Internal Medicine Section

Prevalence and Involvement of Different Valves in Rheumatic Heart Disease- An Observational Echocardiographic Study in a Tertiary Care Centre, Bengaluru, India

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ABSTRACT

Introduction: Rheumatic Heart Disease (RHD) is a non suppurative sequelae of group A beta haemolytic streptococci, resulting from inadequately treated streptococcal sore throat or scarlet fever and leading to valvular heart disease. Rheumatic heart disease is a major cause of morbidity and mortality in younger population in developing countries. The present study was done at a tertiary care medical college hospital with the objective of establishing prevalence and involvement of different valve patterns by Echocardiography (ECHO).

Aim: To analyse the valvular pattern of RHD over a period of four years in a tertiary care centre and highlight the importance of ECHO in the definitive diagnosis of RHD, and to know the continuing burden of RHD.

Materials and Methods: This was a hospital based retrospective observational study conducted at Vydehi Institute of Medical Sciences and Research Centre, Bengaluru, Karnataka, India. A total of 518 cases of RHD were selected as a study population among the ECHO performed between January 2016 and January 2020 after an exclusion criterion of degenerative mitral and aortic valve disease, congenital aortic and mitral valve disease, myxomatous mitral valve disease, trivial and functional

regurgitation. Analysis of valvular pattern was performed. Data analysis was done by tables, charts, percentages and ratio.

Results: A total of 518 patients were diagnosed to have RHD by 2-Dimensional ECHO. Among them 276 (53%) were females and 242 (47%) were males. The average age was 41.9 years. The most common valve involved independently and in combined lesions was the mitral valve. Of the study population, 446 patients had Mitral Stenosis (MS) and 393 had Mitral Regurgitation (MR). Aortic Stenosis (AS) was found among 111 patients and 304 patients had Aortic Regurgitation (AR). Tricuspid Stenosis (TS) (organic) was found in seven cases. Multiple valves were involved in 204 cases. Among them 104 of the cases had MS, MR and AR, 69 cases had MS, MR, AS and AR, 21 cases had MS, AS and AR, seven cases had MR, AS and AR and three cases had MS, AS, AR and TS. Though aortic valve was involved in multi valvular lesions, significant AR (moderate and severe) was seen in 109 patients and significant AS (moderate and severe) was seen in 67 patients.

Conclusion: RHD continues to be a major burden to population in developing countries. In the present study, various patterns of valvular involvement were noted. Drastic measures are to be taken primary and secondary prevention of RHD.

Keywords: Aortic regurgitation, Aortic stenosis, Echocardiography, Mitral regurgitation, Mitral stenosis

INTRODUCTION

The Rheumatic Heart Disease (RHD) remains a significant cause of morbidity and mortality, affecting children and younger population in their formative years. The burden of RHD varies among countries as per the socio-economic status and health care systems [1-4]. Rheumatic fever and RHD have disappeared from wealthy countries, whereas it is still a burning problem in developing countries [5]. The burden of RHD has been estimated from population, school and hospital based studies which have their own limitations (no uniformity and standardisation). School health and population surveys are performed clinically and symptom based. ECHO surveys have yielded more diagnosis (>30% of clinical surveys) [6,7]. The prevalence of RHD is varied among urban, rural and different geographic areas based on over-crowding, poor sanitation, under nutrition, poor housing, poverty which can cause rapid spread of group-A beta haemolytic streptococci [8]. ICMR study conducted between 2002 to 2010, in 10 different urban locations, found the prevalence to range from 0.2 to 1.1 per 1000 [9]. The prevalence of RHD in India, based on population survey, was found to be 2.2/1000 in rural areas and 1.23/1000 in urban areas [10-12].

Diagnosis of rheumatic fever- the Jones criteria, was introduced in 1944, which included major and minor criteria, which was

further modified by American heart association and world health organisation in order to improve specificity. Diagnosis of rheumatic fever required the demonstration of streptococcal aetiology [13,14], which improved specificity but compromised with sensitivity.

Recurrence of RHD occurs if an initial episode has involved the heart [15]. Systematic screening with ECHO in comparison to clinical screening reveal much higher prevalence of RHD (>10 times) [15]. It can be recognised with clinical features like onset of new murmur, pericardial rub, development of features of congestive heart failure with evidence of cardiomegaly in chest X-ray and previous echocardiographic study diagnosing RHD [16]. The burden on healthcare system also involves repeated hospital admissions and expensive surgical interventions [17], handling the complications like cerebrovascular accidents, thromboembolic phenomenon, acute ischemia, arrhythmia, Infective Endocarditis (IE), pregnancy with RHD and prosthetic valve thrombosis [18-20]. At the time of presentation, about 50% of newly diagnosed RHD patients had complications [21]. Primordial, primary, secondary prophylaxis with benzathine penicillin as per WHO recommendation should be followed [22,23].

