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ORIGINAL ARTICLE

# Predictive value of pre procedural mitral valve commissural score in in patients undergoing balloon mitral valvotomy.

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**ABSTRACT… Objective:** To evaluate accuracy of commissural score in patients with mitral stenosis through Transesophageal Echocardiography (TOE) and correlate it with outcomes of BMV. **Study Design:** Prospective study. **Setting:** Chaudhry Pervez Elahi Institute of Cardiology, Multan. **Period:** June 2022 to November 2022. **Material & Methods:** Study was conducted on total 171 patients. Transesophageal echocardiography was performed before BMV by consultant cardiologist. The subvalvar apparatus and mitral valve leaflets were examined at transgastric and mid esophageal levels. Morphology of mitral valve was assessed on the basis of mitral valve commissural score. Graded ballooning was performed stepwise in increments of 1 to 2 mm for reducing the transmitral gradient to satisfactory level. If satisfactory hemodynamic result were not achieved even at maximum, process was stopped. Pre and post procedural echocardiographic measurements were recorded. **Results:** Mean age of the participants was 42.2±14.0 years. Mitral valve commissural score of ≥2 was noted in 151 (88.30%) patients. After BMV, good outcome was achieved in 150 (87.72%) patients, and in remaining 21 (12.28%) patients outcome was poor. The mitral valve commissural score had a PPV of 96.7% and NPV of 80.0%. Stratification was performed on the basis of age, gender, rheumatic heart disease, obesity and NYHA class. No association was found between these variable and mitral valves commissural score with good outcome. **Conclusion:** In patients undergoing BMV, high commissural score (3-4) is predictor of good outcome, while low commissural score is associated with unfavorable outcome.

**Key words:** Balloon Mitral Valvotomy, Mitral Valve Commissural Score, Transesophageal Echocardiography.

## INTRODUCTION

Balloon mitral valvotomy (BMV) is considered effective and safe treatment of severe rheumatic mitral stenosis.[1] In BMV, area of mitral valve is increased through commissural splitting. Transthoracic echocardiographic (TTE) score is used to assess morphology of mitral valve.[3] The Wilkins score provides the assessment of calcification, mobility, subvalvar and leaflet thinking. Wilkins scores > 8 is indicative of severe degenerative disease.[4] However, commissural assessment is not included in it. Previous studies show that BMV outcome can be predicted through commissural morphology assessment by TTE.[5] Commissural calcification indicates higher risk of mitral valve replacement and lower survival rate after BMV.[6] Transthoracic approach helps in predicting increase in valve area and commissural splitting after BMV.[7] A study reported significant association between outcome of BMV and commissural score. Results showed that 94% patients with score 3-4 had better outcome compared to 6% with commissural score 0-2.[8] Another study showed that 57% patients undergoing BMV had good results. Pre procedural mitral commissural score ≥ 2 had 67% positive predictive value and 82% negative predictive value for good results.[9] In local cardiology hospital, Transesophageal Echocardiography (TOE) is used and it offers better resolution and overcomes issues of anterior leaflet shadowing, thus providing thorough scan of mitral valve calcification and mitral commissure. In this study we will evaluate accuracy of commissural score

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in patients with mitral stenosis through TOE and correlate it with outcomes of BMV. If results show high accuracy of this scoring system, it can be used to assist in patient selection for BMV. In case of unfavorable commissural morphology, mitral valve replacement can be considered.

## MATERIAL & METHODS

The prospective study was in Chaudhry Pervez Elahi Institute of Cardiology, Multan from June 2022 to November 2022. The study included patients aged 20-65 years diagnosed with mitral valve stenosis and planned for BMV. Patients with left arterial thrombosis, severe aortic stenosis or regurgitation and mitral regurgitation > grade 2+ were excluded. Study was conducted on total 171 patients. Informed consent of the participants was taken. Ethical board of the hospital approved the study (15-40/21-11-21).

