

# CLINICAL AND PARACLINICAL PECULIARITIES OF STRESS-DEPENDENT DISTURBANCES OF HEART ACTIVITY IN CHILDREN GOING IN FOR SPORT

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**ABSTRACT** — 40 children, 10–14 years of age, going in for acrobatics during 6 months were under observation in the aim to study the level of activity of myocardial fraction of creatin-phosphokynaza (MF-CPhC) and troponin – T in blood serum and the main spectral indices of heart rhythm variability (TP, VLF, LF, HF). It was stated that the disturbance of heart activity in young sportsmen to be connected with decrease of energetics in cardiomyocytes. In diagnostics of stress-dependent cardiomyopathy alongside with clinical data it should be important to take into consideration the levels of troponin-T and activity of MF-CPhC in blood serum on the phone of decrease of main spectral indices of heart rhythm variability.

**KEYWORDS** — children, sport, children going in for sport, disturbances of heart activity, biochemical indices (MF-CPhC, troponin-T), spectral indices of heart rhythm variability.

The problem of estimation of heart activity condition in children's cardiology was and is still actual. It is due to higher demands to training of young sportsmen, on the other hand because of formation of different morphofunctional changes in organs and systems of children under the influence of physical strain. It is known that the organism of young sportsmen may be dependent on physical and psychic components.

At the same time, pathogenesis of disturbances of heart activity is not yet studied. Their clinical manifestations are characterized by changes of heart rhythm, metabolic disfunction of myocardium and are explained by some scientists as stress-dependent cardiomyopathy [1, 2, 3].

It is well-known that the changes of levels in activity of myocardial fraction of creatinphosphokinaza (MF-CPhC), troponin-T and etc. in blood serum may reflect the condition of myocardium and its energetic potentials. At the same time to define the parameters



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of heart rhythm variability should be considered the most informative method of quantitative value of vegetative regulation of heart rhythm and its energetic supply as the response on any stress influence [4, 5, 6, 7]. Combined investigation of these biochemical and instrumental data in stress-dependent cardiomyopathy among young sportsmen should be of definite interest.

## *The aim of investigation:*

to find out the pathogenetic and diagnostic features of stress-dependent disturbances of heart activity in children going in for sport.

## **THE CHARACTERISTIC OF CHILDREN AND METHODS OF INVESTIGATION**

On the base of SBEHP AR regional curative-physical-culture dispensary and polyclinics of Astrakhan there were observed 93 children (63 girls and 30 boys) at the age of 10–14 years (middle age  $12 \pm 0,5$ ) going in for acrobatics for 6–8 hours in a week during 6 months. The criteriae of exclusion were: presence of organic damages of cardio-vascular and nervous systems, chronic diseases and acute respiratory infections. The investigations were conducted during basic cycle of training in autumn-winter period. Control group was 22 conditioned healthy children of the same age going in for sport less than 5 months.

The methods of investigation included the examination which consisted of: physical observation of organs and systems paying attention to cardiovascular ones. There was studied the condition of levels of activity MF-CPhC by method of IFA, content of troponin-T by enzyme-immune test system of Beringer Mannheim firm. They were examined according to standard ECG, Holter monitoring of ECG (Cardio-technic-4000); echocardiographic investigation (Echo-CG), with interpretation of data according to standard, veloergometry (VEH) to protocols of Bruce. Besides it, there was studied the main spectral parameters of heart rhythm variability by apparatus "Polyspectrum-12E" at rest and orthostatic probe. The analysis of results in investigation were done with usage of general methods of variative statistics (Statistika-6,0).

## RESULTS AND DISCUSSION

From 93 sportsmen there were formed 2 groups of children using method of simple randomization. The first group had 53 children without clinical and paraclinical features of disturbances of heart activity. The second one had 40 children having features of stress-dependent cardiomyopathy. Making thorough analysis of clinico-instrumental data of the 2nd group there were defined 2 subgroups: the 1<sup>st</sup> — with disturbances of heart rhythm — 21 children (52,5%), the 2<sup>nd</sup> — with metabolic changes in myocardium — 19 (47,5%).

In formation of subgroups there were taken into consideration the following clinical data: weak heart sound, soft systolic sound, changes of heart rhythm (tachycardia, bradycardia, extrasystoly).

On the ECG there were found out: sinus tachybradycardia, epiventricular extrasystoly, disturbances of repolarization (changes of T-wave, depression of ST segment). In Holter ECG there was found out 2500–5000 (3500) epiventricular extrasystoly. In Echo-ECG: there was the decrease of diastolic myocardial function.

