PEDIATRICS

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TWO-DIMENSIONAL ECHOCARDIOGRAPHIC CHARCTERISTICS IN PREADOLESCENT ATHLETES

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Abstract: Data of echocardiographic characteristics of 59 children 10-11 years old, involved in football is presented in article. Depending on the duration of sports activities the children were divided into 3 groups: group 1 - children who play football up to 3 years (24 children), Group 2 - children who play football from 3 to 5 years (23 children), Group 3 - training duration over 5 years (12 children). It was found that the linear size of the heart was not significantly different in the groups studied, which may indicate that myocardial remodeling as cardiac adaptation to sporting loads takes more time. It was revealed that more trained children (group 3) have significantly higher left ventricular ejection fraction compared with group 1 (p = 0.05) and Group 2 (p = 0.0051).

KeyWords: athletes, children, echocardiography

INTRODUCTION

Among professional athletes the risk of sudden death is more than 2 times higher at 1.6 per 100 000 compared with 0.75 per 100 000 in the general population [1]. In the structure of the sudden death of athletes more than 50% of cases are caused by cardiovascular diseases [2]. However, in sportsmen with high achievements economic motivation may affect the decision to continue sports career, despite the presence of established and perceived by the athletes with health problems.

Whether the hypertrophy found in the hearts of athletes is physiologic or a risk factor for the progression of pathologic hypertrophy remains controversial. The diastolic and systolic functions of athletes with left ventricular (LV) hypertrophy are usually normal when measured by conventional methods [3].

However, echocardiographic findings in young athletes remain unremarkable and provoke discussion on its inclusion in screening program [4].

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2 PURPOSES, SUBJECTS AND METHODS:

2.1 Purpose

The aim of study was to evaluate echocardiographic parameters in pre-adolescent athletes depending on the duration of training process.

2.2 Subjects & Methods

The study involved examination of 43 boys aged 10-11 from different football teams. Weekly duration of training was 6-8 hours. Depending on the duration of football playing, children were divided into three groups:

The first group: children who play football up to 3 years, n = 24;

The second group: children who play football 3-5 years, n = 23;

The third group: children who have been playing football for more than 5 years, n = 12.

Based on the values obtained during two-dimensional echocardiography end-diastolic (EDV) and end-systolic (ESV) left ventricular volume (ml), stroke volume (SV), ejection fraction (EF), myocardial mass and left ventricular myocardial mass index were determined by formulas according to Recommendations for Quantification Methods During the Performance of Pediatric Echocardiogram [5]. Checking for Gaussian division was performed with Shapiro-Wilk or x2 Pearson criteria, which proved the use of nonparametric methods (non-parametric U-Mann-Whitney criterion (the MW), Wilcoxon (T), Fisher criterion (F)). The difference in the results was considered statistically significant at p <0.05. During the multiple comparison ANOVA and Kraskal-Wallis tests were used, and the difference was assessed with Bonferroni correction (at p ^ = p / k, where k - the number of paired comparisons) as follows: p '= p / m -1, where m - number of groups in the experiment. Statistical analysis was performed using the statistical software "Microsoft Excel 2010", "StatSoft 7.0. for Windows".

Conflict of interests

There is no conflict of interests.

3 RESULTS AND DISCUSSION

Mean training experience of boys from the first group was 2.07 ± 0.7 years, second group 4.34 ± 0.5 years and third group 5.75 ± 0.3 years. Comparison of linear echocardiographic measurements was performed. The results of measurement statistical analysis are presented in Table 1.

Table 1.

