Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-10, Issue-2 | March-April 2024
https://doi.org/10.53339/aimdr.2024.10.2.3
Page no- 22-31 | Section- Research Article (Cardiology)

A Prospective Study on Clinical and Echocardiographic Outcomes of Percutaneous Transvenous Mitral Commissurotomy (PTMC) in Patients with Isolated Rheumatic Mitral Stenosis

Mohammad Faridul Hoque[1*], A. K. M. Monwarul Islam[2], Mohammad Mozibul Hoque[3], Atikur Rahman[4], Mohammad Mostafijur Rahman[5], Md. Shameem Aktar[6], Md. Abdul Hamid[7], AFM Rezaul Islam[8]

[*1]Assistant Professor, Department of Cardiology, Colonel Maleque Medical College, Manikganj, Bangladesh.
Email: drfaridk50mc@gmail.com,
Orcid ID: 0009-0008-5364-0155
[2]Associate Professor, Department of Cardiology, National Institute of Cardiovascular Diseases, Dhaka. Bangladesh,
Email: drmonwarbd@yahoo.com,
Orcid ID: 0000-0001-6997-379X
[3]Assistant professor, Department of Pediatrics, Cox's Bazar Medical College, Cox's Bazar, Bangladesh.
Email: mozibulhoquedr@gmail.com,
Orcid ID: 0009-0003-0812-4577
[4]Assistant Registrar, National Institute of CardioVascular Diseases (NICVD), Dhaka, Bangladesh.
Email: atik.cmc@gmail.com,
Orcid ID: 0009-0001-2049-5130
[5]Assistant Professor, Department of Cardiology, Chattogram Medical College Hospital, Chattogram, Bangladesh.
Email: drmostafij34cmc@gmail.com,
Orcid ID: 0009-0003-2687-8014
[6]Resident Physician, Department of Cardiology, M. Abdur Rahim Medical College Hospital, Dinajpur, Bangladesh.
Email: shameemwase@gmail.com,
Orcid ID: 0009-0003-3398-1685
[7]Consultant, Department of Cardiology, Chattogram Medical College Hospital, Chattogram, Bangladesh.
Email: sagarcmc45@gmail.com,
Orcid ID: 0009-0002-3927-3391
[8]AFM Rezaul Islam, Registrar, Department of Cardiology, Sylhet MAG Osmani Medical College Hospital, Sylhet, Bangladesh.
Email: munaim87@yahoo.com,
Orcid ID: 0009-0005-1747-3669
*Corresponding author

Received: 19 October 2023
Revised: 22 December 2023
Accepted: 09 January 2024
Published: 29 February 2024

Abstract

Background: Mitral Stenosis (MS) is the most common valve lesion in chronic rheumatic heart disease (RHD). Percutaneous Transvenous Mitral Commissurotomy (PTMC) has emerged as an alternative to surgical intervention for the management of patients with isolated rheumatic MS. The aim of this study was to assess the clinical and echocardiographic outcomes of Percutaneous Transvenous Mitral Commissurotomy (PTMC) in patients with isolated rheumatic mitral stenosis. **Material & Methods:** This prospective observational study was conducted in Department of Cardiology of National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh, during the period from May 2019 to April 2020 for a period of one (01) year. Total 30 patients with moderate to severe MS due to chronic rheumatic heart disease undergoing PTMC were included in this study. **Results:** In this study of 30 patients undergoing PTMC, the majority were aged 30-39 years (40%), with a mean age of 32.7 years. Females predominated (63.3%), with a female-to-male ratio of 1.7:1. Most patients were of normal weight (63.3%), with a mean BMI of 20.8 kg/m2. The severity of heart failure, assessed by NYHA class, was highest in class III (56.7%). Echocardiographic improvements post-PTMC were significant, with notable correlations between GLS and other cardiac parameters. **Conclusions:** This present study concludes that PTMC is a vital intervention in managing mitral stenosis, particularly in terms of functional improvement and symptom relief. The clinical and echocardiographic outcomes advocate for the continued use of PTMC as a key therapeutic strategy in suitable patients with mitral stenosis.

Keywords:- Clinical outcome, Echocardiographic Outcome, Percutaneous Transvenous Mitral Commissurotomy (PTMC), and Isolated Rheumatic Mitral Stenosis.