Baseline data including age, gender, BMI, duration of mitral stenosis and history of rheumatic heart disease was recorded. Transesophageal echocardiography was performed before BMV by consultant cardiologist. The subvalvar apparatus and mitral valve leaflets were examined at transgastric and mid esophageal levels. Morphology of mitral valve was assessed on the basis of mitral valve commissural score. Echocardiographic measurements including mitral valve area ($cm^2$), left ventricle ejection fraction (LVEF, %), mitral valve peak gradient (MVPG, mm Hg), mitral valve mean gradient (MVMG, mm Hg), size of left atrium (LA – mm), pulmonary artery systolic pressure (PAPs – mm Hg) and systolic and diastolic left ventricle dimension (sLVD - mm and dLVD - mm) were recorded before and after BMV. Commissurotomy was performed using self-positioning balloon, whose upper limit was according to height of the patient. Graded ballooning was performed stepwise in increments of 1 to 2 mm for reducing the transmitral gradient to satisfactory level. If satisfactory hemodynamic result were not achieved even at maximum diameter, process was stopped.

SPSS version 23.0 was used for data analysis. The quantitative variables like age, duration of mitral valve stenosis, mitral valve area, left ventricle ejection fraction, mitral valve peak gradient, mitral valve mean gradient, systolic and diastolic left ventricle dimension, left atrium size, pulmonary artery systolic pressure and mitral valve commissural score were presented as mean and standard deviation. The qualitative variables like gender, obesity, rheumatic heart disease, NYHA class and good outcome were presented as frequency and percentages. 2x2 contingency table was made taking post procedure echocardiography result (good outcome – yes/no) as reference, positive and negative predictive accuracy of commissural score with 95% confidence interval were calculated. Data was stratified on age groups, gender, rheumatic heart disease, obesity and NYHA class. Post-stratification positive & negative predictive accuracy of commissural score was calculated. Chi-square test was used for significant differences and p-value $\leq 0.05$ was taken as significant.

## RESULTS

Mean age of the participants was 42.2±14.0 years. Mean duration of mitral valve stenosis was 6.4±3.8 years. Mean mitral valve area before BMV was 0.7±0.2 cm2. Mean mitral valve area after BMV was 1.4±0.8 cm2. Mean LVEF before BMV was 58.4±6.0%. Mean LVEF after BMV was 59.8±5.9%. Mean MVPG before BMV was 21.35±4.92 mm Hg. Mean MVPG after BMV was 9.52±2.75 mm Hg. Mean MVMG before BMV was 12.50±3.8 mm Hg. Mean MVMG after BMV was 5.80±2.35 mm Hg. Mean SLVD before BMV was 35.6±7.1 mm. Mean SLVD after BMV was 32.8±6.01 mm. Mean DLVD before BMV was 51.6±9.6 mm. Mean DLVD after BMV was 47.8±7.4 mm. Mean left atrium before BMV was 16.96±2.72 mm. Mean left atrium after BMV was 14.46±1.98 mm. Mean PAPs before BMV was 45.9±10.4 mm hg. Mean PAPs after BMV was 36.7±6.53 mm hg.

There were 103 (60.23%) females and 68 (39.77%) male patients. Rheumatic heart disease was present in 133 (77.78%) and absent in 38 (22.22%) patients. There were 72 (42.11%) obese and 99 (57.89%) non-obese patients. Regarding

frequency of NYHA functional class, class III was found in 67 (39.18%) and class IV in 104 (60.82%) patients. Mitral valve commissural score of ≥2 was noted in 151 (88.30%) patients. After BMV, good outcome was achieved in 150 (87.72%) patients, and in remaining 21 (12.28%) patients outcome was poor. The mitral valve commissural score had a PPV of 96.7% and NPV of 80.0% (Table-I). Stratification of age was performed and there was no association between age and mitral valve commissural score with good outcome. In patients having age 18-41 years, PPV was 96.0% and NPV was 81.8%. In patients having age 42-65 years, PPV was 97.4% and NPV was 77.8%. Stratification was also performed on the basis of gender, rheumatic heart disease, obesity and NYHA class. No association was found between these variable and mitral valve commissural score with good outcome (Table-II).

| Mitral Valve Commissural Score | Good Outcome | |
|---|---|---|
| | Yes | No |
| ≥ 2 | 146 (97.3%) | 05 (23.8%) |
| <2 | 04 (2.7%) | 16 (76.2%) |

