

NEW STRESS-INDUCED CARDIOMYOPATHY RISK CRITERIA IN CHILDREN AND ADOLESCENTS IN THE SPORT OF HIGH ACHIEVEMENT

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INTRODUCTION:

«Stress cardiomyopathy» is one of the most frequent manifestations of pathological athlete's heart transformation, developing in young athletes under the impact of inadequate exercise load. This pathological condition develops in 4 - 30% young athletes and is far more common in those who are engaged in sports aimed at the development of endurance (8 – 11%), than in those who are training the quickness, the agility and the strength (4 – 6%).

Immunological imbalance with overproduction of proinflammatory cytokines, mainly tumor necrosis factor-alpha (TNF-a), can influence the occurrence of the pathological transformation of athlete's heart and formation "of stress cardiomyopathy" in children and adolescents engaged in the sport of high achievements with inadequate overexertion.

The mechanism of cytokines' activities includes the negative inotropic action, the remodeling of the heart, the disturbances in the endothelium-dependent arteriolar dilatation and the enhanced processes of cardiomyocytes' apoptosis. Some authors suggest the role of proinflammatory cytokines in the decreased tolerance to physical exercise, progressing myocardial dysfunction and formation of cardiomegaly.

OBJECTIVE:

to establish risk criteria of stress cardiomyopathy in young athletes by comparing the "quality" of adaptation to the maximum physical exertion with immunological and molecular biochemical parameters reflecting the degree of myocardial damage

RESEARCH METHODS

A total of 100 young athletes of high and medium sporting skills (sportive orienteering, swimming, synchronized swimming), aged 10 to 19 years were examined.

Assessed parameters: clinical - functional state of the cardiovascular system, the adequacy of energy supply peak loads in the gas analytic stand; level of antibodies to antigens of endothelium, cardiomyocytes, conduction system, smooth muscle fibers of the myocardium and the level of proinflammatory cytokines (TNF-a , IL6,8).; troponin I, cardiac fractions LDH, CK and CK MB (Table 1)

The first stage of examination was aimed at the comparison of the levels of immune markers of myocardial damage and of the main indices of maximal treadmill tests in young athletes with reliably different athletic history.

The second stage of examination, carried out after 6 months of intense training, included the study of the changes in proinflammatory cytokines and antimyocardial antibodies in comparison with the previous examination and immediately during maximal treadmill-testing.

The proinflammatory cytokines and the antimyocardial antibodies were studied:

- Before maximal testing;
- During early post-training period (within 1 minute of the recovery period);
- In 24 hours after testing.

Tab.1. General characteristics of complex two-staged clinical and immunological examination of the young athletes

	ECG (n=67)		EchoCG (n=49)		Maximal treadmill-tests (n=67)	
	Girls	Boys	Girls	Boys	Girls	Boys
First stage of examination	n=49		n=49		n=49	
	n=22	n=27	n=22	n=27	n=22	n=27
Second stage of examination	n=18		-		n=18	
	n=8	n=10	-	-	n=8	n=10
	Biochemical lactate identification (n=67)		Identification of proinflammatory cytokines using EIA method (n=67)		Identification of antimyocardial antibodies using indirect IE method (n=67)	
First stage of examination	n=49		n=49		n=49	
	n=22	n=27	n=22	n=27	n=22	n=27
Second stage of examination	n=18		n=18		n=18	
	n=8	n=10	n=8	n=10	n=8	n=10

RESULTS

In the subgroup of beginners, we have found a fivefold increase in TNF- α (3%), a threefold increase – (17%) and the normal value in 46% of athletes. The subgroup of skilled athletes the value of TNF- α commonly was either normal (73%), while in 9% in was threefold increased. In athletes of high sports rank and high sports working capacity ($15,0 \pm 0,3$ km / h), the average level of NF-a ($38,4 \pm 2,0$ pg / ml) was not beyond the average rate of the population (50pg / ml).

In 67% of cases, the effective increase in the maximum physical capacity (PC) and the improvement of the oxygen transport system after 6-months training was associated with a trend towards lower levels of proinflammatory cytokines (TNF-a, IL-6 and IL-8) during the early post-training period.

In 11% of medium-skilled athletes, the negative trend for the increased level of proinflammatory cytokines and a fivefold increase in anti-myocardial antibody titers in the early post-training period was associated with a reduction in PC and poor indices of oxygen transport system.

