



Clinical and Echocardiographic Profile of Rheumatic Heart Disease: A Cross-Sectional Study

**Abdul Qadir Khan Dall^{1*}, Muhammed Kashif Shaikh²,
Syed Zulfiquar Ali Shah³, Tarachand Devrajani³,
Abdul Salam Memon⁴, Imran Karim³ and Samar Raza⁵**

¹Department of Operative Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro, Hyderabad, Sindh, Pakistan.

²Department of Interventional Cardiology, LUMHS, Pakistan.

³Department of Medicine, LUMHS, Jamshoro, Pakistan.

⁴Department of Surgery, LUMHS, Jamshoro, Pakistan.

⁵Department of Medicine, LUH Hyderabad, Pakistan.

Authors' contributions

This work was carried out in collaboration among all authors. Author AQKD managed the literature searches and drafting. Author MKS designed the study. Author SZAS did the statistical analysis and data collection. Author TD wrote the protocol and data collection. Authors AQKD, ASM and IK wrote the first draft of the manuscript. Authors MKS, SZAS and SR managed the analyses of the study, data collection. All authors read and approved the final manuscript.

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ABSTRACT

Background: Rheumatic Heart disease (RHD) is the leading cause of acquired heart disease and more prevalent in developing countries. The objective of the study was to determine the clinical and echocardiographic profiles of patients with rheumatic heart disease (RHD).

Materials and Methods: All patients above the age of 12 years of either gender diagnosed with Rheumatic heart disease from January 2018 to December 2019 at tertiary care hospital, Hyderabad were enrolled in the study. Detailed patient data was obtained from the hospital records. Information regarding gender, age, Electrocardiogram findings, clinical and echocardiographic manifestations was obtained.

*Corresponding author: E-mail: qadir.dall@lumhs.edu.pk;

Results: Throughout the two-year study period, a total of fifty patients with RHD were studied. The mean age of the population was 33.71 years. Females (64%) outnumbered males and 60% were rural population. The clinical features observed were fever (80%), joint pain (64%), palpitation (60%), breathlessness (90%) and chest pain (50%), tachycardia (60%), raised JVP (10%), hypertension (20%). The common echocardiographic findings observed were mitral stenosis (50%), mitral regurgitation (24%) and pulmonary hypertension (36%), left atrial enlargement (56%), and right atrial enlargement (16%) whereas the majority of the patients (70%) have ejection fraction between 40-50% and thrombus was identified in 15 (30%) patients respectively.

Conclusion: Common clinical findings observed were breathlessness and fever while the common echocardiographic findings were mitral stenosis and regurgitation, pulmonary hypertension, and left atrial enlargement. Population-based screening by echocardiography could be a potential route for early screening of rheumatic heart disease.

Keywords: Rheumatic heart disease; rheumatic fever; echocardiography; and valvular disorders.

1. INTRODUCTION

Rheumatic heart disease (RHD) is a significant cause of morbidity and mortality in third world countries [1]. It imposes a substantial burden on healthcare resources [2]. In Pakistan, RHD is one of the major causes of early cardiovascular death. The reported prevalence of RHD is very high in both rural and urban areas of Pakistan. Some causes are low income, illiteracy, overpopulation, and limited access to healthcare facilities. It results from repeated episodes of rheumatic fever, which is an inflammatory disease that appears as a delayed sequela to streptococcal pharyngitis (group A). A major outcome of this illness is rheumatic carditis. Rheumatic carditis usually reappears with severity, and ultimately causes various valvular lesions [3]. As streptococcal pharyngitis affects young children, its recurrent attacks can ultimately lead to early cardiovascular death [4].

Despite the gravity of the problem, there is no recent work done in Pakistan to gather data regarding RHD characteristics, demographics of the population, ECG, and echocardiographic findings. The World Health Organization suggests decreasing the mortality rate of RHD by 25% by the year 2025. "Therefore; an understanding of existing features of the disease in patients living in endemic regions is mandatory" [5].

Hence, we have designed this study to determine the relative frequency of various forms of valvular involvements and the clinical characteristic and patterns of RHD among patients presenting to our teaching hospitals. This study is a hospital-based registry of patients with rheumatic valve disease, aimed to collect demographic, clinical,

and echocardiographic data and also raise awareness of RHD and its clinical burden.

