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Patterns of Rheumatic Heart Disease Among Yemeni Patients in Cardiac Center of Al-Thawra General Hospital

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ABSTRACT

Background: Rheumatic heart disease (RHD) is still a major public health problem and remains the most common cardiovascular cause of death among children and young adults. The recurrent episodes of acute rheumatic heart disease may cause the rapid progressive damage of the heart valves and chronic residual deformity resulting in stenosis or regurgitation or a combination of both stenosis and regurgitation.

Methodology: A cross sectional Study, consecutive patients with RHD were enrolled from outpatient cardiac clinics and inpatient department of cardiac center of Al-thawra hospital in Sana'a city, Yemen between January and July 2020. Demographic, clinical, echocardiographic, and coronary angiography characteristics of patients were recorded.

Results:

261 consecutive patients with rheumatic heart disease were analyzed with mean age of 33 ± 12.65, female patients represented 62.8% (165), illiterate patients represented 63.6% (166). The majority of the patients about 79.7% (208 patient) had mitral valve disease, 63.6% (166 patient) had aortic valve disease, 10.7% (28 patient) had organic tricuspid valve disease but the Isolated Mitral valve disease 23%(60) , Isolated Aortic valve disease 10.3% (27) and Isolated organic tricuspid valve disease represent 4.2% (11) , double valve disease (mitral & aortic) represent 56% (146), triple valve disease (Mitral + Aortic + Tricuspid)represent 6.5% (17).A lot of complications of RHD detected in our study; CHF 36%(94) with low EF <50% in 55.0%(144) and 34% (89) had dilated LV , 33.7%(86) developed AF , 14%(37) of the patient complicated by IE , spontaneous echo contrast 11%(29) but only 7.3%(19) developed Intra cardiac thrombus and new stroke 9.5% (25) , pericardial effusion 5.4% (14) and Active ARF 2.3%(6).

Conclusion:

Rheumatic heart disease is a big medical problem in Yemen and it affects children and young adults of poor and illiterate patients of both genders. The most common valvular lesion reported in our study was multivalvular lesion the predominant pure lesion was Mitral regurgitation followed by Mitral stenosis, Aortic regurgitation, with high organic affection of the tricuspid valve.

1. Introduction:

Cardiovascular diseases (CVDs) are the main cause of death globally, taking an estimated of 17.9 million lives each year. RHD is a major contributor to morbidity and premature death in poor and developing countries. Rheumatic heart disease (RHD) is the result of valvular damage caused by an abnormal immune response to group A streptococcal infection, usually during childhood[1] Although this disease associated with

poverty has almost disappeared from wealthy countries, its burden remains a major challenge in developing nations [(1)].

RHD predominantly affects young and working age group. RHD is a residual and progressive valve deformity resulting in stenosis or regurgitation or a combination of both stenosis and regurgitation, which appears between 2-10 years after an episode of acute rheumatic fever. Its pattern has changed in developed countries and appears to undergo changes in certain developing countries probably in association with the use of antibiotic and improvement of socioeconomic conditions [(2)]. In these countries, degenerative heart diseases are increasing while heart diseases related to infection are decreasing. Therefore, rheumatic heart diseases have become rarer. On the other hand, in developing areas, where predisposing factors to rheumatic fever persist and prophylactic penicillin therapy is inadequate, the recurrent episodes of acute rheumatic heart disease may cause the rapid progressive damage of the heart valves, chronic residual deformity resulting in early stenosis or regurgitation or a combination of both stenosis and regurgitation [(2 ,3)]. Rheumatic heart disease is still a major public health problem and remains the most common cardiovascular cause of death among children and young adults [(3)].

RHD steadily worsens in people who have multiple episodes of ARF [(4)]. ARF is predominantly a disease of children aged 5-14 years and generally does not affect children less than 3 years old or adults [(5)]. However, people can have recurrent episodes well into their forties. The prevalence of RHD peaks in the third and fourth decades [(6)]. The world health organization (WHO) commissioned an expert consultation on RF and RHD, and this WHO Technical Report, as well as a significant amount of recent literature [(6,7)] outline the important part socioeconomic and environmental factors play in contributing to the magnitude and severity of RF and RHD, and although it is a disease rarely seen now in most developed populations, it is still a cause of major concern in many of the world's developing nations and selected populations of some developed countries. This paper has since been cited frequently in a number of articles focused on contemporary issues and management related to RF and RHD. However, investigations have been made into using echocardiographic screening to detect the true prevalence of RHD [(8)].

