Original Research Article

Transition of pattern of Valvular Involvement in RHD after Rising Trend of Using Screening Echocardiography

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Abstract

Background: Worldwide rheumatic heart disease (RHD) is the most common cause of heart disease with multi valvular pattern. Hospital or autopsy based studies related to valvular patterns in RHD over represents severe symptomatic cases. Over last few years, screening echocardiography has emerged as an important tool for diagnosis of asymptomatic RHD.**Objective:** To estimate the true prevalence of different patterns of valvular involvement across whole clinical spectrum (asymptomatic and symptomatic phase) of RHD.**Methods:** New patients attending cardiology OPD for cardiac evaluation for the presence of suspected heart disease were evaluated by screening echocardiography. Based on World Heart Federation (WHF) echocardiographic criteria 2012, total 3656 patients diagnosed to have RHD, out of which 1877(51.3%) patients were asymptomatic and rest 1779(48.6%) patients were symptomatic. Frequency of different valvular patterns were analysed in each group and also in total cases of RHD.**Result:** Majority of patterns were mixed type. Out of total cases RHD, MR +AR or isolated MR were the common patterns observed in 20.5%, 19.5% cases respectively. Among the asymptomatic group, mild MR, mild to moderate MR + mild AR were the common patterns observed in 35.4%, 32.4% cases respectively. Among the symptomatic group, severe MS most commonly observed in 55% cases.**Conclusion:** MR or MR + AR with mild to moderate intensity were the most common pattern observed in asymptomatic cases of RHD . As the burden of asymptomatic cases is high among total cases of RHD, therefore such patterns also reflected across whole clinical spectrum of RHD. Whereas patterns like severe MS (mixed / isolated) were observed most commonly observed in symptomatic cases of RHD.

Keywords: RHD, asymptomatic RHD, symptomatic RHD, AR, MR, MS

Introduction

Rheumatic heart disease (RHD) is a major health burden, that represents an important cause of morbidity and mortality in developing countries like India.[1] Chronic RHD is highly prevalent in the population of Western part of Odisha including adjacent part of Chhattisgarh and Jharkhand, [2] on which the present study is based. Worldwide RHD is the most common cause of heart disease with multi valvular pattern. [3] Most of the studies related to valvular pattern in RHD were either hospitals based or autopsy based .Majority of the hospital based studies were conducted in tertiary hospital. Patients with RHD, who attend tertiary hospitals for advanced treatment or cardiac surgery usually represent severe symptomatic phase of disease, therefore the chances of over representation of severe symptomatic cases more likely in hospital based studies. [4] Similarly patients in autopsy based studies, died due to RHD, most often represent end stage disease. Therefore hospital or autopsy based studies may not reflect the true prevalence of valvular pattern across whole clinical spectrum in RHD .Based on progression of cardiac symptoms and signs, clinical spectrum of rheumatic heart disease can be categorised in to three important phases,i.e 1.asymptomatic subclinical(asymptomatic, no murmur), 2. asymptomatic clinical(asymptomatic,low grade murmur) 3. symptomatic (symptomatic, high grade murmur).[5]

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Patients with asymptomatic (clinical or subclinical) phase of RHD, usually do not attend hospital for evaluation due to absence of cardiac symptoms, therefore most often remains undetected, till the disease progresses to symptomatic phase. Even if they attend hospital for routine health check-up, their diagnosis most often missed due to subtle cardiac signs . History of past rheumatic fever can provide a clue to suspect RHD in these groups of patients. However half of the patients with RHD do not provide the history of past rheumatic fever, [6] so it becomes very challenging in the part of physicians to diagnose asymptomatic undetected cases of RHD from history and clinical examination. Hence screening echocardiography is the most important tool to detect the disease in patients with asymptomatic RHD. It is also superior to clinical examination in detection of disease in asymptomatic RHD.[7] Echocardiographic prevalence of RHD found to be several fold higher than clinical prevalence of RHD.[8] Hence World Health Organization (WHO) and National Institute of Health (NIH) consensus recommended screening echocardiography for detection of asymptomatic cases in endemic areas of RHD.[9] World Heart Federation (WHF) criteria 2012 further standardised the echocardiographic screening criteria for diagnosis of the RHD to detect asymptomatic cases.[10] Over the last few years, use of screening echocardiography has also increased due to increase in frequency of referrals for routine cardiac evaluations. Hence we took this opportunity to evaluate the cases for presence of RHD and find out the true prevalence of different pattern of valvular involvement across the whole clinical spectrum (symptomatic and asymptomatic phase) of RHD

