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Original Research Article

ASSOCIATION BETWEEN SPONTANEOUS ECHO CONTRAST AND MITRAL VALVE AREA IN MITRAL STENOSIS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: When the mitral valve is narrowed, it restricts blood flow from the left atrium to the left ventricle. This is characterized as mitral stenosis (MS). Rheumatic mitral stenosis (RMA) is the primary cause of MS. When some dynamic, smoke-like echoes are observed on echocardiography, it refers to spontaneous echo contrast (SEC). This represents blood reflections within the heart chambers. Commonly, transesophageal echocardiography and transthoracic echocardiography (TTE) is used to detect SEC. A well established predictor of LA appendage thrombus and embolic events is SEC. If MS is not diagnosed on time and it is not managed properly, it can lead to severe mortality and morbidity. The objective is to evaluate the relationship between SEC and mitral valve area (MVA) in patients having mitral stenosis. Study design is a cross-sectional analysis. This study was conducted at CMCH @ Shaheed Mohtarma Benazir Bhutto Medical University Larkana from September 2024 to September 2025.

Materials and Methods: This study is a cross sectional analysis which included 120 patients. This study included those patients who were diagnosed with MS and were particularly undergoing percutaneous transvenous mitral commissurotomy (PTMC). Patients who had left atrial thrombus, mitral valve calcification were a part of this research. Moreover, PTMC-eligible patients were also included. Data was collected using a structured proforma which includes clinical risk factors, demographics, ECG findings, and echocardiographic measurements. Data was analysed using SPSS version 26.

Results: There were a total of 120 patients involved in this study. The females were in majority, representing 75% of the total sample size (n=90). The mean age was 34.5 ± 10.2 years. The prevalence of diabetes was 12.5% while it was 9.1% and 5.8% for smoking and hypertension. There were a total of 86 patients with SEC and 34 without SEC. We found an MVA of 0.7 ± 0.2 cm^2 in patients with SEC and 1.3 ± 0.3 cm^2 in patients without SEC. LAAFV was reported to be lower in SEC patients, showing a mean of 14.6 ± 6.8 cm/s.

Conclusion: MS patients who had a lower MVA and atrial fibrillation (AF) had more prevalence of Spontaneous Echo Contrast (SEC.)

Keywords: Mitral stenosis (MS), transthoracic echocardiography, commissurotomy.

INTRODUCTION

When the mitral valve is narrowed, it restricts blood flow from the left atrium to the left ventricle. This is characterized as mitral stenosis (MS).[1] Rheumatic mitral stenosis (RMA) is the primary cause of MS.[2] Another contributing factor is severe mitral annular calcification.[3] Approximately two-thirds of rheumatic cases occur in females. Some rare cases include age-related fibrosis or calcification and congenital defects.[4] When some dynamic, smoke-like echoes are observed on echocardiography, it refers to spontaneous echo contrast (SEC).[5] This represents blood reflections within the heart chambers. Commonly, transesophageal echocardiography and transthoracic echocardiography (TTE) is used to detect SEC. The latter is more sensitive for detecting intracardiac SEC.[6] According to studies, the specificity and sensitivity of TEE to detect SEC are reported to be 100% and 99%.[7]

A well-established predictor of LA appendage thrombus and embolic events is SEC. The LA thrombus appears as an echo-dense mass which is distinct from the chamber wall.[8] It moves independently with the LA appendage or LA cavity. Patients with MS have a prevalence of left atrial thrombi ranging from 20% to 33%.[9] According to a Pakistani study, patients with MS had a frequency of 14.5% of LA clot frequency.[10] There are a few factors that contribute to the risk of thrombus formation in MS. These factors include abnormal blood flow dynamics, LA enlargement, endothelial dysfunction, and impaired atrial contraction.[11] Most importantly, the risk of embolic events significantly increases due to the presence of an LA thrombus. This leads to severe complications such as stroke.

If MS is not diagnosed on time and it is not managed properly, it can lead to severe mortality and morbidity. SEC is a key surrogate marker of thrombus formation. This study was conducted to evaluate the relationship between SEC and mitral valve area (MVA) along with other echocardiographic parameters of MS.

MATERIALS AND METHODS

This study is a cross sectional analysis which included 120 patients. This study was performed to evaluate the relationship between SEC and mitral valve area (MVA) in people having mitral stenosis (MS). This study included those patients who were diagnosed with MS and were particularly undergoing percutaneous transvenous mitral commissurotomy (PTMC). This diagnosis was confirmed before PTMC through transesophageal echocardiography (TEE), transthoracic echocardiography (TTE), and clinical symptoms. Patients who had left atrial thrombus, mitral valve calcification were a part of this research. Moreover, PTMC-eligible patients were also included. Patients were informed about the study and their written consent was obtained. The Ethical Review Committee approved this research.