In developed countries, coronary artery disease and hypertensive heart disease are the two most common causes of death, while RHD is the major cause in developing countries. [(9)]

The near elimination of acute rheumatic fever and reduction in the rates of rheumatic heart disease in high-income countries during the late 20th century was attributed in part to improvements in socioeconomic conditions and the widespread use of penicillin G benzathine to treat streptococcal pharyngitis [(11, 12, 13)].

The remaining burden of rheumatic heart disease is found mostly in low-income and middle-income countries and among immigrants and older adults in high-income countries [(11, 12, 13)]. In developing countries like Ethiopia, RHD is a significant cause of cardiovascular morbidity and mortality [(14 ,15 ,16)]. According to previous studies, up to two thirds of cases of AF in Ethiopian patients could be attributed to RHD [(17)] RHD causes considerable morbidity and mortality as a result of cardio-embolic stroke, congestive heart failure and infective endocarditis [(17)].

RHD remains one of the most common health burdens in Yemen, it is one of the most important cardiovascular diseases seen in medical practice [(2)]. However, there are no community-based data regarding the prevalence and distribution of echocardiography proven RHD in this population in our country.

1. Methods

This study is a prospective hospital–based cross-sectional study carried out in the cardiac center of Al-Thawra general hospital in Sana'a city, Yemen. Patients were enrolled from adult cardiac OPD, and Cardiac surgery OPD in addition to the medical and surgical departments.

between January and July 2020. The clinical and echocardiographic data from each participant were recorded on predesigned questionnaire by a trained cardiologist. Data on demographic variables (age, gender, marital status, home address (residence) and education level) and clinical variables (symptoms, body mass index, physical examination), ECG and echocardiographic findings**,** were recorded on the questionnaire and then analyzed. Cardiac Center at Al-Thawra Hospital is a referral cardiac center with five Echocardiography Machines as well as there are three echocardiographic machines inside Al-Thawra general hospital.

Statistical analysis

All statistical studies performed using IBM SPSS statistics for windows version 26 (IBM Corp, Amonk, NY, USA). The categorical variables represented as frequencies and percentages.

2. Results:

We enrolled 261 patients with rheumatic heart disease during 6 months' time. The mean age was 33 ±12.6 with Male represent 37.2% (97) and female 62.8% (164) with female to male ratio was **1.7: 1**. Table (1) shows the baseline characteristics of the whole group.

Patients from rural areas represent 79.7% (208) of the whole group and urban areas represents only 20.3% (53). Illiteracy was in 63.6% (166) of the patients, 16.9% (44) had primary school education, 13.8% (36) had secondary school education and only 5.7% (15) had university level of education. Normal weight represents 73.2% (191) ,10.7% (28) were underweight, overweight represent 14.6% (36) and 1.5% (4) only were obese patients. Khat and smoking represent 43.7% (114) and 21.5% (56) respectively. Sinus rhythm was present in 76.3% (173) and atrial fibrillation was present in 33.7% (88). Our patients presented mainly with dyspnea which represent 85.8%, palpitation in 43.7%, fatigue in 38.3%, fever 24.5%, chest pain in 15.3%, lower limb edema in 14.9% and cough in 6.9%.

Past history of decompensated heart failure represents 24.1%, stroke 6.1%, transient ischemic attack 4.2%, valve replacement 31%, balloon mitral valvuloplasty 10.3%, infective endocarditis 3.8% and rheumatic fever represent 9.96%. Patients who are receiving secondary prophylactic penicillin represent 88% (229) with 77% (201) were adherent to the secondary prophylaxis penicillin injection. Oral anticoagulant among AF patients represents 45% (117) and patients with AF who were not on oral anticoagulant represent 8% (21)

Echocardiographic assessment showed that 36.0%(94) of patient's population had calculated ejection fraction (ejection fraction) of less than 55.0%(144). Dilated LA in 59% (154) and dilated LV in 34% (89), about 72% (188) of the patient have secondary TR and 70% (183) of them have a PHT, Table (1)

Mitral valve disease in the whole group represents 79.7% (208), Aortic valve disease represent 63.6% (166) and organic Tricuspid valve disease was 10.7% (28), isolated Mitral valve disease 23% (60), isolated Aortic valve disease 10.3% (27), isolated organic tricuspid valve disease represents 4.2% (11), double valve disease (mitral & aortic) represents 56% (146), triple valve disease (Mitral + Aortic + Tricuspid) represents 6.5% (17), Table (2).

Post cardiac surgery represent 31% (81) in form of mixed mitral and aortic valves prosthesis which represent 42% (34), pure mitral valve prosthesis 40.7% (33) and pure aortic valve prosthesis 17.3% (14), Table (3).