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-10, Issue-2 | March-April 2024
https://doi.org/10.53339/aimdr.2024.10.2.3
Page no- 22-31 | Section- Research Article (Cardiology)

INTRODUCTION

Mitral stenosis (MS), predominantly caused by rheumatic heart disease, remains a significant cause of morbidity and mortality worldwide, particularly in developing countries.[1] Rheumatic heart disease is the result of valvular damage which is caused by an abnormal immune response to Streptococcus pyogenes infection, which is classified as a group A streptococcus that causes acute rheumatic fever.[2] Characterized by the narrowing of the mitral valve, MS leads to a spectrum of hemodynamic changes, culminating in symptoms such as dyspnea, fatigue, and palpitations. The pathophysiology of MS involves progressive fibrosis and calcification of the mitral valve, leading to restricted leaflet motion and reduced valve area, thereby impeding blood flow from the left atrium to the left ventricle.[3] It is observed in developing countries in particular.[4] The management of MS has evolved significantly over the years, with Percutaneous Transvenous Mitral Commissurotomy (PTMC) emerging as a preferred intervention for selected patients. PTMC, a less invasive alternative to surgical commissurotomy and valve replacement, involves the use of a balloon catheter to dilate the stenotic mitral valve.[5] Since the introduction of the Inoue balloon catheter in 1984, the safest treatment modality for MS is reported to be PTMC.[6,7] This procedure has been shown to provide symptomatic relief and improve hemodynamic parameters in patients with suitable valve morphology.8 Clinical and echocardiographic outcomes post-PTMC have been the focus of numerous studies, reflecting the procedure's efficacy and safety. A retrospective observational study demonstrated significant improvements in mitral valve area (MVA), trans-mitral pressure gradient, and pulmonary artery systolic pressure post-PTMC, with a high immediate success rate of 94.3%.[9] Another study echoed these findings, reporting substantial increases in MVA and reductions in peak pressure gradients, underscoring PTMC's role in alleviating the hemodynamic burden of MS.[10] Echocardiographic parameters, particularly MVA and pressure gradients, serve as crucial indicators of PTMC success. A study involving a decade-long follow-up of PTMC patients revealed sustained improvements in MVA and reductions in left atrial pressure, highlighting the procedure's long-term efficacy.[11] Furthermore, echocardiography plays a pivotal role in patient selection for PTMC, with factors such as leaflet mobility, valvular calcification, and sub-valvular thickening (assessed using the Wilkins score) influencing procedural outcomes.[12] The impact of PTMC on specific patient populations has also been explored. For instance, in pregnant women with critical MS, PTMC has been shown to be safe and effective, significantly improving maternal and fetal outcomes.[13] This is particularly relevant given the hemodynamic stress of pregnancy, which can exacerbate MS symptoms. Additionally, the procedure's effect on right ventricular (RV) function has been studied, with improvements in RV function observed post-PTMC, further illustrating the comprehensive benefits of this intervention.[14] PTMC represents a pivotal advancement in the management of MS, offering a less invasive yet effective treatment option. Its ability to improve clinical and echocardiographic outcomes has been consistently demonstrated across diverse patient populations. However, patient

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-10, Issue-2 | March-April 2024
https://doi.org/10.53339/aimdr.2024.10.2.3
Page no- 22-31 | Section- Research Article (Cardiology)

selection remains critical to its success, and long-term follow-up is essential to monitor for potential complications and restenosis. This study aims to further elucidate the clinical and echocardiographic outcomes of PTMC in patients with mitral stenosis, contributing valuable insights to the existing body of literature and aiding in the optimization of treatment strategies for this patient population.

Objectives

- To assess the clinical and echocardiographic outcomes of Percutaneous Transvenous Mitral Commissurotomy (PTMC) in patients with isolated rheumatic mitral stenosis.

MATERIAL AND METHODS

This prospective observational study was conducted in Department of Cardiology of National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh, during the period from May 2019 to April 2020 for a period of one (01) year. Total 30 patients with moderate to severe MS due to chronic rheumatic heart disease undergoing PTMC in NICVD were included in this study. The study protocol was approved by the Ethical Review Committee of NICVD. Informed written consent was taken from each patient or relatives. All data was processed and analyzed manually and using SPSS (Statistical Package for Social Sciences) Version 16.0. Continuous variables were summarized as means and standard deviations. Categorical variables were summarized as numbers and percentages. The clinical and echocardiographic parameters before and after PTMC in patients with MS were compared using paired t-test. Correlations among different echocardiographic parameters were assessed using Pearson's correlation coefficients. Multivariate linear regression analysis was performed to identify the independent determinants of GLS in patients with MS. P-value ≤ 0.05 was considered statistically significant.

