV

Results: Following BMV, MVA increased significantly from 0.94 ± 0.10 to 1.79 ± 0.13 cm², while mean mitral valve gradient decreased from 14.57 ± 2.59 to 6.97 ± 1.47 mmHg

(both $p < 0.001$). PASP and mPAP decreased significantly from 56.32 ± 8.07 to 47.55 ± 6.24 mmHg and 38.40 ± 5.05 to 32.48 ± 4.50 mmHg, respectively (both $p < 0.001$). LA diameter and LAVI also decreased significantly (both $p < 0.001$). LVEF remained unchanged ($p = 0.687$). RV function improved significantly, with increases in TAPSE, FAC, and RV S' velocity and a reduction in RIMP (all $p < 0.001$). RV dimension decreased significantly, whereas RV wall thickness showed no significant change ($p = 0.958$). RVGLS improved from $-11.48 \pm 1.90\%$ to $-14.62 \pm 1.98\%$ ($p < 0.001$). LA pressure decreased significantly from 27.69 ± 5.76 to 18.21 ± 3.87 mmHg ($p < 0.001$), while LVEDP remained unchanged ($p = 0.198$).

Interpretation: Successful BMV rapidly improved mitral haemodynamics, pulmonary pressures, LA loading, and RV function, with early RVGLS recovery while LV systolic function remained preserved.

Comparison of Echocardiographic Parameters at Baseline, 48 Hours, and 3 Months After BMV

Results: A progressive improvement in echocardiographic parameters was observed during follow-up. LA diameter decreased from 49.25 ± 3.78 mm at baseline to 47.82 ± 3.64 mm at 48 hours and 44.36 ± 3.21 mm at 3 months ($p < 0.001$). LAVI similarly decreased from 51.10 ± 6.86 to 45.13 ± 5.85 and 39.74 ± 5.12 mL/m², respectively ($p < 0.001$). PASP declined from 56.32 ± 8.07 to 47.55 ± 6.24 and 36.84 ± 5.56 mmHg, while mPAP decreased from 38.40 ± 5.05 to 32.48 ± 4.50 and 25.86 ± 3.92 mmHg (both $p < 0.001$). MVA increased progressively from 0.94 ± 0.10 to 1.79 ± 0.13 and 1.88 ± 0.14 cm² ($p < 0.001$), accompanied by a reduction in mean mitral valve gradient from 14.57 ± 2.59 to 6.97 ± 1.47 and 5.50 ± 1.18 mmHg ($p < 0.001$). LVEF remained stable across the three time points ($p = 0.289$).

Interpretation: Sustained improvement in mitral haemodynamics, pulmonary pressures, and LA remodelling indicated progressive reverse remodelling, while LVEF remained preserved during follow-up.

Multivariable Regression Analysis of Predictors of RVGLS Improvement Following BMV

Results: On multivariable regression analysis, age was not significantly associated with RVGLS improvement ($\beta = 0.033$, $p = 0.166$). Wilkins score ($\beta = 0.208$, $p = 0.420$), baseline MVA ($\beta = -0.543$, $p = 0.810$), baseline PASP ($\beta = 0.028$, $p = 0.324$), baseline mPAP ($\beta = 0.031$, $p = 0.500$), baseline LA pressure ($\beta = 0.044$, $p = 0.272$), and baseline LAVI ($\beta = 0.052$, $p = 0.119$) were also not significant predictors. However, baseline RVGLS was significantly associated with subsequent RVGLS improvement ($\beta = 0.254$, 95% CI: 0.019–0.488, $p = 0.034$).

Interpretation: Baseline RVGLS independently predicted post-

BMV RVGLS improvement, suggesting myocardial deformation is more informative than other clinical or haemodynamic parameters.

