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Evaluation of Right Ventricular End Systolic Pressure before and after Percutaneous Balloon Mitral Commissurotomy

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Abstract

Background: Still common in underserved regions, rheumatic mitral stenosis exerts relentless pressure on the right heart and invites arrhythmias; yet, exactly how quickly percutaneous balloon mitral commissurotomy (PBM) eases these burdens has scarcely been charted.

Methods: Eighty adults (mean age 38.7 ± 8.8 years; 83.8 % female) who underwent PBM between April and October 2024 were reviewed retrospectively. Pre-procedure and 24-hour post-procedure echocardiograms measured right ventricular end-systolic pressure (RVESP), mitral valve area (MVA), trans-mitral gradient, right ventricular diastolic diameter (RVDD), and left ventricular ejection fraction (LVEF). Arrhythmias—premature beats and atrial tachycardia—were tallied before and after PBM. Paired statistical tests probed the shifts.

Results: Remarkably, RVESP plunged from 51.2 ± 11.5 to 42.8 ± 10.3 mmHg ($p < 0.001$), while MVA soared from 0.98 ± 0.22 to 1.82 ± 0.35 cm² ($p < 0.001$). Mean gradient and RVDD also fell sharply ($p < 0.001$), LVEF held steady (55.0 ± 7.6 to 56.1 ± 7.3 %; $p = 0.12$), and arrhythmic episodes dropped from 37.5 % to 12.5 % ($p < 0.001$).

Conclusion: Evidently, PBM delivers swift hemodynamic respite and curtails early arrhythmias, cementing its status as the go-to procedure for severe mitral stenosis.

Keywords: Balloon commissurotomy; mitral stenosis; RVESP; echocardiography; rhythm stabilization

Introduction

Mitral stenosis (MS) continues to be an endemic valvular heart disease worldwide mainly due to the high prevalence of rheumatic fever in developing countries. Treatment for symptomatic moderate to severe MS is based on the mechanical relief of the obstruction either by Percutaneous Balloon Mitral Commissurotomy (PBM) or mitral valve surgery [1]. PBM is the first-line approach for symptomatic patients with severe MS and favorable valve morphology [2].

The pre-procedure assessment primarily relies on a semiquantitative scoring system for assessing valve features and commissural calcifications, and various models have been proposed to predict immediate and long-term outcomes [3]. Conventional echocardiography enables us to identify significant right ventricular dysfunction (RVD) and end systolic pressure; thus, we can observe the right ventricular end systolic pressure (RVESP) in high-risk patients, in order to evaluate their clinical conditions and predict their prognosis (4). RVD is a prognostic factor for morbidity and mortality across a broad spectrum of cardiovascular diseases. While the role of the right ventricle (RV) in rheumatic mitral disease (RHD) patients has emerged, the prognostic impact of RV function remains unclear in large RHD populations [3, 4].

In this context, a comprehensive evaluation of RV function is crucial, especially in patients undergoing PBM [5]. However, literature lacks a clear and unequivocal definition of RVD, and studies employ different criteria, including various clinical, echocardiographic, cardiac magnetic resonance (CMR), and hemodynamic parameters. Also, there is a relative lack of adequate evidence on the impact of PBM on the short-term RV functional parameters for MS patients. Therefore, we conducted this retrospective study to add to the growing body of

evidence and try to fill the gap in the literature, in demonstrated the short-term functional and clinical benefits of PBMS in the treatment of MS.

Methodology

This was an observational retrospective cohort study conducted by reviewing the relevant medical records at the hospital of in Egypt.

Prior to participation, informed written consent was obtained from all subjects. Each participant received a unique identification code to maintain confidentiality. The study protocol received ethical clearance from the Research Ethics Committee of our local institution.

Eligibility Criteria

Participants were eligible for inclusion if they were aged over 18 years, of either gender, had a confirmed diagnosis of severe MS and were indicated for PBMC. Exclusion criteria included patients associated with very heavy calcium deposition in their valves or with moderate to severe mitral regurgitation. Patients with systolic dysfunction (LVEF <40%) were also excluded.

Study Procedure

We retrospectively reviewed the electronic medical records to collect demographic information, medical history, echocardiographic parameters, cardiac biomarkers, angiographic data, and procedural details.

