

Prevalence of Rheumatic Heart Disease among Primary School Students in Mid-Eastern Ethiopia

Hailu Abera Mulatu^{1*}, Mihret Woldemichael² and Mengistu Aberra³

¹Department of Medicine, Addis Ababa University, Ethiopia

²Clinical Addis Ababa University, Ethiopia

³Department of Pediatrics, Taipei Medical University, Taiwan

*Corresponding author: Mulatu HA, Postgraduate program coordinator, St. Paul's Hospital Millennium Medical College, Internal Medicine, Africa Avenue, Addis Ababa, 1784 code 1250, Ethiopia, Tel: +251911678287; E-mail: dhailu2001@gmail.com

Rec date: Oct 13, 2015; Acc date: Dec 17, 2015; Pub date: Dec 26, 2015

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Abstract

Objective: To determine the prevalence of rheumatic heart disease (RHD) among primary school students in Shashemene town of Oromia regional state of Ethiopia.

Method: Using a cross sectional study design and a multistage sampling technique, pupils were selected from public and private primary schools in Shashemene town. They were clinically screened for evidence of RHD by auscultating for significant murmurs. The students with significant murmurs then had echocardiographic evaluation to confirm the presence of RHD.

Results: Out of the 1874 students recruited, 956 (51.01%) were females while 918 (48.99%) were males. The mean age of the students was 8.86 ± 2.14 years. 1162 (62.01%) and 712(37.99%) respectively were recruited from public and private schools. Of the 1874 students, fifteen (0.80%) had significant murmur. Only six of the fifteen had RHD, giving a prevalence of 3.2/1000 students. Four of the students with RHD were females and the rest two were males, all from public school and in the low socioeconomic class.

Conclusion: The prevalence of RHD in this study is low compared to similar studies conducted previously in the country. The true prevalence may be underestimated since higher prevalence is obtained from echocardiographic screening compared to clinical screening.

Keywords: Rheumatic; Heart disease; Chronic; Haemolytic

Introduction

Rheumatic heart disease (RHD) is the chronic complication of rheumatic fever (RF) [1]. It is often the outcome of repeated RF infections [1,2]. Rheumatic fever in turn is a non-suppurative complication of group A β -haemolytic streptococcal upper respiratory tract infection due to delayed immune reactions [2]. Rheumatic fever and RHD are of public health importance being major causes of acquired heart diseases in the developing countries [3-5].

The World Health Organization (WHO) estimated that 16 million people suffer from RHD in the world [6]. The RHD and RF burden is highest in the developing countries accounting for 90% of the global burden of RF/RHD. These diseases have reduced considerably or have practically been eliminated in the developed countries. The success had been ascribed to improved living conditions, environmental sanitation and access to improved healthcare [7].

The recurrence of rheumatic fever can lead to the onset of RHD or worsen the severity of an existing RHD. Thus if the RF is prevented from re-occurring in individuals with previous RF or one with RHD, the burden of RHD can be reduced substantially in the patients, their families and the country at large [8,9]. This concept is embedded in the secondary prevention program of RF. The administration of depot

preparation of benzathine penicillin every three to four weekly has been shown to be successful in preventing recurrent episodes of RF [9]. An individual with RHD has to be diagnosed with the condition before this preventive measure can be instituted. Whereas the diagnosis of RF seems uncommonly made in most clinics in developing countries as might

be suggested by the paucity of studies on RF in the developing countries, the continued reports from studies on RHD, [5,10] the sequela of RF would suggest otherwise. The high RHD burden will increase the cost of healthcare and economic burden both to the individual and the community. The only two school based screening for RHD in Ethiopia were conducted in Butajira town and Addis Ababa before fifteen years [10,11]. The prevalence of RHD was 4.6/1,000 and 6.4/1000 primary school pupils using echocardiographic method in Butajira town and Addis Ababa respectively. However, there are no recent data on the disease prevalence. There are hospital based studies on RHD which may not reflect the true burden of the disease in the community [5,9,10].

