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FREQUENCY OF LEFT ATRIAL THROMBUS IN PATIENTS OF MITRAL
STENOSIS WITH ATRIAL FIBRILLATION

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Abstract
Background Mitral stenosis is a common valvular heart disease and is often associated with atrial fibrillation. Combined, these conditions significantly heighten the risk of a thromboembolic event as a consequence of the formation of a left atrial thrombus that can lead to stroke and systemic embolization. Therefore, early detection of thrombus is crucial for proper management and prevention of complications.
Objective To find out the prevalence of left atrial thrombus in patients with mitral stenosis and atrial fibrillation, and to see if there are any factors involved.

Place and duration of study. From May 2025 to October 2025, Cardiology Department Bolan Medical College / Hospital Quetta/ Sandeman Provincial Hospital, Quetta.

Methodology

This was a cross-sectional study carried out in the Department of Cardiology, a tertiary care hospital . Patients with echocardiographic ally confirmed mitral stenosis and atrial fibrillation were consecutively non-probability sampled over a period of one year and a total of 100 patients aged 18-70 years were finally enrolled. Patients with a history of cardiac surgery, congenital cardiac disease, long-term anticoagulation treatment, and high degree of comorbidities were excluded. A clinical evaluation and echocardiographic assessment (and transesophageal echocardiographic evaluation when appropriate) was carried out to identify left atrial thrombus. Data was analysed using SPSS version 26 and association was examined using Chi-square test with an acceptable level of significance $p \leq 0.05$.

Results

The mean age of participants was 47.8 ± 11.2 years, with 58% females and 42% males. Left atrial thrombus was identified in 28 (28%) patients. Patients with thrombus were significantly older than those without thrombus (50.3 ± 10.5 vs. 46.8 ± 11.4 years; $p=0.041$). Thrombus occurrence was significantly associated with severe mitral stenosis (36.7% vs. 15.6%; $p=0.018$), atrial fibrillation duration greater than one year (40.9% vs. 17.9%; $p=0.012$), and left atrial enlargement ($p=0.008$). Gender showed no significant association with thrombus formation ($p=0.214$).

Conclusion

Patients with MS and atrial fibrillation are at high risk for the development of left atrial thrombus. Risk factors include advanced age, severe mitral stenosis, longer duration of atrial fibrillation, and left atrial enlargement. Early echocardiographic screening could help intervene in a timely manner and reduce the risk of a thromboembolic event.

INTRODUCTION

In the developing world, especially, rheumatic heart disease is still one of the most frequent valvular heart diseases; hence, mitral stenosis (MS) is still a public health issue. Mitral valve involvement in rheumatic disease leads to progressive leaflet thickening and commissural fusion. It causes the mitral valve to narrow, preventing normal blood flow from the left atrium to the left ventricle. As time goes on, the pressure in the left atrium builds up, leading to atrial enlargement, pulmonary venous congestion, and other cardiovascular complications [1]. As the disease progresses, atrial fibrillation (AF) occurs in a significant number of patients and is the most common arrhythmia related to mitral stenosis. AF is more common with age, with greater narrowing of the valve, and with greater left atrial enlargement. AF is characterized by blood stasis in the left atrial appendage and the left atrium. This sluggish blood flow increases patients' risk of thrombus formation and the development of thromboembolic complications [2,3]. Mitral stenosis with atrial fibrillation is associated with left atrial thrombus (LAT), which is a serious problem that can be life-threatening. A thrombus is a risk factor for transient ischemic attack, peripheral arterial embolization, ischemic stroke, and other systemic embolic events. AF is a common complication in patients with rheumatic mitral stenosis (RMS), and stroke is still a major cause of morbidity and mortality among this patient population. Patients with both conditions have a higher risk for thromboembolism than do patients in normal sinus rhythm [4,5]. An echocardiogram is a crucial part of diagnosing and assessing mitral stenosis and its sequelae. A transthoracic echocardiogram is useful for assessing valve morphology, stenosis severity, chamber sizes, and ventricular function. The advantages of TEE, however, are its sensitivity and specificity, which make it the gold standard for detecting left atrial and left atrial appendage thrombosis. It is important to identify the thrombus early, even before interventions such as cardioversion, percutaneous balloon mitral valvotomy, or surgical valve procedures [6,7]. The incidence of left atrial thrombus in patients with mitral stenosis and atrial fibrillation has been reported as ranging from 15% to 40%, depending on patient characteristics, severity of disease, and diagnostic methods used. Some predictors of the likelihood of developing a thrombus have been

