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Physiological Response Of Intravascular Platelet Activity In Adolescents With High Normal Blood Pressure To Regular Exercise.

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ABSTRACT

The study attempted to find out the severity of the effect of measured physical activity on intravascular platelet activity in adolescents with high normal blood pressure. Included in the study were 34 people of 18 years of age with high normal arterial pressure who were assigned regular dosed physical exercises with an assessment of the dynamics of cardiovascular reactivity, lipid peroxidation activity and intravascular platelet activity. In 18-year-olds with high normal blood pressure, a high reactivity of the cardiovascular system, activated lipid peroxidation in the liquid part of blood and blood platelets, and increased intravascular platelet activity are detected. As a result of regular physical training throughout the year, individuals who had high normal blood pressure at the age of 18 have normalized reactivity of the cardiovascular system, blood pressure level, body weight and intravascular platelet activity. The continuation of physical activity fixes the achieved optimization of the indicators taken into account in adolescents with high normal blood pressure.

Keywords: high normal blood pressure, exercise, intravascular platelet activity, adolescence.

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INTRODUCTION

At a young age, the development of dysfunctions can lead to the formation of resistant pathology [1–4], which in the future can only deepen and cause various complications [5, 6]. Currently, this statement is true for - diseases, including cardiovascular disease [7,8], which is the most common cause of death in humans [8,9].

The progress of modern medical science in developed countries has provided a significant improvement in the quality of medical care, however, the prevalence of arterial hypertension (AH), including that accompanied by metabolic disorders, still tends to increase, manifesting already at a fairly young age and negatively affecting the working capacity of the working population [10,11]. An important early predictor of this disease is high normal blood pressure [9]. Numerous studies have allowed to prove that hypertension causes platelet activation, which is the basis for the subsequent development of intravascular thrombosis [12]. At the same time, in spite of the high scientific and practical significance of the problem of thrombocytopeny formation in adolescents with high normal arterial pressure, threatening the occurrence of hypertension, intravascular platelet activity (BAT) and approaches to its correction are estimated very insufficiently. Previous studies have shown the dynamics of platelet activity in healthy organisms [14,15], including persons with metabolic disorders and against the background of the use of regular exposure [16,17]. At the same time, the possibility of correcting the functional activity of platelets in adolescents with high normal blood pressure is not evaluated with their help.

Taking into account these circumstances, in this study, the goal was set: to clarify the severity of the effect of measured physical activity on the intravascular activity of platelets in adolescents with high normal blood pressure.

MATERIALS AND METHODS

The study was approved by the local ethics committee of the Russian State Social University on September 14, 2016 (protocol №19). The study was conducted on the basis of the Russian State Social University.

There was no conflict of interest in this work. The study was performed on 34 people of 18 years of age with high normal blood pressure, risk 1-2. Those included in the study showed a hereditary predisposition to cardiovascular and metabolic diseases, including hypertension, abdominal obesity, metabolic syndrome and, in some cases, smoking. The control group consisted of 147 healthy people of adolescence, who do not have bad habits and hereditary burden, who regularly exercise physically as part of general physical training. The study was performed in accordance with Good Clinical Practice standards and the principles of the Helsinki Declaration. The study protocol was approved by the Ethics Committees of all participating clinical centers. Prior to inclusion in the study, all participants received written informed consent. All the observed individuals evaluated the functional reactivity of the cardiovascular system. The size of its increment against the background of psycho-emotional load was estimated type of reactivity of the cardiovascular system: when the value of the index of functional reactivity of more than 20 used units reactivity was considered hyperfunctional, with a functional reactivity index of less than 10 conventional units. the response to the load was assessed as hypofunctional, with the values of functional reactivity indicators from 10 to 20 used units. type of functional reactivity was considered normal. The subjects recorded the plasma lipid peroxidation intensity according to the content of thiobarbituric acid-active products with the Agat-Med kit, the antioxidant potential of the liquid part of the blood, the intraplatelet lipid peroxidation oxidation by the concentration of malonic dialdehyde in the recovery of thiobarbituric acid. The number of platelets in capillary blood in the Goryaev chamber was counted. Intravascular platelet activity was determined visually using a phase contrast microscope. All persons under adolescence with high normal arterial pressure were recommended to have regular adequate physical training, including morning hygienic gymnastics, therapeutic and preventive gymnastics and fractional physical exercises throughout the day. An assessment was made of the indicators taken into account in the outcome and their dynamics after 1 (19 years), 2 (20 years) and 4 (22 years) regular physical activities, as well as after another 3 years (25 years) when they were already irregularly performed. Statistical processing of the results obtained was carried out using Student's t-test.

RESULTS AND DISCUSSION

In boys with a high normal blood pressure in the initial state, the systolic blood pressure was 138.4 ± 2.16 mm. Hg Art., diastolic - 88.9 ± 2.01 mm. Hg Art., heart rate - 88.4 ± 2.69 beats in 1 min. The increment of the functional reactivity index on the load was 30.1 ± 2.60 used units, which was regarded as a manifestation of hyperfunction of the cardiovascular system. Already after 12 months of correction in those included in the study with high normal blood pressure, the systolic blood pressure steadily decreased to 130.2 ± 2.74 mm. Hg Art., diastolic - up to 85.2 ± 1.25 mm. Hg Art., heart rate decreased to 84.0 ± 1.93 beats in 1 min. When the load was fulfilled, a decrease in the increments of the functional reactivity index to 11.5 ± 2.24 standard units was observed, which indicated a stable elimination of the hyperfunction of the cardiovascular system, an increase in its tolerance to psycho-emotional stress and the economization of cardiac activity.

