

RELATIONSHIP BETWEEN LEFT ATRIAL THROMBUS AND ATRIAL FIBRILLATION IN RHEUMATIC MITRAL VALVE HEART DISEASE PATIENTS

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Abstract:

Background: The development of left atrial (LA) thrombus and the risk of embolization are common complications in individuals with mitral stenosis (MS). In cases of rheumatic heart disease (RHD), multiple factors influence thrombus formation in the left atrium, with atrial fibrillation and the severity of mitral stenosis being the most significant contributors.

Objective: This research aimed to investigate the association between left atrial thrombus and atrial fibrillation in patients with rheumatic mitral valve heart disease.

Material and Methods: It is a descriptive observational prospective study. This research took place at LUMHS Jamshoro/Hyderabad. Patients admitted with 120 individuals with comprehensive clinical histories and examinations suggestive of rheumatic mitral valve disease were included in the study through a non-probability purposive sampling method from January 2022 to December 2022. Electrocardiography was done for atrial fibrillation and a non-invasive Tran thoracic and semi-invasive Tran esophageal echocardiography (TEE) was conducted utilizing advanced imaging technology ultra mark 6 ultrasound Toshiba in recently identified atrial fibrillation individuals, to evaluate left atrium/LA appendage thrombus.

Results: The average age of patients in this research was 37.83 ± 16.39 years. Females constituted the larger proportion, representing 80 (66.7%) participants, while males accounted for 40 (33.3%). Shortness of breath and palpitations were the most commonly reported symptoms, occurring in 92 (76.7%) and 54 (45.0%) cases, respectively. In this research, as correlation was observed between atrial fibrillation and left atrial thrombus (p-value 0.01).

Conclusion: This study found a strong association between atrial fibrillation and the occurrence of a thrombus in the LA. All patients who underwent Tran thoracic echo and are found to have larger left atrial diameters must undergo TEE to exclude LAT as TTE very low sensitivity for Left atrial thrombus.

Keywords: Atrial fibrillation (AF), Left Atrial Thrombus (LAT), Mitral stenosis (MS), Rheumatic heart disease (RHD).

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Introduction:

Rheumatic heart disease continues to be a prevalent health issue and a significant contributor to both morbidity and mortality¹. Mitral valve most frequently affected by RHD/RF. Approximately 25% of all cases with RHD have isolated mitral stenosis, while a further 40% of individuals exhibit both mitral stenosis alongside mitral regurgitation.³ In rheumatic heart disease, especially in cases involving mitral stenosis, atrial fibrillation is acknowledged as a major contributor to the risk of systemic embolization⁴. AF prevalence as mitral stenosis complication is projected at 40 percent⁴. Atrial fibrillation typically occurs in patients

with existing left atrial enlargement, as seen on an Electrocardiography. This enlargement is a distinctive feature of mitral stenosis, which may involve either valve stenosis, incompetence, or both⁵. An enlarged left atrium is a significant predictor of increased mortality, impacting both cardiovascular health and overall life expectancy⁶. Severe damage to the heart valves can obstruct normal blood circulation, resulting in structural and functional changes in the heart chambers. This cascade can eventually cause heart failure, pulmonary hypertension, atrial fibrillation (AF), thromboembolism, infective endocarditis, and

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ultimately premature death⁷. In individuals with rheumatic mitral valve disease, thrombus formation may happen in areas beyond the left atrial appendage (LAA)⁸, including the right atrial appendage⁹. Echocardiography is crucial in diagnosing and assessing valve disease, serving as a primary non-invasive imaging technique for evaluating valve stenosis¹⁰. The purpose of this study was to evaluate an association b/w Left atrium thrombus formation between pts with sinus rhythm and those with AF.

Material and Method:

Study Design :

It is a descriptive observational prospective study.

Study Setting :

This research took place at Liaquat University, Jamshoro/Hyderabad, Sindh.

Study Duration:

From January 2022 to December 2022

Sample Technique:

Non probability purposive technique

Data Collection Procedure:

Patients admitted with 120 individuals with comprehensive clinical histories and examinations suggestive of RHD were enrolled using a non-probability purposive sampling method from January 2022 to December 2022 after taking approval from Ethical review committee NO.LUMHS/REC/=300 . Electrocardiography was done for AF and a non-invasive Transthoracic echocardiography and semi-invasive Transesophageal echocardiography (TEE) were conducted utilizing advanced imaging technology ultra mark 6 ultrasound Toshiba by the standard method in recently identified AF individuals, to evaluate LA or LA appendage thrombus. After administering local pharyngeal anesthesia, the transesophageal probe was carefully inserted 25–35 cm into the esophagus, and the procedure was performed at the position that ensured the most accurate and clear imaging. The ejection fraction of the left ventricle was determined utilizing the modified Simpson's technique with a 2-D echocardiographic apical 4-chamber view. The anteroposterior diameter of the left atrium was assessed by applying M-mode echocardiography. The transmittal gradient and peak flow velocity of the LA appendage were assessed by applying Doppler echocardiography. A thrombus was defined as a uniform structure, either mobile or fixed, with acrogenic characteristics similar to that of the surrounding myocardium, observed within the left atrium or its appendage during imaging.