Mitral valve regurgitation represented 68.6% (179), and mitral valve stenosis represented 50.2% (130). Aortic valve regurgitation represented 60.2% (157), and aortic valve stenosis represented 20.3% (53). Organic tricuspid valve disease represented 10.7% (26), Most of patients with mitral valve regurgitation had mild regurgitation represented 49.7% (89), Most of patients with mitral valve stenosis had severe stenosis represented 48.85% (64). patients with aortic valve regurgitation mostly had mild regurgitation represented 67.5% (106). Most

of patients with aortic valve stenosis had moderate to severe stenosis represented (37.73% (20) & 26.42% (14)) respectively collectively 64.15% (34). Most of patients with organic tricuspid valve disease had moderate to severe form (25.0% (7) & 39.3% (11)) respectively collectively 64.3% (18) Table (4)

The majority of the patient complicated by CHF 36% (94), AF 33.7% (86), 14% (37) by IE, spontaneous echo contrast 11% (29) but 7.3% (19) developed Intra cardiac thrombus, stroke 9.5% (25), pericardial effusion 5.4% (14) and Active ARF 2.3% (6) figure (1

Table (1) : Baseline Characteristics of patients population

Variable	**%(N)**
Mean age; Mean ± SD	 33.00±12.649
Gender; Male patient Female patient	37.2% (97) 62.8% (164)
Residence; Rural Residence Urban Residence	79.7% (208) 20.3% (53)
Educational Level; Illiterate Primary Secondary University	63.6% (166) 16.9% (44) 13.8% (36) 5.7% (15)
Khat Chewing	43.7% (114)
Smoker	21.5% (56
BMI Underweight Normal Overweight Obese	10.7% (28) 73.2% (191) 14.6% (38) 1.5% (4)
Sinus rhythm	76.3 %(173)
Atrial fibrillation	33.7 % (88)
Past History ; Decompensated heart failure Stroke Transient ischemic attack Valve replacement Balloon mitral valvuloplasty Infective endocarditis Rheumatic fever	24.1% (63) 6.1% (16) 4.2% (11) 31.0% (81) 10.3% (27) 3.8% (10) 9.96% (26)
Presented symptoms; Dyspnea Palpitation Fatigue Fever Chest Pain LL swelling Cough	 85.8% (224) 43.7% (114) 38.3% (100) 24.5% (64) 15.3% (40) 14.9% (39) 6.9% (18)
ON Secondary prophylaxis	88% (229)
Adherent to Secondary prophylaxis	77% (201)
Oral anticoagulation ON oral anticoagulation AF not on anticoagulation	45%(117) 8% (21)

ECHO measurement	
EF< 50%	36%(144)
LA dilation (>40mm)	56%(154)
LV dilation (LVEDD> 56mm in male 52mmin female)	34%(89)
Secondary TR	72%(188)
PHT	70%(183)

Table (2): The affected valves

Variable	**% (n.)**
Total MVD	79.7% (208)
Total AVD	63.6% (166)
Total Organic TVD	10.7% (28)
Isolated Mitral Valve Disease	23%(60)
Isolated Aortic Valve Disease	10.3% (27)
Isolated Organic Tricuspid Valve Disease	4.2% (11)
MVD and AVD (double Valve disease)	56%(146)
MVD , AVD and TVD (Triple valve disease)	6.5%(17)
Isolated organic TVD	4.2%(11)

