Prevalence Of Rheumatic Heart Disease In Urban School Going Children
In South India, A Community Based Cross Sectional Study

J.S. Poyyamozhi1, C. Rajan Rushender2, G.Dinesh Kumar2

Abstract

Background: Rheumatic fever and rheumatic heart disease (RF & RHD) continues to be a significant public health problem in less privileged regions of the world. Considering the importance of periodic surveys in countries where organized screening programmes at national or regional level are not in place, the current study has been planned to assess the prevalence and clinical profile of Rheumatic heart disease (RHD) in school going children aged 5 – 17 years in selected schools, using echocardiograph and to analyze the factors associated Rheumatic heart disease in the study population. METHODS: The current study was a school based Cross sectional study of 7137 school children aged 5 to 17 years from 3 randomly selected urban schools. Students suspected of having rheumatic fever or RHD in the past or currently by history and clinical examination were subjected to, 12 lead ECG, Echo cardiography. RESULTS: The overall prevalence of RHD was 0.34% (95% CI 0.23% to 0.50%). Previously undiagnosed proportion of RHD was 66.67%. The prevalence was highest in 8 to 10-year-old children (0.82%) and girls had higher prevalence, compared to boys (0.46% in girls compared to 0.23% in boys). There was a gradually declining trend in proportion of cases with increasing socioeconomic score. Mitral valve alone was involved in 75% of the affected children. Isolated mitral regurgitation was the most common lesion seen in 37.5% of the subjects. CONCLUSION: The undiagnosed burden of RHD is very high in Indian school children. Poor socio economic and housing conditions are associated with higher prevalence of RHD. Mitral valve was the most common valve involved.

Key words: Rheumatic heart disease, prevalence, School children, screening, Echocardiography

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1. INTRODUCTION:

Rheumatic fever (RF) is caused by exaggerated autoimmune response of the host following group A streptococcal pharyngitis. Recurrent attacks of rheumatic fever can progress to rheumatic heart disease (RHD). RF & RHD continues to be a significant public health problem in less privileged regions of the world. 1,3

It is currently estimated that at least 15.6 million people have clinically recognized RHD with annual mortality rate between 3 and 12.5% [2–5], which accounts for 200,000 to 250,000 premature deaths. 4 According to the Vos, t., et al between 1990 to 2010 heart failure due to RHD increase in absolute numbers by 45.1% and documented 11.6% relative increase in YLDs per 100,000. 5 Recently published REMEDY study has also highlighted poor access of
RHD patients to surgical interventions, in advanced stages of disease.6

Many studies across the globe have highlighted the contribution of rheumatic heart disease towards maternal mortality and adverse neonatal outcomes, especially in low and middle income countries.7,10. This can be attributable to the fact that RHD is asymptomatic in the initial periods and manifests with symptoms only after significant hemodynamic compromise has resulted from the underlying valvar damage. In majority of the females, it is during the pregnancy, that the RHD becomes symptomatic and puts both the mother and neonate at risk for adverse consequences. given the progressive nature of RHD in the absence of secondary prophylaxis, surgery is currently the main remedy for preventing.3

Various screening strategies have been proposed and implemented across the globe, for early detection of RHD. Even though majority of these strategies involve screening of School children, the criteria and tools used for detection are quite heterogeneous. Considering low sensitivity of clinical methods, echocardiography based screening is being strongly recommended by many recent guidelines.1,3 Timely installation of secondary antibiotic prophylaxis may prevent progression of subclinical lesions to severe valvular damage and heart failure mediated by cumulative exposure to streptococcal antigens.1

Considering the importance of periodic surveys in countries where organized screening programmes at national or regional level are not in place, the current study has been planned to assess the prevalence and clinical profile of Rheumatic heart disease (RHD) in school going children aged 5 – 17 years in selected schools, using echocardiograph and to analyze the factors associated Rheumatic heart disease in the study population

   2. METHODS:

   2.1Study design and study setting: The current study was a school based Cross sectional study conducted in urban locality of Chidambaram town in Cuddalore district of Tamilnadu in South India.

   2.2 Study period:

The data collection for the study was done between November 2005 and October 2006.