Exclusion criteria:

Patients who had mitral regurgitation, severe aortic regurgitation, or significant aortic stenosis were not a part of this study. Moreover, patients having anticoagulation therapy were also not a part of this study. Furthermore, patients whose left atrial thrombus was confirmed on TEE were also excluded.

Data was collected using a structured proforma which includes clinical risk factors, demographics, ECG findings, and echocardiographic measurements. To minimise the bias in measurement, experienced cardiologists were there to perform all echocardiographic assessments. Data was analysed using SPSS version 26. Chi-square test was used to evaluate the categorical variables. On the other hand, Kolmogorov-Smirnov test was used to assess the normality of continuous data. A p-value of less than 0.05 was considered statistically significant.

RESULTS

There were a total of 120 patients involved in this study. The females were in majority, representing 75% of the total sample size (n=90). The mean age was 34.5 ± 10.2 years. [Table 1] shows the socio-demographic data.

Table 1

Parameters	N	%
Gender		
Male	30	25
Female	90	75
Smoking	11	9.1
Hypertension	7	5.8
Diabetes	15	12.5

[Table 2] shows the echocardiographic parameters. All the values are in terms of mean and standard deviation.

Table 2

Echocardiographic parameters	Mean ± SD
Left Atrial Area (mm)	24.9 ± 6.1
Left Atrial Appendage Flow Velocity (cm/s)	20.4 ± 11.2
Left Ventricular Ejection Fraction	65.3 ± 3.6
Mitral Valve Area (cm²)	0.9 ± 0.01
Pulmonary Artery Systolic Pressure (mmHg)	66.2 ± 20.2
Left Ventricular Fractional Shortening	33.2 ± 2.9
Mitral Valve Pressure Gradient (mmHg)	16.8 ± 6.3

[Table 3] shows the relationship between SEC and echocardiographic parameters.

Table 3

Echocardiographic parameters	SEC	
	Present (n=86)	Absent (n=34)
Left Atrial Area (mm)	27.5 ± 4.7	18.3 ± 4.3
LAAFV (cm/s)	14.6 ± 6.8	35.4 ± 3.4
LVEF (%)	65.1 ± 4.1	66.2 ± 2.3
Mitral Valve Area (cm²)	0.7 ± 0.2	1.3 ± 0.3
PASP (mmHg)	74.7 ± 16.9	44.3 ± 7.9
LVFS (%)	33.1 ± 2.9	33.3 ± 2.8
MVPG (mmHg)	19.3 ± 5.6	10.5 ± 3.2

DISCUSSION

The left atrium (LA) and the left ventricle (LV) are connected by the mitral valve (MV).[12] This ensures that there is unidirectional blood flow and prevents regurgitation. Its structure functions in a way that facilitates efficient opening and closure during the cardiac cycle. SEC (spontaneous echocardiographic contrast) in the LA is a precursor to thrombus formation. It is mainly due to blood stasis, hypercoagulability, and endothelial injury.[13]

According to the study of Bernstein et al., the mean MVA in patients with SEC was 1.0 ± 0.5 cm² while it was 1.4 ± 0.5 cm² in patients without SEC.[14] It showed a significant difference between both ($p<0.02$). These results are similar to the results of our study where we found an MVA of 0.7 ± 0.2 cm² in patients with SEC and 1.3 ± 0.3 cm² in patients without SEC. Similarly, the study of Black et al. observed an MVA of 1.1 ± 0.3 cm² in patients with SEC as compared to 1.4 ± 0.3 cm² in non-SEC patients.[15]

According to the study of Bilgel et al., SEC is linked with increased left atrial plasma viscosity which contributes to its pathogenesis.[16] Our study used a chi-square test which yielded a significant p-value between SEC and AF. This indicates that AF is a strong predictor of SEC development. Another study by Shah et al. reported that SEC was associated with AF in patients with MS.[17] In our study, LAAFV was reported to be lower in SEC patients, showing a mean of 14.6 ± 6.8 cm/s. According to Handke et al., the thrombogenic risk increases due to reduced LAAFV.[18]

The overall prevalence of SEC in our study was 71.6%. This number is higher than the percentage reported in previous studies which is around 50% to 60%.[19,20] This difference may be due to a number of reasons such as focusing only on PTMC-eligible MS patients. These patients are likely to exhibit lower LAAFV, greater LA enlargement, and higher thrombotic risk.

CONCLUSION

MS patients who had a lower MVA and atrial fibrillation (AF) had more prevalence of Spontaneous Echo Contrast (SEC.)

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