In the 1st subgroup of examined sportsmen there were found out the following disturbances of heart rhythm clinically: bradyrhythmy in 9 (42,9%), tachyarrhythmy — 7 (33,3%), extrasystoly — 6 (28,57%) and some other cases but rarely. They were confirmed and stated exactly in ECG-diagnostics: sinus bradyrhythmy in 9 (42,9%); in 6 cases (28,6%) there were found out multiply epiventricular extrasystoly, moderate sinus tachycardia — 3 (14,3%), in Holter-ECG there were 2500–5000 (3500) epiventricular extrasystoly. In Echo-CG there were no significant changes.

In the 2<sup>nd</sup> subgroup there were observed clinically: suppression of heart sounds — 15 (78,94%), systolic

noise — 4 (21,5%). In ECG there was defined: the presence of changes in wave T — 12 thoracic parts — 9 (47,4%); Holter-ECG — without peculiarities. In Echo-CG diastolic dysfunction was marked in 12 (63,16%).

Further, in these two subgroups and control group there was made the investigation of levels in activity MF-CPhC and troponin-T in blood serum and studied the condition of the main spectral parameters BPC: general power of spectrum (TP), very low frequency (VLF), low frequency (LF), high frequency (HF) diapozones. It was found out that the most expressed changes had undergone the levels of troponin-T and activity MF-CPhC in blood serum in subgroup of children with myocardial dysfunction ( $p < 0,01$ ;  $p_1 < 0,05$ ). At the same time the children of 1st subgroup (table 1) their changes were statistically not exact ( $p < 0,1$ ;  $p_1 < 0,05$ ).

In estimation of spectral parameters BPC the most expressed changes were marked in orthoprobe. In comparison of data of the main parameters BPC there was defined the decrease of them in studied subgroups in accordance with the same among conditioned healthy children. Besides it, statistically significant differences of these data in children of the 1st and 2<sup>nd</sup> subgroups were not determined ( $p > 0,05$ ;  $p_1 > 0,1$ ;  $p_2 > 0,05$ ;  $p_3 > 0,1$ ). It may prove that the disturbances of heart rhythm and myocardial dysfunction in young sportsmen may take place on the phone of decrease of energy supply of the organism.

The attention was paid to the fact that the increase of levels MF-CPhC and troponin-T in the 2nd subgroup were correlated with the decrease of data TP, VLF, HF ( $K=0,75$ ;  $K_1=0,77$ ;  $K_2=0,79$ ). It was due to metabolic disturbances taking place in myocardium on the phone of physical overstrain in young sportsmen.

In most children of the 1st subgroup the increase of levels MF-CPhC, troponin-T was not correct and correlated dependence of them from the main data BPC was not defined. At the same time 8 (38%) children had the increased level of activity MF-CPhC, troponin-T and it was correlated with the decrease of VLF, HF ( $k=0,32$ ;  $k_1=0,54$ ). So, in this subgroup there were not only the disturbances of heart rhythm but there may be the onset of disturbances of metabolic processes in myocardium. It was defined that the disturbances of heart rhythm: epiventricular extrasystoly, sinus tachycardia in the most degree were connected with decrease of data TP, HF and in the less degree with the changes of markers of myocardium disturbance. These children, also as the sportsmen with myocardial dysfunction, demand special attention and usage of correcting therapy.

Table. The condition of laboratory-instrumental data in studied groups of children

Data	Control group (n=22)	First subgroup (n=21)	Second subgroup (n=19)
MB-CPhC(f/l)	27,4±0,4	32,1 ±0,3*	51,6±0,4**#
Troponin-T (ng/l)	0,039± 0,006	0,041±0,006*	0,086±0,005***#
TP(мс²)	3421,4 ±556,4	2922,4±504,1**	2116,2±526,4**##
VLF(мс²)	1269,2 ±432,4	1100,2±422,4*	907,2±231,4*##
LF(мс²)	1012,2±465,4	909,1±421,4*	508,4±207,1***#
HF(мс²)	782,4±284,1	675,1±274,1*	412,4±128,4*#

\* — meanings of reality in comparison of data with conditionally healthy;  
 \* —  $p > 0,05$ ; \*\* —  $p < 0,05$ ; \*\*\* —  $p < 0,01$ .

# — meanings of reality in comparison of data in the first and second subgroups among themselves;  
 # —  $p > 0,05$ ; ## —  $p < 0,05$ .

It was found out that metabolic stress-dependent disturbances of heart activity in the most cases may be found in cases of disturbances of energy supply of the organism which were characterized by decrease of the main parameters of BPC, correlating with changes of levels of biochemical markers of myocardium damage.

So, it was stated that the disturbances of heart activity in young sportsmen were connected with the processes of decrease of energy in cardiomyocytes. It may be due to increase of energy usage during lessons of sport and also by insufficiency of the main energetic substrates. In the diagnostics of stress-dependent cardiomyopathy alongside with clinical data it should be important to take into consideration the changes of levels of troponin-T and activity MF-CPhC in blood serum on the phone of decrease of the main spectral data of heart rhythm variability.

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