

THE PREVALENCE OF CLINICAL AND SUBCLINICAL RHEUMATIC HEART DISEASE (RHD) DIAGNOSED BY COLOUR DOPPLER ECHOCARDIOGRAPHY USING WORLD HEART FEDERATION (WHF) CRITERIA IN 5-15 YEARS OLD SCHOOL GOING CHILDREN OF A NORTH-EASTERN INDIAN STATE (MANIPUR)

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ABSTRACT

BACKGROUND

RHD is the leading cause of morbidity and mortality in the underdeveloped world. The burden of RHD has been estimated variably depending on the method and tool of examination. Recent echocardiography-based studies, generally accepted as the best tools to detect RHD, had shown 10-fold increased prevalence of RHD compared to clinical examination albeit fear for overestimation of the disease. While studies using more stringent criteria of WHF 2012 are limited and no such study has been conducted in this part of the country, we felt it necessary to conduct such a study in this hilly state of India.

MATERIALS AND METHODS

This is a community based cross sectional study in which each and every selected child aged 5-15 years from randomly selected schools of Manipur were examined physically and by 2D colour Doppler Echocardiography. The anthropometric parameters, clinical details and echocardiography findings were all recorded. Echocardiography loops were recorded for review by another cardiologist later. Analysis was done by using T test, descriptive statistics and with 95% confidence interval. All the analysis was done using STATA 13.0 (Stata Corp, USA).

RESULTS

3600 children were screened in two years. The mean age was 11.77 years \pm 2.50 SD, 1865 (51.8%) were male, 1442 (40%) were from government school and majority belonged to rural population (67%). Only 1 case of Clinical RHD with a combination of MR and AS was found giving a prevalence of 0.28/1000 (CI: 0.04-1.97). Echocardiography detected 3 cases of definite subclinical (prevalence rate of 0.83/1000 (CI: 0.27-2.58) and 14 cases of borderline subclinical RHD (prevalence rate of 3.9/1000 (CI: 2.30-6.56) befitting WHF 2012 criteria.

CONCLUSION

Prevalence of clinical RHD (0.28/1000) is very low compared to that of other Indian states. Using echocardiography, the prevalence becomes several folds higher compared to clinical examination alone, 0.83/1000 for Definite Subclinical and 3.9/1000 for Borderline Subclinical RHD. Further follow up studies using less stringent criteria (modified WHO criteria), may still have a role in detection of true burden of RHD in our community from the public health point of view.

KEYWORDS

Rheumatic Heart Disease, Subclinical, Echocardiography, Prevalence, School Children.

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BACKGROUND

Rheumatic heart disease continues to pose as a major public health problem in developing country including India.

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Secondary prophylaxis by giving penicillin injection to prevent recurrent attacks of RF thereby preventing further worsening of valvular lesions has been accepted as the only cost-effective strategy to decrease the disease burden.¹ Prevention will be more effective if the measure is instituted early in the course of the disease. But many vulnerable cases may remain in the society even without definite noticeable history of RF. So, it has become apparent to find these cases from the masses for effective control of the disease.

There are well established American Heart Association (AHA) criteria for Acute Rheumatic Fever (ARF) diagnosis but no such widely accepted criteria exist for RHD. In 2001, a

WHO expert committee established a consensus for the echocardiographic diagnosis of subclinical RHD based on the detection of valvular regurgitation by Doppler interrogation of the cardiac of the cardiac valves.²

It is generally accepted that echocardiography is more sensitive and specific to diagnose RHD compared to clinical examination using stethoscope.³⁻⁹ In 2005, a joint WHO and NIH (National Institute of Health) working party established consensus case definition for RHD which were published 5 years later in 2010.¹⁰ Definition of subclinical RHD is another evolving area. It may be defined as RHD detected on echocardiography without an associated clinically pathological cardiac murmur. According to some author, the burden of subclinical RHD appears to be underestimated if one use WHO diagnostic criteria of RHD.