It is therefore imperative to educate patients with RF to have antibiotic prophylaxis to prevent recurrent attacks of RF. More importantly, identifying patients who already have RHD in the community especially those with mild cases and the commencement of prophylaxis in these patients will prevent recurrent attacks of RF and may halt the progression of the disease process. This study is therefore

carried out to determine the prevalence of RHD among primary school pupils in Shashemene town of Oromia regional state of Ethiopia.

Materials and Method

This is a cross sectional study design that was used to evaluate the prevalence of RHD among primary school children in Shashemene town. Shashemene lies on the **Trans-African Highway from Cairo-Cape Town**, about 150 miles (240 km) from the capital of **Addis Ababa**. The population projected for 2014, using the census data in 2007, was 140,717; of which 70,378 (50.01%) were men and 70,339 (49.99%) were women [12]. It is predominantly a semi-urban setting with 10 Kebeles (the smallest administrative units) with an average population of over 6000 in each Kebele [13]. Shashemene was chosen because it is representative of many other towns in terms of demography and social class. This study was conducted over a three months period (October 2013 to December 2013). This period included the times the schools were in session. Ethical approval for this study was obtained from the ethics committee of the Oromia Health Bureau.

Sampling technique

A sample size of 1874 pupils was selected using a multi stage sampling technique. Of the ten kebeles, 30% [3] kebeles were randomly selected from a list of the kebeles as the first stage sampling process. There was 6 public and 9 private schools in the three selected kebeles from which 30% each of private and public schools were selected from a list of alphabetically arranged schools. Thus two public and three private schools were selected using a systematic sampling technique after randomly selecting the first school (second stage). The school sample size was determined as the ratio of the product of index school population and study sample size (1874) over the pooled population of the five selected schools. The school sample size was thus determined in proportion to school population. A systematic sampling method was employed to select pupils from each school.

Evaluation of selected pupils

An informed consent was obtained from the parents of each selected pupil. Any child whose parent declined to give consent was replaced by the next pupil on the list, selected using the sampling interval and whose parent gave consent. A socioeconomic class (SEC) was ascribed to each selected pupil using the method described by Olusanya et al [14].

The selected pupil then had a thorough general and systemic examination with emphasis on the cardiovascular system. The weight was taken with the shoes, wrist watches, belts and other thick clothing taken off and the subject was in his or her school uniform only. The Omron body composition monitor (HBF-510 W) was employed to measure the weight. The pupils were instructed to stand on the weighing machine looking ahead. The weight once captured was displayed on the machine. The weight was read to the nearest 0.1 kg. The height was taken with the aid of a stadiometer with the pupils' shoes and stockings off; the pupils were instructed to stand against the stadiometer with the heels, buttocks and occiput resting against the stadiometer. The chin was raised as the subject was looking ahead with the upper border of the ear canal in the same horizontal plane as the lower border of their eye socket (Frankfurt plane) and the height was read to the nearest 0.1 cm.

In auscultating the pupils' heart, all the cardiac areas (apical, tricuspid, pulmonary and aortic areas) were listened to for abnormal sounds. Particular attention was paid to the presence of apical pansystolic murmur that radiates to the axilla which suggests the presence of mitral regurgitation, or basal early diastolic murmur of aortic regurgitation. Apical diastolic murmur and basal systolic murmurs were listened for as well. Any other murmur was also evaluated. Auscultation was done by the first investigator and a team of five senior general medical practitioners. Each murmur heard was re-evaluated by one of the researcher who is a Paediatric Cardiologist. Any other abnormality found during the general and systemic examination was noted.