2. MATERIALS AND METHODS

This cross-sectional descriptive study was conducted from January 2018 to December 2019 at Liaquat University Hospital, Hyderabad. The study obtained data regarding 50 cases, aged 12 and above, who were diagnosed as RHD. The inclusion criteria of the study were the patients having age ≥ 12 years and either gender presented with dyspnea, palpitation, shortness of breath (SOB), murmur on auscultation, and arrhythmia on ECG had echocardiography for evaluation of any cardiac disease / valvular lesion while the patients with congenital heart disease patients, post-operative cases, autoimmune disease, malignancy, rheumatoid and juvenile arthritis, collagen vascular disease, myxomatous and old age degenerative disorders were excluded from the study. All the patients had to detail clinical history including inquiries about throat infection, joint pain, and fever, skin lesion, or CNS symptom, had a thorough clinical examination and advised for routine investigations. The echocardiography was performed by a senior cardiologist in accordance with American College of Cardiology / American Heart Association guidelines. All included patients underwent 2D, M-mode, color Doppler, continuous-wave, and pulse wave Doppler echocardiography using standard echocardiographic views to determine any valvular pathology while the diagnosis of each patient was recorded. In patients who were diagnosed with RHD, the valve involved, whether the lesion was stenotic or regurgitant or mixed lesion was recorded. The demographic variables were age, gender, residence, and chief

complaints. Clinical assessments were completed after written informed consent to decide patients' manifestations. Along with the baseline investigations/blood biochemistry ECG was performed regarding all matters to decide valvular association and other related conditions while the echocardiography was performed to decide irregularities, particularly valvular disorders. Mitral stenosis was considered as thickening of the mitral valve cusps; enlargement of the LA, with a normal or small LV; and a reduction in the size of the mitral valve orifice in diastole and a diminished E-F slope, is noted on M-mode images. The features suggest mitral regurgitation were symmetric tenting of leaflets, a central jet of MR, and dilated mitral valve annulus. The aortic stenosis is considered as an echo-dense aortic valve with no cusp motion and decreases in the maximal aortic cusp separation (<8 mm in adults) and the presence of otherwise left ventricular hypertrophy. The aortic regurgitation was determined by estimating the ratio of the aortic jet width (diameter) to left ventricular outflow tract (LVOT) diameter. The tricuspid stenosis was considered as diastolic doming of the valve, thickening of the leaflets and restriction in the motion of the leaflets, reduction in the separation of the commissures of the leaflets, and diminished tricuspid opening. The tricuspid regurgitation labeled when the valve had subnormal / flail / large coaptation defect and very large central jet or eccentric wall impinging jet. The pulmonary hypertension was determined by a simplified Bernoulli equation from the peak tricuspid regurgitant velocity and adding this to an estimate of right atrial pressure. The RA greater than or equal to 25 cm² was considered enlarged. The LA enlargement was considered as a transverse dimension greater than 4.0 cm or a ratio of transverse atrial to transverse aortic root dimension greater than 1.17. The left ventricle ejection fraction of less than 50% was considered as left ventricular enlargement. The right ventricle ejection fraction of less than 45% along with tricuspid annular plane systolic excursion (TAPSE) <1.5 cm was considered as right ventricle enlargement. The vegetation was considered as an oscillating or nonoscillating mass attached to a valvular structure, with a motion independent of that of the valve. Following the specific diagnosis, all the patients went through appropriate treatment for each case and had followed up until discharge from the hospital. Information was recorded and analyzed in SPSS 21 to determine the frequencies and percentages while the post stratification chi-square test was applied on

categorical variables to determine the level of statistical significance.

3. RESULTS

During two years of the study period, a total of fifty patients with RHD were diagnosed as RHD. The mean age was identified as 33.71±6.82 years, with a female gender predominance of 64%. The demographical and clinical profile of the study population is presented in Table 1. Almost all patients had cardiovascular signs (raised JVP, Tachycardia, or hypertension) and symptoms (dyspnea, palpitation, or chest pain). Auscultatory findings of Mid Diastolic murmur were quite frequent. It was demonstrated in 56 % of the cases. The echocardiographical profile of the patients (echocardiographic findings) is mentioned in Table 2.

