Undiagnosed Cardiac Abnormalities Among School-Aged Children

Okul Çağı Çocuklarda Tanı Almamış Kardiyak Anomaliler

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SUMMARY

Introduction: The aim of this study was to assess the frequency of undiagnosed congenital and acquired heart diseases among school-aged children.

Materials and Method: The study population consisted of 4.370 children (2081 boys and 2289 girls) who were chosen from a total school-aged children population of 51,891 students (aged 7-15 years) (10.7±2.4) (8.4%).

Results: In this population, a total of 11 (0.25%) children had been diagnosed and treated for structural cardiac abnormalities before the study. In the study period (after an assessment by a questionmaire), cardiac evaluation was needed in 405 (9.3%) children who were invited to the pediatric cardiology unit. Among them, a total of 153 (37.8%) children were admitted for further evaluation, and 21 (13.7%) were diagnosed as having undiagnosed congenital (12.4%) or acquired (1.3%) heart diseases. Five children with congenital heart diseases were treated by surgical or invasive techniques, and penicillin prophylaxis was begun in two patients with rheumatic heart disease. The most frequent congenital heart diseases were atrial septal defect and mitral valve prolapse among the admitted children.

Conclusions: Some children still reach school age with undiagnosed congenital or acquired heart diseases. All children should be examined carefully at the time of school registration in order to diagnose and treat congenital and acquired heart diseases in an effort to prevent the occurrence of undesirable events during sports or social activities. *(Journal of Current Pediatrics 2010; 8: 63-6)*

Key words: School children, cardiac disease

ÖZET

Giriş: Bu çalışmanın amacı, ilköğretim çağı okul çocuklarında tanı konulmamış doğumsal ve kazanılmış kalp hastalıklarının sıklığını belirlemektir.

Gereç ve Yöntem: Çalışma grubu ilköğretim okullarına devam eden 7-15 yaş grubu, toplam 51.891 okul öğrencisi arasından 4,370 öğrencinin (%8,4) seçilmesi ile oluşturuldu. Öğrencilerin 2.081'i erkek, 2.289'u kız olup ortalama yaşları 10,7±2,4 yıl (6,8 -15,4 y) idi.

Bulgular: Seçilen çalışma grubunda; çalışma tarihinden önce toplam 11 (%0,25) çocuk yapısal kalp hastalığı tanısı almış ve tedavi edilmişti. Çalışma sırasında (bir anket formu ile yapılan değerlendirme sonrasında) 405 (%9,3) çocuk ileri kardiyolojik değerlendirmeye gerek duyularak Çocuk Kardiyoloji ünitesine davet edildi. Davetimizi kabul edip ünitemize başvuran 153 (%37,8) çocuk ünitemizde değerlendirildi ve 21 çocukta (%13,7) doğumsal (%12,4) ve edinsel (%1,3) kalp hastalığı saptandı. Konjenital kalp hastalığı olan 5 çocuk cerrahi veya invaziv teknikler ile tedavi edildi, romatizmal kalp hastalığı olan iki hastaya penisilin proflaksisi başlandı. Başvuran hastalar arasında en sık tespit edilen kalp hastalıkları atriyal septal defekt ve mitral valv prolapsusu idi.

Sonuç: Konjenital veya edinsel kalp hastalığı olan bazı çocuklar, hala tanı almadan okul çağına kadar gelebilmektedir. Tüm çocuklar okula kayıt esnasında dikkatli bir şekilde muayene edilmeli; konjenital ve edinsel kalp hastalığı olanlar tedavi edilmelidir. Böylece sportif faaliyetler ve sosyal aktiviteler esnasında meydana gelebilecek istenmeyen olayların gelişmesi önlenebilir. *(Güncel Pediatri 2010; 8: 63-6)*

Anahtar kelimeler: Okul çağı çocukları, kalp hastalığı

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Introduction

Congenital heart diseases (CHD) are the most frequent of all major birth defects (1). Furthermore, rheumatic heart diseases are still important health problems in developing countries (2-4). Although most of the children with overt symptoms related to cardiac pathologies can be diagnosed, some children can reach adolescence and even adult life with asymptomatic or undiagnosed significant congenital and acquired heart diseases. These patients carry the risk of infective endocarditis and recurrence of rheumatic fever, which may cause severe problems. Cardiovascular screening during studies performed on large groups of students can facilitate identification of children with undiagnosed heart diseases.