The aims and objectives of this study were to analyse the valvular pattern of RHD with the importance of ECHO in diagnosis of RHD and to know the continuing burden of RHD in order to execute primary, secondary and tertiary prevention.

MATERIALS AND METHODS

The present hospital based retrospective observational study was conducted at Vydehi Institute of Medical Sciences and Research Centre, Bengaluru, Karnataka, India. A total of 518 cases of RHD were selected as a study population among the ECHO performed between January 2016 and January 2020. The ethical committee clearance was obtained. Analysis of valvular pattern was performed using echocardiographic criteria [24]. The analysis was done and completed by January 2021.

Inclusion criteria: Assessment of mitral valve and tricuspid valve included leaflet mobility, anterior mitral leaflet doming and posterior mitral leaflet restriction, valve thickening (>5 mm), thickening of sub valvular apparatus, commissural fusion, valvular calcification and assessment of mitral valve area in grading mild, moderate and severe stenosis by planimetry and EF slope.

Exclusion criteria: An exclusion criterion include degenerative mitral and aortic valve disease, congenital aortic and mitral valve disease, myxomatous mitral valve disease, trivial and functional regurgitation.

Study Procedure

MR was assessed quantitatively by measuring distal jet area relative to left atrial area and vena contracta width (narrowest portion of MR jet) and Proximal Iso Velocity Area (PISA). Aortic valve gradient was used to assess Aortic Stenosis (AS) severity. Aortic Regurgitation (AR) was assessed by jet width, percentage of jet area with respect to Left Ventricular Outflow Tract (LVOT) and diastolic flow reversal [24]. The tricuspid regurgitation was assessed by measuring the width of the colour jet at its narrowest point as it passes through the Vene Contracta (VC). The VC <3 mm indicates mild TR, 3 to 7 mm width moderate TR and >7 mm width severe Tricuspid Regurgitation (TR). Tricuspid Stenosis (TS) was indicated by doming of tricuspid valve, reduced EF slope, commissural fusion, thickening of sub-valvular apparatus, valve thickening and mean tricuspid valve gradient on continuous wave doppler of >2 mmHg [24].

STATISTICAL ANALYSIS

Data analysis was done by tables, pie charts, percentage and ratios.

RESULTS

In the patients who underwent 2-D ECHO over a four year period, 518 patients were diagnosed to have RHD, following the standard echocardiographic criteria. Among the patients of RHD, youngest was four years and the oldest was 80 years of age, with the average age being 41.9 years, mode 47 years and median 42 years. The age distribution is shown in [Table/Fig-1]. A total of 276 (53%) were females and 242 (47%) were males with leading involvement of females.
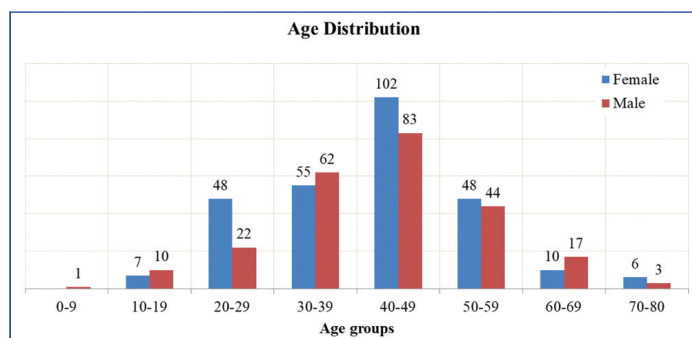

[Table/Fig-1]: Age distribution.