identified as more important, including advanced age, severe mitral stenosis, long duration of atrial fibrillation, an enlarged left atrium, and poor anticoagulation [8]. Despite the advancements in the treatment of cardiovascular disease, rheumatic mitral stenosis is still one of the commonest diseases in Pakistan and other developing countries. There is little local information on the prevalence of left atrial thrombus in patients with mitral stenosis and atrial fibrillation. Estimating the incidence of this complication and recognizing its risk factors can help with early diagnosis, optimal anticoagulation, and minimize the number of devastating thromboembolic events. Hence, the present study was conducted to determine the prevalence of left atrial thrombus in patients with mitral stenosis and atrial fibrillation presenting to a tertiary care hospital [9,10].

Study Objective

To assess the prevalence of left atrial thrombus in MS patients with AF and its relation with age, sex, degree, and duration of AF.

Materials And Methods

Design and Setting of a Study.

The study was a cross-sectional study conducted in the Cardiology Department of a Tertiary Care Teaching Hospital, following approval from the Institutional Ethical Review Committee.

Participants

Consecutive nonprobability sampling was used to enroll 100 patients diagnosed with mitral stenosis and atrial fibrillation. Included were patients, 18–70 years of age, of either sex who had echocardiographic proof of mitral stenosis and documented AF. All eligible patients were clinically evaluated thoroughly and underwent echocardiographic evaluation to detect left atrial thrombus.

Sample Size Calculation

The sample size of 100 patients was determined using the WHO sample size formula: $n = Z^2P(1-P)/d^2$. With an expected prevalence of left atrial thrombus of 28% at a 95% confidence level and an absolute precision of 9%, the minimum sample size required was about 96 patients. To enhance study power and address missing data, 100 patients were included.

Inclusion Criteria

- Patients aged 18–70 years.
- Both male and female patients.
- Mitral stenosis was confirmed echocardiographically.
- Had an ECG showing atrial fibrillation.
- Patients who will give informed consent.

Exclusion Criteria

- History of previous cardiac valve surgery.
- Congenital heart disease.
- Severe left ventricular systolic dysfunction.
- Long-term anticoagulant treatment (> 3 months).
- Active infective endocarditis.
- Renal/hepatic disease, severe.
- Patients unwilling to participate.

Diagnostic and Management Strategy.

Clinical examinations, electrocardiography, and echocardiographic examinations were performed in all patients. Initially, a transthoracic echocardiogram (TTE) was performed; when needed, a transesophageal echocardiogram (TEE) was performed to identify left atrial thrombus (LAT).

Patients with a thrombus diagnosis were referred for guideline-directed anticoagulation and continued cardiology management.

Statistical Analysis

The data were entered and analyzed in SPSS version 26. Quantitative variables, such as age, were presented as mean $\pm$ SD. Qualitative variables – gender, severity of mitral stenosis, and left atrial thrombus – were presented as frequencies and percentages. The chi-square test was used to find associations between categorical variables. Means were compared between the two groups using an independent-samples t-test. The P value of ≤ 0.05 was considered statistically significant.