We performed a previous study to determine the normal ECG limits in children aged 7-15 years living at a moderately high altitude (5). Cardiovascular system examination was performed in all children comprising the study population. The children with any symptoms and/or signs indicating a cardiovascular problem were invited for further examination. In the present study, we evaluated the results of these further evaluations and attempted to accumulate information about the prevalence of asymptomatic or undiagnosed significant heart diseases among school-aged children in our region.

Materials and Method

The original study aimed to obtain 12-lead surface ECG from a group of school-aged children living at a moderately high altitude (1850 meters). For this purpose, a total of 4.370 children were chosen from the total population of 51.891 students aged 7-15 years (8.4%). Selection was performed by using random systematic sampling method, which facilitates selection of a sample population that can represent the whole.

A questionnaire was used to investigate the presence of any previously diagnosed heart disease or signs of any heart disease. All children (n=4.370) were examined by the same investigator, a fellow in pediatric cardiology.

It was ascertained that 11 of the children had a previous diagnosis of heart disease from birth for which they were being monitored and/or had already undergone a surgical procedure for correction. These patients were observed as a separate group. In 405 (9.3%) children with no history of heart disease, further cardiac evaluation was needed because of a positive family history or physical examination finding. These children comprised the cohort of the present study.

Results

The mean age of the 4.370 children was 10.7±2.4 years (range 6.8-15.4 y), and 2.081 of them were male. Among them, 11 children were determined to have previously diagnosed structural cardiac abnormalities (Table 1).

After initial evaluation, a total of 405 children were invited to our center for further investigation. The indications for further evaluations are given in Table 2. Cardiac complaints were chest pain (n=3), easy fatigability (n=3), palpitation (n=2), and chest pain with palpitation (n=1). The extracardiac anomalies were cataract (n=1), polydactyly (n=1), amelia (n=1), and multiple congenital malformations (n=1). Only 153 (37.8%) children were admitted to the clinic. Table 3 gives the results of the cardiac investigations in these children. The number of diagnosed congenital and acquired pathologies and their relative frequencies are summarized in Table 4.

Table 1. Children with previously diagnosed cardiac abnormalities among the whole study group (n=4,370)

Cardiac pathology	n
Rheumatic heart disease	3
Tetralogy of Fallot*	2
Ventricular septal defect	2
Transposition of the great arteries**	1
Atrial septal defect***	1
Aortic coarctation****	1
Patent ductus arteriosus*****	1
Total 11 (0.25%)	

*Total correction had been performed
**Total cavo-pulmonary anastomosis had been performed
***Surgically closed
****Balloon angioplasty had been performed
*****Coil embolization had been performed

Table 2. Reasons for further investigations in 405 children

Cause	n (%)
Murmur	342 (%84.4%)
History of syncope	13 (3.2%)
Cardiac complaints*	9 (2.2%)
Pectus excavatum	8 (2%)
Pectus carinatum	8 (2%)
S_2 hardness	7 (1.7%)
Hypertension	6 (1.5%)
History of acute rheumatic fever	5 (1.2%)
Extracardiac anomalies**	4 (1%)
Split S_2	2 (0.5%)
Hypertension and weak femoral arterial pulsation	1 (0.3%)

*Chest pain, easy fatigability, palpitation and chest pain with palpitation
**Cataract, polydactyly, amelia and multiple congenital malformations

Aortic and/or mitral insufficiency were detected in 2 children and accepted as rheumatic heart disease. In these children, penicillin prophylaxis was started. In 19 patients, a CHD was detected; in 5 of them the detected CHDs were hemodynamically significant and were treated surgically (n=3) (atrial septal defect [ASD], ventricular septal defect [VSD], coarctation of aorta) or interventionally (n=2) (patent ductus arteriosus [PDA] coil embolization, ASD closure).