**Table-I. Association between mitral valve commissural score and procedural outcome**

## DISCUSSION

In current study we evaluated prognostic value of transesophageal echocardiography on prediction outcomes of BMV. Research has shown that BMV increases valve area by splitting fused mitral commissures, like surgical commissurotomy.[10]

| Mitral Valve Commissural Score | Variable | Good Outcome | |
|---|---|---|---|
| | | Yes | No |
| | Gender (male, n=68) | | |
| ≥ 2 | | 56 (96.6%) | 05 (50.0%) |
| <2 | | 02 (3.4%) | 05 (50.0%) |
| | Gender (female, n=103) | | |
| ≥ 2 | | 90 (97.8%) | 0 |
| <2 | | 02 (2.2%) | 11 (100%) |
| | Rheumatic heart disease present (n=133) | | |
| ≥2 | | 115 (98.3%) | 04 (25.0%) |
| <2 | | 02 (1.7%) | 12 (75.0%) |
| | Rheumatic heart disease absent (n=38) | | |
| ≥2 | | 31 (93.9%) | 01 (20.0%) |
| <2 | | 02 (6.1%) | 04 (80.0%) |
| | Obese (n=72) | | |
| ≥2 | | 66 (100%) | 03 (50.0%) |
| <2 | | 0 (0%) | 03 (50.0%) |
| | Non obese (n=99) | | |
| ≥2 | | 80 (95.2%) | 02 (13.3%) |
| <2 | | 04 (4.8%) | 13 (86.7%) |
| | NYHA* class III (n=67) | | |
| ≥2 | | 58 (93.5%) | 0 |
| <2 | | 04 (6.5%) | 05 (100%) |
| | NYHA class IV (n=104) | | |
| ≥2 | | 88 (100%) | 05 (31.3%) |
| <2 | | 0 | 11 (68.8%) |

**Table-II. Association between mitral valve commissural score and study variables**

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Thus, in case of no or minimal commissural fusion or presence of calcification BMV will not result in increased valve area.

In current study, 9 patients had commissural calcification due to suboptimal procedural outcome was predicted. A previous study conducted by reported Nunes et al that localized commissural calcification was associated with increased incidence of valve replacement and lower survival rate.[11] In another study, Mazaherinia et al used transthoracic approach, and BMV resulted in increased mitral valve area if at least single commissure was not calcified or fibrosed.[12] Though Wilkins score does not assess commissures, there is significant correlation between commissural calcification and Wilkins score. However, in our study, the commissural score had higher predictive value compare to Wilkins score, similar to what was reported by the above mentioned studies. It can also be used for semi quantitative assessment of non calcified commissural fusion. Calcified commissures resulted in adverse outcomes. Patients with 1 commissure was absent, minimal or calcified (commissural score 0/1) had suboptimal outcome. Patients with non calcified commissures can have score of 0 or 1 if mitral stenosis is mild or is due to localized defect in subvalvar apparatus and mitral leaflets. In these scenarios, balloon dilation will not cause optimal increase in MVA.

In our study, significant correlation was found between increase in MVA and commissural score ($P<0.001$). Both calcification and non fusion commissures were assigned score 0. 28 patients had score 2, of which 9 had severe fusion in one and calcification in other commissure. Of these 9 patients, 2 had favorable outcomes. 70 patients had commissural score 3 or 4, and 94% of them had favorable outcome. In our study, high Wilkins score was associated with severe mitral regurgitation, and though not clear commissural morphology may have some contributing role. MR is common complication of balloon mitral valvotomy and can't be predicted from clinical variables and pre procedural valve morphology alone. It increases mildly at sites of commissural splitting.[13] A study by Palacios et al reported that combined commissural calcification, subvalvar disease and leaflet thickening are significant independent predictor of MR after BMV.[14] In this study, we assessed predictive value of commissurotomy score in patients undergoing BMV. The mitral valve commissural score had a PPV of 96.7% and NPV of 80.0%. A previous study reported PPV of mitral valve commissural score to be 94% and NPV to be 80%.[15] In another study on patients undergoing BMV, mitral commissural score ≥ 2 had 67% PPV and 82% NPV.[8] The limitation of our study is small sample size, larger study is required for detailed evaluation.

## CONCLUSION

In patients undergoing BMV, high commissural score (3-4) is predictor of good outcome, while low commissural score is associated with unfavorable outcome.



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## AUTHORSHIP AND CONTRIBUTION DECLARATION

| No. | Author(s) Full Name | Contribution to the paper | Author(s) Signature |
|---|---|---|---|
| 1 | Muhammad Shahid | Writing and design. | |
| 2 | Azhar Shahzad | Conceived and review. | |
| 3 | Jawad Ahmad | Data collection and analysis. | |
| 4 | Muhammad Sohail Saleemi | Data collection and writing. | |
| 5 | Kashif Ali Hashmi | Review and design study. | |