Regarding the mitral stenosis, the statistical significance was observed in relation to gender (p=0.04) while the nonsignificant correlation was observed in relation to age and residence (p=1.52 and p=1.85) whereas in context to mitral regurgitation the statistical significance was observed in relation to gender (p=0.03) while the nonsignificant correlation was observed in relation to age and residence (p=1.83 and p=2.61).

The severity of mitral stenosis was observed to be significant in relation to age and moderate disease (p=0.02) while it is not significant in relation to gender, residence and severe disease (p=1.62 and p=1.74) whereas in context to mild disease it is observed to significant in relation to age, gender and residence (p<0.01, p=0.03 and p=0.05) respectively.

The severity of mitral regurgitation was observed to be significant in relation to gender and moderate disease (p=0.03) while it is not significant in relation to age, residence and severe disease (p=2.66 and p=3.42) whereas in context to mild disease it is observed to significant in relation to residence (p=0.04) and nonsignificant in relation to age and gender (p=4.85 and p=5.93) respectively.

Regarding the aortic stenosis, the statistical significance was observed in relation to gender and residence (p=0.01 and p<0.01) while the statistical nonsignificant correlation was observed in context to age (p=1.94) while in context to aortic regurgitation the statistical non significance was observed in relation to age,

gender and residence ($p=2.21$, $p=4.74$ and $p=5.53$) respectively.

The severity aortic regurgitation was observed to be non-significant in relation to age and mild disease ($p=1.75$) while it is significant in relation to gender, residence and moderate disease ($p=0.04$ and $p=0.03$) whereas in context to severe disease it is observed to nonsignificant in relation to age, gender and residence ($p=7.42$, $p=6.32$ and $p=5.21$) respectively.

Regarding the tricuspid stenosis, a statistically non-significant correlation was observed in context to age, gender, and residence ($p=3.73$, $p=7.51$, and $p=6.42$) respectively while in context to tricuspid regurgitation the statistical significance was observed in relation to age and residence ($p=0.04$ and $p=0.01$) while statistical non significance was identified in relation to gender ($p=1.95$).

Regarding pulmonary hypertension, the statistical significance was observed in relation to gender ($p=0.05$) while the nonsignificant correlation was observed in context to age and residence ($p=4.84$ and $p=5.62$) respectively.

The right atrial enlargement shown to be statistically significant in relation to age ($p=0.04$) while it is observed to be nonsignificant in relation to gender and residence ($p=8.63$ and $p=7.64$) while the left atrial enlargement observed to be statistically significant in relation to residence ($p=0.03$) while it is found to be nonsignificant in relation to gender and age ($p=3.31$ and 5.32).

The right ventricular enlargement was found to be statistically nonsignificant in relation to age, gender and residence ($p=7.52$, $p=6.51$ and $p=7.83$) while the left ventricular enlargement was observed to be statistically significant in relation to gender ($p=0.04$) whereas it is nonsignificant in context to age and residence ($p=3.21$ and $p=5.84$) respectively.

4. DISCUSSION

Around the world, infections of the heart valves establish a significant reason for cardiovascular morbidity and mortality. Rheumatic coronary illness (RHD) being the prevailing type of valvular heart disease in under-developed countries [6]. Acute rheumatic fever and rheumatic heart

Table 1. The demographical and clinical profile of study population

Parameter	Frequency (N=50)	Percentage (%)
AGE (yrs)		
12-19	13	26
20-29	16	32
30-39	11	22
40-49	10	20
GENDER		
Male	18	36
Female	32	64
RESIDENCE		
Urban	20	40
Rural	30	60
Symptoms		
Fever (temperature $\geq 100.4^{\circ}\text{F}$)	40	80
Joint Pain (discomfort, pain or inflammation)	32	64
Palpitation (fast, fluttering or pounding heart)	30	60
Breathlessness (shortness of breath)	45	90
Chest Pain (pain or discomfort in the chest)	25	50
SIGNS		
Tachycardia (heart rate >100 b/min)	30	60
Raised JVP (>5 cm above the sterna angle)	05	10
Hypertension ($>140/90$ mmHg)	10	20
AUSCULTATORY FINDINGS		
Mid Diastolic Murmur (MDM)	28	56
Ejection Systolic Murmur (ESM)	06	12
Early Diastolic Murmur (EDM)	05	10
Pan Systolic Murmur (PSM)	11	22