Inclusion Criteria

- Symptomatic rheumatic moderate to severe MS.
- Patients aging between 15 and 50 years.

Exclusion Criteria

- Patients with mild MS (MVA >1.5 cm2).
- Patients who are not candidates for PTMC (due to higher Wilkins score i.e >8, commissural calcification or left atrial thrombus).
- Moderate to severe valvular disease other than MS.
- Patients with established coronary disease.
- Patients with clinical evidence of right heart failure.
- Patients with atrio-ventricular conducton abnormalities.
- Patients having post procedural complications like severe mitral regurgitation / cardiac tamponade.
- Patients with arrhythmia including atrial fibrillation.
- Patients with LVEF less than 50 %.
- History of PTMC.

RESULTS

[Table 1] demonstrates the demographic characteristics of 30 patients that were studied. Among them a highest number of patients were found in the range of 30-39 years which

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-10, Issue-2 | March-April 2024
https://doi.org/10.53339/aimdr.2024.10.2.3
Page no- 22-31 | Section- Research Article (Cardiology)

was 40% followed by 33.3% patients in the range 20-29 years and 26.7% patients in the age range of 40-49 years. The mean age of the studied patients was 32.7±7.6 years ranging from 20 to 46 years. In this study, 11 (36.7%) and 19 (63.3%) patients were male and female respectively. Female and male ratio was 1.7:1. Female patients were predominant in the study. The table also indicates that underweight and normal weight were present in 36.7% and 63.3% patients respectively. On the contrary, no patients had overweight. Finally, on an average the study patients had normal weight with mean BMI 20.8±2.3 kg/m2 with ranging 17.8 – 24.0. The heart failure severity was shown by NYHA class. A highest number of 17 (56.7%) had NYHA class III followed by 8 (26.7%) of class II and 5 (16.7%) of class IV. [Figure 1] presents the distribution of the study subjects by complications. Mild MR and moderate MR were found to be in 23.3% and 10% patients respectively. 1 patient had vascular access-site hematoma, while another patient had puncture site infection. [Table 2] shows the comparison of mean heart rate in patients with MS before and after PTMC. The above table shows that mean heart rate was lower after PTMC than that before PTMC, and the difference was statistically significant ($p<0.05$). [Table 3] demonstrates the comparison of echocardiographic measurements in patients with MS before and after PTMC. The echocardiographic parameters including GLS were found to be significantly improved after PTMC among the study patients ($p<0.05$). [Figure 2] shows that there is an insignificant positive correlation between LAD and GLS by Pearson's correlation coefficient ($r=0.11$, $p=0.59$). The diagram in [Figure 3] shows that there is a weak negative correlation between GLS and LVEDV by Pearson's correlation coefficient ($r=-0.27$, $p=0.04$). [Figure 4] presents that there is an insignificant negative correlation between GLS and MVA by Pearson's correlation coefficient ($r=-0.13$, $p=0.44$). [Figure 5] demonstrates that there is a moderate negative correlation between GLS and LVEF before PTMC as demonstrated by Pearson's correlation coefficient ($r=-0.42$, $p=0.02$). The lower the LVEF, the less negative the LV GLS, and the correlation between the two is statistically significant. The linear regression analysis in [Table 4] revealed that in patients with MS undergoing PTMC, LVEDV and LVEF are significant independent predictors of GLS. The remaining variables were also found to be associated with changes in GLS but they were failed to reach the level of significance.

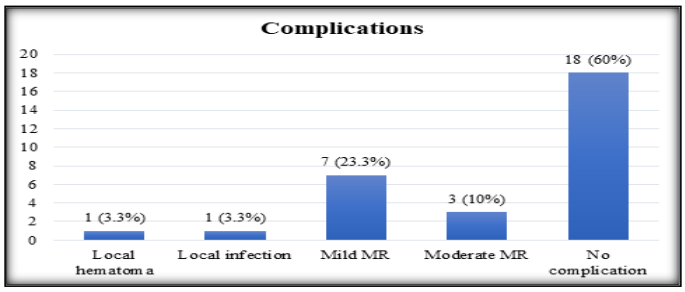

Figure 1: Distribution of the study subjects by complications (N=30).