Materials and Methods

New patients attending cardiology OPD, VIMSAR, BURLA between November 2015 to November 2020 for routine medical check-up and cardiac evaluation for the presence of suspected heart disease were evaluated by screening echocardiography. Patients with valvular heart diseases with aetiology other than RHD (congenital, degenerative, connective tissue disorder) and patient with RHD with prior history of cardiac intervention/valve replacement/ taking medication for RHD were excluded from the study. Based on World Heart Federation (WHF) echocardiographic criteria, 2012, [10] total 3656 patients diagnosed to have RHD and included as final study participants. All patients were reviewed by two cardiologists during echocardigraphy to remove any bias in reporting before establishing diagnosis of RHD. Patients were categorised in to two groups based on presence or absence of cardiac symptoms. Out of 3656 patients, 1877(51.3%) patients were asymptomatic and included in group A (asymptomatic group). Rest 1779(48.6%) patients were symptomatic and included in group B (symptomatic group). The Severity of each valvular lesion was defined according to AHA/ACC 2006 guidelines. [11] Frequency of different valvular patterns as per type, severity calculated and analysed in each group and also in total cases of RHD.

Results

1) Age and gender wise distribution of chronic RHD

Out of 3656 patients, 2345(64.1%) patients were female and 1311(35.9%) patients were male .Highest prevalence chronic RHD was noted in the age group of 41- 50 yrin 798(21.8%) cases followed by 31-40 years[653(17.9%)], 51 – 60 years[501(13.7 %)] ,21-30 years [581(15.9%)],61-70 yrs[403(11%)],>70 yrs[438(12%)], <20 years [284(7.8%.)].

2) Prevalence of valvular involvement in RHD

a) Mitral valve most commonly involved in 3487(95.3%) cases. Aortic valve, tricuspid valve and pulmonary valve involved in 2488(68.0%), 235(6.4%), 6(0.16%) cases respectively (Table 1).

b) While studying combined valvular involvement, mitral and aortic valve involvement was most commonly observed in 2488 (68.0%) cases. Mitral and tricuspid involvement in 122 (3.3%) cases and mitral, aortic and tricuspid valve involvement was observed in 113(3.1%) cases. Involvement of all the four vales were observed in 6 (0.16%) cases (Table 1, figure 1).

c) Only one case of MS AS TS and PS was observed during whole period of observation (Table 2). Mitral valve disease observed in all the patients with organic tricuspid valve disease and both mitral and tricuspid disease observed in all the patients with pulmonary disease (Table 1).

Table 1:Prevalence of valvular involvement in RHD

Valvular Involvement	Number of patients (n)	Frequency (%)
Mitral Valve(MV)	3487	95.3%
Aortic Valve(AV)	2488	68.0%
Tricuspid Valve(TV)	235	6.4 %
Pulmonary Valve(PV)	6	0.16%
Combined Valvular Involvement	**Number of patients (n)**	**Frequency(%)**
MV+AV	2488	68.0%
MV+TV	122	3.3 %
MV+AV+TV	113	3.1 %
MV+AV+TV+PV	6	0.16%

(MV-mitral valve, AV-aortic valve, TV-tricuspid valve, PV-pulmonary valve.)

