Screening for the prevalence of Rheumatic Heart Disease among school children in Egypt

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November 26, 2022

Abstract

Background: In low-income nations, Rheumatic valvular heart disease remains a major cause of morbidity and premature deaths. Accurate prevalence data in Egypt are still lacking yet highly desirable to facilitate health care planning. *Methodology:* An cluster sample of school children in eastern Egyptian Governorates was examined clinically and echocardiographically (using abbreviated protocol) for detection of rheumatic valvular heart disease based on 2012 World Heart Federation criteria (the Doppler and the morphological criteria) for diagnosis. According to echocardiography interpretation, participants were categorized as having definite RHD, borderline RHD or no RHD. *Results:* A total A total of 1680 students aged between 6 and 18 years were screened, 119 echocardiographic studies were non-interpretable; so, a total of 1560 studies were evaluated. From the total screened students, 1560 studies were adequate and interpretable according to the criteria specified in the methods section. This revealed a prevalence of 2.3% of the sample with RHD without adding the equivocal cases. The most prevalent lesion as detected by echocardiography was mitral regurgitation (29% of definite RHD cases). *Conclusion:* Rheumatic valvular heart disease remains prevalent in Egypt and the findings of this study should influence early detection, primary and secondary prevention, and adequate future national health plans.

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Conclusion: Rheumatic valvular heart disease remains prevalent in Egypt and the findings of this study should influence early detection, primary and secondary prevention, and adequate future national health plans.

Key Words:

Rheumatic valvular heart disease, Echocardiography, prevalence .

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Introduction:

In low-income nations, rheumatic heart disease (RHD) remains a major cause of morbidity and premature death and imposes a substantial burden on health care systems with limited budgets [1,2]. Nevertheless, primary and secondary prevention efforts may be highly effective [1,3]. Secondary prevention relies on accurate case detection for the appropriate use of prophylactic antibiotics and regular medical surveillance. Exact prevalence data are also highly desirable to facilitate health care planning.

Rheumatic Heart disease continues to be a major health problem in many parts of the world particularly developing countries including Egypt. While it has been eliminated from developed countries and we aim that Egypt has to go in the same direction and get rid from this disabling major health problem as it remains a significant cause of cardiovascular morbidity and mortality. The most devastating effects are on children and young adults and the first acquired cardiovascular disease in this health group [2,3].

For at least five decades this unique non-supportive sequel to group A streptococcal infections has been a concern of the World Health Organization (WHO) and its member countries. Sentinel studies conducted under the auspices of the WHO during the last four decades clearly documented that the control of the preceding infections and their sequelae is both cost effective and inexpensive. Without doubt, appropriate public health control programs and optimal medical care reduce the burden of the disease. RHD accounts for 25-50 % of all cardiac admissions in developing countries and is considered a major health concern including the middle east, the Indian subcontinent and south America. As many as 20 million occur each year; 233 thousand die each year as a result of RHD. Estimated 12 million patients worldwide required further treatment to prevent disability and death and about 8 million school children require further treatment to prevent morbidity and mortality [4-8].

In Egypt there is no national data yet for the prevalence of RHD which makes any action plan for combating, preventing and eliminating this major health problem is difficult. In WHO disability adjusted life years (DALYs) lost (the sum of years of life lost owing to premature death, plus the years lived with disability adjusted for the severity of the disability) remains much higher in the Eastern Mediterranean zone, to which Egypt geographically belongs, coming only second after South-East Asia [9].

We aim from this population-based study to detect the prevalence and patterns of RHD affection among school children in Suez Canal region using echocardiographic screening by screening (primary, preparatory and secondary schools) representing urban and rural regions as a precursor for nationwide survey.

Methods:

Study design and sampling:

Suez Canal region representing the eastern section of Egypt was our study area. A cluster random sample was used to ensure full representation of all population varieties of the region. The region was divided into rural and urban areas and then in each area the schools were divided into primary, preparatory and secondary schools. A cluster random samples was chosen from the studied region then a random number of students were included.

Approval of the survey by the ethics committee of the Ministry of Health and Education Ministry of the selected regions were obtained. After obtaining an informed consent from parents or guardians, children at school age (6-18 years) were included in the study as follows:

The region under study was classified into rural and urban areas. All schools in the chosen area were enumerated and classified into either primary, preparatory or secondary. The sample size was distributed proportionally on the three stages according to gender distribution (Table 1). Schools in each stage were chosen on random basis by using computer software (Epi-Info 3.4.3) and the selected schools were visited by the study group.

A total of 1680 students were screened, 119 echocardiographic studies were non-interpretable; so, a total of 1560 studies were evaluated.

Each student from the chosen sample was subjected to 1) Medical history (including demographic data, pervious history of rheumatic fever and any current symptoms) through a verbally administered questionnaire. 2) Detailed cardiac examination and detected murmurs were reported and correlated with echocardiographic findings. 3) A transthoracic Echocardiographic assessment by portable echo machine (Esoate MyLab30) were performed on site by well-trained experts in the standard views.

We developed an abbreviated echocardiographic protocol that took 5–10 min per child and focused on rheumatic pathology of the mitral and aortic valves from the parasternal long axis, apical four and five chamber views, with particular attention being paid to valve morphology on two-dimensional imaging and the degree and extent of mitral and aortic regurgitation, assessed by color flow Doppler imaging. Transvalvular flow was assessed by measuring the peak velocity with continuous wave Doppler imaging. Echocardiographic data was stored on the device to be revised in the echo lab by two separate experts blinded to the clinical data.

Diagnosis of RHD:

To assess the echocardiographic RHD prevalence (including clinical and subclinical cases), we used the 2012 World Heart Federation (WHF) criteria (the Doppler and the morphological criteria) for diagnosis (10). Only left-sided valves were examined for features of rheumatic heart disease; mild tricuspid regurgitation and pulmonary regurgitation were frequently noted but were not regarded as indicating rheumatic heart disease. For a definite diagnosis of rheumatic heart disease, these features had to be identified concordantly by each of the echocardiographers. According to the 2012 WHF criteria; subjects were classified into definite RHD, borderline (equivocal) RHD or non-RHD (normal). Children with a definite RHD were reported and referred to a specialized clinic in Suez Canal University Hospital for further follow-up and possible intervention.

Statistical analysis:

Data was tabulated using Statistical Package for the Social Sciences software version 22 (SPSS Inc. v.22) and analysis of these data was done to determine the statistical inference of the variables in question.

All patients' numerical characteristics was described as mean $\pm$ SD or proportions as relevant, and nominal data as number and percentage. RHD prevalence with exact 95% confidence intervals were computed for the whole sample.

Prevalence rates of RHD between categories of was compared with the use of exact chi square test. Odds ratios with exact confidence intervals for positive diagnosis was calculated. A 2-sided P value < 0.05 was considered statistically significant.

Results:

From the total screened students, 1560 studies were adequate and interpretable according to the criteria specified in the methods section. This revealed a prevalence of 2.3% of the sample with RHD without adding the equivocal cases (Figure 1).

Most of the sample were males (65.8%). Due to the variable distribution among different stages of school, greater proportion were in the primary stage (46%) and the lower number was in the secondary stage (27%) with mean age of the whole sample of 12.9+ 3.4 years. The patients with definite RHD are older with mean age of 13.1+ 3.4 when compared to the other two groups as shown in table 2.

The table also shows what presumed to be the risk factors for developing the disease. However no significant difference was noticed between groups even with univariate analysis shown in table 3 and after adding the equivocal cases to the definite cases. The clinical examination performed by the trained staff is shown in table 2. The discrepancy shown between the confirmed diagnosis and the finding is due to the mild form of the disease found by echocardiography (as stated below). Some of the staff reported the finding as an innocent murmur and others (~1%) reported an MR.

The most prevalent lesion as detected by echocardiography was mitral regurgitation which was observed also in subjects with normal valve morphology however it was in the mild category in those pupils (table 4). The two cases with morphological changes in the mitral valve were diagnosed as mitral valve prolapse not fulfilling the criteria of RHD. Neither of the patients with aortic regurgitation had normal valve morphology.

Discussion:

Rheumatic heart disease still constitutes a health problem in low- and middle-income countries in Africa, Middle East, India and Southeast Asia with health, social and economic consequences as it affects children, adolescents and young generation mainly [1]. That is why much emphasis should be given by the health system in these developing countries to combat this problem which includes screening not only for the cases but also for subclinical RHD for early detection and identifying patients affected will have an impact on secondary prophylaxis and general health of the country.

In Egypt there is a great concern among medical profession and health care authorities of the still existence of RHD in the country with its unwanted sequalae of morbidity in important section of age of the population. Egypt has 100 million inhabitants and has traditionally good infrastructure primary health care system spread all over the country which encouraged us to plan for nationwide screening for RHD aiming to identify the size of the problem and start a process of secondary prophylaxis in response to WHO statement that a proper health care and secondary prevention are both cost effective and inexpensive and hence reduce the burden of the disease which has been estimated that about 20 million people worldwide diagnosed as RHD and 47000 new cases 233000 deaths annually.

Screening of subclinical RHD using portable echocardiography in developing nations was tested and proved beneficial by many authors as it improves case detection which result in better chances of appropriate prevention of advanced RHD [11].

In agreement with other previous survey studies, the mean age in our study was 12 years of age in the spectrum of age group we studied. The prevalence of RHD was more in male gender than in females in our study in contrast to the study by El-Aroussy et al who reported more definite RHD diagnosis in females than males. This may be contributed to the geographic difference of the two studies and the number recruited in both. The community factors that may contribute to the development of rheumatic fever and hence RHD was claimed to be poverty, high crowding index and parental education among to the region of living either urban or rural. In our study these factors although were studied but were not found to be statistically significant between children who developed RHD and healthy ones [12]. In the study by Yacoup et al, they also reported some community factors but were all found non-significant as well [13].

It has been established now from different studies that clinical examination and auscultation is not accurate

in detection of RHD and echocardiography study is 10 times more sensitive in case detection than clinical examination particularly in subclinical RHD. This category of patients is recommended to be labeled probable RHD and consideration of secondary prophylaxis. In 2001 WHO had set up criteria to define subclinical RHD using echocardiography and consequently in 2007 auscultation guidelines now consider subclinical valve regurgitation is a major criteria for ARF in endemic area [2]. We used the world heart federation criteria for echocardiographic diagnosis of subclinical RHD and by application of morphological valve changes criteria; many children with subclinical RHD but without significant valve regurgitation had been detected which make them eligible for secondary RHD prophylaxis under current international guidelines[11].

We found that definite RHD cases represents 2.3% (4% after adding equivocal cases) of the total number of the echocardiographically screen school children. Though the data about the prevalence of RHD in Egypt is scant; our data was comparable to the most recent data from Northwestern Egypt stating that definite rheumatic valvular disease was documented in 2.2% (6.6% after adding equivocal cases) of the school children by using portable echocardiography screening [12].

Rural vs urban prevalence:

Our findings show that echocardiographic screening of schoolchildren, and particularly urban children, greatly underestimates the true prevalence (rural and urban) of this disease in countries such as Ethiopia. The likely reason for this is that the poverty-related major risk factors for the disease are more prevalent and thus more important in rural areas and are linked with poor school attendance[13].

We found mitral valve involvement in most of the cases and MR is the commonest lesion (75%) in RHD cases and this goes with data from many authors [14]. We didn't find any MS , this could be explained as we screened children younger than 15 years and the development of MS takes a longer time to develop, but in general this is lower MS incidence compared the previous study in India for school children (up to 16 years of age) where they found MS in 50% of the cases but this may be due to higher incidence of juvenile MS in India as noted in earlier studies [14].

Combined mitral and aortic valve disease, is the second most common lesion representing 25% of diagnosed cases. All TR cases we found were functional unlike the other lesions, which were pathological which is the same found by previous authors. The incidence of aortic valve disease was found to be low (25%) in our study. Routray et al has reported combined mitral and aortic valve involvement as 27%, which is close to our findings. AS also was not found in our study which is the same found by many previous authors [14].

The most recent world heart federation criteria have solved many debates concerning signs early rheumatic heart disease. Application of this criteria may result in higher numbers diagnosed with RHD and less equivocal and borderline cases. Gemechu et al had applied the same criteria during their screening of RHD in rural Ethiopia and accordingly the had less borderline cases compared to previous studies[13]. It was also found that diagnosing subclinical rheumatic heart disease is more specific when both Doppler criteria and morphologic valve changes are present [12].

It worth mentioning that echocardiographic screening may face some obstacles such as significant costs, and practitioners would require education and training about echocardiography. But we found that after appropriate training, the use of echocardiography for RHD screening is relatively straightforward not only for cardiologists but also for many non-cardiologist physicians which goes with some previous authors' recommendations [11].

List of abbreviations

RHD : Rheumatic Heart Disease.

WHO : World Health Organization.

DALYs : Disability adjusted life years.

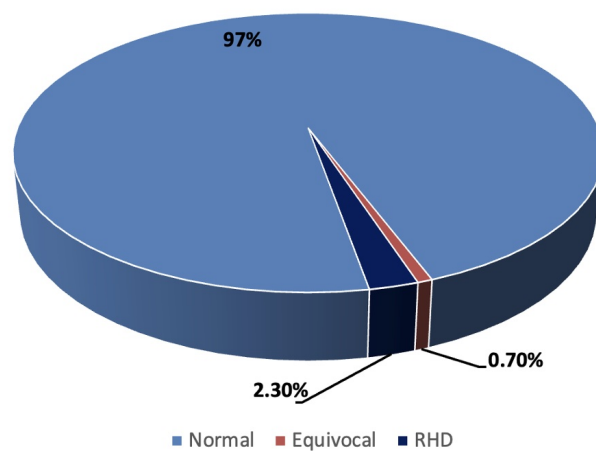**WHF:** World Heart Federation.

Declarations:

Conflict of Interest: The authors declare that they have no conflict of interest.

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Figure (1): Final diagnosis of the studied population

97%

0.70%

2.30%

■ Normal ■ Equivocal ■ RHD

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`Tables.docx` available at https://authorea.com/users/319631/articles/606498-screening-for-the-prevalence-of-rheumatic-heart-disease-among-school-children-in-egypt