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Physiological Response Of Platelet Activity In Young People With High Normal Blood Pressure To Regular Exercise.

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ABSTRACT

A frequent precursor to the formation of arterial hypertension is high normal blood pressure. It cannot be ruled out that signs of platelet activation activating with high normal arterial pressure can further aggravate the manifestation of arterial hypertension quickly leading to the development of intravascular thrombosis. It is recognized that a fairly effective non-drug component of the correction of elevated blood pressure and platelet dysfunction are metered static and dynamic exercise. At the same time, this type of correction was not tested in young people with high normal blood pressure in terms of leveling their platelet dysfunctions. The use of individually selected physical exertion in young people with high normal blood pressure normalized their cardiovascular reactivity, enhanced lipid peroxidation and brought to a normal rate of impaired platelet hemostasis. The use of rational physical training for 12 months fully optimizes the increased adhesive and aggregation functions of platelets in vitro, which is fixed with the continuation of training. These changes persist for a long time and are able to prevent in these young people an increase in platelet hemostasis and the occurrence of the risk of thrombosis in the future.

Keywords: blood pressure, exercise, platelets, adolescence, hemostasis.

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INTRODUCTION

At present, arterial hypertension (AH) is starting to "look younger" [1,2], affecting the most able-bodied age [3,4]. A frequent precursor to its formation is high normal blood pressure [5,6]. It cannot be ruled out that signs of platelet activation activation observed in high normal blood pressure can further aggravate the manifestation of hypertension [7, 8], quickly leading to the development of intravascular thrombosis [9, 10]. At the same time, the peculiarities of the violation of the functional state of platelets in young people with high normal arterial pressure with aggravated heredity by hypertension are not well understood.

A fairly effective non-drug component of the correction of elevated blood pressure and platelet dysfunction is dosed static and dynamic exercise [11-17]. At the same time, this type of correction was not tested in young people with high normal blood pressure in terms of leveling their platelet dysfunctions.

In this regard, the author was tasked to identify the possibility of correction with the help of metered exercise of violations of platelet hemostasis in young people with high normal blood pressure.

MATERIAL AND METHODS

The research was approved by the Ethics Committee of Russian State Social University (record №5 from 12.05.2014).

34 young people aged 18 years old with high normal blood pressure were under observation, including 18 males and 16 females. Patients noted 1-2 risk factors - familial predisposition to cardiovascular diseases and in some cases smoking. The control group consisted of 141 healthy young people of the same age, without bad habits and hereditary burdens, regularly not experiencing physical exertion. The value of the index of functional reactivity of the cardiovascular system was traditionally determined. According to the value of its increment against the background of psycho-emotional load, the type of reactivity of the cardiovascular system was assessed: when the value of the functional reactivity index was more than 20 standard units reactivity was considered hyperfunctional, with the value of the functional reactivity index of less than 10 conventional units. the response to the load was assessed as hypofunctional, and at values of the functional reactivity index from 10 to 20 conventional units, the type of functional reactivity was normal. Plasma lipid peroxidation activity was determined by the content of thiobarbituric acid-active products with the Agat-Med kit and the antioxidant potential of the liquid part of blood [1], and intraplatelet lipid peroxidation by basal malondialdehyde (MDA) concentration in a thiobarbitric acid recovery reaction The number of platelets in capillary blood in the Goryaev chamber was counted. Platelet aggregation (AP) was studied by a visual micromethod (Shitikova A.S., 1999) using as inducers ADP (0.5×10^{-4} M), collagen (1: 2 dilution of the main suspension), thrombin (0.125 units/ml), ristomycin (0.8 mg/ml), adrenaline (5×10^{-6} M) and hydrogen peroxide (7.3×10^{-3} M). All 34 young people with high normal arterial pressure taken under observation were prescribed regular dosed physical exercises according to the scheme developed by the authors, including morning hygienic gymnastics, therapeutic and preventive gymnastics and fractional exercise during the day. The design of the study included the initial assessment of the studied parameters and the determination of their dynamics after 1, 2 and 4 years of regular physical activity. Statistical processing of the results obtained was carried out using Student's t-test.

RESEARCH RESULTS

In the initial state, the systolic blood pressure in the examined was equal to 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 at the load was 30.1±2.60 used units, which was regarded as a manifestation of hyperfunction of the cardiovascular system.

After 12 months of correction in young people with high normal blood pressure, systolic blood pressure 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 executing the load, a decrease in the increments of the functional reactivity index by 11.5±2.24 conventional units was observed, which indicates the elimination of the cardiovascular system hyperfunction, increasing its tolerance to psycho-emotional stress and economization of the cardiac activity.