Subsequent to later studies using echocardiography for diagnosis of RHD there has been concern for possible over diagnosis of the disease leading to overestimation of its burden. Accordingly, an international advisory group of experts in RHD screening and echocardiographic manifestations of RHD brought out a consensus WHF criteria for diagnosis of RHD.¹¹

MATERIALS AND METHODS

Study Design

The study was designed as a cross-sectional epidemiological survey. The purpose of this study was to determine the prevalence of Rheumatic Heart Disease in the age group most likely to be affected, i.e. 5-15 years. This is a part of the multisite extension study of RHEUMATIC study (e RHEUMATIC).¹² Study was conducted from mid 2012 to 2014, with attempted follow up till 2016 of the subclinical cases.

Setting of the Study

The study was conducted in Manipur which represent an underdeveloped region of the world. Manipur is situated in the eastern corner of India and has a unique geographical characteristic having a blend of valley and larger portion of hilly areas covering a total area of 22,327 sq. km. hosting a population of 21,66,788 inhabitants giving a population density of 631 per sq. km. in the valley and 44 per sq. km. in the hills as per 2001 census publication of Govt. of India.

The schools, both government and private, in various districts of the state were randomly selected and the principals of these schools were initially approached formally, and consent forms duly signed by the parents or class masters were later collected before the study.

The project team visited the schools for the study after consent forms had been collected. The paramedical staff notes the demographic data as per Performa. The onsite physician/ investigator took a brief history (history suggestive of rheumatic fever) and examine the child. The examination includes general physical examination inclusive of recording height, weight, waist circumference to measure body mass index.

Cardiovascular examination was performed for any respiratory distress, cyanosis, cardiomegaly, congestive heart failure, abnormal heart sounds, murmurs etc. first by

any one of the post graduate degree holder physician, and later re-examined by a cardiologist, if necessary, in case of doubt. Clinical data were recorded in the Performa. Thereafter, an echocardiography including colour Doppler was performed, using a portable echo machine (Sonosite M Turbo, USA) for all children in the study by the cardiologist in the team who has been blinded from the finding of clinical examination. All the echocardiographic images were stored in digital format for later review by one or more of the central or nodal investigators. In cases where two investigators disagreed, opinion of third investigator was sought.

Clinical RHD is defined as the presence of a clinically detectable pathological murmur of aortic or mitral valve origin, subsequently confirmed by colour Doppler Echocardiography showing morphological and Doppler abnormalities of the respective valves compatible with RHD.

Subclinical RHD has been defined by WHF 2012 Criteria using an Echocardiography, as follows:

Definite RHD (either A, B, C, or D):

- A) Pathological MR and at least two morphological features of RHD of the MV.
- B) MS mean gradient > 4mmHg.
- C) Pathological AR and at least two morphological features of RHD of the AV.
- D) Borderline disease of both the AV and MV.

Borderline RHD (either A, B, or C):

- A) At least two morphological features of RHD of the MV without pathological MR or MS
- B) Pathological MR
- C) Pathological AR

Criteria for Pathological Regurgitation (Mitral Regurgitation / Aortic Regurgitation)

(All four Doppler echocardiographic criteria must be met)

- Seen in two views.
- In at least one view, jet length > 2cm* for MR (> 1cm for AR).
- Velocity > 3 m/s for one complete envelope (> 3m/s in early diastole for AR).
- Pan-systolic/pan diastolic jet in at least one envelope.

If any abnormality is detected either on clinical examination or by echocardiography, the parents of the child were informed and advised for subsequent treatment and further follow up study at JNIMS.

RESULTS

A total of 3600 children have been screened over a period of two years. The age ranges from 5-15 years and children of government and private schools have been enrolled. Out of total 3386 children screened during this period, 1442 children are studying in government schools and 1944 in private schools. 1758 were males and 1628 were females. 2672 were living in Kucha house made of bamboo/wood and mud. The base line characteristics are given in table 1.