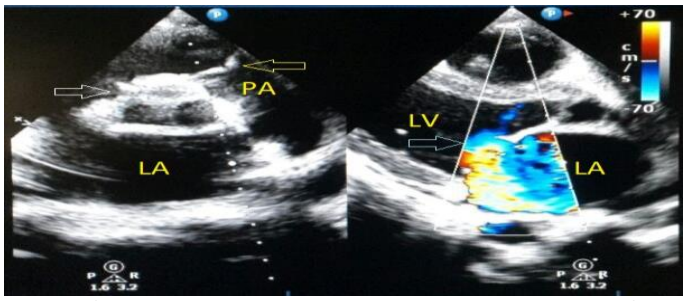

Fig 1:Echocardiography in a rare case of multivalvular involvement.including pulmonary valve. Left panel shows short axis view, white arrow shows a thick aortic valve and yellow arrow a thick pulmonary valve, Right panel shows a parasternal long axis view, blue arrow indicates a thick mitral valve with a jet of MR of moderate severity. [LA- Left Atrium., LV-Left Ventricle, PA-Pulmonary artery.]

3) Prevalence of multivalvular pattern across whole clinical spectrum of RHD

Total 81 number of multiple pattern of valvular involvement was observed and the prevalence of different patterns of valvular involvement is given in detail in Table 2.

Table 2: Prevalence of different pattern of valvular involvement in RHD

Pattern of valvular lesion	No	%	Pattern of valvular lesion	No	%
1.Mild MR	665	18.2	41.Severe MS Severe AR Mod AS	14	0.38
2.Mild MR Mild AR	461	12.6	42.Mild MS Severe MR Mod AR	10	0.27
3.Severe MS Mild MR Mild AR	234	6.4	43.Mod MS Mod AR	9	0.24
4.Severe MS Mild MR	197	5.4	44.Mod MS Mild MR Mod AR Mod AS	8	0.21
5.Severe MS	150	4.1	45.Mod MR Severe AR	8	0.21
6.Mod MR Mild AR	149	4.1	46.Severe MS Mild AR Mild AS	8	0.21
7.Severe MS Mild AR	132	3.6	47.Mild MS Mild MR Mod AR Mild AS	8	0.21
8. Mild MS Mild MR	121	3.3	48.Mod MS Mild MR Mod AR Mild AS	8	0.21

