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FREQUENCY OF RHEUMATIC MITRAL VALVE STENOSIS AND SEVERITY DISTRIBUTION AMONG THE AGE GROUP OF 20-45 YEARS PRESENTED TO HEALTH SETUPS OF DISTRICT SWAT: A CROSS-SECTIONAL STUDY

Original Research

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ABSTRACT

Background: Rheumatic heart disease (RHD) is the most prevalent acquired cardiovascular condition in developing regions, largely affecting young populations. It typically results from an autoimmune response following untreated group A streptococcal infections. The mitral valve is most frequently compromised, with disease progression often exacerbated by limited access to antibiotics, poor sanitation, and delayed healthcare-seeking behavior in underserved communities.

Objective: To determine the frequency and severity distribution of mitral valve stenosis among patients aged 20 to 45 years diagnosed with rheumatic heart disease in District Swat, Pakistan.

Methods: A descriptive cross-sectional study was carried out over four months (November to February 2024–2025) across multiple echocardiographic centers in District Swat, Khyber Pakhtunkhwa. A total of 152 patients aged 20–45 years with echocardiographically confirmed rheumatic mitral stenosis were selected using non-probability convenience sampling. Data were collected through structured questionnaires and diagnostic imaging. Severity of mitral stenosis was classified as mild (>1.6 cm^2), moderate (1.0–1.6 cm^2), or severe (<1.0 cm^2). Data analysis was performed using SPSS version 23.

Results: Among 152 participants, 64 (42.1%) were male and 88 (57.9%) female; 104 (68.4%) were married. Most patients (94, 61.8%) were aged 20–30 years. Mitral valve involvement was isolated in 110 cases (72.4%), while tricuspid, aortic, and pulmonic valve involvement was observed in 25 (16.4%), 12 (7.9%), and 5 (3.3%) patients respectively. Moderate mitral stenosis was the most common grade (64, 42.1%), followed by mild (56, 36.8%) and severe (32, 21.1%). Mild mitral regurgitation was found in 86 patients (56.6%). Complications were present in 35 patients (23%), including arrhythmia (13, 8.6%), heart failure (12, 7.9%), respiratory complications (9, 5.9%), and stroke (1, 0.7%).

Conclusion: Rheumatic mitral stenosis is predominantly observed in young adult females, with moderate stenosis being the most frequent form. These findings highlight the need for early diagnosis and preventive strategies targeting streptococcal infections at the community level.

Keywords: Echocardiography, Gender, Mitral Regurgitation, Mitral Stenosis, Rheumatic Fever, Rheumatic Heart Disease, Valve Disease.

INTRODUCTION

Rheumatic heart disease (RHD) continues to pose a major public health challenge worldwide, remaining a leading cause of cardiovascular morbidity and mortality, particularly in low- and middle-income countries (1). In 2019 alone, an estimated 40.5 million individuals were living with RHD, resulting in approximately 306,000 deaths globally (2). Despite advances in medical care, RHD remains the most prevalent acquired heart disease in children and young adults, with incidence rates nearly 60 times higher in resource-limited settings compared to high-income nations such as the United States and Western Europe (3,4). The burden of disease is not evenly distributed, with poorer regions bearing a disproportionate share, largely due to systemic inequalities in access to healthcare, hygiene, housing, and preventive medical resources (5). RHD arises as a long-term sequela of acute rheumatic fever (ARF), which itself is an autoimmune response triggered by group A beta-hemolytic streptococcal (GAS) infections, typically originating in the pharynx and, less commonly, the skin (6). However, the pathway from ARF to clinically manifest RHD is not straightforward; not all individuals with ARF develop RHD, and the disease often remains silent for years. Frequently, patients present only once complications such as heart failure, arrhythmias, or thromboembolic events have emerged, often without a previously recognized episode of ARF (7). In fact, up to 90% of RHD cases are asymptomatic in early stages, highlighting the silent progression of the disease (8).

Key risk factors for the development and progression of RHD are strongly linked to poverty, including limited access to antibiotics, overcrowded living conditions, and poor sanitation (9). Genetic susceptibility also plays a role, with certain HLA alleles such as HLA-DR4 being associated with increased risk, although this link is influenced by ethnic background and environmental interactions (10). Disparities in disease prevalence between socioeconomic and ethnic groups, as observed in certain Arab versus Jewish populations in Israel, further underscore the role of environmental and systemic inequities in shaping disease distribution (11). Early detection remains a cornerstone of disease control. Echocardiographic screening has gained prominence for identifying subclinical RHD before the onset of irreversible valve damage, thereby offering opportunities for secondary prevention through antibiotic prophylaxis (12,13). Among the various cardiac manifestations of RHD, mitral valve involvement is the most common and clinically significant. Mitral stenosis, in particular, is associated with profound hemodynamic alterations such as elevated pulmonary artery pressures, left atrial enlargement, and increased transvalvular gradients. As the disease progresses, these changes can culminate in severe complications including atrial fibrillation, right heart failure, and pulmonary hypertension, which considerably worsen the prognosis. Given the predominance of RHD among young adults and the central role of mitral stenosis in influencing clinical outcomes, it becomes imperative to characterize the burden and severity of mitral valve narrowing in this demographic. This study therefore aims to determine the frequency and severity distribution of mitral stenosis among patients aged 20 to 45 years diagnosed with rheumatic heart disease. The findings are expected to inform early diagnostic strategies, guide clinical management, and ultimately contribute to reducing the long-term morbidity associated with rheumatic mitral valve disease.

METHODS

This study employed a descriptive cross-sectional design and was conducted over a four-month period from November 2024 to February 2025 across various echocardiography centers situated in District Swat, Khyber Pakhtunkhwa, Pakistan. The target population comprised patients aged between 20 and 45 years who had been diagnosed with rheumatic heart disease (RHD) accompanied by mitral valve stenosis. Both male and female patients were included, irrespective of marital status. Inclusion criteria involved individuals within the specified age range presenting with echocardiographically confirmed rheumatic mitral stenosis. Exclusion criteria involved cases of mitral stenosis due to non-rheumatic etiologies or patients outside the defined age range. The selection of participants was conducted using a non-probability convenience sampling method. A total of 152 participants were enrolled based on a sample size calculation performed using OpenEpi software, which applied a 95% confidence level and a 5% significance threshold (14). Prior to data collection, ethical approval was obtained from the Institutional Ethical Review Committee of the Institute of Paramedical Sciences, Khyber Medical University (IPMS-KMU), and from the respective diagnostic centers in Swat. All participants were briefed about the study's objectives and procedures, and informed consent was obtained before their inclusion. No financial burden was imposed on the patients during the diagnostic or data collection processes.

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Data were collected through structured proformas documenting demographic details, clinical symptoms, and echocardiographic parameters. The primary variable under assessment was the presence and severity of mitral stenosis, categorized based on mitral valve area (MVA) measurements as mild (>1.6 cm^2), moderate (1.0–1.6 cm^2), and severe (<1.0 cm^2). For cases with coexisting mitral regurgitation, severity was determined using transvalvular pressure gradients: mild (<5 mmHg), moderate (5–10 mmHg), and severe (>10 mmHg), measured via Doppler echocardiography. These criteria were aligned with standard diagnostic thresholds for mitral valve pathology. The diagnostic process included comprehensive clinical evaluations, electrocardiography (ECG), and transthoracic echocardiography (TTE). Characteristic echocardiographic findings of rheumatic mitral stenosis included thickened mitral valve leaflets with restricted mobility, commissural fusion producing a 'fish mouth' appearance in the parasternal short-axis view, and doming of the anterior mitral leaflet resulting in a ‘hockey-stick’ appearance during diastole. Associated chamber enlargement, particularly of the left atrium, and pulmonary hypertension were also documented. ECG findings commonly exhibited features of left atrial enlargement, such as bifid P waves (P mitrale) in lead II and a biphasic P wave in lead V1 with a pronounced terminal negative deflection. These imaging and electrocardiographic findings were supported with clinical symptoms such as exertional dyspnea, fatigue, chest discomfort, episodes of syncope, and nonspecific gastrointestinal symptoms in some cases.

