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Original article

Prevalence of rheumatic and congenital heart disease in school children of Andhra Pradesh, South India

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ABSTRACT

Objective: To determine the prevalence of rheumatic heart disease (RHD) and congenital heart disease (CHD) using clinical and echocardiographic criteria in rural and urban school children in Andhra Pradesh, South India.

Materials and methods: A total of 4213 school children between 5 and 16 years of age were screened. 1177 were from rural schools and 3036 from urban schools. Prevalence of RHD and CHD was estimated.

Results: Clinically RHD was present in 3 (prevalence 0.7/1000). Using echocardiography RHD was detected in 32 (7.6/1000), 11 (7.3/1000) from rural and 21 (7/1000) from urban schools. ($P = 0.000$, O.R = 0.093 and C.I. = 0.023–0.317). Total prevalence of RHD is 8.3/1000.

Clinically CHD was present in 39 (9.2/1000) children, rural 9 (7.6/1000) and urban 30 (9.9/1000). Using echocardiography CHD was detected in 44 (10.4/1000) children, rural 11 (9.3/1000) and urban 33 (10.8/1000).

Conclusion: RHD was detected several fold using echocardiographic screening than by clinical examination alone. Longitudinal follow-up of children with echocardiographically diagnosed subclinical RHD is needed.

1. Introduction

Rheumatic heart disease (RHD) is a major public health problem. It is estimated that the number of patients in India with RHD are around 1.4 million.[1] Echocardiographic validation of clinical diagnosis could provide a more definite evidence of its true prevalence.[2–5,6] Non-detection of RHD places a heavy economic burden on the health care system in low and middle income countries because of costs of medical treatment and heart valve surgery and also because it affects the young adults who are the most economically active group of the population.[7] WHO criteria for diagnosing probable rheumatic heart disease are more sensitive and are based on the detection of significant regurgitation of mitral and/or aortic valves by colour Doppler.[8] The present study was done using clinical as well as echocardiographic criteria to determine the prevalence of RHD and CHD in school children in Andhra Pradesh state of south India.

2. Methods

The study was a cross sectional survey conducted between February and April, 2011 that included rural and urban school children in Ongole Mandal, Prakasam District of Andhra Pradesh, South India. Urban Area is selected based on Census of India definition i.e., places having 5000 or more population and density of more than 400 persons per sq. km. and 75% of male population is engaged in non-agricultural pursuits. Other places are classified as rural. The ratio of rural school children to urban school children in Ongole Mandal is 1:2.6. In our study 8 rural schools and 18 urban schools were selected using stratified random sampling technique. The sample size in rural schools was 1177 (593 girls, 584 boys). In urban schools the sample size was 3036 (1385 girls, 1651 boys). All established cases of rheumatic heart disease, congenital heart diseases and all postoperative cases of RHD and CHD were included in the study to know the true prevalence.

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Table 1
Age and sex distribution of rural and urban school children.

Age of children (years)	Rural			Urban		
	Boys (%)	Girls (%)	Total (%)	Boys (%)	Girls (%)	Total (%)
5–10	134 (22.9)	127 (21.4)	261 (22.1)	455 (27.5)	350 (25.2)	805 (26.5)
11–16	450 (77)	466 (78.5)	916 (77.8)	1196 (72.4)	1035 (74.7)	2231 (73.4)
Total	584	593	1177	1651	1385	3036

There were two field teams. Each team consisted of one senior cardiologist, three nurses and one microbiology technician. One team performed clinical examination and another team performed the echocardiographic study.

The field team visited the school after informing the District Collector, District Medical & Health Officer, District Education Officer and Head Masters of the School. Informed consent was taken from all the students and their parents. The Proforma included details of demography, birthplace and current residential address, number of family members, family background and history of past illness (symptoms, duration, recurrence and treatment). A record of absentees was maintained and they were examined subsequently. The attendance rate was 96%. The first field team headed by cardiologist examined 4213 students, a detailed clinical examination and cardiac auscultation was done. The second field team headed by another cardiologist performed echocardiogram on all school children (4213) using SonoSite M-Turbo Portable Colour Doppler System with a Digital 10′4 LCD screen display with P10X/4–8 MHz phased array transducer. Sonsosite Inc 21919 30th Drive SE, Bothell, WA 98021 3904, USA. Tel.: (425) 951-1200, Fax: (425) 951-1201, http://www.sonosite.com. Clinically and echocardiographically diagnosed RHD students were further evaluated by estimation of complete blood cell count, erythrocyte sedimentation rate, anti-streptolysin-O titre, qualitative C-reactive protein, chest radiography and electrocardiography. WHO Criteria was utilized for the diagnosis of rheumatic fever (RF)/rheumatic heart disease (RHD).[8]

A throat swab was taken, and tested with the qualitative rapid antigen detection test (RADT, for Group A beta haemolytic Streptococcus) in children found to be suffering from pharyngitis. The reagent used was Directigen™ Group A Strep Test (Korea).