Sample Size:

The sample size for this research was determined to be approximately 120 participants, based on a 95% confidence interval, a 5% margin of error, and a predicted atrial fibrillation prevalence of 0.4%²³.

INCLUSION CRITERIA:

Each case is characterized by a clinical history and examination findings suggesting rheumatic heart disease affecting the mitral valve.

EXCLUSION CRITERIA:

- Patients younger than eighteen years or more than eighty-five years
- Congenital heart diseases
- Valvular abnormalities involving valves other than the mitral valve
- History of essential hypertension
- Previous history of balloon valvuloplasty, valve replacement, or percutaneous transvenous mitral commissurotomy (PTMC)
- Coronary artery disease (CAD)
- Pregnant individuals
- Diabetes mellitus (DM)
- Cardiomyopathy
- Degenerative conditions
- Connective tissue disorders

CONFOUNDING FACTORS:

Patients under 18 years old or over 85 years old., those with extended disease duration, involvement of valves other than the mitral valve, essential hypertension, diabetes mellitus, or cardiomyopathy were excluded to avoid factors that could influence the study results.

DATA ANALYSIS: -

The data analysis was conducted utilizing SPSS software version 16. The Chi-square test was applied to examine categorical variables. The p-value less than 0.05 was interpreted as statistically significant.

Results:

A sum of 120 patients admitted to the cardiology department at LUMHS Hyderabad were enrolled in the research. The mean age, pulse rate, systolic blood pressure, diastolic blood pressure and respiratory rate of the participants were 37.83 ± 16.14 years, 103 ± 21.12 beats/minute, 98.25 ± 10.26 mmHg, 67.42 ± 10.96 mmHg and 21.19 ± 2.5 breaths/minute respectively. (as shown in Table:1)

Table:1 Baseline Characteristics Of Study Participants(n=120)	
	Mean age + SD
AGE(years)	37.83+16.13
PULSE RATE(beats/min)	103 + 21.12
SYSTOLIC BLOOD PRESSURE(mmHg)	98.25 + 10.26
DIASTOLIC BLOOD PRESSURE(mmHg)	67.42 + 10.96
RESPIRATORY RATE(breaths/minute)	21.19 + 2.5

Table:2 Gender Category Distribution(Total =120)

GENDER CATEGORY	Number of cases
Male	40/(66.7%)
Female	80/(33.3%)

Table 3: Classification of Cases by Sinus Rhythm and Atrial Fibrillation in Association with LAT in Rheumatic Mitral Valve Disease (cases=120)

Sinus rhythm	Thrombus in the left atrium(LAT)		Probability-value
	Present	Absent	

Present	24 (20%)	26(21.6%)	0.01
Atrial fibrillation with a controlled rate	19(15.8%)	00	
Atrial fibrillation with a fast rate	47(39.2%)	02 (1.7%)	
Atrial fibrillation with the slow rate	02(1.7%)	00	

Discussion:

In developed nations, coronary artery disease is the leading cause of atrial fibrillation (AF), with the condition being more prevalent in men than in women. Conversely, in developing countries, rheumatic heart disease (RHD), particularly mitral stenosis (MS), is the primary cause of AF. Atrial fibrillation (AF) is a prevalent complication in rheumatic heart disease (RHD) and is associated with an elevated risk of various adverse events, including stroke, peripheral embolism, heart failure, and mortality⁷. Patients with mitral stenosis, especially those with AF, are more prone to (LA) thrombus formation¹¹. Rheumatic heart disease is an autoimmune disease that can affect both males and females, with a higher prevalence in females¹²⁻¹³.

A sum of 120 patients admitted to the cardiology department at LUMHS Hyderabad were chosen for the research. The mean age of the participants in this study was 37.83 ± 16.14 years, Niaz Z *et al*³ reported that the patients' ages varied from 7 to 73 years, with a mean age of 28.88 ± 12.50 years. Additionally, the study noted that 42 patients (37.5%) were male, while 70 patients (62.5%) were female. Similarly, in this series, the majority of participants were women, totaling 80 individuals (66.7%), while men comprised 40 individuals (33.3%). We performed this study to establish the association between rhythm disturbance and LA thrombus formation observed in echocardiography. This study observed an increased occurrence of LAT in pts with AF. Out of 120 no cases 50 pts(41.6%) were in sinus rhythm in which LAT was present in 24pts(20%) whereas 70 pts (58.3) were present with atrial fibrillation in which LAT was present in 68pts(56.6%) Probability- value 0.01. This study identified a strong association between LAT and AF, with a P-value of 0.01. Pts with mitral MS) and AF are at a greater risk of developing a left atrial thrombus (LAT) Probability- value of 0.01. Ahmed K. *et al*¹⁷, in their study observed and analyzed data from 256 individuals diagnosed with mitral stenosis (MS). A considerable proportion of patients, 42.2% (108 individuals), were diagnosed with very severe mitral stenosis (MS), with rheumatic etiology accounting for 98.8% (253 cases). Left atrial thrombus was detected in 25% (64 individuals) on transthoracic echocardiography (TTE), while 12.1% (31 patients) exhibited left atrial thrombus. The presence of a left atrial thrombus was strongly correlated with the severity of MS ($p < 0.001$), occurring in 0% (0/9) of those with mild to moderate MS, 8.6% (12/139) of those with severe MS, and 48.1% (52/108) of those with very severe MS. Hange US. *et al*¹⁴, reported in their study that in patients with rheumatic heart disease (RHD), LAT is typically