Echocardiographic examination

Every subject with suspected RHD murmur on clinical evaluation had an echocardiogram by the Paediatric Cardiologist. Parental consent was once sought before the procedure could be done. The echocardiogram was done with Mindray M5 Sonograms systems. The interrogation was performed from the apical four chamber view, long axis parasternal and short axis parasternal views. Two dimensional echocardiography (2D), M-mode, pulsed and continuous wave and color Doppler techniques were used. The structure of the intracardiac valves particularly the mitral and aortic were evaluated with respect to the presence of thickening and deformity such as the elbow or bent knee appearance of the mitral valve leaflets. The evidence of valvular incompetence or stenosis was noted. Where there was regurgitation, the length of the regurgitant jet was measured. The function of the heart was evaluated with the value of fractional shortening and ejection fraction [15,16]. The 2006 WHO echocardiographic criteria for case definition of RHD were used. The RHD cases are classified into definite, probable or possible RHD.

Statistical analysis

The data were entered into SPSS version 18 spread sheet and analysis done with the tool. Values were presented as percentages while the prevalence of RHD was presented as number of affected pupils/1000 pupils. Differences in means were compared using student's t-test. More than two means were compared using one-way ANOVA with Turkey Kramer post hoc test when significant. Level of significance was set at $p \leq 0.05$.

Results

Characteristics of the study population

The recruited 1874 children were aged five to fifteen years with a mean age of 8.86 ± 2.14 years. Majority of the pupils 1240 (66.17 %) were in the age group five to nine years of age while the others 634 (33.83 %) were in the age group ten to fifteen years. Majority of the pupils, 956 (51.01%) were females while 918 (48.99%) were males. There were 1162(62.01%) pupils from public schools while 712(37.99%) were from private schools. Most of the pupils 1814 (96.79%) had enough information to compute their SEC. Over two-third of these pupils 1256 (67.02%) were from the low SEC, 427 (22.79%) were in the middle SEC and the least 191 (10.20%) were in the high SEC. The characteristics of the study population with respect to the type of school are shown in Table 1. The mean number of pupils per class in public school was 57.33 ± 5.20 , was significantly more than

those in private schools: 32.56 ± 3.43 , $p \leq 0.0001$, (CI: -33.21 to -27.33).

Characteristics	Public Schools	Private Schools	P- value	Confidence Interval
Mean age (years)	9.96 2.24	8.08 1.76	<0.0001	-1.84 to -1.44
Mean no. pupils/class	57.33	32.56	<0.0001	-33.21 to -27.33
Gender				
Males	650 (55.94)	268 (37.64)	0.31	
Females	512 (44.06)	444 (62.36)		
Socioeconomic class				
High	15 (1.29)	276 (38.76)		
Middle	246 (21.17)	281 (39.47)	0.001	
Low	901 (77.54)	155 (21.77)		

Table 1: Characteristics of study population.

The mean weight of the pupils in the public and private schools were 28.19 ± 7.51 and 29.63 ± 8.58 kg respectively, $p \leq 0.0001$, (CI: -1.84 to -1.44). The mean weight of the female and male pupils were 29.18 ± 8.65 kg and 28.51 ± 7.35 kg respectively, $P=0.08$. The mean height of the male and female pupils were 130.31 ± 9.90 cm and 130.65 ± 10.65 cm, $p=0.488$. The pupils in private schools were taller 130.67 ± 9.74 cm than those in public schools 130.32 ± 10.74 , $P=0.52$ (Table 1).

The prevalence of the rheumatic heart disease in the study population: Of the 1874 pupils screened clinically for evidence of RHD, fifteen (0.80%) have significant heart murmurs. Of these six (40%) have echocardiographic evidence of RHD. The prevalence of RHD in the study population is thus $6/1874=3.2/1000$ pupils. Four pupils with RHD have mild to moderate mitral regurgitation with thickened anterior mitral valve leaflet. The rest two pupils had mild mitral stenosis with thickening of both anterior and posterior valve leaflets. Thus the pupils had definite RHD according to WHO RHD case definition. All pupils with RHD are from low SEC and are in a public school. The pupils were unaware of the condition and could not remember having pharyngitis.

Other findings

There were 12 (0.64 %) pupils in the study population who had clinical pallor. They were all from public schools. Twenty (1.07%) had Taenia capitis, and of these, 19 (95%) were in the public school while one (5%) was in private school.