Table 2. The echocardiographical profile of study population

Parameter	Frequency (N=50)	Percentage (%)
Echocardiographic findings		
Valvular lesions		
Mitral stenosis (MS)	25	50
Mitral regurgitation (MR)	12	24
Aortic stenosis (AS)	07	14
Atrial regurgitation (AR)	06	12
Tricuspid regurgitation (TR)	09	18
Tricuspid stenosis (TS)	02	4.0
Pulmonary HTN (PH)	18	36
HEART CHAMBER SIZE		
Right atrial enlargement	08	16
Left atrial enlargement	28	56
Right ventricular enlargement	05	10
Left ventricular enlargement	10	20
Ejection Fraction		
<40%	09	18
40-50%	35	70
>50%	06	12
THROMBUS / VEGETATION		
Yes	15	30
No	35	70

disease are thought to be the outcome of an autoimmune response, but the precise pathogenesis remains unclear [7]. In this study, out of fifty patients, the majority of study subjects were in the age group of 20-29 years, with a female preponderance of 64% while the mean age was 33.71 ± 6.82 years. Similarly, a study conducted by Laudari S, et al has found nearly similar findings wherein, the age of the patients ranged from 07 to 76 years with mean age 39.82 ± 4.2 years with female preponderance [8]. Joseph N et al, have also noted the mean age of RHD being 33.20 ± 18.61 years [9]. On the other hand, few studies have shown the mean age to be much younger where it was 28 years and 25 years [10–12].

The most common complaint among the study subjects with RHD was breathlessness at 90%. Similarly, a study conducted by Grover A, et al also reported 83% of patients presenting with dyspnea on exertion [13].

A study conducted by Figueroa F, et al has demonstrated that echocardiography is very important in the diagnosis of RHD. It confirms that in some patients there might be no auscultatory evidence of RHD but echocardiography can reveal acute valvular lesions and happen in 50% of cases [14].

In the present series, all fifty patients have valvular involvement and the majority had multi-

valvular heart disease with a minimum of 2 valves involved. However, in a study by Manjunath CN, et al the order of involvement was mitral stenosis with mitral regurgitation > mitral stenosis with aortic regurgitation > mitral regurgitation with aortic regurgitation > aortic stenosis with aortic regurgitation > mitral regurgitation with aortic stenosis > mitral stenosis with aortic stenosis [15]. Faheem M, et al have noted mitral stenosis as the most frequent valvular lesion affecting 70%, 51.4% were in a combination of multivalvular involvement. Of those with mitral stenosis, 24.5% patients had severe, 37.9% and 37.6% patients were having moderate and mild mitral stenosis respectively [16].

ECG findings in the current study showed 40.0% of the subjects had atrial fibrillation (AF). The same findings correlated with echocardiographic findings for atrial fibrillation. According to a study by Sharma SK et al, the incidence of atrial fibrillation in RHD patients was 43.61% [17]. Similarly, a study conducted in Nepal by Laudari S, et al revealed that the most common arrhythmia in patients with RHD was atrial fibrillation (29.78%) mostly seen in mitral stenosis (60.24%) followed by mitral regurgitation (26.34%) [18].

In our study, thirty-six percent of the patients with RHD had pulmonary HTN as pulmonary venous

hypertension is known to be common in valvular lesions and is said to be due to the large prevalence of rheumatic valvular heart disease burden in our country and hence contributes to a large majority of patients with severe pulmonary hypertension. Sani MU et al reported pulmonary hypertension (72.1%) in individuals with rheumatic heart disease [19]. The data suggest that recurrences of RF are higher in patients with RHD and each recurring disease episode further damages the heart [20]. The monitoring of medical therapy because RHD at this stage would warrant lifelong prophylaxis while in order to counter these recurrent attacks effective secondary prevention is required, which relies on accurate case detection for the appropriate use of prophylactic antibiotics and regular medical surveillance whereas the echocardiography plays an important role firstly, in early detection of RHD [21, 22].

5. CONCLUSION

RHD is a major acquired valvular heart disease among young individuals. The study revealed that the common clinical findings were breathlessness, fever, joint pain, and palpitation while the common echocardiographic findings were mitral stenosis and regurgitation. Atrial fibrillation was also identified in several cases. Population-based screening by echocardiography can be performed for patients with rheumatic heart disease to facilitate early diagnosis before complications develop. Furthermore, there is a need to introduce widespread primary and secondary preventive methods to decrease the burden of the disease.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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