Our variables of interest were categorized into three tables; first the baseline characteristics of the enrolled population which included age, gender, diabetes mellitus, hypertension, smoking, dyslipidemia, rheumatic heart disease, heart rate and presence or absence of arrhythmia. Second, the relevant echocardiographic parameters utilized in our study were right ventricular end systolic pressure (RVESP), mitral valve area, mitral valve gradient, right ventricular diastolic diameter (RVDD) and left ventricular ejection fraction (LVEF). Finally, we recorded arrhythmic events (premature beats and atrial tachycardia) to monitor their presence pre and post procedure.

In our institution, echocardiographic parameters were evaluated with transthoracic echocardiography (TTE) by a standard technique utilizing echocardiographic machines before PBMC and 24 hours post-procedure. Severe mitral stenosis has been delineated via echocardiographic parameters as being concomitant with a mean transvalvular gradient exceeding 10 mmHg, pulmonary artery pressures surpassing 50 mmHg, and a valve area measuring less than 1 cm².

The Percutaneous Balloon Mitral Commissurotomy (PBMC) was executed utilizing the double balloon technique in a multitrack fashion. This intervention was conducted by two highly experienced interventional cardiologists, who concurrently observed the hemodynamic parameters throughout the procedure.

Study Endpoints: Our primary endpoint was the change in the RVESP from baseline to 24-hours post-procedure. Secondary endpoints included change in mitral valve area, mean trans-mitral pressure gradient, RVDD, LVEF and incidence of arrhythmic events.

Statistical analysis: Statistical analysis was done by SPSS v28 (IBM Inc., Armonk, NY, USA). Quantitative variables

were presented as mean and standard deviation (SD). Qualitative variables were presented as frequency and percentage (%). Pearson or spearman correlation was done to estimate the degree of correlation between two quantitative variables.

Results

In our study, we included 80 patients with severe rheumatic mitral stenosis, with a mean age of 8.7 ± 8.8 years. The majority of the patients were female (83.8%), with only 13 males (16.3%). Regarding the present co-morbidities, 4 patients (5.0 %) had diabetes mellitus, 12 (15.0 %) had hypertension, 11 (13.8 %) were current smokers, and 12 (15.0 %) had dyslipidemia. At baseline, the average heart rate was 80.1 ± 11.3 beats per minute, nearly 30 patients (37.5%) exhibited arrhythmias (premature beats and/or atrial tachycardia), while the remaining 50 patients (62.5) were normal sinus rhythm. (Table 1)

Regarding the echocardiographic parameters, RVESP was reduced from 51.2 ± 11.5 mmHg pre procedure to 42.8 ± 10.3 mmHg post procedure ($p < 0.001$), while Mitral valve area nearly doubled, increasing from 0.98 ± 0.22 cm² to 1.82 ± 0.35 cm² post-procedure ($p < 0.001$). Moreover, the mean trans mitral gradient fell from 14.6 ± 5.2 mmHg pre PBMC to 5.1 ± 2.3 mmHg post PBMC ($p < 0.001$), while simultaneously; RVDD also decreased significantly, from 23.3 ± 4.2 mm to 19.9 ± 1.5 mm ($p < 0.001$). Finally, LVEF showed a small but statistically insignificant rise from 55.0 ± 7.6 % to 56.1 ± 7.3 % ($p = 0.12$). (Table 2)

Arrhythmia monitoring before and after PBMC revealed a significant reduction in overall arrhythmic events. Pre-procedure analysis revealed that 30 patients (37.5%) exhibited either premature beats or atrial tachycardia. The overall number dropped significantly to 10 patients (12.5%) after 24 hours post-procedure. Further analysis revealed that premature ventricular beats dropped from 10 patients (12.5%) to only 4 patients (5.0%) post-procedure ($p = 0.012$), while atrial tachycardia dropped from 14 patients (17.5%) to 6 patients (7.5%) post-procedure ($p = 0.018$). (Table 3)

Discussion

Summary of The Results

This retrospective cohort study of 80 patients with severe rheumatic mitral stenosis demonstrated significant hemodynamic and clinical improvements following PBMC. Our analysis revealed that PBMC was statistically and clinically associated with a significant improvement in the echocardiographic parameters including RVESP, mitral valve area, mitral valve gradient, RVDD and LVEF. Furthermore, we also observed that post-procedure patients were associated with a reduced risk of arrhythmia.