2.3 Study population: The study has included School Children in the age group of 5 -17 Years.

2.3 Sample size: All the studies about Rheumatic heart disease used the sample size which ranged from 500-2,25,000 students. The reported frequency of Rheumatic heart disease in the studies mentioned was in the range of 1 – 5.4 / 1,000 children. In order to increase the accuracy of the estimate, total strength of all these schools was included in the sample. On any day the average number of absentees on the previous year was less than ten percent. The absentees (except long absentees) were covered during subsequent visits of the investigator. So the sample size was adequate even after adjusting for the absentees.

2.5Sampling method: The Chidambaram municipality area is about 4Sq. Km. The total number of schools in Chidambaram Taluk is 10 schools. Due to difficulty in getting permission, only three schools were randomly selected from the list of schools located in the Chidambaram municipal Town Area. In the randomly selected three schools, one is co-education school and one school is exclusively for boys and other one is exclusively for girls. Total number of students in all the three schools enrolled were Seven thousand Two hundred and fifteen students as per register available in the school for the year 2006.

2.6Operational definitions:

- **Rheumatic fever**: Those patients who fulfilled revised jones criteria at the time of screening were considered as having rheumatic fever. (Reference)
- **Rheumatic hear8disease**: Those who were having clinical and echo cardiographic evidence of valvular involvement were considered as rheumatic heart disease.
- **Arthralgia**: It is subjective pain which is a minor manifestation of rheumatic fever.
- **Rheumatic arthritis**: It is migratory poly arthritis with affected joints showing redness, warmth, swelling, pain and limitation of movements.
- **Chorea**: abnormal, purposeless, involuntary movements of the arms and legs.
- **Erythema marginatum**: Non-pruritic, erythematous rash with raised margins and

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central clearing on the trunk and proximal limbs but never on face.

- **subcutaneous nodule**: firm, non-tender nodule appearing over the extensor surface of the elbows, knees, ankle, knuckles, scalp and spinous processes.

2.7 Ethical and administrative approval: Necessary Permission was obtained from the district school authorities and local authorities to conduct the study. The study was approved institutional human ethics committee. Informed written consent was obtained from the parents and ascent form was obtained from the students.

2.8 Data collection tools: A structured questionnaire, prepared and validated by pre and pilot testing was used to capture all the relevant sociodemographic data. Since the parental income details could not be obtained the students, father's occupation was noted. The socio-economic score was calculated by giving scores to father’s occupation ( coolie-1, clerical / salaried-2, agriculture-3, business-4 ), ownership of house ( own-1, rental-2 ), and type of house (hut-1, katcha-2, pucca-3). Certain modifications were done in the questionnaire after pretesting.

2.9 Study procedure: All the students were interviewed by the investigators to collect the socio demographic and relevant clinical data. Necessary enquiries were made from school teachers and parents, if the students were not able to provide necessary information. All the students were examined clinically by the investigating medical officers, with special emphasis on cardiovascular examination and general examination.

Students suspected of having rheumatic fever or RHD in the past or currently byhistory and clinical examination were subjected to, 12 lead ECG, Echo cardiograph and other further investigations at Department of cardiology, Raja Muthiah Medical College and Hospital (RMMCH). In confirmed cases, students and parents were given moral support and advised them to carry on penicillin prophylaxis 1.2 mega units every three weeks for the period suggested by the expert and to get regular follow up. Towards the end of this study, teachers of all the schools were given proper orientation to identify heart disease among children in future and referring them to hospitals for confirmation of the disease.

2.10 Statistical analysis: The prevalence of the disease was estimated as number of cases per 100 populations and it’s 95% Confidence intervals are presented. The difference in the proportion disease was compared across the age groups and genders, using chi square test. The frequency of the disease in various categories of explanatory factors and the clinical profile of cases was presented as frequency and proportions. IBM SPSS statistical software version 21 was used for statistical analysis.