Statistical analysis was conducted using SPSS version 23 and Microsoft Excel. Descriptive statistics, including frequencies and percentages, were used to summarize the demographic profile and clinical characteristics of participants. The severity distribution of mitral stenosis was analyzed across different age brackets and gender groups. To aid interpretation, results were presented using data visualization tools such as tables and graphs. All ethical standards were strictly observed throughout the study. Confidentiality was maintained, and no personal identifiers were disclosed. The study protocol and consent procedures were approved by the institutional review board.

RESULTS

A total of 152 patients diagnosed with rheumatic heart disease (RHD) and associated mitral valve stenosis were enrolled in the study. Among them, 64 (42.1%) were male, and the remaining 88 (57.9%) were female. The patients' ages ranged from 20 to 45 years, with a mean age of 29.90 ± 7.44 years. Most participants were in the 20–30 year age group, comprising 94 individuals (61.8%), followed by 41 patients (27.0%) aged 31–40 years, and 17 patients (11.2%) aged 41–45 years. In terms of marital status, 104 patients (68.4%) were married. All participants had mitral stenosis, presenting with one or more clinical symptoms. Chest pain was the most frequently reported symptom, affecting 62 patients (40.8%), followed by syncope in 42 patients (27.6%). Shortness of breath was noted in 11 patients (7.2%), dyspnea in 7 patients (4.6%), and vomiting in only 1 patient (0.7%). A total of 29 patients (19.1%) reported experiencing all listed symptoms simultaneously. Regarding complications associated with RHD, 117 patients (77.0%) did not exhibit any complications at the time of diagnosis. However, arrhythmias were observed in 13 patients (8.6%), heart failure in 12 patients (7.9%), respiratory complications in 9 patients (5.9%), and stroke in 1 patient (0.7%). These findings underline that although complications were relatively infrequent, a notable subset experienced serious cardiac and systemic issues.

In evaluating valve involvement, all patients with mitral stenosis also had concurrent involvement of additional cardiac valves. The mitral valve was the most frequently affected, with pathological changes identified in 110 patients (72.4%). Tricuspid valve involvement was observed in 25 patients (16.4%), aortic valve in 12 patients (7.9%), and pulmonic valve in 5 patients (3.3%). These data affirm the systemic and progressive nature of RHD, with multi-valvular disease being a common manifestation. The echocardiographic grading of mitral valve pathology revealed that mitral stenosis severity was mild in 56 patients (36.8%), moderate in 64 patients (42.1%), and severe in 32 patients (21.1%). In terms of mitral regurgitation, 86 patients (56.6%) had mild regurgitation, 42 patients (27.6%) had moderate, and 24 patients (15.8%) had severe regurgitation. Diagnosis was primarily made through echocardiographic assessment in 141 patients (92.8%), while electrocardiography (ECG) was used in 11 patients (7.2%). The stratified analysis of mitral stenosis severity by age group revealed that among patients aged 20–30 years (n=94), 35 (37.2%) had mild stenosis, 38 (40.4%) had moderate stenosis, and 21 (22.3%) had severe stenosis. In the 31–40 years age group (n=41), mild stenosis was present in 15 patients (36.6%), moderate in 18 (43.9%), and severe in 8 (19.5%). Among those aged 41–45 years (n=17), 6 (35.3%) had mild stenosis, 8 (47.1%) had moderate, and 3 (17.6%) had severe stenosis. Across all age categories, moderate mitral stenosis remained the most prevalent grade, highlighting a consistent burden of mid-stage disease in this population. These findings underscore the need for proactive screening and management strategies, especially in younger adults who may still be in the early or moderate stages of valve dysfunction.

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Table 1: Demographic characteristics of patients with rheumatic heart disease (N = 152)

Variable	Category	Frequency (n)	Percent (%)
Sex	Male	64	42.1
Age Group		66	33.0
	20-30years	94	61.8
	31-40years	41	27.0
	41-45years	17	11.2
Marital Status	Married	104	68.4

Table 2: Symptoms and Complications Among Patients with Rheumatic Heart Disease.

Variable	Frequency (n)	Percent (%)
Symptoms		
Chest pain	62	40.8
Syncope	42	27.6
Shortness of breath	11	7.2
Dyspnea	7	4.6
Vomiting	1	0.7
All symptoms	29	19.1
Complications		
No complication	117	77.0
Arrhythmia	13	8.6
Heart failure	12	7.9
Respiratory complication	9	5.9
Stroke	1	0.7

Table 3: Valve involvement in patients with rheumatic heart disease.