The total number of Mitral Stenosis (MS) cases (both isolated and combined) was 446 (86% of total). Among them 243 (54%) were females and 203 (46%) were males as shown in [Table/Fig-2]. Mild (94, 21%), moderate (106, 23.7%) and severe (246, 55%) MS cases were analysed. Most of the patients had moderate to severe MS at presentation.
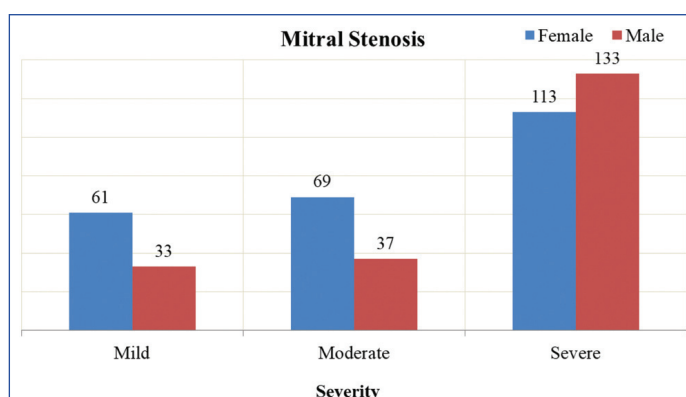

[Table/Fig-2]: Gender prevalence of Mitral Stenosis (MS).

MR cases, combined and isolated, were 393 (76% of total). Among them 220 (56%) were females and 173 (44%) were males. Thus, the most commonly involved valve was mitral valve. Mild (162, 41%), moderate (106, 26%) and severe (246, 62.5%) MR cases were analysed in the [Table/Fig-3].
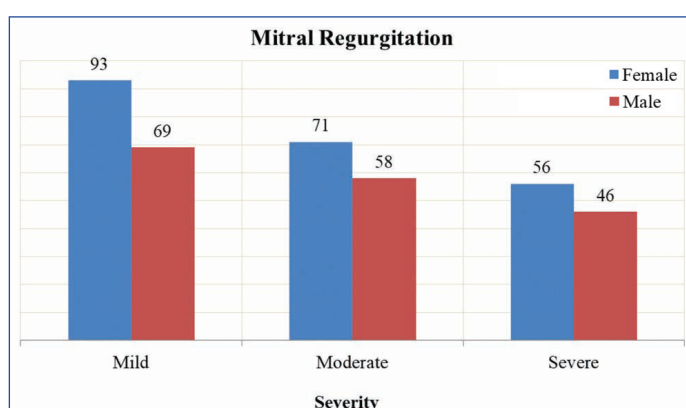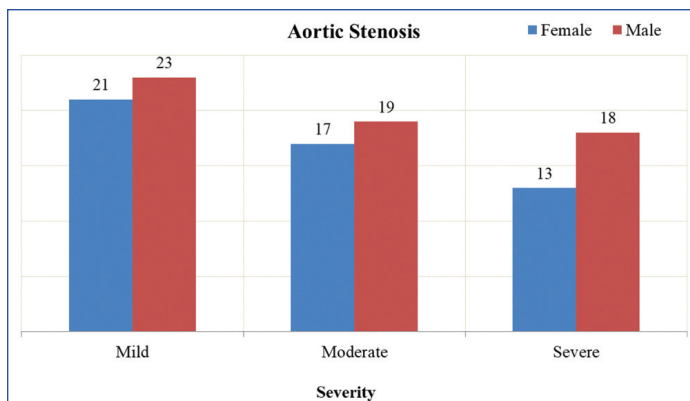

[Table/Fig-3]: Gender prevalence of Mitral Regurgitation (MR).

AR cases were 304 (59%) with 142 (47%) females and 162 (53%) males. AR was more common in males. 195 (64%) cases had mild AR, 72 (24%) had moderate AR and 37(12%) had severe AR. Both isolated and combined valvular lesions were considered and compared in [Table/Fig-4]. AS were 111 (21%) with 51 (46%) females and 60 (54%) males and mild AS was 44 (40%), moderate AS were 36 (32%) and severe AS were 31 (28%) are as shown in [Table/Fig-5].
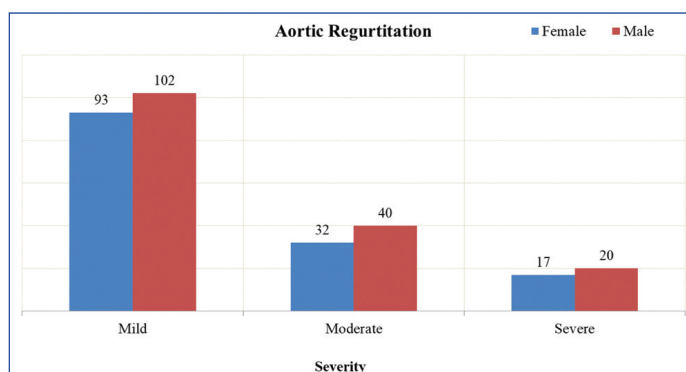
[Table/Fig-4]: Gender prevalence of Aortic Regurgitation (AR).

A total of 414 cases had both MS and MR including multi-valvular lesions, with 227 (55%) being females and 187 (45%) males. Among the significant lesions (moderate and severe), isolated MS cases were 164 (32%). Of these 125 (76%) cases were severe MS and 39 (24%) cases were moderate MS. These can further be categorised under no Pulmonary Arterial Hypertension (PAH) 11 (7%), mild PAH 67 (40%), moderate PAH 41 (25%) and severe PAH 45 (27%). Isolated MR was 60 cases (12%), of which moderate MR 11 (18%) and severe MR 49 (82%). These can

[Table/Fig-5]: Gender prevalence of Aortic Stenosis (AS).

further be categorised under no PAH 2 (3%), mild PAH 32 (53%), moderate PAH 17 (28%) and severe PAH 9 (15%). Combined MS and MR cases were 78 (15%). The total isolated and combined mitral valve lesions were 302 (58%). These can further be categorised under no PAH 4 (5%), mild PAH 32 (41%), moderate PAH 24 (31%) and severe PAH 18 (23%).

Seven (1.4%) cases had organic TS and mild-to-moderate TR. All these cases had moderate to severe MS, 4 cases had MR, 5 cases had AR, 4 cases had AS which implies that TS was associated with multi-valvular involvement. Organic tricuspid regurgitation (identified by low pressure TR) was seen in 125 cases and remaining 233 cases of TR (with moderate to severe PAH) were a resultant of mitral and aortic valve diseases.

Complications of RHD

Analysis of the complications of RHD, AF, LA thrombus, increased LA size, LV dysfunction, RV dysfunction, IE was done and the results are shown in [Table/Fig-6-8].
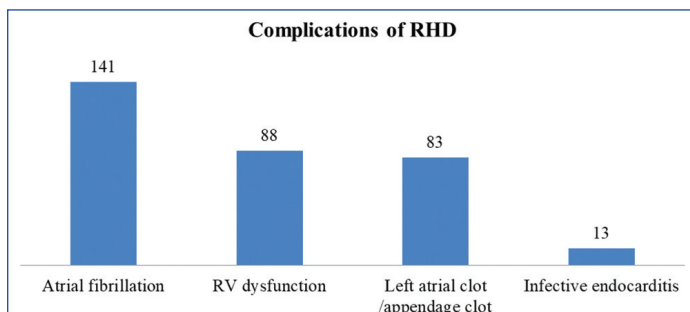

[Table/Fig-6]: Complications of Rheumatic Heart Disease (RHD).
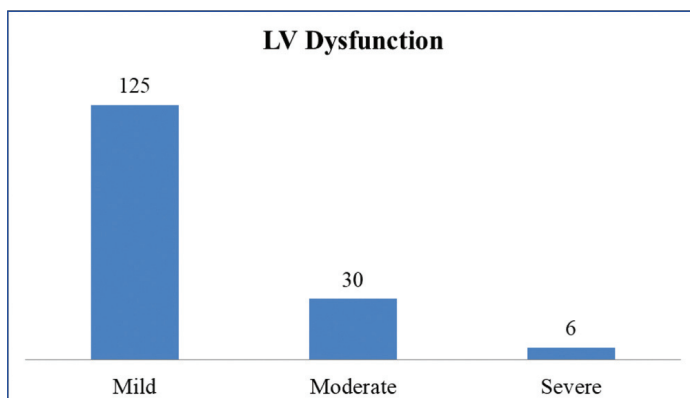
[Table/Fig-7]: Severity of Left Ventricular (LV) dysfunction.

Comparing the dilated LA sizes, >4, 51.5% were 4-5 cm, 22.2% were 5-6 cm , 6% were 6-7 cm, 3% were 7-9 cm. 24.1% had mild LV dysfunction, 5.8% and 1.1% had moderate LV dysfunction, RV dysfunction as measured by TAPSE was seen in 17%. LV dysfunction indicated valvular Cardiomyopathy. IE was seen in 2.5%. Left Atrial/Appendage clot was seen in 16%.
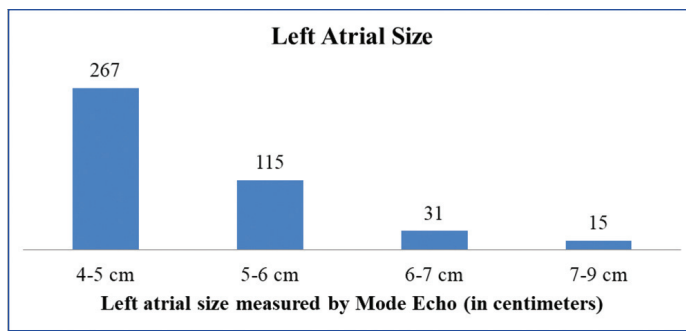
[Table/Fig-8]: Left atrial size distribution.