3. Statistical analysis

All the data was analysed statistically with the help of a package known as STATISTICA and was developed by StatSoft. Prevalence rates were reported as 'per thousand'. Significance of inter-group differences was estimated by chi-square test. P value < 0.05 was considered significant.

4. Results

Of the 4213 children screened, 2235 were boys and 1978 girls. 1066 (589 boys and 442 girls) were in the age group of 5–10 years. 3147 (1646 boys and 1501 girls) were in the age of 11–16 years. 1177 children (584 boys and 593 girls) were from rural areas. 3036 (1651 boys and 1385 girls) were from urban area (Table 1). The age and sex distribution was shown in Table 1. Cardiac murmur was observed in 25 children (prevalence 5.9/1000) out of which 15 children suspected of having RHD on the basis of a 2/6 systolic murmur over the precordium were found to have minimal to mild TR with normal valve anatomy on echocardiography. 10 children suspected to have CHD on the basis of the presence of a grade 2–3/6 systolic murmur over the pulmonary area were found to have no abnormal findings on echocardiography. The first field team (clinically) diagnosed RHD in 3 (2.5/1000) rural school children. Of these 3 children, one had isolated rheumatic mitral regurgitation. Second case was a previously diagnosed rheumatic mitral regurgitation which was on secondary prophylaxis. Third case was also a previously diagnosed CRHD with MR which was on secondary prophylaxis. Clinically there was no RHD case detected in urban school children. In contrast using Echocardiogram/Doppler the second field team detected RHD in 32 (7.6/1000) additional cases in school children, 11 (9.3/1000) from rural and 21 (7/1000) from urban schools ($P = 0.000$, O.R. $= 0.093$ and C.I. $= 0.023$–0.317). So the total number of RHD cases detected by both the field teams, clinical and echocardiogram, in the rural schools are 14 (3 + 11) (11.9/1000) and 21 (0 + 21) (6.9/1000) in the urban schools and the total number of RHD cases in both rural and urban schools are 35 (3 + 32) (8.3/1000) (Table 2).

In rural schools 16 children had history of sore throat and throat culture was positive in 1. In urban schools 34 had history of sore throat and culture was positive in 2 (Table 2).

Other prominent cardiac lesions detected clinically in rural schools were Congenital Heart Disease (CHD) in 9 (7.7/1000) that included Atrial Septal Defect (ASD) in 5 (4.2/1000), Patent Ductus Arteriosus (PDA) in 1(0.9/1000), Dextro Cardia (Situs inversus totalis without structural cardiac defect was detected clinically by palpating liver on left side and cardiac apical impulse on right side and conformed by echocardiogram) in 2 (1.7/1000) and Cyanotic Congenital Heart disease in 1 (0.9/1000). Additionally the echocardiographic examination, apart from the above 9 cases in rural school, could detect 2 cases of silent Patent Ductus Arteriosus. So the total number of CHD cases detected by both the field teams (clinical & echocardiogram) in the rural schools were 11 (9.3/1000).

Other prominent cardiac lesions detected clinically in urban schools were CHD in 30 (9.9/1000) that included ASD in 13 (4.2/1000), PDA in 7, Ventricular Septal Defect (VSD) in 6 (1.9/1000), Dextro Cardia (Situs inverus totalis without structural heart disease) in 1 (0.3/1000), Valvular Pulmonic Stenosis (PS) in 2 (0.6/

Table 2
Total prevalence of RF/RHD in rural area and urban area/prevalence of Group A beta haemolytic streptococcus culture positive cases rural and urban.

Age group	Clinical and echocardiographic RHD (Total)				Throat culture positive cases	
	Rural		Urban		Rural	Urban
	Total	Per thousand	Total	Per thousand		
5–10	3	2.6	2	0.7	0	1 (0.3)
11–16	11	9.4	19	6.3	1 (0.8)	1 (0.3)

($P = 0.000$, odds ratio $= 0.093$, CI 0.023–0.0317).