9. Mod MS Mild MR Mild AR, Mild AS	117	3.2	49.Severe MS Severe MR Mild AR Mild AS	8	o.21
10.Mild MS Mild MR Mild AR	118	3.2	50.Mild MS Mod AR Mild AS	8	0.21
11.Mild MS Severe MR Mild AR	84	2.3	51.Mild MS Severe MR Severe AR	7	0.21
12.Mild AR Thick MV	77	2.1	52.Severe MS Severe AR	7	0.21
13.Severe MS Mod MR Mild AR,TS,TR	69	1.9	53.Mod MS Mod AR	6	0.16
14.Severe MS Mild MR Mild AR, TS,TR	69	1.9	54.Mod MS Mild AR Mild AS	6	0.16
15.Mild MS Mod MR Mild AR	68	1.9	55.Severe MS Mod MR Mild AR Mild AS,TS,TR	6	0.16
16.Mild MR Severe AR	68	1.9	56.Severe MS Severe AR Mod AS	6	0.16
17.Severe MS Mild MR, Mild AR Mod AR, TR	59	1.6	57.Severe MS Mod AR Mod AS	6	0.16
18.Mod AR Thick MV	52	1.4	58.Mild MS Severe MR Severe AR,TS	6	0.16
19.Severe MR Mild AR	51	1.4	59.Mild MS Mild MR Mild AR Severe AS	6	0.16
20.Severe MR	51	1.4	60.Severe MS Mild MR Mod AR	6	0.16
21.Mod MS Severe MR Mild AR and Mild MR, TR	44	1.2	61.Mild MS Mild MR Severe AR Mild AS	5	0.14
22.Mild MS Mod MR	38	1.03	62.Mild MS Mild AR Mild AS	5	0.14
23.Mod MS Severe MR Mild AR	37	1.03	63.Mild MR Mild AR Mild AS	5	0.14
24.Severe MS Mod MR,TR	29	0.8	64.Severe MS Mod MR Severe AR Mild AS	5	0.14
25.Mild MR Mod AR	26	0.7	65 Severe MS Severe MR Mild AR	5	0.14
26.Severe MS Severe MR	25	0.68	66.Mod MS severe AR	5	0.14
27.Mild MS Severe MR	25	0.68	67.Mod MS Severe MR Mod AR	5	0.14
28.Severe MS Mod AR	19	0.5	68.Mild MS Mild MR Severe AR	5	0.14
29.Mod MS	18	0.5	69.Mild MS Mild MR Mild AS	4	0.11
30.Mild MS Mild AR	18	0.5	70.Mild MS Mod MR mild AR Severe AS	4	0.11
31.Mod MS Severe MR	18	0.5	71.Mild MS Mild MR Mild AR Mod AS	4	0.11
32.Mod MS Mild AR	18	0.5	72.Severe MS MOD MR Severe AR	4	0.11
33.Mod MS Mild MR	18	0.5	73.Severe MS Mild MR Mod AR Severe AS	4	0.11
34.Mild MS	18	0.5	74.Mild MS Severe AR	4	0.11
35.Severe MS Mild MR Mild AR Mild AS	17	0.46	75.Severe MS severe MR Mild AR	4	0.11
36.Severe MS Severe MR Mild AR,TS	15	0.4	76.Mild MR Mild AR Mod AS	3	0.08
37.Mod MR Mod AR	15	0.4	77.Severe MS Mod MR Mild AR Mild AS	3	0.08
38.Severe MS Mod AR Mod AS	14	0.38	78.Mild MS Mild MR Severe AR Mild AS	3	0.08
39.Mod MR Mild AR Mild AS	14	0.38	79.Mod MS Mild MR Severe AR, TS, PS	3	0.08
40.Severe MS Mild MR Severe AR	14	0.38	80.Severe MS, mild MR, TS, PS	2	0.05
			81.Severe MS, mild AS, TS, PS	1	0.03

[MS-mitral stenosis, AR-aortic regurgitation, MR-mitral regurgitation.AS-aortic stenosis, PS-pulmonary stenosis, TS-tricuspid stenosis, TR-tricuspid regurgitation (organic), Mod-moderate, no-numbers]

4) Distribution of valvular lesions in RHD as per severity

MR was the most common lesion observed in 3105(84.9%) cases. Mild MR found more prevalently in 2295 (62.7%) cases as compared to moderate MR and severe MR in 415(11.3%), 395(10.8%) cases respectively. AR was the most common lesion after MR, observed in 2252 (61.5%) cases. Mild AR more prevalently observed in 1882 (51.4%) as compared to moderate AR and severe AR in 210 (5.7%), 160(4.3%) cases respectively. MS was observed in 2021(55.2%) cases, out of which severe MS observed more commonly in 1132 (30.9% cases) as compared to mild MS and moderate MS in 569(15.6%),320(8.7%) cases respectively.AS was the least common lesion observed in 282(7.7 %)cases .Mild AS, moderate AS and severe AS was observed in 233(6.3%), 35(0.95%), 14 (0.38 %) cases respectively(table 3).Organic tricuspid valve disease (either in the form of organic TR or TS or both) was observed in 235(6.4%) of cases only and all the patients with organic tricuspid valve disease had associated mitral valve lesion (Table 1,Table 2). Functional TR is observed 833(22.7%) patients.

Table 3: Prevalence valvular lesions in RHD as per severity

Valvular lesion	Mild n (%)	Moderate n (%)	Severe n (%)	Total n (%)
MR	2295(62.7%)	415(11.3%)	395(10.8%)	3105(84.9%)
MS	569(15.6%)	320(8.7%)	1132(30.9%)	2021(55.2%)
AR	1882(51.4%)	210(5.7%)	160(4.3%)	2252(61.5%)
AS	233(6.3%)	35(0.95%)	14(0.38%)	282(7.7%)

[MS-mitral stenosis, AR-aortic regurgitation, MR-mitral regurgitation.AS-aortic stenosis, n-number, %-percentage)

5) Prevalence of different type of valvular patterns in RHD

1. Majority of lesion in chronic rheumatic heart disease were mixed type, observed in 2635(72%) cases .Whereas isolated valvular lesion observed in 1021(28%) cases .
2. Among isolated lesions, isolated MR was observed most commonly in716(19.5%) cases as compared to isolated MS, isolated AR(with mitral valve thickening) in 186(5%) , 129(3.5%) cases respectively. No case of isolated AS detected during whole period of observation (figure 2).