In the outcome of the observed young men with high normal blood pressure there was a significant increase in plasma lipid peroxidation. Thus, the concentration of thiobarbituric acid-active products in their plasma was 3.46 ± 0.16 $\mu\text{mol/l}$, in the control - 3.21 ± 0.81 $\mu\text{mol/l}$ ($p < 0.05$). The level of malondialdehyde in platelets was also increased (0.64 ± 0.25 $\text{nmol}/10^9$ platelets), versus control (0.49 ± 0.16 $\text{nmol}/10^9$ platelets, $p < 0.01$). The activation of free-radical oxidation in them became possible due to the weakening of the antioxidant activity of their body to $32.2 \pm 0.20\%$ against $38.8 \pm 0.22\%$ in the control ($p < 0.01$).

The use of rationally dosed physical loads caused a normal normalization of plasma lipid peroxidation (3.23 ± 0.15 $\mu\text{mol/l}$) with an increase in its antioxidant activity in $36.9 \pm 0.16\%$ in patients with high normal blood pressure after a year of training. Against the background of regular workouts, a decrease in the activity of lipid peroxidation in platelets was achieved in the observed ones - the basal malonic dialdehyde in them was 0.50 ± 0.17 $\text{nmol}/10^9$ platelets.

Table. Dynamics of intravascular platelet activity in persons 18-25 years old, had at 18 years high normal blood pressure

Indicators	Exodus, M \pm m	Regular physical training, M \pm m				Stopped regular physical training, M \pm m	Control, n=147, M \pm m
	18 years, n=34	19 years, n=34	20 years, n=34	22 years, n=34	25 years, n=34		
Platelet-Discocytes, %	79.2 \pm 0.16	84.7 \pm 0.16 $p_1 < 0.05$	84.9 \pm 0.11	84.9 \pm 0.12	84.6 \pm 0.07	85.1 \pm 0.10 $p < 0.01$	
Sum of active forms of platelets, %	20.8 \pm 0.17	15.3 \pm 0.13 $p_1 < 0.01$	15.1 \pm 0.17	15.1 \pm 0.12	15.4 \pm 0.17	14.9 \pm 0.15 $p < 0.01$	
The number of small units per 100 free platelets	4.5 \pm 0.12	2.9 \pm 0.10 $p_1 < 0.01$	3.0 \pm 0.04	2.9 \pm 0.05	2.8 \pm 0.02	2.8 \pm 0.14 $p < 0.01$	
The number of medium and large units per 100 free platelets	0.16 \pm 0.014	0.07 \pm 0.011 $p_1 < 0.01$	0.06 \pm 0.006	0.06 \pm 0.003	0.06 \pm 0.004	0.06 \pm 0.012 $p < 0.01$	

Legend: p - the reliability of differences in outcome and control, p_1 - the reliability of the dynamics of indicators in the process of correction.

The content of platelets in the blood of the observed persons before and during physical exertion was within the normal range. The number of discocytes in the blood of 18 year olds with high normal blood pressure before exercise began was $79.2 \pm 0.16\%$, significantly increased by the age of 19 to $84.7 \pm 0.16\%$ and remained unchanged with continued training (at 22 years - $84.9 \pm 0.07\%$). The termination of regular morning gymnastics, treatment-and-prophylactic gymnastics and fractional exercise during the day did not affect this indicator in the surveyed 25 years of age ($84.6 \pm 0.07\%$). The number of disco-echinocytes, spherocytes, sphero-echinocytes and bipolar forms of platelets in their bloodstream decreased by 19 years, also remaining stable during regular training and after the transition to irregular exercises until the final age taken into

account. As a result, the initially increased amount of active forms of platelets was already optimized after a year of regular classes, without undergoing any significant changes in subsequent years and amounted to $15.4 \pm 0.17\%$ in 22 years. Termination of regular physical activities with the transition to irregular workouts maintained over the next 3 years the amount of active platelet forms at the same level as for adolescence (25 years old - $15.4 \pm 0.17\%$). In the bloodstream of people with high normal blood pressure, who regularly experience physical exertion at the age of 18-22 years old, the levels of freely circulating small and large platelet aggregates by the age of 19 decreased to optimal values: 2.9 ± 0.10 and 0.07 ± 0.011 per 100 free-standing platelets, remaining at this level during the entire youthful age (at 22 years old 2.9 ± 0.05 and 0.06 ± 0.003 per 100 free-lying platelets). The termination of regular physical activities with the transition to irregular workouts did not affect their level until the end of observation. The number of platelets involved in the process of aggregation in individuals with high normal blood pressure, regularly experiencing physical exertion, decreased during the year of observation to normal values, not experiencing further significant fluctuations and at 19 years of age $6.0 \pm 0.10\%$ and $5.7 \pm 0.07\%$ at 22 years. During the transition to irregular physical training, this indicator in the observables remained at the level similar to that of the youth (25 years old - $5.8 \pm 0.05\%$).

CONCLUSION

In the presence of high normal blood pressure in adolescence, the reactivity of the cardiovascular system and intravascular platelet activity increase. Regular dosed physical exertion, started at 18 years of age in individuals with high normal blood pressure, is able to consistently optimize the functional activity of the cardiovascular system, lowering blood pressure and weakening the intravascular platelet activity. This can serve as the basis for the prevention of development in this category of patients in subsequent hypertension and thrombotic manifestations.

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