Table 3. The reasons and results of cardiac investigations in 153 children admitted to our clinic

Cause of cardiac evaluation	n
Cardiac murmur	133
Normal	107
Atrial septal defect	4
Mitral valve prolapse	4
Physiological mitral regurgitation	4
Mitral valve abnormality	2
Patent foramen ovale	2
Patent ductus arteriosus	2
Ventricular septal defect	2
Parachute mitral valve	1
Pulmonary stenosis	1
Atrial septal defect + mitral valve prolapse	1
Aortic stenosis	1
Aortic insufficiency	1
Mitral and aortic insufficiency	1
Syncope	3
Normal	2
Vasovagal syncope	1
Cardiac complaint	6
Normal	6
Chest deformity	5
Normal	4
Physiological mitral regurgitation	1
Hypertension	3
Normal	3
Split second heart sound	1
Normal	1
Extracardiac anomaly	1
Normal	1
Hypertension and weak femoral pulses	1
Aortic coarctation	1

Discussion

Recent advances in techniques and widespread availability of health services have made it possible to diagnose most children with CHDs in early life. In developing countries, however, some children even with severe CHDs may not be diagnosed until adolescence. There are many studies reporting the prevalence of CHDs in live birth infants (6-11). In developing countries, it is hard to give this ratio for various reasons (1). Thus, many authors have attempted to determine the frequency of CHDs among school-aged children (1,12-14). The prevalence had been reported between 0.07 and 0.2% in these studies (1,12-14). In our country, the same ratio was reported, ranging from 0.1-0.44% in different regions, between 1986 and 1998 (15-20).

Acquired heart diseases, especially rheumatic heart diseases, are still prevalent in developing countries (2-4). Their diagnosis is important to prevent recurrences and hence surgeries for severe valvular heart diseases.

In our region, Özkan et al. (21) evaluated 2,547 schoolchildren in terms of cardiac murmurs and reported a frequency of undiagnosed CHD of 0.3% and of rheumatic heart disease of 0.11%. The examinations in that study were done by a pediatrician and echocardiographies by adult cardiologists. In the current study, 405 out of 4,370 children were invited for further evaluation, but only 153 presented. Congenital heart disease was determined in 19 (12.4%) of these children, and rheumatic heart disease in 2 (1.3%). Since we were unable to reach an important portion of the group that needed to be studied, we are not able to report a true prevalence of heart diseases among school-aged children. Nevertheless, when our incidence rates are compared with those of Özkan et al. (21), it can be seen

Table 4. The detected congenital and acquired cardiac pathologies and their relative frequencies

Number of school children examined	**Number of children with positive history or physical findings**	**Number of children admitted for evaluation**	**Number of children with cardiac abnormality**		
4370	405	153	n	% of invited children	% of admitted children
		Congenital HD*	19	4.7	12.4
		Acquired HD**	2	0.5	1.3
		Total	21	5.2	13.7

*Congenital HD: Congenital heart disease.
**Acquired HD: Acquired heart disease.

that the presence of a pediatric cardiology clinic in the region facilitated the diagnosis and monitoring of more patients, and more children with undiagnosed congenital or acquired heart disease were thus discovered during check-ups. In the present study, hemodynamically important heart diseases were revealed and treated. These children are of course at risk for natural and harmful results of the heart defects (sudden cardiac death during sportive activities, infective endocarditis, pulmonary vascular disease, etc.) and for recurrence of rheumatic carditis. Therefore, it is important that children who reach school age without a diagnosis are diagnosed appropriately as soon as possible. An important means for this would be in conjunction with the required check-ups at the time of registration for elementary school. Even though the check-up is a requirement for admission to elementary school in Turkey, the results of the current study show that the implementation of this policy is inadequate.

Study Limitations

Since we could not perform echocardiographic examination in all 4,370 children, it is impossible to report a true prevalence for undiagnosed heart diseases in our cohort. In addition, the majority of the children who were invited for further evaluation did not admit to our unit. This hindered the determination of the number of children with undiagnosed heart disease among those with abnormal symptoms. Nevertheless, we believe that the high frequency of pathologies observed in the patients who presented to our department for advanced examinations is an indication that the frequency would also be quite high in the study group as a whole.

In conclusion, our results suggest that there are still important numbers of school-aged children with significant heart disease who require treatment and follow-up. A more detailed compulsory check-up before admission to elementary school for children in this age group will help to identify and properly treat children with important heart diseases. Furthermore, educational programs should be conducted among families to increase participation in these screening programs.

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