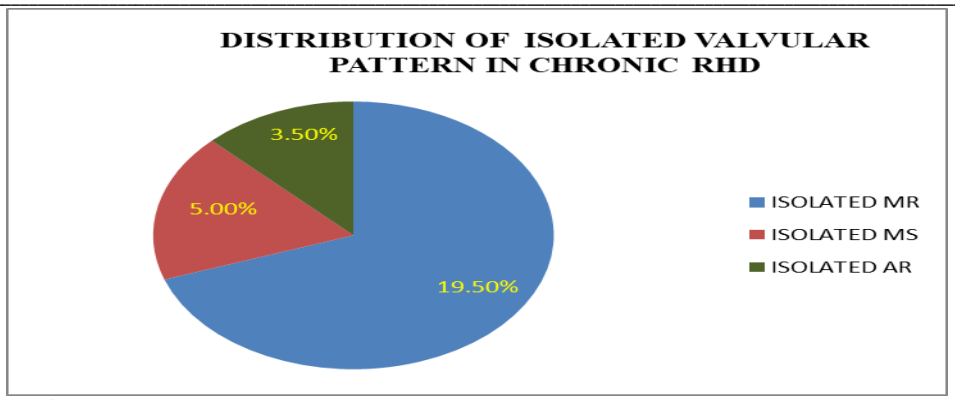

Fig 2: Distribution of isolated valvular pattern in chronic RHD [MS-mitral stenosis, AR-aortic regurgitation, MR-mitral regurgitation]

3. Among mixed lesions, MR+AR was the most common pattern observed in 752(20.5 %) cases. MS+MR+AR, MS+ MR and MS+AR were observed in 668 (18.3%), 471 (12.9 %), 208(5.7%) cases respectively (figure 3).

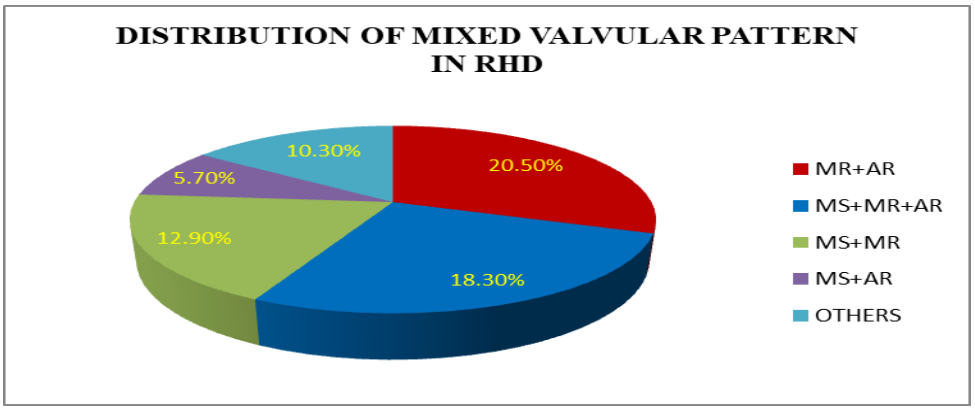

Fig 3: Distribution of mixed valvular lesion in chronic RHD [MS-mitral stenosis, AR-aortic regurgitation, MR-mitral regurgitation]

6) Distribution of valvular patterns among symptomatic & asymptomatic group

1. Among the asymptomatic group, mild MR was the commonest lesion observed in 665 (35.4%) cases. Mild MR + mild AR ,mod MR+ mild AR , mild MR+ mild MS observed in 461 (24.5%), 149 (7.9%) , 121 (6.4%) cases respectively(figure 4).