Valve	Frequency (n)	Percent (%)
Mitral Valve	110	72.4
Tricuspid valve	25	16.4
Aortic valve	12	7.9
Pulmonic valve	5	3.3

Table 4: Severity grading of mitral valve disease among patients.

Disease	Severity	Frequency (n)	Percent (%)
Mitral Stenosis	Mild	56	36.8
	Moderate	64	42.1
	Severe	32	21.1
Mitral Regurgitation	Mild	86	56.6
	Moderate	42	27.6
	Severe	24	15.8

Table 5: Distribution of Mitral Stenosis Severity by Age Group

Age Group	Mild	Moderate	Severe	Total
20-30 years	35	38	21	94
31-40 years	15	18	8	41
41-45 years	6	8	3	17

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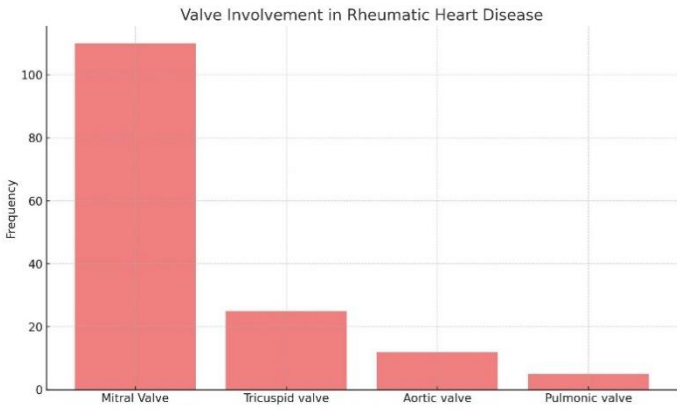


Figure 1 Valve Involvement in Rheumatic Heart Disease

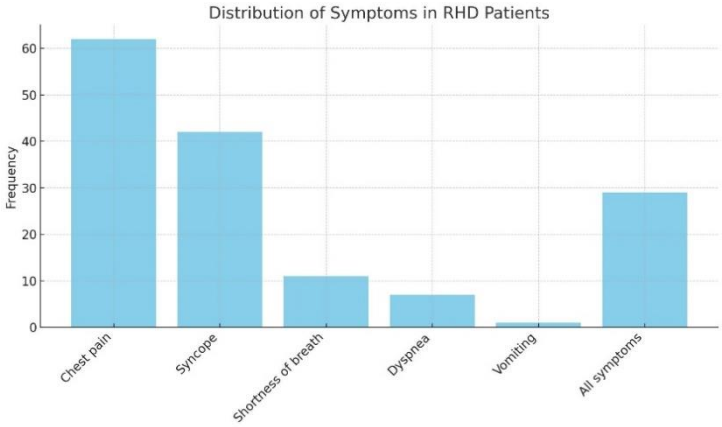
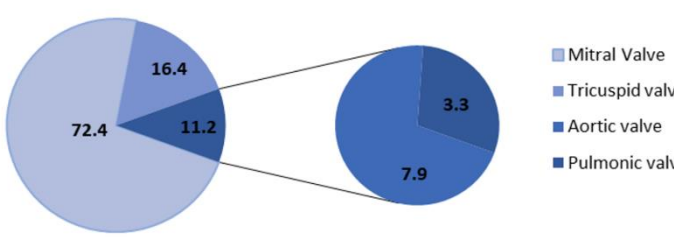
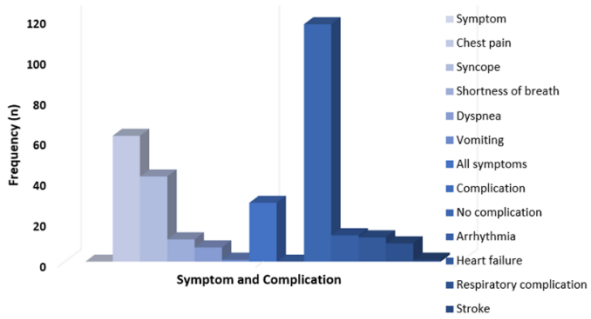