Characteristics	RHD (17 subjects)		Non RHD (3583 subjects)		
	Mean/Proportion/ Median	SD	Mean/Proportion/ Median	SD	P-value
Age (years)	11.71	2.25	11.06	2.86	1.00
Class	5		5		1.00
Number of Family members	6		6		1.00
Number of rooms	3		3		1.00
Weight (Kg)	36.24	13.11	34.37	12.07	0.86
Height (cm)	142.77	16.63	136.30	16.63	0.94
Waist circumference (cm)	59.64	7.57	60.15	8.38	0.94
BMI	17.06	2.85	17.76	2.81	1.0
Systolic BP	112.94	12.63	110.13	12.34	1.0
Diastolic BP	71.17	11.11	70.58	9.61	1.0
Government vs. Private Schools	10/7		1432/2156		0.81
Kucha/Pukka house	14/3		2658/928		0.9
Male/Female	6/11		1859/1724		0.82

Table 1. Comparison of the Baseline Characteristics of RHD and Non RHD (Normal) Children

Compared to non-RHD group, children with suspected RHD are found to belong to higher age group and higher class. The higher weight, height, BMI and waist circumference may be pertinent to being older aged. Secondly, majority of the children in the RHD group are found living in kutch house and attending government school which may reflect lower socio-economy.

Children aged 5-10 years were comparatively less comprising of 41% of the total study population while the highest representation was from the age range of 12-15 years of age. The age and gender wise breakup of the study population is given in table 2.

Age (Years)	Male		Female		Total	
	No.	%	No.	%	No.	%
5	70	1.77%	67	1.68%	137	3.45%
6	97	2.56%	89	2.33%	186	4.90%
7	126	3.42%	119	3.21%	245	6.64%
8	110	2.95%	133	3.63%	243	6.58%
9	133	3.63%	147	4.04%	280	7.67%
10	181	5.05%	205	5.75%	386	10.80%
11	183	5.10%	147	4.04%	330	9.15%
12	228	6.43%	215	6.05%	443	12.49%
13	284	8.09%	224	6.32%	508	14.41%
14	227	6.40%	216	6.08%	443	12.49%
15	226	6.46%	173	4.90%	399	11.37%
Total	1865	51.80%	1735	48.20%	3600	100%

Table 2. Age and Gender Distribution of Study Population

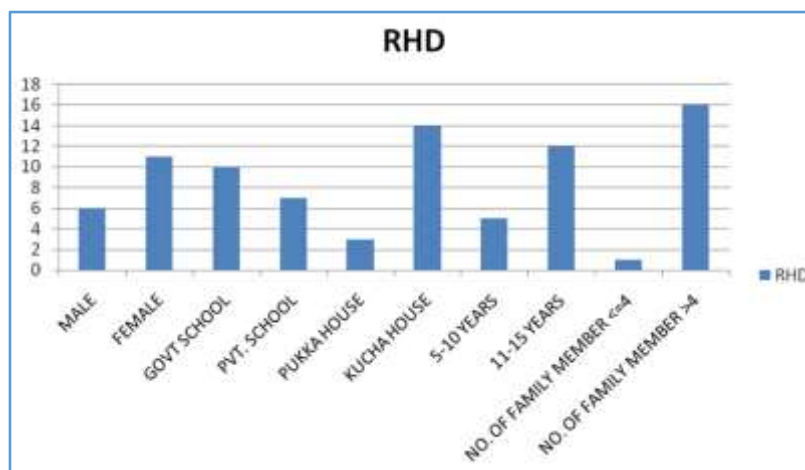


Table 3. Prevalence of RHD among Various Subgroups

Lesion Type	Clinical RHD	Subclinical Definite RHD (WHF)	Subclinical Borderline RHD (WHF)
MR		1	11
AR			2
MR + AR		2	1
MR + AS	1		
NIL			

Table 4. Distribution of Valve Lesions in All the Spectrum of RHD

DISCUSSION

The prevalence and incidence of RHD has been variably estimated depending on the different types and methodology of studies conducted in different parts of the world. While the prevalence and incidence of RHD has been observed declining even in the developing countries, the total disease burden need relook based on the importance of echocardiography as a sensitive and specific tool of diagnosing subclinical RHD, which may in fact turn into clinically significant case of RHD in subsequent years. The average prevalence of Clinical RHD based on the studies conducted in the last 3 decades ranges from as low as 0.12 (Kerala) to as high as 5.09 (J & K) in the Indian subcontinent (Table 5).