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-10, Issue-2 | March-April 2024
https://doi.org/10.53339/aimdr.2024.10.2.3
Page no- 22-31 | Section- Research Article (Cardiology)

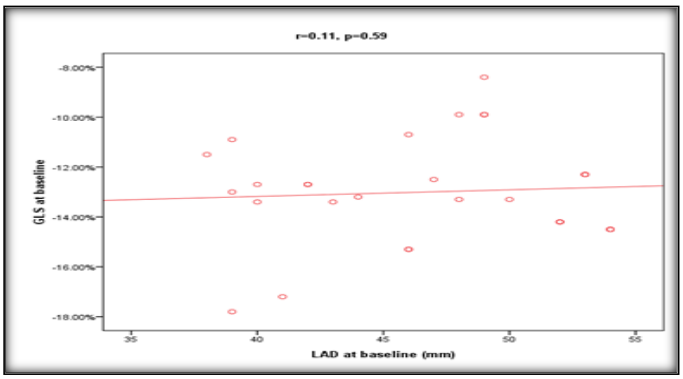

Figure 2: Scatter plot diagram showing correlation between GLS and LAD in patients with MS before PTMC.

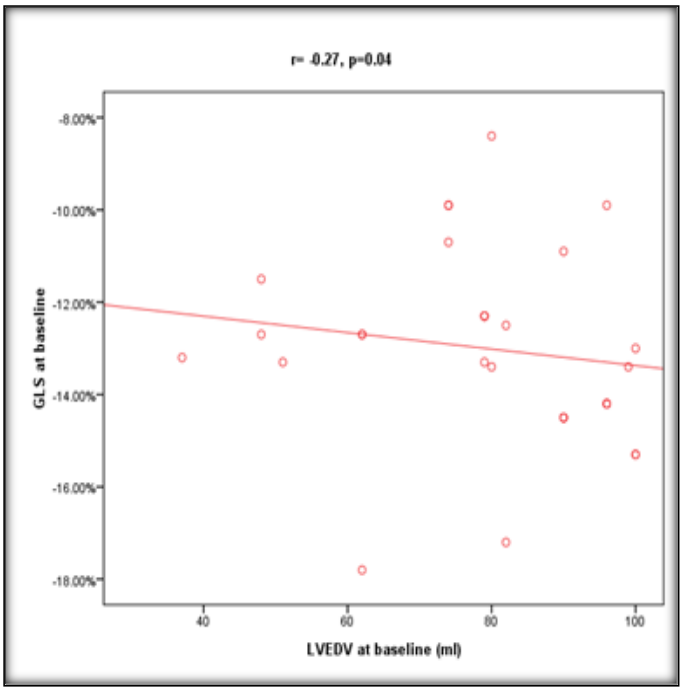

Figure 3: Scatter plot diagram showing correlation between GLS and LVEDV in patients with MS before PTMC.

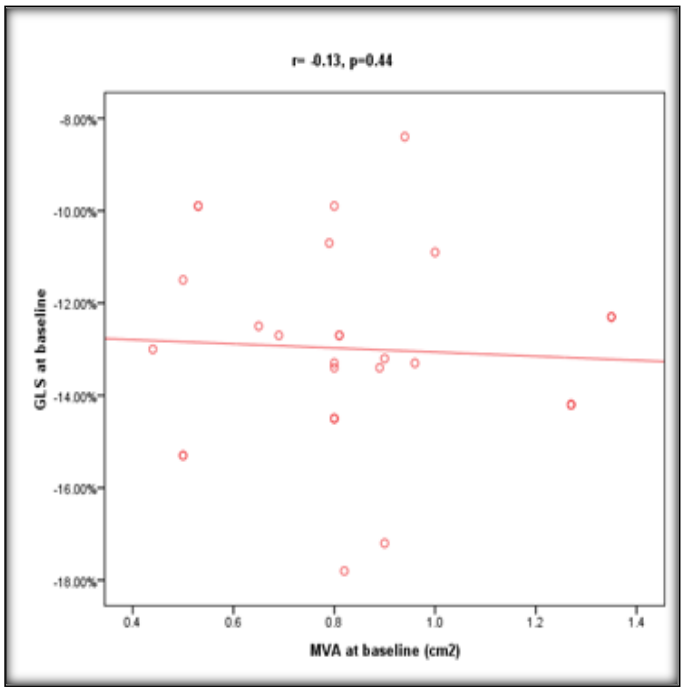

Figure 4: Scatter plot diagram showing correlation between GLS and MVA in patients with MS before PTMC.