Discussion

The prevalence of RHD in this study is slightly lower than the 4.6/1000 and 6.4/1000 obtained in Butajira town in 1991 and Addis Ababa in 1999 respectively. This difference might be due to improved standard of living as shown by the rising gross domestic product (GDP) of the country in the last decade [17].

The prevalence obtained in this study is far lower than the values obtained in some other developing countries where similar methodology was used. In a study conducted among primary school

pupils aged five to fifteen years in Sudan, [18] the prevalence of RHD was 11/1000 pupils. In studies done in Kinshasa in 1998 on school children aged five to sixteen years the prevalence was 14.03/1000 children [19]. The higher values obtained in these African countries compared to the present study may be due to prevailing poor socioeconomic circumstances in those countries at the time of the study. The relatively high values were attributed largely to overcrowded living conditions and poor socioeconomic background. However in a recent study done in Nigeria in 2012, the prevalence of RHD in school children aged five to fifteen was 0.57/ 1000 pupils which is far lower than studies done elsewhere in Africa [20].

Some studies outside of Africa have also demonstrated a higher prevalence of RHD compared to the present study. In two studies conducted in Rahim Yaar Khan [21] and Lahore22 both districts in Parkistan in 2004 and 2009 respectively, RHD was identified in 5.7/1000 and 21.9/1000 in school children aged five to fifteen years. Both studies have higher RHD prevalence than the present study and suspected cases on clinical examination were confirmed on echocardiography. The Rahim Yaar Khan study conducted in a periurban setting did not find any relationship between the prevalence and well known determinants of RHD such as education, overcrowding and SEC. The Lahore study however was conducted in rural slums with widespread poverty and overcrowding. This might explain the wide difference in the prevalence of RHD in the two districts of the same country. The difference in prevalence also suggests that the prevalence of RHD do not only vary between countries, but also within the same country based on the prevailing socioeconomic and environmental situation of the studied community [22].

The pupils with RHD in the present study was unaware of the condition and thus were not accessing the very important penicillin prophylaxis for preventing recurrent episodes of RF which may worsen and cause the condition to deteriorate. The lack of awareness of the RHD condition by affected children has similarly been reported in previous studies [10,11] This calls attention to the need to identify these children with RHD early and follow them up with penicillin prophylaxis and regular evaluation of the state of the affected valve.

The prevalence obtained in this study was from echocardiographic confirmation of suspected cases on clinical evaluation. Previous studies in the country also used similar method of screening. In a multicentre study conducted in Cambodia and Mozambique, [23] the prevalence of RHD on echocardiographic screening was ten times higher than clinical screening. This suggests that had the present study been conducted by echocardiographic screening, the prevalence might have been higher. The reason for the estimated higher prevalence is the detection of the subclinical forms of RHD. The advantage of detecting the subclinical cases is that opportunity is provided for early follow up and such cases are prevented from deteriorating into the severe forms that are more difficult and expensive to manage. It is however important to identify any child with RHD whether clinical or subclinical and initiate therapy and follow up.

The difficulty with carrying out echocardiographic screening in resource limited setting like ours is that the echocardiography machine is expensive to procure and the machine requires an expert to operate for reliable results.

In conclusion, the prevalence of RHD in this study is low compared to similar studies conducted previously in the country. Similar studies done in different parts of the country or better still, studies employing echocardiographic screening will provide a better country

representative prevalence. At the same time, the lack of awareness about their disease observed among the cases is worrisome and deserves serious concern.

Acknowledgement

We wish to thank Drs. Esubalew A, Adugna M, Belete G, Dereje J and Mohammed A for their assistance with the field work.

Our Contribution

Hailu A.M. developed the study and wrote the introduction with Mihret W.M., and Mengistu supervised the data collection and contributed to the writing and review of the final draft of the manuscript. The methodology was done by Mengistu A. Statistical analysis of the data, the results sections, and the abstract were written by Hailu A.M. and Mengistu A. Discussion and conclusion was written with equal contributions from all of us.

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