Author	Year	Place	Age Group	Method	Sample Size	RHD Prevalence per 1000
Grover	1988-91	Ambala (Haryana)	5-15	Clinical→Echo	31200	2.1
Thakur	1992-93	Shimla	5-16	Clinical	15080	2.98
Kumar	1992	Churu, Rajasthan	5-15	Clinical	10168	3.34
Gupta	1992	Jammu Tawi	6-16	Clinical→Echo	10263	1.36
Vashistha	1993	Agra (UP)	5-15	Clinical→Echo	8449	1.42
Agarwal	1995	Aligarh (UP)	General population	Clinical	3760	6.4
Kaul	1999-2000	Srinagar	5-15	Clinical → Echo	4125	5.09
Lalchandani	2000	Kanpur (UP)	7-15	Clinical	3963	4.54
Jose	2001-02	Vellore	6-18	Clinical → Echo	229828	0.68
Periwal	2003-04	Bikaner	5-14	Clinical → Echo	3292	0.67
Misra	2003-06	Gorakhpur	4-18	Clinical → Echo	118212	0.5
Soman	2003-06	Cochin	5-16	Clinical → Echo	25033	0.12
Anita	2008-10	Ballabgarh	5-15	Echo in all	6270	0.8 (clinical) 20.4 (subclinical)

Table 5. Studies on Prevalence of Rheumatic Fever or RHD from India during the Last 3 Decades

Source: Adapted and modified from: Jonathan R Carapetis. Rheumatic heart disease in Asia.¹³

Our study has shown one of the lowest prevalence of both the clinical (0.28/1000), definite subclinical (0.83/1000) and borderline subclinical (3.9/1000) RHD cases. Similar recent echocardiographic study by Anita et al has found a prevalence of clinical and subclinical RHD as 0.8/1000 and 20.4/1000 respectively.¹⁴ A study from Cambodia by Marijon et al³ has shown a similar prevalence of 21.5/1000 of combined clinical and subclinical RHD, where echocardiography revealed 10-fold increased detection of the case.

The limitations of our study is the small sample size, and the resultant difficulty in the estimation of the total disease burden of the state as this result cannot be extrapolated in the entire population. Better generalization and extrapolation of the finding could have been achieved if we

include more of older populations, say up to 30 years of age in whom the disease is more common in addition to just increasing the sample size. However, we could do best this much at that point of time with our limited resources coupled with inherent difficulties and hurdles in covering the difficult terrain far and wide punctuated with extremely volatile law and order situation and social turmoil.

The advantage of this study is the ability to cover almost all the representative populations of the state, both in the hills and valleys. Secondly, we adhered to the protocol to our best level. Only one cardiologist performed the echocardiographic examinations and cross checking of the clinical examinations done by the post graduate degree holders. Hence, inter individual variations is limited. Specificity of the findings is not compromised as two other

cardiologists independently analyse the recorded loops of echocardiography and only the cases with consensual agreement were selected for analysis of the results.

The author feels that the true burden of the disease in the state may be much more than our finding. Our study using stringent criteria of WHF may underestimate the true disease burden, based on the author's experience and observation in the routine hospital practice. Over the preceding 10 years, when quite a good number of acute rheumatic fever (ARF) some of which presented in heart failure, on follow up over 6-12 months were found to have minimal residual findings entirely short of WHF criteria. These patients either have minor morphological changes or trace / non-pathological regurgitant lesions, not in combination. What is more interesting is that few of these patients later presented to us, about 2 years, with features of ARF again. These individuals, who could have been prevented by proper prophylaxis measures from further progression or recurrence, would be missed out by any study if the stringent criteria of WHF are applied for case detection.

CONCLUSION

Rheumatic heart disease appears to be declining in this part of the globe. However, we continue to see a significant number of these cases. Though the prevalence of the disease appears to be much lower than any other part of the country, the true estimate of the disease burden can be estimated only by conducting larger studies covering a large population. Echocardiography based screening study to explore more potential cases of RHD followed up for one to two decades will truly help in determining the burden and fighting the disease in the long run.

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