Table 1: Demographic characteristics of the study subjects (N=30).

Characteristics		**Frequency**	**Percentage**
Age (Years)	20-29	10	33.3
	30-39	12	40
	40-49	8	26.7
	Mean ± SD	32.7±7.6	
	(Range)	(20 - 46)	
Sex	Male	11	37
	Female	19	63

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-10, Issue-2 | March-April 2024
https://doi.org/10.53339/aimdr.2024.10.2.3
Page no- 22-31 | Section- Research Article (Cardiology)

BMI kg/m2	Under weight (<18.5)	11	36.7
	Normal weight (18.5 – 24.9)	19	63.3
	Overweight (25 -29.9)	0	0
	Mean ± SD	20.8±2.3	
	(Range)	(17.8 – 24.0)	
NYHA class	II	8	26.7
	III	17	56.7
	IV	5	16.7

Table 2: Comparison of mean heart rate in patients with MS before and after PTMC (N=30).

Clinical characteristic	**Before PTMC (Mean ± SD)**	**After PTMC (Mean ± SD)**	**p value**
Heart rate (bpm)	94.17±6.01	80.13±4.70	<0.001s

Here, MS = Mitral stenosis
PTMC = Percutaneous transvenous mitral commissurotomy
s= Significant (p<0.05).
p value was reached from paired t-test.

Table 3: Comparison of echocardiographic measurements in patients with MS before and after PTMC (N=30).

Echocardiographic characteristics	**Before PTMC (Mean ± SD)**	**After PTMC (Mean ± SD)**	**p value**
LAD (mm)	46.73±5.34	42.63±4.84	<0.001s
MMPG (mmHg)	16.50±7.65	5.30±2.04	<0.001s
MVA (cm2)	0.86±0.27	1.80±0.37	<0.001s
PASP (mmHg)	64.40±18.91	31.13±12.78	<0.001s
LVEDV (ml)	79.17±17.41	93.57±19.41	<0.001s
LVESV (ml)	33.07±9.12	36.17±11.00	0.001s
LVEF (%)	58.33±5.83	62.17±5.86	<0.001s
GLS (%)	-13.00±2.09	-17.83±2.78	<0.001s

Here, LAD= Left atrial diameter, LVEF= Left ventricular ejection fraction, MMPG= Mean trans mitral pressure gradient, MVA= Mitral valve area, PASP= Pulmonary artery systolic pressure, LVEDV= Left ventricular end diastolic volume, LVESV= Left ventricular end systolic volume, GLS= Global longitudinal strain.
s= Significant (p≤0.05).
p value was reached from paired t-test.

Table 4: Multiple linear regression analysis to assess determinants of GLS in patients with MS (n=30).

Variables	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**P**
	B	**Std. Error**	**B**		
(Constant)	0.149	6.874		0.022	0.983^{ns}
LAD	0.031	0.09	0.079	0.342	0.736^{ns}
PASP	0	0.029	-0.002	-0.007	0.994^{ns}

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-10, Issue-2 | March-April 2024
https://doi.org/10.53339/aimdr.2024.10.2.3
Page no- 22-31 | Section- Research Article (Cardiology)

MVA	-1.398	1.84	-0.182	-0.76	0.455^{ns}
LVEDV	-0.039	0.02	-0.376	-1.685	.033s
LVEF%	-0.181	0.075	-0.504	-2.419	.024^{s}
Dependent variable: GLS at baseline					

Here, LAD= Left atrial diameter, LVEF= Left ventricular ejection fraction, MMPG= Mean trans mitral pressure gradient, MVA= Mitral valve area, PASP= Pulmonary artery systolic pressure, LVEDV= Left ventricular end diastolic volume, GLS= Global longitudinal strain.
s= Significant (p≤0.05).
ns=Not significant (p>0.05)
p value was reached from paired t-test.