DISCUSSION

The present study demonstrated that patients with severe rheumatic mitral stenosis were predominantly young to middle-aged women, with a mean age of 43.39 ± 9.60 years, and most patients had NYHA Class II–III symptoms, reflecting the substantial functional limitation associated with advanced mitral stenosis. The baseline echocardiographic findings confirmed severe haemodynamically significant mitral obstruction, with a mean MVA of 0.94 ± 0.10 cm², elevated mean mitral valve gradient, increased pulmonary artery pressures, enlarged LA dimensions and raised LA pressure. Following BMV, there was a marked increase in MVA from 0.94 ± 0.10 to 1.79 ± 0.13 cm² and a substantial reduction in mean mitral valve gradient, PASP, mPAP and LA pressure, confirming the immediate haemodynamic effectiveness of the procedure. Setouhi et al. similarly demonstrated significant improvement in left atrial functional parameters immediately after BMV, with continued improvement during 6- and 12-month follow-up, supporting the concept of progressive left atrial reverse remodelling after relief of mitral obstruction.^[15] In the present study, LA diameter and LAVI decreased significantly within 48 hours and showed further reduction at 3 months, suggesting that reduction in chronic LA pressure overload produces both early and sustained structural remodelling. Samrat et al. also reported improvement in left atrial reservoir function and reduction in LA volume following PBMV, highlighting the importance of assessing atrial recovery beyond conventional chamber dimensions.^[16] The progressive reduction in PASP and mPAP observed in the present study indicates significant unloading of the pulmonary circulation following correction of mitral obstruction. This reduction in RV afterload provides an important physiological explanation for the improvement in RV function observed after BMV. Praveen Kumar Reddy Sakkuru et al. reported significant improvement in RV global longitudinal strain after PBMV, with changes evident at 48 hours and persisting during follow-up, and concluded that RV dysfunction in mitral stenosis is predominantly related to increased RV afterload.^[17] Consistent with these observations, the present study demonstrated significant improvement in TAPSE, FAC and RV S' velocity, accompanied by a reduction in RIMP and RV basal dimension within 48 hours. More importantly, RVGLS improved significantly from $-11.48 \pm 1.90\%$ to $-14.62 \pm 1.98\%$ at 48 hours and further to $-18.27 \pm 2.04\%$ at 3 months, indicating rapid as well as sustained recovery of RV myocardial deformation. Agarwal et al. demonstrated similar improvement in RV and LV deformation following PBMV and showed that the reduction in LA pressure was correlated with improvement in RVGLS, supporting the haemodynamic mechanism underlying RV recovery.^[18] Likewise, Sakkuru et al. found that conventional RV parameters and RV strain improved after PBMV, emphasizing that speckle-tracking

echocardiography can detect functional improvement that may not be fully appreciated by conventional assessment alone [19]. The absence of significant change in RV wall thickness over the short-term period is understandable because structural myocardial remodelling is expected to occur more gradually than haemodynamic and functional recovery. Similarly, LVEF remained essentially unchanged throughout follow-up, suggesting that the principal effects of BMV were related to relief of mitral obstruction, reduction in LA pressure and pulmonary vascular loading rather than improvement in global LV systolic function. The multivariable regression analysis further demonstrated that baseline RVGLS was the only significant independent predictor of subsequent RVGLS improvement, whereas age, Wilkins score, baseline MVA, PASP, mPAP, LA pressure and LAVI were not significant predictors. Reddy et al. previously demonstrated that RV strain is sensitive to haemodynamic alterations in severe mitral stenosis and improves following reduction in RV afterload, supporting the prognostic and mechanistic relevance of baseline myocardial deformation assessment.^[20]

CONCLUSION

Successful percutaneous balloon mitral valvuloplasty resulted in significant improvement in mitral valve haemodynamics, left atrial dimensions, pulmonary pressures, and right ventricular function in patients with severe rheumatic mitral stenosis. Conventional RV parameters improved significantly, while RVGLS demonstrated marked early and sustained improvement, indicating its sensitivity for detecting subclinical and functional RV recovery. Progressive reduction in LA diameter, LAVI, PASP and mPAP at 3 months suggested ongoing reverse cardiac remodelling. LVEF remained preserved throughout follow-up. Baseline RVGLS was the only significant independent predictor of RVGLS improvement, highlighting its potential clinical value in assessing recovery after BMV.

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Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Watkins DA, Johnson CO, Colquhoun SM, Karthikeyan G, Beaton A, Bukhman G, et al. Global, regional, and national burden of rheumatic heart disease, 1990–2015. *N Engl J Med*. 2017;377(8):713–22.
2. Khadar SA, Velayudhan G, Manjuran RJ, Jayaprakash VL, Johns F. Prevention and Control of Rheumatic Fever in India—A Blue Print for Introduction of a Pragmatic Program with Limited Resources. *Indian Journal of Cardiovascular Disease in Women*. 2024 Sep 28;9(3):162–6.
3. Dixit J, Brar S, Prinja S. Burden of group A streptococcal pharyngitis, rheumatic fever, and rheumatic heart disease in India: a systematic review and meta-analysis. *Indian Journal of Pediatrics*. 2022 Jul;89(7):642–50.
4. Roth GA, Mensah GA, Johnson CO, Addolorato G, Ammirati E, Baddour LM, et al. Global burden of cardiovascular diseases and risk factors, 1990–2019. *J Am Coll Cardiol*. 2020;76(25):2982–