Results

A total of 100 patients with mitral stenosis and atrial fibrillation were included in the study. The mean age was 47.8 ± 11.2 years, ranging from 22 to 70 years. Females constituted 58% (n=58) of the study population, while males accounted for 42% (n=42). Left atrial thrombus was detected in 28 (28%) patients, whereas 72 (72%) patients had no thrombus. Among patients with thrombus, the mean age was significantly higher compared with patients without thrombus (50.3 ± 10.5 years vs. 46.8 ± 11.4 years; $p=0.041$). Thrombus was identified in 19 (32.8%) females and 9 (21.4%) males; however, the association between gender and thrombus formation was not statistically significant ($p=0.214$). Severe mitral stenosis was present in 49 patients and moderate mitral stenosis in 51 patients. The frequency of left atrial thrombus was significantly greater among patients with severe mitral stenosis compared with those having moderate disease (36.7% vs. 15.6%; $p=0.018$). The duration of atrial fibrillation exceeded one year in 44 patients. Left atrial thrombus was detected in 18 (40.9%) of these patients compared with 10 (17.9%) patients with atrial fibrillation duration of less than one year ($p=0.012$). Left atrial enlargement also demonstrated a significant association with

thrombus formation (p=0.008). Overall, older age, severe mitral stenosis, prolonged atrial fibrillation, and left atrial enlargement were important predictors of left atrial thrombus.

Intervention Outcome

All 28 patients with left atrial thrombus received anticoagulation therapy per institutional protocol. Follow-up echocardiographic evaluation showed that 88% of the compliant patients had partial or complete resolution of the thrombus. Early detection and timely anticoagulation minimized the risk of thromboembolic complications, and future interventional and/or surgical procedures were planned safely.

Table 1: Demographic Characteristics of Study Participants (n = 100)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	42	42.0
Female	58	58.0
Age (Years)	Mean ± SD	47.8 ± 11.2
Age Range	22-70	-

Table 1 shows the baseline demographic characteristics of patients with mitral stenosis and atrial fibrillation included in the study. Females constituted the majority of participants, and the overall mean age was 47.8 ± 11.2 years.

Table 2: Frequency of Left Atrial Thrombus in Patients with Mitral Stenosis and Atrial Fibrillation (n = 100)

Left Atrial Thrombus	Frequency (n)	Percentage (%)
Present	28	28.0
Absent	72	72.0
Total	100	100.0

Table 2 demonstrates the frequency of left atrial thrombus among study participants. Left atrial thrombus was detected in 28% of patients on echocardiographic evaluation.

Table 3: Association of Left Atrial Thrombus with Gender and Severity of Mitral Stenosis

Variable	Thrombus Present n (%)	Thrombus Absent n (%)	p-value
Gender			
Male (n=42)	9 (21.4)	33 (78.6)	0.214
Female (n=58)	19 (32.8)	39 (67.2)	
Severity of Mitral Stenosis			
Moderate (n=51)	8 (15.6)	43 (84.4)	0.018*
Severe (n=49)	18 (36.7)	31 (63.3)	

Table 3 illustrates the association between left atrial thrombus, gender, and severity of mitral stenosis. Severe mitral stenosis showed a significantly higher prevalence of thrombus formation compared with moderate mitral stenosis.

Table 4: Association of Left Atrial Thrombus with Age, Duration of Atrial Fibrillation, and Left Atrial Enlargement

Variable	Thrombus Present	Thrombus Absent	p-value
Mean Age (Years)	50.3 ± 10.5	46.8 ± 11.4	0.041*
AF Duration >1 Year (n=44)	18 (40.9%)	26 (59.1%)	0.012*
AF Duration ≤1 Year (n=56)	10 (17.9%)	46 (82.1%)	
Left Atrial Enlargement Present (n=61)	23 (37.7%)	38 (62.3%)	0.008*
Left Atrial Enlargement Absent (n=39)	5 (12.8%)	34 (87.2%)	

Table 4 presents the association of left atrial thrombus with age, duration of atrial fibrillation, and left atrial enlargement. Older age, prolonged atrial fibrillation, and left atrial enlargement were significantly associated with thrombus formation.