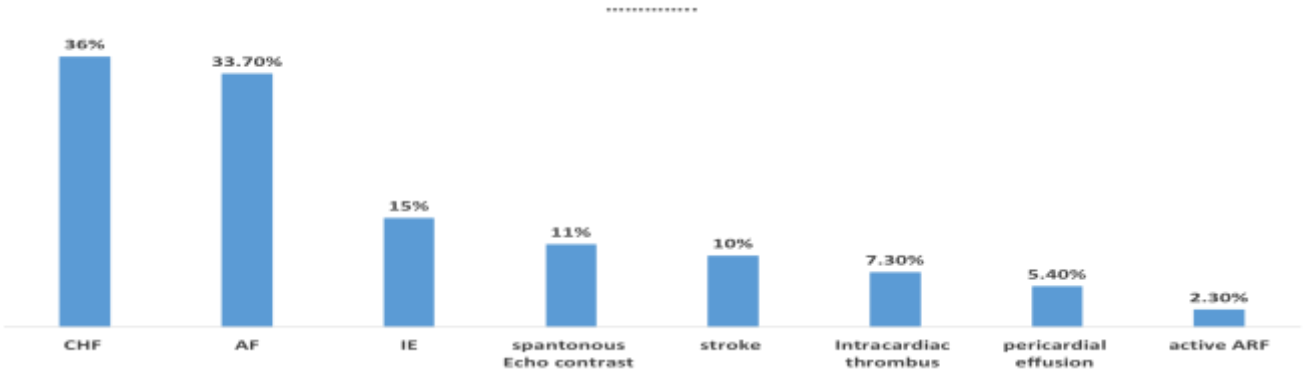
Table (3): Prosthetic valves

Variable		% (n.)
Prosthetic valve:		31.0% (81)
Mixed mitral and aortic valves prosthesis.		42.0% (34)
Pure mitral valve prosthesis;		40.7% (33)
Type Mitral prosthesis:	Mechanical	92.5% (62)
	Biological	7.5% (5)
Pure aortic valve prosthesis		17.3% (14)
Type Aortic prosthesis:	Mechanical	91.7% (44)
	Biological	8.3% (4)

Table (4): Severity of each Isolated valve lesion

Variable	**Severity**			
Lesion	Total	Mild	Moderate	Severe
MR	68.6%(179)	49.7% (89)	23.5% (42)	26.8% (48)
MS	50.2%(130)	25.95% (34)	25.19% (33)	48.85% (64)
AR	60.2% (157)	67.5% (106)	17.8% (28)	14.6% (23)
AS	20.3%(53)	35.85% (19)	37.73% (20)	26.42% (14)
Organic TVD	10.7% (26)	35.7% (10)	25.0% (7)	39.3% (11)

Figure (1) : Complications of RHD



3. Discussion

The present study was done in a tertiary cardiac center of Al-thawra Hospital, Sana'a, Yemen, with the goal of efficiently assessing patterns of clinical and echocardiographic data of rheumatic heart disease patients who were enrolled in outpatient clinics and inpatient departments.

The major determinants of acute rheumatic fever and chronic rheumatic valvular heart disease are poverty, malnutrition, overcrowding, poor housing and shortage of health care resources [(6).] All of these factors are still common in Yemen.

Like many other studies, this study also showed that RHD is a disease of young people where the mean age of our patients was 33 ±12.6. the majority of patients with age group 20-39 years 59.40% (155). Similar to our study, (Laudari et al., 2017) reported that the majority of patients were of productive age group and with low socioeconomic status. Similarly, in the studies by (Saleh HK.; 2007; Chapagain et al., 2018; Manjunath et al., 2014; Mathur et al., 2019; Kafle. et al., 2016) [(18 ,19, 20, 21)]

The RHD is more common in females than males [(22).] This has been shown in our study where rheumatic heart disease affects (62.8%) of females with a female to male ratio of 1.69:1. This was in concordance with other study [(19) (23).]

It has been hypothesized that female predominance is due to greater exposure to GABHS because of greater involvement of women in the childbearing age group, increased innate susceptibility, or reduced medical access to medical care but still no scientific reason for female predominance of the disease has been clearly explained [(24)] and this needs to be studied further. our patients in this study were mainly from rural areas which represent 79.7%.

Over (90.0%) of patients in the current study were presented for the first time with symptoms of heart failure. This was because most of the patients were from rural areas, poor and illiterate (only 5.7%) patients were university level of education and 63.6% were illustrates and these factors were the most important factors responsible for late presentation (ZHANG et al, 2013) [(26).]

The past history of rheumatic fever among patients with rheumatic heart disease in current study was (9.96%) Decompensated heart failure 24.1%, Stroke 6.1%, Transient ischemic attack 4.2%, Valve replacement 31%, Balloon mitral valvuloplasty 10.3%, Infective endocarditis 3.8% 88%and the majority of our patients were presented with symptoms of heart failure which means that our patients are not aware of RHD or very poor taking care of their disease. 88% were prescribed secondary prophylaxis long-acting penicillin (LAP) but only 77% were adherent to LAP. 45% of our patients were received anticoagulants by primary healthcare physician in treasury center (for AF and Non-AF patients) and this may be explained by practice of Yemeni patients to give anticoagulants in patient with sinus rhythm a large left atrial dimension to prevent stroke.

The incidence of AF in our study was 33.7 % and this is was nearly the same as in a meta-analysis study by Jean Jacques Noubiap which showed that incidence of AF was 32.8% (27)

Post Prosthetic valve replacement presentation in our study was (31.0%). This is concordant with other study done in southern Yemen (2) where prosthetic valve replacement was (34.8%) and its higher than other developing country where only 6.07% of patients had valve replacement (28). mixed mitral with aortic valve replacement was the most common group represented (42.0%), followed by isolated mitral valve replacement (40.7%), followed by isolated aortic valve replacement (17.3%). This was different from study in Pakistan where mitral valve was replaced in (52.9%), mixed mitral and aortic valves were replaced in (18.9%) and aortic valve was replaced in (15.0%). Also, this was different from study by (Lasher, 2018) where the isolated mitral valve replacement was the most common valve replacement represented (43.8%), followed by mixed mitral and aortic valve replacement (41.0%), followed by aortic valve replacement (15.0%).

