Cardiovascular Development Abnormalities in Young Athletes

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Abstract

The article discusses the issues of small anomalies of heart development in young athletes. The question of the admission of young athletes with small anomalies of heart to sports and their impact on the state of the cardiovascular system during exercise is still an open question. To avoid subjectivity and the subsequent over diagnosis of small anomalies of heart, their objectification is necessary, through a quantitative assessment.

Keywords: *Small abnormalities of the development of the heart, additional chord, mitral valve prolapse, young athletes, sports, ventricular fibrillation.*

Introduction

Physical education and sports require increased functional capabilities of all body systems, including CVS. In this regard, any deviations, especially from the CVS, can negatively affect both the health and success rate of athletes. The term CDMA is usually used to denote inherited or congenital structural changes in the valvular apparatus and/or its connective tissue framework, including the main vessels, in the form of various anatomical abnormalities that are not accompanied by hemodynamically 'gross' disorders [1]. False ('supplemental', 'abnormally located') chords (tendons) are manifested by the presence in the ventricular cavity of additional formations in the form of connective tissue cords. Unlike normally located chords, these formations have an ectopic attachment not to the valves of the atrioventricular valves, but to the free walls of the ventricles and interventricular septum [3]. The term 'tendon' reflects the position of the abnormal cord as a geometric body which crosses the cardiac chamber. True chords are fibrous strands consisting of collagen fibers. They receive blood and innervation from the heads of papillary muscles, supply and innervation of which provided by muscle trabeculae located at their base [4]. Some clinical data and numerous morphological studies suggest that transverse, diagonal and longitudinal false tendons of basal and median localization, as well as multiple left ventricular false tendons (LVFTs) have an independent clinical significance, as it often acts as an independent cause of ventricular extrasystole. With that, single apical LVFTs are usually considered as normal variant [2]. In recent years, an active study of intracardiac structures has clearly demonstrated not only the independent clinical significance of CDMA, but also their close relationship with heritable connective tissue disorders (HCTD)[3]. The development of HCTD is based on disruption of the genes responsible for the synthesis or decay of the extracellular matrix components. A large group of HCTD is caused by mutations in the genes of extracellular matrix proteins (collagens, fibrillin, tenascin, etc.). These genes mutations lead to the development of many mendelating HCTD, the number of which exceeds 250, and most of them are very rare. Connective tissue dysplasia (CTD) is a pathological condition of organs and tissues. It is manifested in a decrease in the content of certain types of collagen or a violation of their ratio, and leads to a decrease in the strength of connective tissue of various organs and systems. In the development of CTD, gene mutations are of primary importance, since they encode the synthesis and spatial organization of collagen. They are also responsible for the formation of the structural components of the matrix and enzymes involved in fibrillogenesis. In addition, there is a complex of exogenous factors that cause a violation of

collagen synthesis. Dysplastic changes can be due to the impact of adverse environmental conditions, inadequate nutrition or stress. The severity of these changes can be affected by polymorphic variants of the genes of the renin-angiotensin system associated with the activity of antioxidant enzymes [5].

As a result, connective tissue dysplasia syndrome (CTDS) forms a pathology of a multifactorial nature with a wide range of clinical signs and a fairly high prevalence. Its further study will contribute to the development of method for identifying patients who respond positively to additional physical exertion, and those for whom such exertion may be undesirable or even harmful [7, 1].

Single false tendons don not form a contraindication to sports. With multiple false tendons, exercise is also not contraindicated, in the absence of cardiac arrhythmias. Located in the pathways of the inflow or outflow of the left ventricle, the false tendons can contribute to the emergence of a local phenomenon of ultrahigh speeds (aliasing phenomenon) and, as a result, lead to injury or the fibrosis development. Being an abnormal way of conducting an exciting impulse, false tendons can cause ventricular arrhythmias, including ventricular fibrillation. Patients with supplementary chords of the heterogeneous structure ('beam' type) are recommended for more frequent and thorough medical supervision, in order to identify early signs of aCVS arrhythmic overstrain [9].

The aim of this study is to do research of the frequency of CDMA occurrence in young athletes.