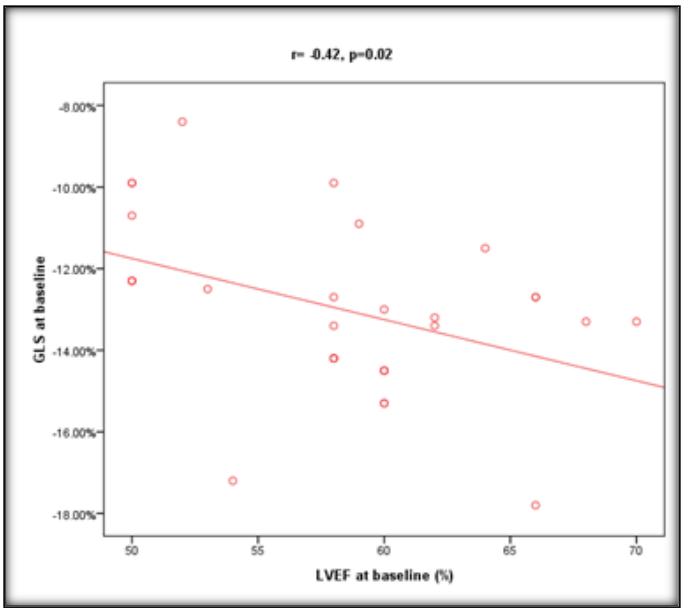

Figure 5: Scatter plot diagram showing correlation between GLS and LVEF in patients with MS before PTMC.

DISCUSSION

Rheumatic heart disease (RHD) continues to be a common health problem in the developing world, causing morbidity and mortality among both children and adults as well as impose a substantial burden on health care systems. There is a striking fall in the incidence of RHD in developed affluent society though unfortunately not in developing countries. The annual incidence of RF in developing countries is 100-200 times than that observed in developed countries.[15] The recently published prevalence of ARF and RHD in Bangladesh 0.9 per 1000 (ARF 0.6 per 1000 and RHD 0.3 per 1000).[16] Therefore, this current study was conducted in Department of Cardiology of National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh, during the period from May 2019 to April 2020 on 30 patients with isolated rheumatic mitral stenosis to assess the clinical and echocardiographic outcomes of Percutaneous Transvenous Mitral Commissurotomy (PTMC) in patients with isolated rheumatic mitral stenosis.

The demographic characteristics of the patient cohort in this study, predominantly female with a mean age of 32.7 years, align with the general epidemiology of mitral stenosis, which is more common in females and often presents in the third or fourth decade of life. This gender disparity has been consistently observed in mitral stenosis, potentially due to the higher prevalence of rheumatic heart disease in women.[1,3] The age distribution in our study, with a significant proportion in the 30-39 years age group, is reflective of the chronic nature of rheumatic heart disease leading to mitral stenosis. The predominance of normal weight individuals in the study cohort, with a mean BMI of 20.8 kg/m2, is noteworthy. This finding contrasts with the general population trends where overweight

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-10, Issue-2 | March-April 2024
https://doi.org/10.53339/aimdr.2024.10.2.3
Page no- 22-31 | Section- Research Article (Cardiology)