A significant increase in plasma lipid peroxidation was observed in young people with high normal blood pressure taken under observation. Thus, the concentration of thiobarbituric acid-active products in their plasma was 3.46 ± 0.16μmol/l, in the control - 3.21±0.81 μmol/l ($p<0.05$). The level of MDA in platelets was also increased (0.64±0.25 nmol/10^9 platelets), in the control - 0.49±0.16 nmol/10^9 platelets ($p<0.01$). Activation of free-radical oxidation in young people with high normal blood pressure became possible due to the weakening of the antioxidant activity of their body to 32.2±0.20% against 38.8±0.22% in control ($p<0.01$).

Appointment of young people with high normal blood pressure rationally dosed physical exertion after a year of training normalized the LPO of plasma and platelets. Thus, in the plasma, the content of thiobarbituric acid-active products was 3.23±0.15 μmol/l, with an increase in its antioxidant activity of 36.9±0.16%. Against the background of regular workouts in young people, a decrease in the activity of lipidav peroxidation in platelets was achieved - basal MDA in them was 0.50±0.17 nmol/10^9 platelets. The number of platelets in the blood of young people with high normal blood pressure before and against the background of the correction was within the normal range. In those included in the study before the start of training, the acceleration of AP was found, most pronounced under the influence of collagen - 28.6±0.20s (in the control - 34.6±0.17s). Somewhat slower AP developed in individuals with high normal blood pressure under the influence of ADP (39.1±0.13 s) and ristomycin (43.8±0.17s). AP with H_2O_2 in the group of individuals with high normal blood pressure was 44.1±0.15s. Thrombin and adrenaline antibodies also developed faster than controls ($p<0.01$) and were equal in young people with a high normal blood pressure of 48.8±0.10 s and 94.7±0.14 s, respectively.

Against the background of regular physical exertion in young people with high normal blood pressure, the AP time increased under the influence of all inductors tested. After 12 months Correction of the most active inducer of AP they turned out to be collagen. ADF, ristomycin and H_2O_2 were somewhat less active. Later, AP developed ($p<0.01$) under the influence of thrombin and adrenaline.

Further three-year observation of young people who continued training at 18 years of age had high normal arterial pressure, did not reveal the negative dynamics of all normalized functional and laboratory parameters until the end of observation.

DISCUSSION

The use of rational physical exertion in cardiac patients can improve metabolism by stimulating the body's hidden reserves [18-21].

Thus, as a result of the use of physical training in young people with high normal arterial pressure, the state of the functional reactivity of the cardiovascular system was normalized in response to the dosed psycho-emotional stress, providing for it tolerance, optimizing hemodynamics under stress and reducing, thereby, the risk of development subsequent arterial hypertension [22-25].

A slight increase in free-radical oxidative processes in plasma and platelets in the examined people with high normal blood pressure revealed a decrease in the antioxidant system of the body [26]. In addition, the increased formation of MDA by their platelets is a marker of the beginning increase in the activity of metabolism [27] of membrane phosphoinositols and increasing thromboxane formation [28]. The positive effect of a complex of physical training on the state of lipid peroxidation in the body of young people with high normal blood pressure is obviously mediated by its effect on the activity of the sympathetic nervous system and on fine cellular processes [29,30]. It manifested itself to the maximum by the end of the first year of training [31]. A decrease in the level of MDA in platelets in the observed young people with high normal blood pressure indicates a decrease in the activity of arachidonate metabolism enzymes in platelets with the achievement of the physiological level of thromboxane formation in them [31].

The improvement in AP levels in young people with high normal blood pressure against the background of the application of metered exercise, indicates a positive effect on platelet hemostasis [32,33]. These effects are due to the improvement of metabolic processes, a decrease in hypersympathicotonia and the optimization of lipid peroxidation in plasma and platelets [34]. The prolongation of AP time under the influence of ristomycin in observable young people with high normal blood pressure during training suggests a decrease in von Willebrand factor blood levels [35–37]. The positive dynamics of AP with H_2O_2 in them additionally

indicates an increase in the activity of the anti-oxidation system in platelets, first of all, catalase and superoxide dismutase [38]. In other words, rational physical exertion in young people with high normal blood pressure should preferably be applied immediately after establishing the fact of increasing blood pressure, which effectively optimizes the reactivity of the cardiovascular system and platelet hemostasis during the year of training [39]. Continued physical activity can consolidate the achieved optimization of platelet hemostasis activity in young people with high normal blood pressure, reducing their risk of hypertension and the development of vascular complications at an older age [40].

CONCLUSION

The use of dosed physical exertion in young people with high normal blood pressure eliminates the increased reactivity of the cardiovascular system, their increased lipid peroxidation, bringing the disturbed platelet hemostasis to normal. These changes reach a maximum by the end of the year of study, largely preventing these young people from strengthening platelet hemostasis in the future.

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