Discussion

We aimed to assess the incidence of left atrial thrombus (LAT) in patients with mitral stenosis (MS) and atrial fibrillation (AF) and to determine clinical characteristics associated with LAT development. LAT was found in 28% of patients (100 enrolled). This study reinforces the high risk of developing a thromboembolism in patients with rheumatic mitral stenosis who have atrial fibrillation, and emphasizes the need for periodic echocardiographic evaluation before treatment [11]. The prevalence of LAT in our study is similar to that reported in recent international studies. There have been several investigations that have documented the prevalence of LAT in patients with moderate to severe mitral stenosis and AF, ranging from 20% to 35%, especially in populations where rheumatic heart disease is still common [12]. The similarities in our results could be attributed to a similar patient population, the severity of valvular disease, and the transesophageal echocardiographic procedures used to detect valvular thrombus. However, there have been a few studies that report slightly lower rates, possibly because of increased use of anticoagulation therapy and increased rates

of atrial fibrillation diagnosis [13]. Thrombus formation was significantly related to age in the present study. LAT patients were significantly older than non-thrombus patients. This has been observed in recent studies showing that aging is associated with atrial remodeling, loss of atrial contractility, and blood stasis, which promote the development of blood clots [14,15]. In elderly patients, the disease is likely to be longer, and the presence of structural cardiac abnormalities is more frequent, thus further enhancing the risk of thromboembolism. There was no significant difference in LAT between males and females in our population. The results are consistent with several recent studies that reported no independent association between gender and the development of a thrombus after controlling for disease severity and atrial size [16]. In our study, females had a higher percentage of LAT, but this difference was not statistically significant, suggesting that other clinical factors are more important in thrombus formation. Mitral stenosis was an important predictor of LAT. More patients with severe MS had thrombus than did those with moderate MS. This has been consistently reported in the recent literature [17]. The severe narrowing of the mitral valve causes a significant rise in left atrial pressure, leading to progressive left atrial enlargement and blood stasis, which can result in thrombus formation. This study highlights the importance of careful monitoring of patients with severe valvular obstruction. There was also a significant relationship between duration of AF and LAT. Patients with AF $\geq$ 1 year were significantly more likely to have a thrombus. This is consistent with recent studies showing that chronic or chronic AF is associated with progressive atrial dysfunction and thrombogenicity [18]. Blood stasis occurs when atrial contraction is ineffective, especially in the left atrial appendage, the most common site of blood clots. The other important result of the present study was that LAT was correlated with left atrial enlargement. Those patients with enlarged left atria had a much higher risk of developing a thrombus than patients without left atrial enlargement. Left atrial size has also recently been shown to be an independent risk factor for thromboembolic events in patients with rheumatic mitral stenosis and AF (15,20). Enlargement is a sign of chronic pressure overload and impaired atrial function, both of which are associated with thrombogenesis [19,20]. The study of the present study corroborates the utility of echocardiographic

screening in high-risk patients before cardioversion, balloon mitral valvotomy, and surgical procedures. Prompt diagnosis of LAT should enable the early start of anticoagulation therapy, which could markedly diminish the risk of stroke and systemic embolization.

Limitations

There are several limitations to this study. The study is a single-center, relatively small (100 patients); therefore, the results are not generalizable to the larger population. The cross-sectional design did not allow for the assessment of long-term outcomes or causal relationships. Moreover, differences in previous treatment and/or anticoagulation status could have affected the incidence of thrombus.

Conclusion

Mitral stenosis and atrial fibrillation are associated with left atrial thrombosis, which was a common occurrence in more than one-quarter of the patients in this study. Significant predictors included advanced age, severe mitral stenosis, long-standing AF, and LAE. Early echocardiographic evaluation and early anticoagulation can reduce thromboembolic complications and improve clinical outcomes.

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Authors Contributions

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Final Approval of version: All Mentioned Authors Approved the Final Version.

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