Discussion of The Results

The current study supports the existing body of knowledge by recording the short-term hemodynamic benefits of percutaneous balloon mitral commissurotomy (PBMC) in patients with severe mitral stenosis. There was a post-procedural drop in right ventricular end-diastolic pressure (RVDD) of 8.4 mmHg, which was similar to the magnitude of reduction reported after conclusive commissurotomy [6]. This early pressure relief is a result of the elimination of mitral valve obstruction, thus reducing left atrial pressure, pulmonary venous pressure and right ventricular afterload

[7]. The recorded increase of mitral valve area by 0.98 to 1.82 cm² (an improvement of 86%) is within the expected range of a successful PBMC procedure and demonstrates the valve opening to be optimal. Taken together, these data support the beneficial effect of PBMC on hemodynamics in a limited group of patients with severe mitral stenosis [8].

An impressive improvement in the right ventricular diastolic diameter, with a reduction in the pre-intervention value of 23.3 mm to a post-intervention value of 19.9 mm, is the early epithelial evidence of reverse remodeling in the right heart [9]. This observation should be noted with particular interest since chronic rise of pulmonary pressures, secondary to severe mitral stenosis, had already caused right ventricular dilatation which might have been at least partially reversible. In the recent past, three-dimensional echocardiography has captured mitral stenosis-related morphological and functional changes in the right ventricle such as reduced ejection fraction and poor strain measures [10]. The dramatic reduction in right ventricular dimensions over 24 hours suggests that this change was mostly hemodynamic, as opposed to an indication of irreversible structural remodeling [11].

The marked reduction in arrhythmic events of 37.5 to 12.5 percent in 24 h after PBMC is a clinically important observation that has significant prognostic implications. Mitral stenosis is often complicated by atrial fibrillation and other arrhythmias, which develop due to chronic elevation of left atrial pressure, atrial dilatation, and structural remodelling. The fast decrease in arrhythmic burden after PBMC is likely to indicate the instantaneous hemodynamic unloading and the reduced atrial stretch. Researchers have demonstrated that patients with atrial fibrillation tend to have poor outcomes following PBMC; nevertheless, the procedure itself is capable of reducing the incidence of arrhythmia when successful [12, 13].

The fact that left ventricular ejection fraction was preserved (55.0% to 56.1%, $p = 0.12$) in patients with isolated mitral stenosis points to a level of functional stability that is consistent with prior studies demonstrating that left ventricular function is generally preserved until late disease stages. This consistency reinforces the patient selection approach of the study, which did not include patients with systolic dysfunction (LVEF <40%), and thus proves that the reported changes in left ventricular function are mostly due to the effect of mitral valve intervention and not to coinciding left ventricular pathology [14].

Clinical Implications

The long-run analysis of data has provided a few clinically important findings in severe rheumatic mitral stenosis patients. First, the immediate and significant (8.4-mmHg) decrease in RVESF means that percutaneous balloon mitral commissurotomy (PBMC) has a rapid hemodynamic benefit that can be measured in right heart functional terms. This outcome supports recent suggestions to use PBMC as first-line therapy in symptomatic patients with severe mitral stenosis and good valve morphology. The corresponding reduction in RVESF is clinically significant and will probably improve symptoms and increase exercise tolerance [15].

The second interesting finding is the high increase of the mitral valve area to 1.82 cm², a level that is above the level that was found to correlate with good long-term survival. Earlier studies show that valve area values after procedure

that exceed 1.5 cm² outcomes in better event free survival and reduced rates of repeat intervention. The significant mitral valve area increase in this cohort highlights the importance of patient selection and technical skill, which both play a critical role in procedural success [16].

Recent reduction in arrhythmic burden is a major improvement in the treatment of mitral stenosis, especially in terms of anticoagulation, prevention of stroke and cardiovascular outcomes. Patients with mitral stenosis and arrhythmic events have markedly increased risks of thromboembolism, and it is possible that mitigation of arrhythmic events after PBMC can allow a more individualised approach to anticoagulation. However, certain patients need a combination treatment- e.g. atrial fibrillation ablation with PBMC especially when arrhythmia arise despite the effective commissurotomy [17].

The finding of right ventricular reverse remodelling as early as 24 hours implies that early treatment is good in saving the right-heart. Research has found that patients who already had developed pulmonary hypertension could not have full recovery of right-ventricular functioning after successful PBMC. This observation lends credence to the hypothesis that early management beats the development of non-reversible right-heart changes and highlights the need to refer to PBMC as soon as possible in eligible patients [18].