In the present study, the patterns of valve involvement in rheumatic heart disease were dominantly mitral valve (79.7%), followed by aortic valve (63.6%), then tricuspid valve (10.7%) with no pulmonary valve lesions detected. This finding was concordant with study by Manjunath CN (20) and Chandrashekhar (34) represented the most commonly involved pathologic heart valve in rheumatic heart disease was the mitral valve and this finding was similar to that found in our study.

In the present study, organic tricuspid valve disease was found in 10.7% of patients which is higher than that found in the study by Mathur R et al (10) where it was found in (3.58%). Also, it was higher than that observed in the necropsy series of Roberts WC et al (34) where tricuspid valve disease was depicted in only (2.0%)

Most valvular lesions in our patients were moderate – to – severe which reflects the late presentation of our patients, which is consistent with previously reported data from different countries (29) (2) further studies and registries are needed to show the extent and the clinical practice in RHD in our country.

Significant past medical history of decompensated heart failure is variable in studies and in current study was (24.1%) and almost half (44.5%) of the patients population presented in NYHA class III/IV, (36.0%) of patients population had decompensated heart failure with calculated ejection fraction (EF) of less than (55.0%). This finding was closer to that observed by (Chinyere, Edward, 2017), in which (33.3%) of patients had decompensated heart failure due to valvular cardiomyopathy. But it was higher than that observed by (ZHANG et al., 2013) in which (20.8%) of patients had decompensated heart failure with calculated ejection fraction (ejection fraction) of less than (55.0%). In developed countries, coronary artery disease and hypertensive heart disease are the two most common causes of stroke, while rheumatic heart disease is the major cause in developing countries such as Ethiopia (Habibzadeh, 2012) and Yemen. In current study, the prevalence of strokes (with right and left sided body weakness and with radiological evidence of ischemic strokes) was (9.58%). The prevalence of old and new stroke events was (6.13% & 3.45%) repectively. Spontaneous echo. contrast was seen in (11.1%). Patients with atrial fibrillation were twice as likely to have stroke than those with no atrial fibrillation. This is similar to that observed in study by (Yadeta et al., 2019) where (9.2%) of patients population had presumed stroke events but it is higher than that observed in (REMEDY study, 2015) where its prevalence was (5.2%). Propably this may be due to the prevalence of patients with mitral stenosis in our study is higher than that in (REMEDY study, 2015) with (50.2% vs 45.0%).

Atrial fibrillation was seen in (33.7%) in our study. This is much higher than that observerd by (Chinyere, Edward, 2017; ZHANG et al., 2013) where it was seen in (20.8% and 13.85%) repectively. This is because most of our patients were presented in late stages and there was a higher rate of mitral valve disease (mitral regurgitation and mitral stenosis) among our patients population.

The presence of vegetations in patients with established valvular rheumatic heart disease suggests infective endocarditis. Prevalence of the past history of infective endocarditis in our study population was (3.8%), but (14.56%) of our patient's population had vegetations at presentation time. This is much higher than that observed in study by (Chinyere, Edward, 2017; ZHANG et al., 2013) where it was seen in (7.69% and 2.1%) respectively. This is because most of our patient's population were illiterate and had no health education for preventive therapy against rheumatic fever. In addition, shortage of health care centers in rural areas was one of the obstacles and difficulties in our country.

Limitations

The study has a small sample size. The study is limited to a single center hence the results cannot be projected for the population. Because this study was a hospital-based study, we cannot comment upon the incidence and prevalence of

acute rheumatic fever / rheumatic heart disease in the general community population.

4. Conclusions

Rheumatic heart disease is a big medical problem in Yemen and it affects children and young adults both genders. The spectrum of rheumatic heart disease in Yemen is near similar to that of developing countries.

Our study shows that mitral regurgitation is the most common lesion of rheumatic heart disease seen at outpatient cardiac clinics and inpatient department of cardiac center of Al-thawra hospital which is a referral teaching governmental hospital, followed by aortic regurgitation then mitral stenosis then aortic stenosis. Mitral stenosis and mitral regurgitation were statistically significant among female.

finally, the organic tricuspid valve disease affection was higher than other developing countries even the prosthetic valve was higher in our country

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