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ORIGINAL ARTICLE

Evaluation of Children Referred to the Pediatric Cardiology Outpatient Clinic for Preparticipation Sports Examination

Nurdan Erol, Lütfi Kılınçkaya, Can Yılmaz, Özlem Akkaya, Abdülkadir Bozaykut

Department of Pediatric Cardiology, Health Sciences University Zeynep Kamil Gynecology and Pediatrics Training and Research Hospital Child Clinic, Istanbul, Turkey

Abstract

Introduction: The number of patients who apply to cardiology outpatient clinics to get a medical certificate in order to participate in sports is increasing day by day. This study was carried out to evaluate the characteristics and cardiological examination results of the cases who applied to the pediatric cardiology outpatient clinic in a period of one year.

Methods: Demographic characteristics, personal and family history, blood pressure (BP), electrocardiogram (ECG) and echocardiogram (echo) results of children who applied to our center for participation in sports between 01.01.2019 and 31.12.2019 from the pediatric cardiology outpatient clinic records and whose ICD code was entered into the system accordingly, were retrospectively analyzed.

Results: The study group consisted of 468 children and adolescents. Of the cases, 312 (67%) were male and 156 (33%) were female. Their mean age was 11.33 (min:3, max:17, n=468). Their mean body weight was 47.35 kg (min:18, max:93, n=147) and their mean height was 152.62 cm (min:112, max:188, n=147). While 104 (22%) of the cases had a history that could affect sports activity, 364 (78%) did not. While there was a family history that might affect their ability to do sports in 123 (26%) cases , there was no cause in 345 (74%) cases. The mean systolic BP values of the cases were 110 mmHg (min:82, max:171), and the mean diastolic BP values were 68 mmHg (min:40, max:90). On ECG examinations, 1 case had extrasystole and 1 had Wolf-Parkinson-White syndrome. The mean QTc interval values were 414.88 ms (min: 350, max: 467). In addition to the examination, exercise stress test, ambulatory BP monitoring or BP monitoring, Holter monitoring were requested in 78 of the cases (17%). Echo evaluation revealed pathology in 26 cases (5.5%). Twenty-five of these pathologies were insignificant pathologies, and 1 of them was a cardiac pathology that would affect performing sports acitivities. Nine of the children (1.9%) were not given a medical certificate to do sports. Four of them were referred to the arrhythmia outpatient clinic.

Discussion and Conclusion: When the cardiology examination findings in the study were evaluated, it was determined that the rate of cardiac pathology that would affect doing sports was very low. Most of the cases were cases that could be evaluated in primary and secondary health care institutions with a good anamnesis, physical examination, ECG and BP monitoring. Standardizing such preparticipation examinations according to a guideline will be beneficial both for obtaining objective results and for ensuring the physician's safety and convenience.

Keywords: Child; pediatric cardiology; preparticipation sports examination; sports.

Participation in physical activity and sports in children and adolescents has important effects on keeping blood pressure (BP) in balance, preventing chronic diseases such as obesity, metabolic syndrome, cardiovascular diseases and type 2 diabetes[1]. Participation in sports activities is recommended and encouraged due to its various benefits. It is re-

Correspondence (İletişim): Nurdan Erol, M.D. Saglik Bilimleri Universitesi Zeynep Kamil Kadin ve Cocuk Hastaliklari Egitim ve Arastirma Hastanesi Cocuk Klinigi, Istanbul, Turkey
Phone (Telefon): +90 216 542 44 44 **E-mail (E-posta):** nurdaneroltr61@gmail.com
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ported that more than 60 million children and adolescents[2] in the United States and 64-85% of children aged 5-17 in Australia participate in sports activities every year[1]. Since participation in physical activities is encouraged also in our country, there is an increasing need for a sports participation examination for children and adolescents.

In the USA, approximately 30 million athletes under the age of 18 each year have to undergo a medical examination in order to participate in sports[3]. The American Academy of Pediatrics published an analysis of medical conditions affecting participation in sports in 1994[4,5]. The requirements for participation in sports have undergone various changes since the first published analysis. The 4th update was published as the pre-participation evaluation monograph[1]. While the first monographs mostly focused on the detection of situations that would threaten the life of the person doing sports, over time, these evaluations focused on how to perform the cardiological examination. The American Heart Association recommends reviewing a person's history and family history along with a physical examination for cardiac examination. There is no definite opinion about whether electrocardiogram (ECG) is necessary[1]. Cardiology control is requested only when necessary in the USA. In the Italian group, ECG control is routinely recommended to prevent sudden cardiac death[6].