3. RESULTS:

A total of 7137 children were included in the final analysis. The highest proportion of children was between 14 to 16 years, followed by 11 to 13 years. Boys constituted 54.66% of the study subjects and girls constituted the remaining 45.34%. Only .9% of study population had family size < 3. In 84.5% of children, the family size was 4 to 5 and in 10.6% of participants, the family size was 6 and above. The most common paternal occupation in the study was clerical or salaried employee (35.56%). The proportion of children, whose father was collarie were 28.96% and almost equal proportion of fathers were farmers. About 80% of children were living in kutcha houses and the proportion of subjects, living in semi pukka and pukka houses were 7.8% and 12.2% respectively. The socio economic score was ≤ 5 in 37.82% of the subjects, 6-7 in 57.66% of the subjects and in only 5.41% of the subjects, it was ≥ 8.

Table 1: Overall prevalence and undiagnosed burden of RHD in study group.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Number</th>
<th>Proportions ( 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall prevalence (N=7137)</td>
<td>24</td>
<td>0.34% (0.23%to 0.50%)</td>
</tr>
<tr>
<td>Newly detected</td>
<td>16</td>
<td>66.67%</td>
</tr>
<tr>
<td>Previously diagnosed</td>
<td>8</td>
<td>33.33%</td>
</tr>
</tbody>
</table>

The overall prevalence of rheumatic heart disease in the study population was 0.34% (95% CI 0.23% to 0.50%).
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Table 4: Proportion of signs and symptoms and pattern of valvular involvement (N=24)

<table>
<thead>
<tr>
<th>Character</th>
<th>Number of Cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs and symptoms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint Pain + Dyspnoea</td>
<td>7</td>
<td>29.2</td>
</tr>
<tr>
<td>Dyspnoea + Chest Pain</td>
<td>5</td>
<td>20.8</td>
</tr>
<tr>
<td>Chest Pain + Joint Pain</td>
<td>4</td>
<td>16.7</td>
</tr>
<tr>
<td>Fever + Joint Pain</td>
<td>2</td>
<td>8.3</td>
</tr>
<tr>
<td>Fever + Joint Pain</td>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>Dyspnea + Chest Pain + Joint Pain</td>
<td>5</td>
<td>20.3</td>
</tr>
<tr>
<td>Valve involvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitral Valve Alone</td>
<td>18</td>
<td>75</td>
</tr>
<tr>
<td>Mitral valve + Aortic Valve</td>
<td>5</td>
<td>20.8</td>
</tr>
<tr>
<td>Mitral + Aortic + Tricuspid Valves</td>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>Type of valvular involvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS</td>
<td>4</td>
<td>16.7</td>
</tr>
<tr>
<td>MR</td>
<td>9</td>
<td>37.5</td>
</tr>
<tr>
<td>MS + MR</td>
<td>1</td>
<td>4.17</td>
</tr>
<tr>
<td>MR + AR</td>
<td>4</td>
<td>16.7</td>
</tr>
<tr>
<td>MR + MVPS</td>
<td>2</td>
<td>8.3</td>
</tr>
<tr>
<td>MS + PAH</td>
<td>2</td>
<td>8.3</td>
</tr>
<tr>
<td>MR + AR + TR + PAH</td>
<td>1</td>
<td>4.17</td>
</tr>
<tr>
<td>MR + AR + PAH</td>
<td>1</td>
<td>4.17</td>
</tr>
</tbody>
</table>


The nature of valvular involvement has shown that majority of the cases having regurgitating valvular deformity. Isolated mitral regurgitation was the most common lesion seen in 37.5% of the subjects. Isolated mitral stenosis was seen in 16.7% of the cases. The other children had various combinations of lesions involving single or multiple valves. About 4 children had Pulmonary artery hypertension. (Table 4)

4. DISCUSSION

Rheumatic heart disease is reported to be one of the important public health problems in under developed and developing nations. Considering the subclinical nature of the disease and serious nature of adverse health and economic consequences resulting from valvular damage due to repeated episodes of rheumatic fever many studies have recommended regular screening of school children for RHD. Early diagnosis of RHD and initiation of secondary prophylaxis are proved to successfully prevent the subsequent attacks of rheumatic fever and resulting valvular heart disease.

In countries and regions, where national or sub national level organized screening programs are not in place, periodic surveys provide important insights into the burden of this important disease. The current study is one such attempt to document the prevalence of RHD in school children in the state of Tamilnadu in south India.

In the current study, the overall prevalence of rheumatic heart disease in the study population was 0.34% (95% CI 0.23% to 0.50%). Out the total RHD cases only 33.3% were already diagnosed, but the remaining 66.67% of the cases were undiagnosed cases of RHD.