DISCUSSION

The RHD is non suppurative, immunological sequelae of group A streptococcal pharyngitis. In the present study, assessment of the various patterns of valvular involvement in 518 patients over a period of four years based on standard echo criteria was performed. Mitral valve involvement was the most common lesion in the present study. MS was the most common lesion (both common and isolated). Aortic valve disease was associated with mitral valve disease. Isolated aortic valve disease was seen in less number of cases. Females were more common in both MS and MR, whereas aortic valve involvement were more commonly seen in males. All these findings were similar to a previous study [25]. The most common isolated lesion was MR and mixed lesion was MS+MR, in a study conducted at a tertiary care hospital in Nepal [26]. Organic TR, though seen in less number of cases was always associated with mitral and aortic lesions. Organic tricuspid regurgitation (identified by low pressure TR) was seen in 125 cases and remaining cases of TR were a resultant of mitral and aortic valve diseases. This was similar to a recent study [27].

The age distribution was from four years to 80 years. The disease in younger age group can be prevented by public health education by all available media, especially through video films as recommended [28]. The younger age of onset (juvenile RHD) is a special feature of both public health and clinical importance [29]. RHD was more common in females as seen in previous studies [30]. MS was more than MR. Age group of maximum cases of MS was between 40 to 50 years. There was no organic pulmonary valve involvement in our study. Isolated aortic valve disease was seen in less number of cases. AR was more common lesion in association with mitral valve. Among aortic valve involvement more cases were mild AR. AS had almost equal number of mild, moderate and severe cases.

In combined lesions, MS+MR were more common as seen in other studies, followed by MS+AR, MR+AR, AS+AR, MS+AS, MR+AS, MS+AS. Most patients, at presentation, had moderate to severe MS with severity of PAH relating with severity of MS. Increased PAH was more in MS than MR or MS+MR. In multi-valvular involvement, MS+MR+AR was the most common valvular involvement and MS+AS+MR was rare. Multi-valvular involvement was more in the present study. In aortic and mitral valvular involvement, Mitral disease was more severe with many cases having mild AR. Significant Aortic involvement was less.

Complications of RHD: Atrial Fibrillation was seen 27.2% similar to a meta-analysis of AF in RHD [31]. AF was proportionate to increasing age of the patient and LA size. IE was noted in few cases. Trans-oesophagial ECHO was done to confirm LA and LAA clots and vegetation. Valvular Cardiomyopathy was also noted. PAH was analysed with respect to valvular lesions.

Execution of continuous quality improvement strategy for implementation of management guidelines at the primary health care level can successfully improve management of RHD [32]. To augment RHD global priority, proponents will need to establish more effective governance, mechanisms to facilitate collective actions, manage differences, surrounding solutions identifying positions that resonate with policy makers and funders [33]. Identification of patients with mild features of the disease by ECHO will facilitate early

treatment. A global vaccine that covers low income countries would be extremely helpful to eradicate RHD completely with the recent computational advancements in the field of vaccinology [34].

Limitation(s)

It was a retrospective study where the clinical features were not included and severe forms of disease were noted. Further studies including the clinical features, can be conducted.

CONCLUSION(S)

The RHD continues to be a significant burden in the productive age group. Analysis of different valvular patterns indicated that Mitral valve is the most common valve involved followed by aortic valve and Tricuspid valve. More studies have concluded about the importance of echo-surveys in early detection and initiation of secondary and tertiary prevention in the population. There is a major role of secondary prevention in containment of the disease. This study indicates that RHD still continues to have a significant prevalence. It also indicates the current trends and rapid need for the change in modality for detection of the disease in endemic areas and the need for active involvement of health services by providing facilities with provision of ECHO in district hospitals and for primary, secondary and tertiary prevention with strategies as per World Health Organisation (WHO) guidelines.

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