Children and adolescents are often referred to pediatric cardiology clinics to be evaluated for participation to sports. This study was carried out in order to evaluate the characteristics and cardiological examination results of the cases referred to our pediatric clinic for examination before participation in sports, for a period of one year.

Materials and Methods

Demographic characteristics, personal and family history, BP, ECG and echocardiogram (echo) results of children from the pediatric cardiology outpatient clinic records who applied to our center for participation in sports between 01.01.2019 and 31.12.2019 with the ICD code of z02.5 (examination for participation in sports) and z10.3 (routine general health check of sports teams) entered into the system accordingly, were retrospectively analyzed. The data obtained from the cases were analyzed with Microsoft Office Excel 2016 software. In this context, analyzes were carried out with descriptive statistical methods using the obtained data.

Results

The study group consisted of 468 children and adolescents. Of the cases, 312 (67%) were male and 156 (33%) were female. Their mean age was 11.33 (min:3, max:17, n=468). 207 (44.23%) of the cases who applied for the certificate of participation in sports were doing at least one or both of the following sports for minimum 1 month and maximum 9 years and for minimum 2 hours and maximum 24 hours a week: aikido, athletics, ballet, basketball, cycling, boxing, fitness, folklore, football, futsal, wrestling, handball, gymnastics, judo, karate, kickbox, table tennis, chess, water hockey, water polo, taekwondo, volleyball, sailing and swimming. Their mean body weight was 47.35 kg (median:45, min:18, max:93, n=147) and their mean height was 152.62 cm (median:152, min:112, max:188, n=147). While 104 (22%) of the cases had a history that could affect sports activity, 364 (78%) did not. While there was a family history that might affect their ability to do sports in 123 (26%) cases , there was no cause in 345 (74%) cases. The mean systolic BP values of the cases were 110 mmHg (min:82, max:171), and the mean diastolic BP values were 68 mmHg (min:40, max:90). Systolic and/or diastolic BP values were above the 95th percentile in 30 cases. These were found to be within normal limits by clinical condition and Holter monitoring of BP. On ECG examinations, 1 patient had extrasystole and 1 had Wolf-Parkinson-White syndrome. The mean QTc interval values were 414.88 ms (min:350, max:467). In addition to the examination, exercise stress test, ambulatory BP monitoring or BP monitoring, Holter monitoring were requested in 78 of the cases (17%). Echo evaluation revealed pathology in 26 cases (5.5%). Twenty-five of these pathologies were insignificant pathologies, and 1 of them was a cardiac pathology that would affect performing sports acitivities (Table 1). Eight of the children (1.7%) were not given a medical certificate to do sports. Four of them were referred to the arrhythmia outpatient clinic (Table 2). Since

Table 1. Structural pathologies detected by echocardiography (echo)

Pathologies Detected in Echo	Number
Valsalva dilatation, mitral valve prolapse, mitral regurgitation	1
Mitral insufficiency (mild, trace, physiological)	8
Patent foramen ovale (PFO)	6
Bicuspid aortic valve, aortic insufficiency	2
Persistent left superior vena cava (PLSVC)	2
Atrial septal defect (small)	2
Ventricular septal defect (small)	1
Tricuspid insufficiency (mild)	1
Patent ductus arteriosus (PDA) (narrow)	1
Pulmonary stenosis (mild)	1
Left ventricular hypertrophy (mild)	1
Total	26

Table 2. Reasons in cases where a medical certificate was failed to be submitted

Age	Gender	Cases with Failure of Medical Certificate Submission	Number
17	M	Valsalva dilatation in echo	1
15	M	Hypertension (with nephrology follow-up)	1
12	F	Exercise hypertension (systolic pressure >250 mmHg)	1
11	M	Receiving atrioventricular nodal reentrant tachycardia (AVNRT) treatment	1
11	M	Wolf-Parkinson-White syndrome	1
11 and 8	F,F	Arrhythmia detected in Holter and exertional arrhythmia	2
13	F	Obesity and family history (light activity recommended)	1
Total			8

the arrhythmia outpatient clinic was performed in other centers, results related to these could not be obtained. Of the remaining 4 cases; the case with valsalva aneurysm and mitral valve prolapse was referred to the genetics unit to be investigated for Marfan syndrome, the patient with obesity (BMI 40) was referred to the endocrine outpatient clinic, the patient with hypertension was sent to the nephrology clinic where he was followed up for the regulation of his treatment, and the patient who was found to have exercise hypertension (maximum systolic BP over 250 mmHg in the cardiac stress test) was not found suitable for sports.