observed in cases of severe mitral stenosis (MS), accompanied by a dilated left atrium (LA) and atrial fibrillation (AF). It occurs in 17% of patients with severe mitral stenosis (MS), and the risk increases twofold in the presence of atrial fibrillation (AF)⁷. The predominant lesion in our study was mitral stenosis¹⁵. Natarajan K. *et al*, demonstrated that spontaneous echo contrast was present in 54 (45%) patients and thrombus was present in 10 (27.8%) patients, which were significant independent predictors of results in their study. Niaz Z. *et al*,³ reported that left atrial thrombus (LAT) was identified in only 6 cases (5.36%). A significant correlation was found between atrial fibrillation and left atrial thrombus ($p=0.002$), as 5 out of the 6 cases (83.3%) were diagnosed with atrial fibrillation. Although thrombus formation in the left atrium (LA) and/or left atrial appendage (LAA) has been observed in 33% of patients with rheumatic mitral stenosis (MS) who also have atrial fibrillation (AF)¹⁶. Thrombus formation has also been noted in 6.6% to 13.5% of pts with normal sinus rhythm. Thrombus formation has also been noted in 6.6% to 13.5% of patients with normal sinus rhythm.¹⁶ In our study, we also observed the same. Out of 120 no cases, 50 pts(41.6%) were in sinus rhythm, and LAT was present in 24 pts (20%). In our study, we also observed that the frequency of AF increases as the severity of the mitral valve area increases. The formation and frequency of left atrial thrombus are strongly associated with very severe MS. Out of 120 pts 50 pts(41.6%) were in sinus rhythm in which LAT was present in 24pts(20%) 18 pts(15%) of them with pure very severe MS whereas 70 pts (58.3%) were present with atrial fibrillation in which LAT was present in 68 pts(56.6%) 48 pts(40%) of them with pure v. severe MS Probability- value 0.01. Similarly, Ahmed K. *et al*¹⁷, reported that a considerable proportion of patients had very severe mitral stenosis (42.2%), with LAT detected on TTE in 25% of cases. This rate is notably higher than the 3.8% to 22.8% frequency observed in earlier regional studies. The elevated frequency of left atrial thrombus in our study might be due to the larger proportion of patients presenting severe mitral stenosis. Our findings suggest a strong correlation b/w the severity of the disease and the presence of thrombus. Most studies conducted on this population have utilized transesophageal echocardiography (TEE). Despite ongoing discussions regarding the sensitivity and specificity of transthoracic echocardiography, research involving ischemic stroke patients has shown that TTE can identify left atrial thrombus with a high degree of accuracy. The method, based on assessing left atrial enlargement, has revealed sensitivity of 88.9% and a specificity of 52.2%, achieving an overall accuracy rate close to 90%¹⁷. Similarly, Kim JY. *et al*, Patients with both MS and AF experienced a significantly higher annual rate of stroke and systemic embolism than those with MS with no AF. The rate of ischemic stroke and systemic embolism was 2.19% in 2008 and 2.26% in 2016 among patients with both MS and atrial fibrillation (p for trend 0.20). In contrast, the rates were 0.26% and 0.31% for

pts with MS without atrial fibrillation.¹⁸ MS along with AF is a frequent condition, with more than 20% of patients experiencing poor outcomes due to systemic embolism.¹⁸ Atrial contraction plays a key role in moving blood from the left atrium to the ventricle. In the case of atrial fibrillation (AF), the lack of atrial contraction causes blood stasis in the left atrium, increasing the risk of thrombus development and contributing to symptoms like dyspnea. Shastri MH, *et al*, 7.5% of patients had LA clots visible on 2D-ECHO¹⁹, whereas in the study by Jyotirmayi Boddu and Srinivas Reddy, 45.3% of total patients had a clot in LA²⁰. In patients with mitral stenosis (MS) and normal sinus rhythm, factors such as increased left atrial (LA) size, a history of paroxysmal atrial fibrillation, smaller mitral valve area (MVA), older age, and greater stenosis severity contribute to the formation of LA thrombus.^{21 22}.

Conclusion:

We found a high link between left atrial thrombus and atrial fibrillation probability value (<0.01). Patients with severe mitral stenosis (MS) and atrial fibrillation (AF) are at a higher risk of developing left atrial thrombus (LAT). Probability- value 0.01. The formation and frequency of left atrial thrombus are strongly associated with very severe MS. Patients with both mitral stenosis and atrial fibrillation (AF) had a significantly higher annual incidence of stroke and systemic embolism compared to those with mitral stenosis without AF. Patients with LA clots warrant measures to prevent thromboembolism episodes. Additional studies are needed to assess a more reliable correlation.

CONFLICT OF INTEREST:-

The authors declared that they have no conflict of interest

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