Figure 2 Distribution of Symptoms in RHD Patients





DISCUSSION

Rheumatic fever continues to be the leading cause of acquired valvular heart disease globally, with mitral stenosis remaining one of its most frequent and serious complications. In almost all cases, mitral stenosis is of rheumatic origin, reflecting the autoimmune pathogenesis initiated by Group A streptococcal infections in genetically predisposed individuals. This study reaffirmed that rheumatic heart disease (RHD) remains a significant public health concern, particularly in underserved and rural populations, where socioeconomic barriers to timely diagnosis and treatment persist. A key finding of this study was the high prevalence of rheumatic mitral valve disease (MVD) among young adult females, echoing previous epidemiological patterns reported by international cardiovascular databases. Female predominance observed in this cohort aligns with data indicating higher age-adjusted mortality rates among women with rheumatic MVD, likely a consequence of both biological vulnerability and gender-based disparities in healthcare access (15). The relatively young mean age of 29.90 ± 7.44 years observed here also mirrors patterns seen in low-resource settings, where earlier onset and faster progression of valvular disease are commonly reported (16).

Comparative evaluation with regional and international studies highlights critical age and gender differences. A population-based analysis from KwaZulu-Natal reported a younger median age with dyspnea as the predominant symptom, closely resembling the symptom profile and age demographics in this cohort (17,18). Another dataset from Virginia indicated high rates of mitral stenosis and female predominance, further supporting the consistency of these findings across diverse populations (19,20). However, contrasts were evident when compared to research in more developed or urbanized areas, where the mean age of affected individuals tends to be significantly higher, suggesting delayed disease onset or better early intervention mechanisms (21,22). In addition to demographic alignment, this study corroborated earlier findings regarding the mitral valve being the most frequently affected structure in RHD, followed by involvement of the tricuspid and aortic valves. The distribution of stenosis severity across age groups showed a consistent predominance of moderate mitral stenosis regardless of age, indicating a uniform burden of mid-stage disease in young adults. Moreover,

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the co-existence of mitral regurgitation in many cases is consistent with regional studies, such as those from Bangladesh, where combined valve lesions have been frequently observed (23,24).

This study benefitted from its multicenter recruitment within echocardiography settings and the application of objective echocardiographic grading systems, enhancing the diagnostic accuracy. However, limitations included the use of non-probability sampling, which may have introduced selection bias, and a lack of longitudinal follow-up to assess outcomes such as progression to complications or response to treatment. Additionally, the study did not account for socioeconomic or environmental variables that could modulate disease presentation and access to care. Future research should incorporate multicenter cohort designs with longitudinal tracking, allowing for better risk stratification, intervention efficacy, and real-world outcome assessment. Despite these limitations, the study's findings hold significant implications. They emphasize the need for improved screening and secondary prevention strategies, particularly in younger adults where the disease remains subclinical for extended periods. Early echocardiographic evaluation, as recommended by global cardiovascular health authorities, must be integrated into primary care workflows, especially in high-risk, low-resource settings. Policies ensuring the availability of essential medications and low-cost surgical interventions at tertiary centers remain vital. Education and training of healthcare providers at both primary and secondary levels, coupled with community awareness campaigns, are essential to curb the ongoing burden of RHD. This study adds to the growing body of evidence that reinforces the systemic, progressive nature of rheumatic mitral valve disease and its early impact on young adults. Addressing this burden requires a multifaceted response encompassing clinical vigilance, health policy reform, and robust public health infrastructure.

CONCLUSION

Rheumatic mitral valve stenosis emerged as a prevalent and clinically significant condition among young adults in District Swat, with a clear predominance in females. The mitral valve was consistently the most affected, with moderate stenosis appearing as the most common severity grade. These findings underscore the pressing need for focused screening, early diagnosis, and tailored interventions aimed at young populations, particularly women. By drawing attention to the disease burden in this age group, the study highlights the importance of strengthening preventive cardiology services and enhancing regional healthcare strategies to reduce long-term complications and improve patient outcomes.

AUTHOR CONTRIBUTION

Author	**Contribution**
Babar Ali*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Hazrat Usman	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Safa Gul	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Kushal Khan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Bashir Ullah	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Saeed Ahmed	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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