- 3021.
5. Negi PC, Sondhi S, Asotra S, Mahajan K, Mehta A. Current status of rheumatic heart disease in India. *Indian Heart J.* 2019;71(1):85-90.
6. Otto CM, Bonow RO. *Valvular Heart Disease: A Companion to Braunwald's Heart Disease Book*• Third Edition• 2009.
7. Zipes DP. *Braunwald's heart disease e-book: A textbook of cardiovascular medicine.* Elsevier Health Sciences; 2018 Jan 9.
8. Tsang TS, Barnes ME, Gersh BJ, Bailey KR, Seward JB. Left atrial volume as a morphophysiologic expression of left ventricular diastolic dysfunction and relation to cardiovascular risk burden. *The American journal of cardiology.* 2002 Dec 15;90(12):1284-9.
9. Voelkel NF, Quaife RA, Leinwand LA, Barst RJ, McGoon MD, Meldrum DR, Dupuis J, Long CS, Rubin LJ, Smart FW, Suzuki YJ. Right ventricular function and failure: report of a National Heart, Lung, and Blood Institute working group on cellular and molecular mechanisms of right heart failure. *Circulation.* 2006 Oct 24;114(17):1883-91.
10. Haddad F, Doyle R, Murphy DJ, Hunt SA. Right ventricular function in cardiovascular disease, part II: pathophysiology, clinical importance, and management of right ventricular failure. *Circulation.* 2008 Apr 1;117(13):1717-31.
11. Ghio S, Klersy C, Magrini G, D'Armini AM, Scelsi L, Raineri C, Pasotti M, Serio A, Campana C, Viganò M. Prognostic relevance of the echocardiographic assessment of right ventricular function in patients with idiopathic pulmonary arterial hypertension. *International journal of cardiology.* 2010 Apr 30;140(3):272-8.
12. Badano LP, Kolas TJ, Muraru D, Abraham TP, Aurigemma G, Edvardsen T, D'Hooge J, Donal E, Fraser AG, Marwick T, Mertens L. Standardization of left atrial, right ventricular, and right atrial deformation imaging using two-dimensional speckle tracking echocardiography: a consensus document of the EACVI/ASE/Industry Task Force to standardize deformation imaging. *European Heart Journal-Cardiovascular Imaging.* 2018 Jun 1;19(6):591-600.
13. Muraru D, Onciul S, Peluso D, Soriani N, Cucchini U, Aruta P, Romeo G, Cavalli G, Iliceto S, Badano LP. Sex-and method-specific reference values for right ventricular strain by 2-dimensional speckle-tracking echocardiography. *Circulation: Cardiovascular Imaging.* 2016 Feb;9(2):e003866.
14. Pai RG, Varadarajan P. Importance of concomitant functional mitral regurgitation on survival in severe aortic stenosis patients undergoing aortic valve replacement. *World Journal of Cardiology.* 2023 May 26;15(5):253.
15. Setouhi A, Boshra H, Askalany H, Farrag HM. Immediate, short-term, and long-term effects of balloon mitral valvuloplasty on the left atrial global longitudinal strain and its correlation to the outcomes in patients with severe rheumatic mitral stenosis. *The Egyptian Heart Journal.* 2023 Dec 1;75(1):98.
16. Sravan K Reddy N, Ranjan Shetty K, Sudhakar Rao M, Sree Madhurya Reddy M. Strain imaging to assess early effects of successful percutaneous balloon mitral valvotomy on left atrium mechanics. *The Egyptian Heart Journal.* 2019 Nov 21;71(1):25.
17. Sakkuru PK, Velam V, Durgaprasad R, Chanda N, Maddala RN, Yandrapu MN. Assessment of immediate effects of percutaneous balloon mitral valvuloplasty on right ventricular and pulmonary functions in severe rheumatic mitral stenosis patients using speckle tracking echocardiography and spirometry. *Journal of Cardiovascular and Thoracic Research.* 2020 Nov 24;12(4):280.
18. Mehta V, Chaudhari D, Mehra P, Mahajan S, Yusuf J, Gupta MD, Kathuria S, Dabla PK, Sukhija R, Mukhopadhyay S. Left atrial function by two-dimensional speckle tracking echocardiography in patients with severe rheumatic mitral stenosis and pulmonary hypertension. *Indian Heart Journal.* 2022 Jan 1;74(1):63-5.
19. Mosa EH, Abd Elkareem TA, Marghany Mhgoub KA, Abd Almagid AL. Right ventricular function outcomes of percutaneous balloon mitral valvuloplasty: a 3-dimensional echocardiography and 2-dimensional speckle tracking analysis. *European Heart Journal-Cardiovascular Imaging.* 2025 Jan;26(Supplement_1):jeae333-363.
20. Sharma P, Garg S, Malani SK. Left atrial strain predicts improvement in left atrial functions of severe rheumatic mitral stenoses undergoing successful percutaneous transmitral commissurotomy. *Echocardiography.* 2023 Jul;40(7):642-6.