Materials and Method

The research was conducted in the Department of Sports Medicine of the City Adolescent Dispensary (Tashkent). The main group consisted of 305 athletes involved in various sports in children and youth sports schools (CYSS), aged 6-18 years - 113 females and 182 males. The control group consisted of 305 children of the same age who were not involved in sports. All children were permanent residents in Tashkent. All athletes underwent an echocardiographic examination. Statistical processing of the obtained data has been performed using the Student's t-test for the significance level $P<0.05$.

Results and Discussion

As a result of the analysis of echocardiographic examination of children, a number of CDMA have been identified. The frequency of their occurrence in comparative groups is presented in Table 1.

Table 1: Frequency of occurrence of CDMA in examined children

CDMA types	Frequency of occurrence of CDMA (%)			
	Main group (n=305)		Control group (n=305)	
	Abs.	M±m	Abs.	M±m
False tendons of the left ventricle (FTLVs)	72	23,6±2,4*	52	17,0±2,15*
Mitral valve prolapse (MVP)	3	0,98±0,56	4	1,31±0,65
Open foramen ovale (OFO)	2	0,65±0,46	1	0,33±0,33
Tricuspid valve prolapse (TVP)	2	0,65±0,46	2	0,65±0,46
Left ventricular abnormal trabeculae (LVAT)	1	0,33±0,33	0	

* - P<0.05 relative to the main group of the control group

As Table 1 shows, the most common CDMA (23%) in both groups - especially in athletes - is asupplementary chord. The second most frequent mitral valve prolapse is 0.98% in the main group, and the dependence of CDMA frequency on physical activity has not been observed.

Table 2: The frequency of occurrence of CDMA in the examined children, depending on gender

CDMA	Number of children with this CDMA (frequency of occurrence (%)							
	Main group-72				Control group-52			
	Females		Males		Females		Males	
	Abs, %		Abs, %		Abs, %		Abs, %	
False tendons of the left ventricle (FTLVs)	31	43±5,8*	41	56,9±5,8*	29	55,7±6,8	23	44,3±6,8
Mitral valve prolapse (MVP)	2	66,6±6,1	1	33,4±5,5	1	25±6,0	3	75±6,0
Open foramen ovale (OFO)	1	50±5,9	1	50±5,9	-		1	100
Tricuspid valve prolapse (TVP)	1	50±5,9	1	50±5,9	-		2	100
Left ventricular abnormal trabeculae (LVAT)	1	100	-		-		-	

Note: * - P<0.05 confidence of differences compared to the main and control groups

According to Table 2, it is clear that FTLVs in the main group is 1.3 times more common in males than in females (56.9% and 43%; respectively, P <0.05). By contrast, mitral valve prolapses (MVP) in the main group in females are 2 times more often than males (66.6% and 33.4%, respectively). In other cases, the frequency of CDMA occurrence depending on gender in the main group has not been detected. The following table presents data on the quantitative ratio of FTLVs in the main and control groups (Table 3)**:**

Table 3: The number and frequency of LVFTs in the experimental and control groups

FTLVs	Number of children from this CDMA (Frequency of occurrence%) n=305			
	Main group n=72		Control group n=52	
	Abs, %		Abs, %	
Single	69	95,8±2,3*	50	96,1±2,6*
Double	2	2,7±1,91	1	1,92±1,9
Multiple	1	1,38±1,35	1	1,92±1,9

Note: * - P<0.05 confidence of differences compared to the main and control groups

As Table 3 shows, the frequency of occurrence of single FTLVs is the same in children involved and not involved in sports activities. Double FTLVs are more common in children involved in sports.

In such a way, single FTLVs predominate in both groups. Duplicate FTLVs have been found to a lesser extent, and the rarest in frequency are multiple FTLVs, that are 1-2% of all FTLVs cases.

Conclusions

As a result of the research performed, it can be concluded that the most common CDMA is a supplementary chord. False tendons can cause ventricular arrhythmias, including ventricular fibrillation, which should be taken into account when admitting children to sports and planning their training regime. No gender differences in the studies have beennoted. However, it has been found that the frequency of occurrence of single chords in athletes is higher than double and multiple ones, which affects CVS in a positive way. Although a single supplementary chord does not affect the cardiac hemodynamics as often as other CDMA do, it is necessary to carry out mandatory regular supervision of transverse chords through electrocardiographic examination.

Ethical Clearance: No ethical approval is needed.

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Conflict of Interest: Nil

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