In a study by, Rama Kumari, N., et al. the echocardiographic prevalence of RHD was 0.76%, but clinical prevalence was only 0.07% and authors have emphasized the importance of Echo citing many fold increase in number of cases diagnosed compared to clinical examination alone. Kumar, R., et al. in their 8 year prospective study from north India have documented a prevalence of 0.1% (0.08 to 0.13) RF/RHD in 5 to 14 year old school children and about two-thirds of them were already enrolled in the hospital-based RF/RHD registries. The undiagnosed burden in this study is lower than the current study, as there was an organized RF/RHD surveillance and registration programme was in place. Bhaya, M., et al. in 2010 have reported a prevalence of 0.51% (0.38% to 0.64%) among 6 to 15 year old school children, by echocardiographic screening. This study also emphasized the need of echocardiographic screening, as they could diagnose
only one case clinically. Sriharibabu, M., et al., who have documented an age-standardized RHD prevalence rate of 0.97% among, adults attending primary health centers in south India, have highlighted the fact that, more than two-thirds had no past history of RHD or penicillin prophylaxis. Kumar, P., et al. reported a prevalence of 0.334% in Rajasthan school children. Many of these studies have emphasized continuing high burden of RHD and need for regular screening programmes. But a recent study by Nair, B., et al. in 2015 have reported a clinical prevalence of 0.24% and echocardiographic prevalence of 0.58%, in one of the largest school survey in Kerala and opined that RHD burden is declining in the community. Negi, P. C., et al., reported five-fold decline in burden of RF/RHD revealed 0.298% in 1992-93 to 0.059% in 2007-2008. But even these studies emphasized huge undiagnosed burden of RHD.

In the current study, girls had higher prevalence, compared to boys (0.46% vs. 0.23%). In both genders highest prevalence was seen in 8 to 10-year-old children. Among the cases highest proportion (50%) were found in children whose father was working as coolie. There was a gradually declining trend in proportion of cases with increasing socioeconomic score. According to Saxena, A., et al., older age, female sex and government funded school student, which is a surrogate measure of lower socioeconomic status were found to be independent predictors of RHD. Periwal, K. L., et al., have observed equal prevalence of RHD in both genders, but higher prevalence in poor SES children in their study. Kumar, P., et al. Maximum prevalence of RHD was in low socioeconomic group. Negi, P. C., et al. have attributed declining trend of RHD to improvement in socioeconomic conditions. So it can be concluded that there are disagreements in association between age group, gender and RHD between the studies, but all the studies have uniformly reported higher prevalence of RHD in poor socio economic status children.

In the current study joint pain plus dyspnea (29.2%) was the most common presenting symptom. None of the children in study group have reported other symptoms like chorea. Mitral valve alone was involved in 75% of the affected children. Mitral and aortic valves were involved in 20.8% of cases and in the remaining 4.2% of cases three valves i.e. mitral, aortic and tricuspid valves were involved. The nature of valvular involvement has shown that majority of the cases having regurgitating valvular deformity. Isolated mitral regurgitation was the most common lesion seen in 37.5% of the subjects. Isolated mitral stenosis was seen in 16.7% of the cases. In study by Kumar, P., et al. the most common valvular lesions reported were isolated mitral stenosis, followed by combined mitral stenosis and mitral regurgitation. Many studies have reported the order of involvement of valves was mitral (60.2%), followed by aortic, tricuspid and pulmonary valves. Mitral stenosis, predominantly seen in females, was almost exclusively of rheumatic etiology (97.4%). The predominant form of isolated MR was rheumatic (41.1%).

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Huge proportion (Almost two thirds) of the RHD burden was undiagnosed and were not on any prophylaxis
Poor socio economic status, poor housing conditions were associated with higher prevalence of RHD
Mitral valve was the most common valve involved and majority of the lesions were regurgitate in nature.

6. Recommendations:
Considering the high burden of undiagnosed RHD, regular ongoing screening or surveillance programmes targeting the school children is the need of the hour
Considering poor validity and diagnostic yield of clinical examination, the screening programmes should be based on echocardiography evaluation

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9. REFERENCES: