Prevalence of latent structural heart disease in Nepali schoolchildren

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Abstract:	Background The present study aimed to quantify the burden of structural heart disease in Nepali children. Methods We performed a school-based cross-sectional echocardiographic screening study with cluster random sampling among children 5 to 16 years of age. Results Between December 2012 and January 2019, 6,573 children (mean age 10.6 ± 2.9 years) from 41 randomly selected schools underwent echocardiographic screening. Structural heart disease was detected in 14.0 per 1000 children (95% CI 11.3 to 17.1) and was congenital in 3.3 per 1000 (95% CI 2.1 to 5.1) and rheumatic in 10.6 per 1000 (95% CI 8.3 to 13.4). Rates of rheumatic heart disease were higher among children attending public as compared to private schools (OR 2.8, 95% CI 1.6 to 5.2, p=0.0001). Conclusion Rheumatic heart disease accounted for three out of four cases of structural heart disease and was more common among children attending public as compared to private schools.

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ABSTRACT

Background The present study aimed to quantify the burden of structural heart disease in Nepali children.

Methods We performed a school-based cross-sectional echocardiographic screening study with cluster random sampling among children 5 to 16 years of age.

Results Between December 2012 and January 2019, 6,573 children (mean age 10.6 ± 2.9 years) from 41 randomly selected schools underwent echocardiographic screening. Structural heart disease was detected in 14.0 per 1000 children (95% CI 11.3 to 17.1) and was congenital in 3.3 per 1000 (95% CI 2.1 to 5.1) and rheumatic in 10.6 per 1000 (95% CI 8.3 to 13.4). Rates of rheumatic heart disease were higher among children attending public as compared to private schools (OR 2.8, 95% CI 1.6 to 5.2, p=0.0001).

Conclusion Rheumatic heart disease accounted for three out of four cases of structural heart disease and was more common among children attending public as compared to private schools.

Keywords: Congenital heart disease; rheumatic heart disease; prevalence

INTRODUCTION

Structural heart disease in children comprises a wide spectrum of congenital and acquired pathologies. Cyanotic congenital heart defects manifest early in life, while acyanotic congenital defects often remain latent throughout childhood and adolescence. Acquired heart disease during childhood is predominantly rheumatic in origin. The prevalence of rheumatic heart disease is distributed unequally across and within regions of socioeconomic development.[1] We aimed to quantify the burden of acquired relative to congenital structural heart disease among children and adolescents in Nepal.

METHODS

Study design and data collection

Children and adolescents between the ages of 5 to 16 years attending randomly selected public and private schools in urban and rural areas were prospectively enrolled into a cross-sectional echocardiographic screening program in the Sunsari district in Nepal. The study was originally designed to detect evidence of latent rheumatic heart disease. Details of the sampling frame, sampling strategy, eligibility criteria and informed consent have been reported previously.[2,3] In brief, cluster random sampling stratified by by the location (rural or urban) and administration (public or private) of schools applied to reflect the socioeconomic demographic distribution in the district. All children attending selected schools underwent screening echocardiography by use of a battery-operated portable ultrasound machine (Samsung Medison MySonoU6). Children suspected to have structural heart disease underwent independent confirmation at B.P. Koirala Institute of Health Sciences in Dharan, Nepal. The study was approved by the institutional review board of the B.P. Koirala Institute of Health Sciences and the Nepal Health Research Council. Informed consent was obtained from each patient and the study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki as reflected in a priori approval by the institution's human research committee. The protocol for data acquisition, confirmation, electronic data capturing and central monitoring has been outlined previously.[2,4]

Definitions

The primary outcome of the present analysis was the prevalence of congenital or acquired structural heart disease. Acquired heart disease consisted of definite or borderline rheumatic heart disease defined according to the World Heart Federation (WHF) criteria for individuals 20 years or younger.[5] Congenital heart disease included incidentally detected structural heart disease present since birth with the exception of bicuspid aortic anatomy, which was not systematically assessed.

Statistical Analysis

Baseline characteristics and clinical findings are presented as numbers and frequencies (%) for categorical variables and as means (± standard deviation) for continuous variables. Categorical variables were compared by means of the Fisher's exact or Chi-squared test, continuous ones by two-sample Student`s t-tests. All statistical analyses were performed with Stata software (version 14.2).

RESULTS

Between December 2012 and January 2019, 6,573 children from 41 randomly selected schools underwent echocardiographic screening. The mean age of the children was 10.6 ± 2.9 years and 48.5% were girls; 50.6% attended public and 49.4% of children attended private schools. Latent structural heart disease was detected in 92 children (14.0 per 1000, 95% CI 11.3 to 17.1) and was congenital in 22 (3.3 per 1000, 95% CI 2.1 to 5.1) and acquired in 70 (10.6 per 1000, 95% CI 8.3 to 13.4). Among the children with congenital heart disease, 18 children had an ostium secundum atrial septal defect, four children were found to have a ventricular septal defect, and one child had Ebstein's anomaly. Among children with acquired valvular heart disease, 38 children had definite and 32 children borderline rheumatic heart disease according to the WHF criteria.

Prevalence of structural heart disease was more common among children attending public (18.6 per 1000, 95% CI 14.3 to 23.8) as compared to private (9.2 per 1000, 95% CI 6.2 to 13.1) schools (OR 2.0 (95% CI 1.3 to 3.3, p=0.001) (Figure 1). The difference was driven by higher rates of rheumatic heart disease in children attending public (15.6 per 1000, 95% CI 11.7 to 20.4) as compared to private (5.5 per 1000, 95% CI 3.8 to 8.8) schools (OR 2.8, 95% CI 1.6 to 5.2, p=0.0001). The prevalence of congenital

heart disease was comparable in children attending public (3.0 per 1000, 95% CI 1.4 to 5.5) or private (3.7 per 1000, 95% CI 1.9 to 6.5) schools (OR 0.8, 95% CI 0.3 to 2.1, p=0.6256).

Discussion

Our findings indicate a substantial burden of latent structural heart disease among children in Nepal. In three out of four cases of structural heart disease, or in 1 out of 100 children, there was an acquired valvular defect consistent with rheumatic heart disease. The burden of acquired but not congenital heart disease was higher in children attending public schools as compared to those attending private schools, indicating a gradient of socioeconomic disparity within a region with an endemic pattern of rheumatic heart disease.

Our findings need to be interpreted in light of several limitations. As a consequence of dismal survival of newborns with cyanotic heart defects in a region with limited healthcare resources, we found no children with cyanotic structural heart defects in our cohort of schoolchildren. Furthermore, numbers are small to reflect robust prevalence estimates of rare structural defects.

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none

CONTRIBUTIONS

TP conceived the study. TP, NRS and PK had responsibility for the design of the study. NRS, SU, KS, RM, SD, KA, KG and NP were responsible for acquisition of the data. MR did the analysis and interpreted the results in collaboration with TP. TP wrote the first draft of the report. All authors critically revised the report for important intellectual content and approved the final version.

DISCLOSURES

TP reports research grants to the institution from Boston Scientifc, Biotronik, and Edwards Lifesciences, personal fees from Biotronik, Boston Scientific, and HighLife SAS outside of this study.

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FIGURE LEGENDS

Figure 1. Prevalence of congenital (blue) and acquired (red) structural heart disease in Nepali schoolchildren from public and private schools.

FIGURES

Figure 1