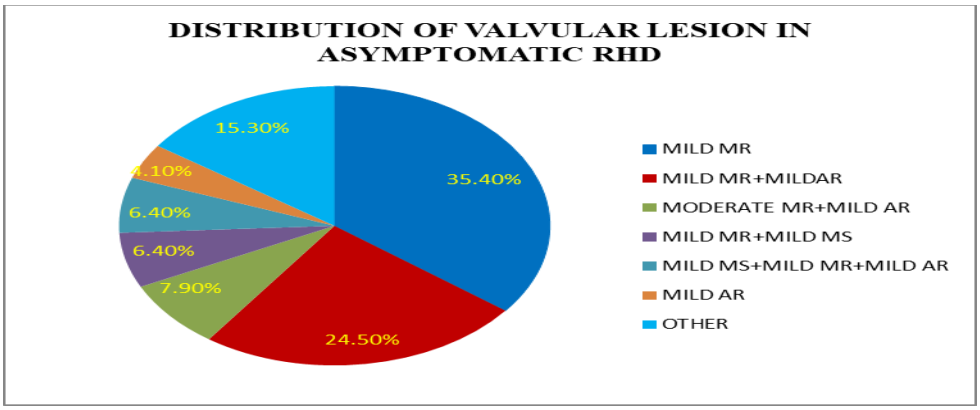

Fig 4: Distribution of valvular pattern in asymptomatic RHD [MS-mitral stenosis, AR-aortic regurgitation, MR-mitral regurgitation]

2. Among the symptomatic group, severe MS most commonly observed in 993 (55.8%) cases. severe MR, severe AR observed in 281 (15.8%), 112 (6.3%) cases respectively .Severe AS least commonly observed in 15 (0.8%) cases (figure 5).

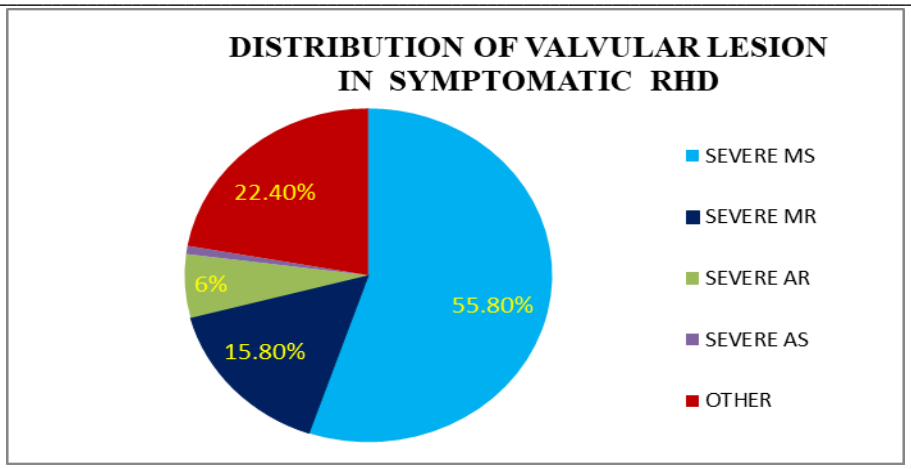

Fig 5: Distribution of valvular pattern in symptomatic RHD [MS-mitral stenosis, AR-aortic regurgitation, MR-mitral regurgitation.AS-aortic stenosis]

Discussion

Hospital based studies may not reflect true prevalence of valvular pattern in RHD, rather they represent patients with severe symptomatic disease. Although autopsy based studies most reliably confirm rheumatic aetiology, however they most often represent patients with end stage disease. On the contrary community based study can reflect true prevalence of valvular pattern in RHD, however it may subject to bias of pseudo disease.[12] Mass screening of community by echocardiography is also not feasible in countries like India , where there is acute shortage of cardiologists. [12] Although present study does not represent whole community, however it detected many cases of chronic asymptomatic RHD who would have escaped detection unless they are screened routinely by echocardiography and on the process it represented whole clinical spectrum of RHD. As the study centre do not have the facility for cardiac surgery and patients are referred purely for initial evaluation, the bias of over representation of symptomatic cases has been avoided. As there is lack of major medical facility in areas adjacent to study centre, the present study population represents all section of society, irrespective of age, sex, socioeconomic status and religion.