Table 3
Echocardiographic prevalence of congenital heart disease (CHD) from rural and urban areas.

	Rural			Urban		
	5–10 years	11–16 years	Total	5–10 years	11–16 years	Total
Atrial septal defects (including postoperative cases)	0	5	5 (4.2/1000)	4	9	13 (4.2/1000)
Patent Ductus Arteriosus (PDA)	2	1	3 (2.5/1000)	5	3	10 (3.3/1000)
VSD (including postoperative cases)	0	0	0	2	4	6 (1.9/1000)
Dextro cardia (situs inversus without structural heart disease)	0	2	2 (1.6/1000)	0	1	1 (0.3/1000)
Valvular Pulmonic Stenosis	0	0	0	1	1	2 (0.6/1000)
Coarctation of aorta	0	0	0	1	0	1 (0.3/1000)
Cyanotic Congenital Heart Disease	0	1	1 (0.8/1000)	0	0	0
Total	2	9	11 (9.3/1000)	13	18	33 (10.8/1000)

1000) and Coarctation of aorta in 1 (0.3/1000). In urban schools, the echocardiogram examination in addition to the above 30, was able to detect 3 more cases of silent Patent Ductus Arteriosus (Table 3). The total number of CHD cases detected by both the field teams (clinical & echocardiogram) in the urban schools are 33 (10.9/1000). The total number of CHD cases in both rural and urban schools detected by both the field teams is 44 (11 + 33) (10.4/1000).

In the RHD Group, MR was the most common lesion, followed by AR. Among subjects with CHD, ASD was the most common lesion followed by PDA and VSD.

5. Discussion

Rheumatic fever and rheumatic heart disease are the most common cardio vascular diseases in children and young adults. The prevalence of RHD varies across the globe, the highest being in sub-Saharan Africa (5.7–55.4/1000[6]) with least being in the developed nations where the prevalence is less than 1/1000. In India the prevalence of RHD as reported (Table 4) by ICMR,[9,10] Padmavathi,[11] Grover et al,[10] Avasthi et al,[12] Patel et al,[13] Jacob Jose et al[2] Periwal et al,[14] Bhaya et al[4] and Saxena et al[5] varied from 1 to 51/1000.

Jacob Jose from Vellore,[2] South India screened 2, 29 829 school children aged 6–18 years. 374 had suspected RHD. The diseased was confirmed in 157 (prevalence 0.67/1000). Mitral valve prolapse was diagnosed in 57 (prevalence 0.25/1000). The prevalence of CHD was not reported in this study. Periwal et al from Bikaner in North India[14] screened 3292 school children in age group 5–14 years. Cardiac murmur was observed in 55 children. RHD was clinically diagnosed in 50, but demonstrated echocardiographically in only 2 (prevalence 0.67/1000). Other prevalent cardiac lesions were CHD in 5 and mitral valve prolapse in 37. We strongly believe that many subclinical RHD and asymptomatic CHD cases must have been missed in the early studies; since they were not screened by a cardiologist and echocardiogram not performed in all school children. Two recent echocardiographic studies by Bhaya et al[4] and Saxena et al[5] done in North India showed high prevalence of RHD varying from 20.4 to 51/1000. Overall prevalence of RHD in India varied from 1 to 51/1000. This drastic difference could not only be due to variation in prevalence of RHD from country to country and region to region, but also due to methods adopted for detection—clinical or echo or clinical plus echo.[15]

Our study was conducted in one district of Andhra Pradesh. It is situated in the southeast portion of Andhra Pradesh and is one of the biggest districts with 17 626 sq. km. area. Of the 3 million population 20% live in urban and 80% in rural areas. In our study all the school children were clinically examined by a field team headed by a cardiologist and another field team headed by another cardiologist screened all school children by echocardiogram. The first field team clinically diagnosed RHD in 3 (2.5/1000) rural school children. Of these 3 children, one had isolated rheumatic mitral regurgitation. Second case was a previously diagnosed rheumatic mitral regurgitation which was on secondary prophylaxis. Third case was also a previously diagnosed CRHD with MR which was on secondary prophylaxis. Clinically there was no RHD case detected in urban school children. Whereas, using Echocardiogram/Doppler the second field team detected RHD in 32 (7.6/1000) additional cases school children (30 cases had Mild MR and 2 cases had Mild AR), 11 (9.3/1000) from rural and 21 (7/1000) from urban schools ($P = 0.000$, O.R. = 0.093 and C.I. = 0.023–0.317). The total number of RHD cases detected by both the field teams, clinical and echocardiogram, in the rural schools are 14 (11.9/1000) and 21 (6.9/1000) in the urban schools and the total number of RHD cases in both rural and urban schools are 35 (8.3/1000).