Strengths, Limitations and Recommendations

The current study has a number of methodological strengths, including the uniformity of the double-balloon procedure performed by skilled investigators, a detailed echocardiographic evaluation that combines structural and hemodynamic parameters, and the complementary addition of arrhythmia monitoring, thus providing a detailed evaluation of the procedural benefits. However, the retrospective design, a small sample of 80 patients, and the follow-up period (24 h) limit the scope of generalisation and interpretation. The lack of a description of valve morphology scoring, reporting of complications, and comparator groups, including surgical commissurotomy, further limits inference. Future studies ought to be prospective designs using larger cohorts, standardised scoring systems (e.g. Wilkins score) and longer follow-up to assess durability. Also, the evidence base would be strengthened by the inclusion of functional, quality-of-life, and hard clinical endpoints as well as advanced right-heart imaging. Clinically, the results support the use of PBMC as a first-line treatment of severe mitral stenosis, especially when performed early, and the need to develop guidelines of post-procedural follow-up to maximise patient outcomes.

Table 1: Baseline Characteristics of Study Population

Variables		Total (n=80)
Age (years)	Mean± SD	38.7 ± 8.8
	Range	22-57
Sex	Male	13 (16.3%)
	Female	67 (83.8%)
Comorbidities	Diabetes Mellitus	4 (5.0%)
	Hypertension	12 (15.0%)
	Current Smoker	11 (13.8%)
	Dyslipidemia	12 (15.0%)
	Rheumatic Heart disease	80 (100%)
Heart Rate (bpm)	Mean± SD	80.1 ± 11.3
Normal Sinus Rhythm	Frequency (Percentage)	50 (62.5%)

SD; standard deviation, bpm; beat per minute.

Table 2: Echocardiographic & Hemodynamic Changes Pre- and Post-PBMC

Variables		Value	P value
RVESP (mmHg)	Pre PBMC	51.2 ± 11.5	<0.001*
	Post PBMC	42.8 ± 10.3	
Mitral valve area (cm², planimetry)	Pre PBMC	0.98 ± 0.22	<0.001*
	Post PBMC	1.82 ± 0.35	
Mitral valve gradient (mmHg)	Pre PBMC	14.6 ± 5.2	<0.001*
	Post PBMC	5.1 ± 2.3	
RVDD (mmHg)	Pre PBMC	23.3 ± 4.2	<0.001*
	Post PBMC	19.9 ± 1.5	
LVEF (%)	Pre PBMC	55.0 ± 7.6	0.12
	Post PBMC	56.1 ± 7.3	

Data is presented as mean (SD), *, statistically significant p value < 0.05, RVESP; right ventricular end systolic pressure, PBMC; Percutaneous Balloon Mitral Commissurotomy, RVDD: right ventricular diastolic diameter, LVEF; left ventricular ejection fraction.

Table 3: Arrhythmia Monitoring Pre- and 24 h Post-PBMC

Variables		Value	P value
Any Arrhythmia	Pre PBMC	30 (37.5 %)	<0.001*
	Post PBMC	10 (12.5 %)	
Premature beats	Pre PBMC	10 (12.5 %)	0.012*
	Post PBMC	4 (5.0 %)	
Atrial Tachycardia	Pre PBMC	14 (17.5 %)	0.018*
	Post PBMC	6 (7.5 %)	

Data is presented as frequency (Percentage), *, statistically significant p value < 0.05, PBMC; Percutaneous Balloon Mitral Commissurotomy.

Conclusion

This study confirms that PBMC provides immediate and significant hemodynamic and arrhythmic benefits in patients with severe mitral stenosis, supporting its role as a first-line intervention. Early referral and structured follow-up are essential to optimize outcomes and prevent irreversible cardiac changes.

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Author contribution

Authors contributed equally to the study.

Conflicts of interest

No conflicts of interest

References

1. Shah SN, Sharma S. Mitral Stenosis. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Jun 20]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK430742/>

2. Bishop MA, Alahmadi MH, Borsody K. Mitral Commissurotomy. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Jun 20]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK563263/>

3. O'Donnell C, Sanchez PA, Celestin B, McConnell MV, Haddad F. The Echocardiographic Evaluation of the Right Heart: Current and Future Advances. *Curr Cardiol Rep.* 2023 Dec;25(12):1883–96.

4. Heerdt PM, Martin-Flores M, Oakland HT, Joseph P, Singh I. Integrating Right Ventricular Pressure Waveform Analysis With Two-Point Volume Measurement for Quantification of Systolic and Diastolic Function: Experimental Validation and Clinical Application. *J Cardiothorac Vasc Anesth.* 2023 Oct;37(10):1929–37.