Results of myocardial geometry measurements

Echocardio-graphic param-eters	Statisti-cal values	Observed groups		
		first n=24	second n=23	third n=12
1	2	3	4	5
LV diastolic dimension, mm	Me (Lq; Uq)	41,8 (40,5; 44,3)	41,7 (39,4; 44,2)	42,5 (42,3; 44,7)
Median Test, Overall Median = 42.1000; χ^2= 4.01; df = 2, p = 0.1346; Kruskal-Wallis ANOVA by Ranks; Kruskal-Wallis test: H (2, N= 43) =2.6029, p =0.2721				
LV systolic dimension, mm	Me (Lq; Uq)	26.4 (26.4; 27.2)	25.9 (25.1; 28.2)	25.1 (24.6; 25.8)
Median Test, Overall Median = 25.9000; χ^2= 3.83; df = 2, p = 0.1472; Kruskal-Wallis ANOVA by Ranks; Kruskal-Wallis test: H (2, N= 43) =2.5494, p =0.2795				
Interventricular septum, mm	Me (Lq; Uq)	7.95 (7.65; 8.65)	7.80 (7.12; 8.30)	7.70 (7.40; 8.22)
Median Test, Overall Median = 7.90000; χ^2=0 .18; df = 2, p =0.9126; Kruskal-Wallis ANOVA by Ranks; Kruskal-Wallis test: H (2, N= 43) =1.1067, p =0.5750				
LV posterior wall, mm	Me (Lq; Uq)	8.15 (7.53; 8.78)	8.20 (6.90; 8.50)	7.90 (7.68; 8.50)
Median Test, Overall Median = 8,00000; χ^2=0,68; df = 2, p = 0,7092; Kruskal-Wallis ANOVA by Ranks; Kruskal-Wallis test: H (2, N= 43) =1,1662, p =0,5582				

Table 1 (continuation)

1	2	3	4	5
LV mass, g	Me (Lq; Uq)	106,9 (96,8; 129,4)	102,1 (88,1; 124,6)	120,8 (110,6; 129,1)
Median Test, Overall Median = 109.067; χ^2=1.03; df = 2, p = 0.5959; Kruskal-Wallis ANOVA by Ranks; Kruskal-Wallis test: H (2, N= 43) =1.9574, p =0.3758				
LV mass index, g/m²	Me (Lq; Uq)	87,9 (76,9; 91,8)	78,6 (72,9; 90,6)	86,1 (82,9; 90,5)
Median Test, Overall Median = 82.2549; χ^2== 2.01; df = 2, p =0.3647; Kruskal-Wallis ANOVA by Ranks; Kruskal-Wallis test: H (2, N= 43) =2.0164, p =0.3649				
Relative wall thickness	Me (Lq; Uq)	0,38 (0,35; 0,43)	0,37 (0,34; 0,39)	0,36 (0,35; 0,37)
Median Test, Overall Median = 0.375296; χ^2=0.97; df = 2, p =0.6147, Kruskal-Wallis ANOVA by Ranks; Kruskal-Wallis test: H (2, N= 43) =2.0191, p =0.3644				
Left atrium, мм	Me (Lq; Uq)	30,6 (29,0; 33,3)	27,8 (25,2; 30,6)	30,4 (28,3; 30,9)
Median Test, Overall Median = 30.0000; χ^2= 4.12; df = 2, p =0.1274, Kruskal-Wallis ANOVA by Ranks;Kruskal-Wallis test: H (2, N= 41) =4.0553, p =0.1316				
Right ventri-cle, mm	Me (Lq; Uq)	16.7 (16.0; 18.5)	16.3 (15.7; 18.8)	17.5 (16.7; 18.4)
Median Test, Overall Median = 16.7000; χ^2= 1.13; df = 2, p = 0.5655, Kruskal-Wallis ANOVA by Ranks; Kruskal-Wallis test: H (2, N= 43) =1.2941, p =0.5236				

Based on linear measurements, there was no statistical difference in the comparison group. However, it is known that myocardial adaptation to intensive training activity includes atrial diameter enlargement and concentric remodeling [3, 6]. Received results may indicate that duration of sport involvement for 6 years is not enough for cardiac remodeling at this age group [7].