The real incidence of CHD is difficult to determine; however, it is around 8/1000.[16] Live births the total prevalence of CHD, by both the field teams, in both rural and urban schools, in our study was 10.4/1000 (9.3/1000 in rural and 10.9/1000 in urban school children). This prevalence is higher than that of Periwal et al study, where prevalence of 1.6/1000 was reported. The prevalence of ASD in our study was 4.3/1000, PDA 3.1/1000, PS 0.5/1000, COA 0.2/1000 and Dextro Cardia (Situs inversus totalis without structural cardiac defect) 0.7/1000. The prevalence of ASD in our study is higher

Table 4
Comparative data of rheumatic heart disease from India.

Author	Place	Year	Age (years)	Population studied	Prevalence (per 1000)
ICMR[9]	Delhi	1982–1990	5–15	13,509	2.9
Padmavathi[11]	Delhi (urban)	1984–1994	5–10	40,000	3.9
Grover et al[10]	Raipurrani	1988–1991	5–15	31,200	2.1
Avasthi et al[12]	Ludhiana	1987	6–16	6005	1.3
Patel et al[13]	Anand	1987	8–18	11,346	2.03
Jacob Jose et al[2]	Vellore	2001–2002	5–18	229,829	0.68
Periwal et al[14]	Bikaner	2006	5–14	3292	0.67/1000
Bhaya M et al[4]	Bikaner	2010	6–15	1059	51/1000
Saxena A et al[5]	Heart	2011	5–15	6270	20.4/1000
Our study	Andhra Pradesh	2011	5–16	4213	7/1000

compared to other studies[17] but different from several other reports.[18,19] 50 students in our study were suffering from pharyngitis at the time of examination (16 rural and 34 urban school children). 3 (prevalence 0.7/1000) were found to be suffering from Group A beta-haemolytic streptococcus infection which was detected by rapid antigen detection test. Of these 3, 1 is from rural school (prevalence 0.8/1000) and 2 from urban schools (prevalence 0.6/1000).

The prevalence of RHD is several folds using echocardiographic screening compared to clinical examination. The CHD prevalence, on the other hand using echocardiographic screening is almost the same as clinical examination i.e., Clinical auscultation had much lower diagnostic efficiency in detecting RHD than CHD. In conclusion, the decline in RHD in India is not uniform. RHD continues to remain a major cardiac illness with an enormous disease burden that translates into huge economic and social losses. Our date support inclusion of echocardiography in screening protocols, even in the most resource-constrained settings and identify lower socioeconomic groups as most vulnerable.

6. Limitations of the study

The study was confined to one district only. It is likely that the results could be different if more districts in the state are included in the study. Our results cannot be generalised to the rest of India. We feel that many such echocardiographic studies should be done in different parts of the country to accurately find out the true prevalence of RHD and CHD in India.

7. Conclusions

The prevalence of clinical RHD in school children of Ongole Mandal of Prakasam District Andhra Pradesh, South India was 3 (0.7/1000), rural 3 (2.6/1000) and nil urban whereas the prevalence using echocardiogram was 11 (9.3/1000) in rural and 21 (7/1000) in urban ($P = 0.000$, O.R. $= 0.093$, C.I. 0.023–0.317). The total number of RHD cases detected both clinically and echocardiographically are 35 (8.3/1000). The prevalence of congenital heart disease was 10.4/1000 (9.3/1000 rural and 10.9/1000 urban), Prevalence of GAS sore throat was 0.7/1000 (0.8/1000 rural and 0.3/1000 urban).

The prevalence of RHD was several folds higher using echocardiographic screening compared to clinical examination. The CHD prevalence, on the other hand using echocardiographic screening is almost the same as clinical examination i.e., Clinical auscultation had much lower diagnostic efficiency in detecting RHD than CHD.

Confilicts of interest

All authors have none to declare.

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