5. Hassanin A, Alom M, Potluri S, Al-Azizi K. Intracardiac Echocardiography-Guided Percutaneous Mitral Balloon Commissurotomy: Technique and Early Experience. *Struct Heart.* 2024 Sep;8(5):100330.

6. Zeb S, Ashraf T, Hashim M, Rizvi SNH. Regression of right ventricular systolic pressure after successful percutaneous mitral commissurotomy in patients with isolated severe mitral stenosis. *Pak J Med Sci.* 2017;33(3):529–33.

7. Abdelrahman Elsayed Attia MD, Omar Mohammed Hashem MS, Sameh Samir Raafat Naguib MD, Osama Rifaie MD. Short Term Effect of Percutaneous Mitral Commissurotomy on P Wave Dispersion in Patients with Mitral Stenosis. *The Medical Journal of Cairo University.* 2023 Sep 1;91(09):1085–101.

8. Meneguz -Moreno Rafael A., Costa JR, Gomes NL, Braga SLN, Ramos AIO, Meneghelo Z, *et al.* Very Long Term Follow-Up After Percutaneous Balloon Mitral Valvuloplasty. *JACC: Cardiovascular Interventions.* 2018 Oct 8;11(19):1945–52.

9. Ahmed MK, Reda AA, Ibrahim MH. Right ventricular function and symptomatology in patients with isolated mitral stenosis: A Doppler tissue imaging study. *The Egyptian Heart Journal.* 2015 Mar 1;67(1):41–6.

10. Ladányi Z, Eltayeb A, Fábíán A, Ujvári A, Tolvaj M, Tokodi M, *et al.* The effects of mitral stenosis on right ventricular mechanics assessed by three-dimensional echocardiography. *Sci Rep.* 2024 Jul 24;14(1):17112.

11. İnci S, Erol MK, Bakırcı EM, Hamur H, Değirmenci H, Duman H, *et al.* Effect of percutaneous mitral balloon valvuloplasty on right ventricular functions in mitral stenosis: Short- and mid-term results. *Anatol J Cardiol.* 2015 Apr;15(4):289–96.

12. Ko K, Cho I, Kim S, Seong Y, Kim D, Seo JW, *et al.* Identification of Distinct Subgroups in Moderately Severe Rheumatic Mitral Stenosis Using Data-Driven Phenotyping of Longitudinal Hemodynamic Progression. *Journal of the American Heart Association.* 2022 Aug 2;11(15):e026375.

13. Díez-Delhoyo F, Sánchez De La Nava AM, Sanz-Ruiz R, Ávila P, González-Torrecilla E, Delgado-Montero A, *et al.* Combined atrial fibrillation ablation and balloon mitral commissurotomy in patients with rheumatic mitral stenosis. *J Cardiovasc Electrophysiol.* 2022 Dec;33(12):2485–95.

14. Rudiktyo E, Soesanto AM, Cramer MJ, Yonas E, Teske AJ, Siswanto BB, *et al.* Global Left Ventricular Myocardial Work Efficiency in Patients With Severe Rheumatic Mitral Stenosis and Preserved Left Ventricular Ejection Fraction. *J Cardiovasc Imaging.* 2023 Oct;31(4):191–9.

15. Vahanian A, Beyersdorf F, Praz F, Milojevic M, Baldus S, Bauersachs J, *et al.* 2021 ESC/EACTS Guidelines for the management of valvular heart disease. *Eur Heart J.* 2022 Feb 12;43(7):561–632.

16. Mughal S, Hanif MI, Riaz A, Hanif A. wilkin's score: predictive value of wilkin's score in determining the

- procedural success of percutaneous transvenous mitral commissurotomy. The Professional Medical Journal. 2018 Sep 10;25(09):1432–7.
17. Abdelghani M, Nunes MCP, Anwar AM, Prendergast B. Assessment of suitability for percutaneous mitral commissurotomy: a contemporary review of key anatomical criteria and predictive models. Eur Heart J Cardiovasc Imaging. 2024 May 31;25(6):739–53.
 18. Pande S, Agarwal SK, Tewari P, Agrawal V, Srivastav N, Tripathi S, *et al.* Right ventricular dysfunction in rheumatic heart valve disease: A clinicopathological evaluation. Natl Med J India. 2020;33(6):329–34.

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