The parameters describing main left ventricle hemodynamics characteristics, such as EDV, ESV, SV and EF fraction were calculated and compared in different groups. The obtained results are presented in Table 2.

Table 2.

Results of left ventricle function assessment

Calculations	Statistical values	Observed groups		
		first n=24	second n=23	third n=12
EDV, ml	Me (Lq; Uq)	77,5 (72,0; 89,3)	77,1 (67,4; 88,5)	80,9 (79,6; 91,0)
Median Test, Overall Median = 79.2000; χ^2= 3.83; df = 2, p =0.1472 Kruskal-Wallis ANOVA by Ranks; Kruskal-Wallis test: H (2, N= 43) =2.3336, p =0.3114				

Table 2 (continuation)

ESV, ml	Me (Lq; Uq)	25.5 (21.7; 28.6)	24.4 (22.8; 30.0)	22.5 (21.4; 24.2)
Median Test, Overall Median = 24.4000; x^2= 3.83; df = 2, p =0.1472, Kruskal-Wallis ANOVA by Ranks; Kruskal-Wallis test: H (2, N= 43) =2.7245, p =0.2561				
Stroke volume, ml	Me (Lq; Uq)	53.0 (44.7; 60.3)	52.0 (47.5; 60.4)	58.5 (58.0; 69.4)
Median Test, Overall Median = 53.6000; x^2= 3.84; df = 2, p =0.1460, Kruskal-Wallis ANOVA by Ranks; Kruskal-Wallis test: H (2, N= 43) =3.8558, p =0.1455				
Ejection fraction, %	Me (Lq; Uq)	68 (63; 72)	67 (63; 70)	73 (72; 75)
Median Test, Overall Median = 68.0000; x^2= 5.69; df = 2, **p = 0.0579**, Kruskal-Wallis ANOVA by Ranks; Kruskal-Wallis test: H (2, N= 43) =7.1451, **p =0.0281**				

Multiple comparison of LV ejection fraction demonstrates that it was significantly higher in the third group as compared to the first and second groups.

The Mann-Whitney test for paired group comparison demonstrated the difference in LV EF in boys of the first and third groups, and in boys of the second and third group (p I, II = 0.5257, p I, III = 0.0500, p II, III = 0.0051). We may conclude that LVEF becomes the most valuable characteristic of myocardial function in boys ages 10-11 with an increase in "experience" training over 5 years.

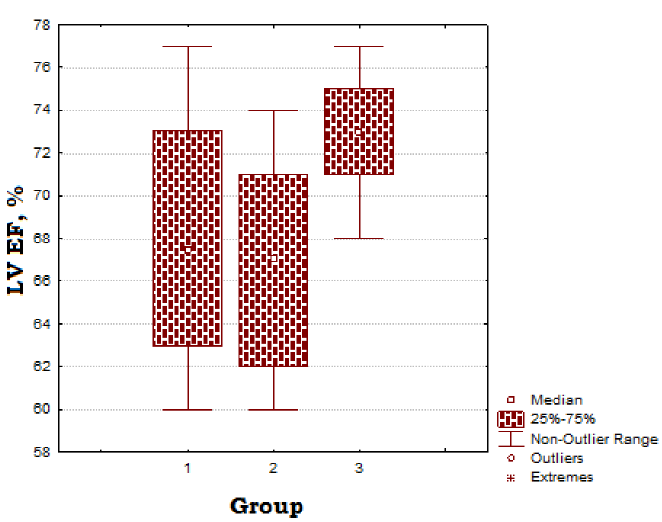

Fig 1. Left ventricle ejection fraction in boys of different training duration

4 CONCLUSIONS

1. The study did not find significant differences in morphological characteristics of the heart and great vessels with the increase of involvement in sports in the boys aged 10-11. This indicated the absence of myocardial remodeling.

2. With the increase of sports involvement over 5 years, LV EF reaches the largest value that mostly characterizes the function of left ventricular myocardium in young preadolescent athletes.

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