In the present study highest prevalence of chronic rheumatic heart disease was observed in patients between 31 to 50 years of age. Whereas in most of earlier hospital based studies highest prevalence of RHD was observed in comparatively lower (21-40 year) age group. [13-15] In 31-50 years age group maximum number of people referred for routine health check-ups for insurances, fitness certificate, non-cardiac surgery and antenatal screening. As more number of asymptomatic RHD cases detected during routine health check-ups and they represented more than half of total number of RHD cases enrolled, therefore higher prevalence of disease noted in 31-50 years of age group in the present study .Whereas prevalence found to be the lowest in younger age group (< 20 years).It reveals that, prevalence of RHD in younger age group is in decreasing trend , which may be due to improved health care, school health programmes and appropriate prophylactic measures. Out of 3656 patients, 2345 (64.1%) patients were female and 1311(35.9%) patients were male. This implies that, female patients were at higher risk for RHD as compared to male patients. Female population in India most often remains home bound . Available health care facilities are less accessible for them due to social and cultural restraints. On the other hand they are more susceptible to streptococcal upper respiratory tract infection during child rearing. Therefore higher prevalence of RHD in female population noted in present study.

In present study, Mitral valve most commonly involved in 95.3 % cases followed by aortic valve (68.0 % cases), tricuspid valve(6.4 % cases) and the least i.e pulmonary valve in 0.16% of cases. (Table 1) Although above sequence of valvular involvement also observed in previous studies, [15-16] however prevalence of aortic valve involvement (i.e 68.0% cases) observed higher in present study as compared to 13-23.3% cases in previous hospital based studies. [16-17] .Above disparity between present study and previous studies can be explained with the facts below. In present study, around half of patients found to have asymptomatic RHD. AR observed more prevalently in this subgroup of patients (figure 4). Therefore higher prevalence of aortic involvement also reflected in total cases of RHD in present study. Prevalence of organic tricuspid valvular lesion was observed quite low (i.e 6.4% cases) in present study (table 1) as compared to 45.8-52.2% cases in previous autopsy based studies.[18-19] However prevalence of organic tricuspid valvular lesion was also observed low (9-10.3%) in many non-invasive studies.[20-21]Higher prevalence organic tricuspid disease in autopsy based studies as compared to non-invasive studies (including present study) may be explained by the fact that, the patients in autopsy studies died from RHD, were likely to have severe form of the disease, with significant involvement of the tricuspid valve .

While analysing valvular patterns in group A (asymptomatic) and group B (symptomatic) separately, it was noticed that among the asymptomatic group, mild MR was the commonest lesion observed in 35.4% cases followed by mild to moderate MR with mild AR observed in 32.4 % cases (figure 4). Whereas among the symptomatic group, severe MS more commonly observed in 55.8% cases as compared to severe MR, severe AR in 15.8%, 6.2 % cases respectively (figure 5). Higher prevalence MR/ MR+AR in patients with asymptomatic RHD in contrast to MS in patients with symptomatic RHD can be explained with facts below. Majority of patients after rheumatic fever present regurgitation lesions like MR or MR+AR due to prolapse of anterior leaflet or annular dilatation. [22]As regurgitation lesions are well tolerated in patients than stenotic lesions, patients most often remains asymptomatic till the late symptomatic stage. As the age of patient advances over decades, relative prevalence of mitral stenosis increases due to commissural fusion and patients develop symptoms gradually.[23] Therefore in present study, regurgitation lesions more prevalently noticed in asymptomatic cases, whereas stenotic lesions more prevalently noticed in symptomatic cases.