Discussion

One of the most important reasons for referral of cases to pre-participation examinations is the risk of sudden cardiac death, which is seen in approximately 1-3% per year in athletes. The primary cause of sudden cardiac death under 35 years of age is hypertrophic cardiomyopathy, congenital coronary anomalies, and less likely aortic stenosis, aortic aneurysm, ion channel diseases, atherosclerotic coronary diseases, arrhythmogenic right ventricular dysplasia. Some of the sudden cardiac deaths in young people develop due to blunt cardiac trauma in individuals with normal healthy hearts[7].

As observed in other studies conducted in our country[8-10], cardiac pathologies that hinder participation in sports were found at a low rate (1.7%) in our study. In a study conducted in Europe, pathologies mostly related to the musculoskeletal system were found in 733 (415 male) adolescents in pre-participation sports examinations performed with history and clinical examination (musculoskeletal system, cardiovascular, general). Cardiologically, moderate disturbance (6.3%), severe disturbance (3.4%) in resting ECG, and ECG disturbance in exercise stress test (3.4%), disturbance in echo (2.3%) were detected. As a result of all examinations, 5.5% of the cases were not allowed to participate in sports[11]. In a study by Ceylan et al. from our country, pathological findings were found in 10.4% of all participants in ECG, pathology in echo in 9.5%, and pathology in 2 cases in Holter ECG. In this study, it was reported that 3 out of 250 young athletes could not get a sports participation certificate due to cardiac pathology[10]. In the study conducted by Dağ et al., 974 cases (661 male) were reported as unable to do sports, two of which had long QT, and six (0.4%) due to aortic root dilatation[12].

One of our cases was not given a sports participation certificate due to obesity. In cases with obesity (BMI above 40), doing sports are not allowed. Patients with aortic root dilatation, which may suggest Marfan, and a Z score above 2.5 should be exempted from doing sports. In cases with second-degree hypertension, which is not under control with treatment and with organ involvement, doing sports cannot be allowed until stabilization of BP is achieved with treatment. In cases with Wolf-Parkinson-White syndrome, doing sports may be allowed according to the evaluation of risk of sudden cardiac death. In our case who developed exercise hypertension, a pre-participation certificate was not given because there was a risk of sudden cardiac pathology. Having a family history of sudden cardiac death before the age of 50, or a history of heart disease in a close relative before the age of 50, and having family memebrs with specific genetic diagnoses such as hypertrophic and dilated cardiomyopathy, long QTc and other ion channelopathies, Marfan syndrome and clinically significant arrhythmias, require cardiac evaluation in children who will do sports[13].

Most of the cases were cases that could be evaluated in primary and secondary health care institutions with a good anamnesis, physical examination, ECG and BP monitoring. Most of the patients for whom cardiology control was requested did not have any risk factors in their personal and family histories that would necessitate cardiological sports examination. Considering this situation, patients who want to participate in sports should apply to pediatricians and

family physicians rather than cardiology outpatient clinics, and referral to cardiology outpatient clinics for cases with risk factors determined by personal and family history, physical examination, BP and ECG will allow the transfer of more time and resources for the treatment of cardiac patients.

It was observed that most of the cases applied to the cardiology outpatient clinic for examination not before starting doing sports, but mostly just before the sports competitions. Such situations can create problems in terms of examination as they do not allow sufficient quality time for additional cardiological examinations.

Conclusion

Just passing the cardiology examination is not enough in terms of participation in sports. Many system pathologies such as musculoskeletal disorders, asthma and other lung problems, hematological, neurological and nephrological problems can also hinder participation in sports. It is also an issue that cannot be decided by whom the pre-participation examination will be carried out. These examinations should be better performed by pediatricians and family physicians who are familiar with musculoskeletal examination which has been standardized by the guidelines. Standardizing the examination for participation in sports through guidelines in order to perform healthy sports will ensure that every child and young person undergoes a pre-participation examination under the same conditions, which will provide more accurate results in terms of examination and will provide convenience and confidence for the doctor who performs the examination.

Ethics Committee Approval: Retrospective study.

Peer-review: Externally peer-reviewed.

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