Table 2. Comparative characteristics of energy supply during the first and the second maximal treadmill testing in 12 «skilled» young athletes.

	First test indices	In 6 months
Vmax (km/hour)	14,5 \pm 0,4	16,0 \pm 0,4*
VO2/kg max (ml/min/kg)	56,2 \pm 0,6	61,9 \pm 1,6*
HRmax (Bpm)	197,0 \pm 1,2	197,0 \pm 3,0
VO2/HRmax (ml/beat)	16,3 \pm 1,4	20,8 \pm 1,6*

Fig. 1. Comparison of average values of TBF-a (pg/ml) in the subgroups of «skilled», «beginners with invariable WC» and «beginners with decreased WC» before, immediately after and in 24 hours after maximal testing

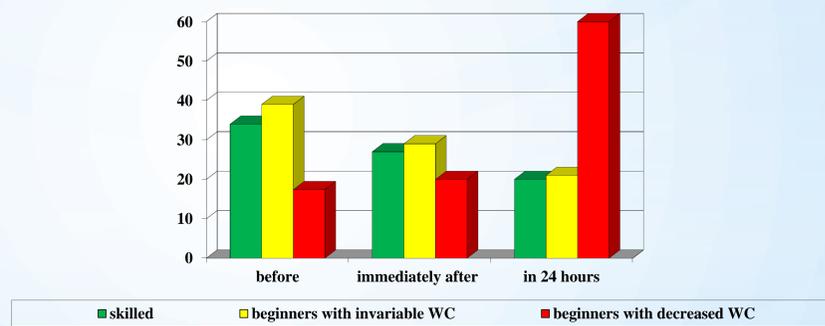


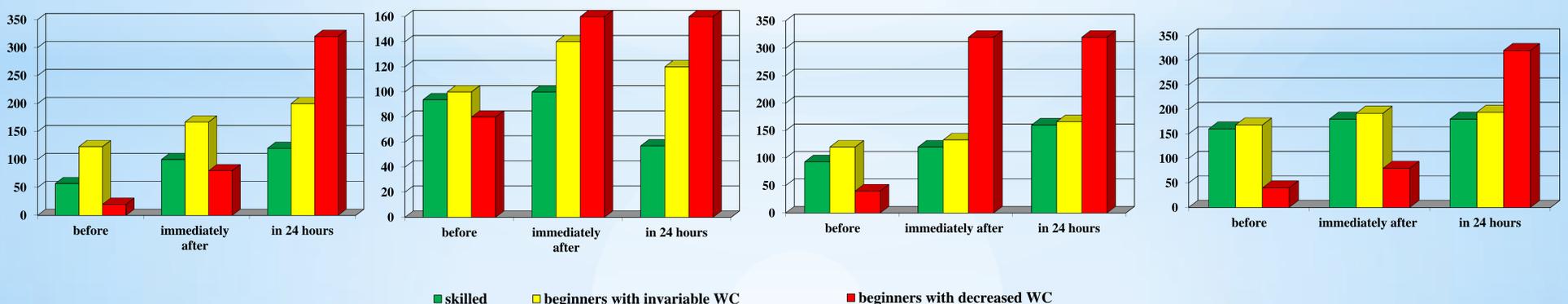
Fig. 2. Comparison of average values of antibody titers in the subgroups of «skilled», «beginners with invariable WC» and «beginners with decreased WC» before, immediately after and in 24 hours after maximal testing

Antibody titers to the endothelium

Antibody titers to the cardiomyocytes

Antibody titers to the smooth muscle

Antibody titers to the cardiac conduction system



We obtain a significant negative correlation between the level of TNF-alpha at rest with the age of young athletes ($r = -0,7$), and with the training load in hours per week ($r = -0,65$). In the early post-exercise period, a significant negative correlation between the level of TNF-a and maximum oxygen pulse ($r = -0,9$), antibody titers to the endothelium ($r = -0,67$), cardiomyocytes ($r = -0,76$), smooth muscle ($r = -0,89$), cardiac conduction system ($r = -0,94$) was revealed. Average levels of proinflammatory cytokines and antibody titers of anti-myocardial correlated reliably with the training load in hours per week, for TNF-alpha $r = -0,79$; for IL-6, $r = -0,94$; for IL-8, $r = -0,6$. It can be used as an independent objective criterion of the adequacy of the training process.

CONCLUSIONS

The obtained data can serve as the basis for the changes in the intensity of training and as the objective criterion for cardiac protection.

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