and obesity are prevalent. The absence of overweight patients in this cohort could be attributed to the increased metabolic demands and decreased caloric intake associated with chronic heart failure, a common complication of advanced mitral stenosis.[3] The severity of heart failure in the study population, as indicated by the NYHA class distribution, highlights the significant impact of mitral stenosis on functional status. A majority of patients in NYHA class III suggests a substantial limitation in physical activity, consistent with the debilitating nature of severe mitral stenosis.[5] The echocardiographic outcomes post-PTMC, particularly the improvement in Global Longitudinal Strain (GLS), are significant. GLS, a sensitive measure of left ventricular systolic function, has been increasingly recognized for its prognostic value in various cardiac conditions, including valvular heart diseases like mitral stenosis.8 The improvement in GLS post-PTMC in our study is consistent with previous findings where PTMC has been shown to alleviate the hemodynamic burden of mitral stenosis, thereby improving left ventricular function.[9] The correlation analyses between GLS and other echocardiographic parameters such as Left Atrial Diameter (LAD), Left Ventricular End-Diastolic Volume (LVEDV), Mitral Valve Area (MVA), and Left Ventricular Ejection Fraction (LVEF) provide insights into the complex interplay between these variables in mitral stenosis. The weak negative correlation between GLS and LVEDV, and the moderate negative correlation between GLS and LVEF before PTMC, suggest that worse left ventricular function is associated with less negative GLS. This finding is in line with the pathophysiological understanding that mitral stenosis leads to left atrial enlargement and increased filling pressures, eventually impacting left ventricular function.[13] The linear regression analysis indicating LVEDV and LVEF as significant independent predictors of GLS further underscores the importance of these parameters in assessing the severity and prognosis of mitral stenosis. These findings are corroborated by previous studies which have emphasized the role of echocardiographic parameters in predicting outcomes in mitral stenosis.[14] Kundu et al,[17] showed after successful PTMC the parameters of infundibular and global right ventricular function significant improvement as assessed by Right ventricular outflow tract fractional shortening (RVOTfs) and total ejection isovolume index (Tei index). Bari et al,[18] did a comparative study of echocardiographic outcome of PTMC done by balloon and metallic valvotome and also found Wilkins score and commissural morphology score to be significant predictor of outcome. The clinical implications of these findings are substantial. The improvement in echocardiographic parameters post-PTMC, particularly GLS, highlights the efficacy of PTMC in reversing some of the deleterious effects of mitral stenosis on cardiac function. This reinforces the role of PTMC as a key intervention in the management of suitable patients with mitral stenosis, as echoed in the current guidelines.[10] However, the study also highlights the need for careful patient selection for PTMC, considering the variability in outcomes based on echocardiographic characteristics. The correlation between GLS and other echocardiographic parameters suggests that a comprehensive echocardiographic assessment is crucial in the pre-procedural evaluation to

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-10, Issue-2 | March-April 2024
https://doi.org/10.53339/aimdr.2024.10.2.3
Page no- 22-31 | Section- Research Article (Cardiology)

identify patients who are likely to benefit the most from PTMC.

The findings of this study contribute to the growing body of evidence supporting the beneficial effects of PTMC on echocardiographic outcomes in patients with mitral stenosis. The improvement in GLS and its correlation with other echocardiographic parameters post-PTMC provides valuable insights into the procedural impact on cardiac function. These findings underscore the importance of PTMC in the management of mitral stenosis, reaffirming its role in improving cardiac function and potentially altering the disease trajectory in selected patients.

Limitations of the study: This was a prospective observational study not a randomized one. In our study, there was small sample size and absence of control for comparison. Study population was selected from one center in Dhaka city, so may not represent wider population. Inoue balloon was re-used, it might have influence upon the outcome of PTMC. The sample size was small in number. Three of my studied subjects had moderate MS, which might have influenced my study result. Only in-hospital outcome was considered, no long-term follow- up was done.

CONCLUSIONS

This present study concludes that there is significant improvement in Global Longitudinal Strain (GLS) post-PTMC, along with favorable changes in other echocardiographic parameters, highlights the procedure's role in enhancing cardiac function. The study's findings reinforce PTMC as a vital intervention in managing mitral stenosis, particularly in terms of functional improvement and symptom relief. These results advocate for the continued use of PTMC as a key therapeutic strategy in suitable patients with mitral stenosis. Further study with larger sample size and longer time duration is recommended. Echo determination of LV GLS may be added for assessment of changes in LV systolic function in mitral stenosis patients undergoing PTMC.

REFERENCES

1. Khan MI, Hashmi MO, Abid SU, Khan B, Iqbal H, Khatoon F. Mid-Term Clinical and Echocardiographic Outcomes of Percutaneous Transvenous Mitral Commissurotomy in Patients with Rheumatic Mitral Stenosis. Pak J Med Health Sci. 2023;17(02):793-.
2. Marijon E, Mirabel M, Celermajer DS, Jouven X. Rheumatic heart disease. Lancet. 2012;379(9819):953-64.
3. Dadjo Y, Moshkani Farahani M, Nowshad R, Sadeghi Ghahrodi M, Moaref A, Kojuri J. Mid-term (up to 12 years) clinical and echocardiographic outcomes of percutaneous transvenous mitral commissurotomy in patients with rheumatic mitral stenosis. BMC Cardiovasc Disord. 2021;21(1):355. doi: 10.1186/s12872-021-02175-3.
4. Rowe JC, Bland EF, Sprague HB, White PD. The course of mitral stenosiswithout surgery: ten-andtwenty-year perspectives. Ann Intern Med. 1960; 52: 741–9
5. Khan B, Awan R, Hussain S, Saghir T, Paracha Y. Percutaneous Transmitral Commissurotomy-Clinical and Echocardiographic Follow-up in Severe Mitral Stenosis. Pak Heart J. 2023;56(1):72-6.
6. Nishimura RA, Otto CM, Bonow RO. AHA/ACC guideline for the management of patients with valvularheart disease: A report of the American College of Cardiology/American Heart Association

Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-10, Issue-2 | March-April 2024
https://doi.org/10.53339/aimdr.2024.10.2.3
Page no- 22-31 | Section- Research Article (Cardiology)

Task Force on Practice Guidelines. J Thorac Cardiovasc Surg. 2014; 148: e1-132. 4.
7. Kaya Z, Karapınar H, Kaya H. Evaluation of the long-term effect of percutaneous balloon valvuloplasty on right ventricular function using tissue Doppler imaging in patients with mitral stenosis. Turk Kardiyol Derneği Arş. 2014; 42: 35-43.
8. Firouzi A, Samiei N, Ahmadi S, Naderi N, Sadeghipour P, Sanati HR, et al. Percutaneous Transluminal Mitral Commissurotomy in Pregnant Women with Severe Mitral Stenosis. J Tehran Heart Cent. 2019;14(1):12-17.
9. Rajbhandari R, Tamrakar R, Shah JP, Pradhan A, Manandhar S, Dangol U, et al. Study of Percutaneous transvenous mitral commissurotomy outcomes in valves with different Echocardiographic features. Nepal Mediciti Med J. 2023;4(1):1-4.
10. Babar HA, Saad AA, Butt ZR, Khan Z, Dastgeer S, Iqbal MM. Severe Mitral Stenosis: In-Hospital Outcomes of Percutaneous Transvenous Mitral Commissurotomy (PTMC) In Patients. Prof Med J. 2017;24(06):850-4.
11. Vijayvergiya R, Suri V, Sikka P, Kasinadhuni G, Gupta A, Kaur N, et al. Maternal and Fetal Outcomes Following Percutaneous Transluminal Mitral Commissurotomy in Pregnant Women with Critical Mitral Stenosis: An Experience of a Tertiary Care Center from Northern India. Anatol J Cardiol. 2022;26(7):552-558. doi: 10.5152/AnatolJCardiol.2022.1644.
12. Setty HS, Hebbal VP, Channabasappa YM, Jadhav S, Ravindranath KS, Patil SS, et al. Assessment of RV function following Percutaneous Transvenous Mitral Commissurotomy (PTMC) for rheumatic mitral stenosis. J Cardiovasc Dis Res. 2016;7(2):58.
13. Rahman MT, Rahman MM, Islam MM, Khan MR, Haque SA, Chowdhury AW, et al. Immediate Clinical and Echocardiographic Outcome of Percutaneous Transvenous Mitral Commissurotomy for Patients of Mitral Stenosis with Atrial Fibrillation. Mymensingh Med J. 2015;24(3):585-91.
14. Khan A, Shafiq I, Jan M, Hassan Z. Echocardiographic assessment before and after Percutaneous Transvenous Mitral Commissurotomy in patients with Rheumatic Mitral Stenosis. Pak J Med Sci. 2021;37(1):104-108. doi: 10.12669/pjms.37.1.2446.
15. Arora R, Kalra GS, Singh S, Mukhopadhyay S, Kumar A, Mohan JC, et al. Percutaneous transvenous mitral commissurotomy: immediate and long-term follow-up results. Catheter Cardiovasc Interv. 2002;55(4):450-6. doi: 10.1002/ccd.10109.
16. Islam MN, Khan LA, Mohibullah AK, Zafar A, Malik A. Clinical profile of rheumatic heart disease in Bangladesh. Bangladesh Med J. 1987;16:6-17.
17. Khanna R, Raghuvanshi AS, Kumar S, Garg N, Tewari S, Kapoor A, et al. Immediate impact of percutaneous transvenous mitral commisurotomy on right ventricle longitudinal strain in patients of mitral stenosis. Echocardiography. 2018;35(10):1525-1532. doi: 10.1111/echo.14093.
18. Bari MA, Rahman S, Uddin SN, Malik F, Ahsan SA, Rahman S. Comparison and outcome of commissurotomy by metallic valvotome and balloon commissurotomy. Mymensingh Med J. 2005;14(1):3-5.

Source of Support: Nil, Conflict of Interest: None declared