While studying different valvular lesions as per severity, it was noticed that, among regurgitation lesions, mild to moderate lesions observed more prevalently as compared severe lesions. Whereas

among stenotic lesions like MS, severe lesions more predominantly observed as compared to mild and moderate lesions (table 3). Majority of lesions were found to be mixed valvular lesion , which is also observed in most of the previous studies.[13-15] However disparities observed between present study and previous hospital based studies in following aspects

1. In present study, MR observed more prevalently in 84.9% cases as compared to MS in 55.2 % cases (table 3), in contrast to findings of previous studies, where MS more prevalently observed as compared to MR .[14,16]
2. While studying mixed type of lesions, MR +AR found to be most common mixed valvular pattern in present study (figure 3), whereas in previous studies either MS +MR+AR or MS +MR were the commonest mixed valvular pattern observed in patients with RHD. [4,14-15]
3. While studying isolated type of lesions in present study, isolated MR was observed most commonly in 19.5 % cases as compared to isolated MS in 5 % cases .(figure 2)Whereas in a previous studies, isolated MS was observed predominantly in 33.9-64.5 % cases as compared to isolated MR in 7.1-8% cases.[14,16]

The disparity observed between present study and previous hospital based studies can be explained by facts below. Most of above studies conducted in tertiary cardiac centre, where chance of overrepresentation of severe and symptomatic cases more likely due to inherent bias. As stenotic lesions like MS is much more prevalent in symptomatic patients, therefore such lesions also reflected across the whole spectrum of RHD in their studies. Whereas in present study, more than half of patients without any cardiac symptoms detected to have RHD by screening echocardiography. Mild to moderate regurgitation lesions like MR or MR+AR observed more prevalently observed in these groups of patients. Therefore such lesions also reflected across whole clinical spectrum of RHD in present study. So above discussion implies that, although lesion with mitral stenosis seems to be most prevalent lesion in previous hospital based studies, actually they do not represent whole clinical spectrum of RHD, rather they represent severe symptomatic RHD. Whereas mild to moderate regurgitation lesions like MR or MR+AR, which actually represent majority of cases of RHD, most often remain clinically under detected .Therefore actual burden of asymptomatic lesions of RHD in the community may be much higher than it is estimated just like a piece of iceberg in a sea. However recent rising trend of using screening echocardiography provided an opportunity to detect such mild to moderate lesion at an early stage in patients with asymptomatic RHD. Approximately 2/3rd of patients with mild to moderate RHD either regress or remains stable after secondary prophylaxis at 10 year follow up.[24] Thus screening echocardiography provides an opportunity of secondary prophylaxis to the patients with RHD at an earlier stage of the illness .

Conclusion

Screening echocardiography has emerged as an important screening tool for diagnosis of asymptomatic rheumatic heart disease. World Heart Federation (WHF) criteria 2012 further standardised the echocardiographic screening criteria for diagnosis of the RHD to detect asymptomatic cases .As a consequences, many patients with previously undiagnosed asymptomatic RHD were diagnosed to have established disease by screening echocardiography. On the process, it was noticed that, the burden of asymptomatic RHDis very high among total cases of RHD. Therefore mild to moderate patterns like MR or MR + AR, which were most prevalently observed in asymptomatic cases, also reflected across whole clinical spectrum of RHD. Whereas patterns like MS (mixed / isolated) which were previously presumed to be as most prevalent lesions across the whole clinical spectrum of RHD before the era of screening echocardiography, were actually represented the most prevalent pattern in symptomatic cases of RHD. Thus recent rising trend of screening echocardiography provided an opportunity to detect mild to moderate asymptomatic lesion at an early stage, so that secondary prophylaxis can be started at an earlier stage of the illness than previously possible, thus potentially reducing morbidity and mortality of RHD.

Abbreviations

RHD-Rheumatic heart disease, MV-mitral valve, AV-aortic valve, TV-tricuspid valve, PV-pulmonary valve, MS-Mitral Stenosis, AR-Aortic Regurgitation, MR-Mitral Regurgitation,

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