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Dynamics Of Functional Parameters Of Platelet Hemostasis In Young People With Hemodynamic And Metabolic Disorders On The Background Of Regular Physical Activity.

Medvedev IN*.

Russian State Social University, st. V. Pika, 4, Moscow, Russia, 129226.

ABSTRACT

In modern society, the manifestations of the metabolic syndrome and, first of all, arterial hypertension and abdominal obesity begin to "look younger" more and more often, developing up to 30 years. One of the earliest predictors of the development of metabolic syndrome may be high normal blood pressure and overweight. It has been observed that their combination in young people quickly activates platelets, which further aggravates the formation of the metabolic syndrome, contributing to the development of intravascular thrombus formation. It was decided to test, as a non-pharmacological component, the correction of an increase in blood pressure and the emergence of overweight body dosage static and dynamic exercise with registration of their effect on the activity of platelet hemostasis in young individuals. The study found that the use of dosed physical exertion in young people with high normal blood pressure and overweight eliminates the increased reactivity of the cardiovascular system, incipient obesity, they have increased lipid peroxidation, bringing to a normal rate of disturbed platelet hemostasis. These changes reach a maximum by the end of the year of classes and prevent hemostasis in these young people in the future, dramatically lowering the risk of thrombosis.

Keywords: blood pressure, overweight, exercise, platelets, young age.

Corresponding author

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INTRODUCTION

In modern society, the manifestations of metabolic syndrome (MS) and, first of all, arterial hypertension (AH) and abdominal obesity (AO) are beginning to "look younger", developing often to 30 years and affecting the most able-bodied age [1-5]. One of the earliest predictors of MS development may be high normal blood pressure and overweight [6,7]. It is possible that the signs of platelet activation observed in combination with young people with high normal arterial pressure and overweight may subsequently worsen during the formation of MS [8.9], quickly leading to the development of intravascular thrombosis [10,11]. However, despite the high scientific and practical significance of this problem [12], the features of the functional state of platelets in young people with high normal blood pressure and overweight with burdened heredity according to MS have not been studied enough [13].

It is known that a very effective non-drug component of the correction of increased blood pressure and overweight is dosed static and dynamic exercise [14,15]. At the same time, their effect on platelet hemostasis in young people with high normal blood pressure and overweight was not evaluated.

In this regard, the authors set the task: to evaluate the possibilities of measured physical activity in terms of correcting disorders of platelet hemostasis in young people with high normal blood pressure and overweight.

MATERIAL AND METHODS

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

The study included 27 young people aged 18 years with high normal blood pressure and overweight, a risk of 1-2, including 19 males and 8 females. Young people included in the study had a predisposition to cardiovascular and metabolic diseases, including metabolic syndrome and, in some cases, smoking. The control group consisted of 147 healthy young people of similar age, without bad habits and hereditary burden, who regularly exercise physically as part of general physical training.

The survey included the determination of anthropometric indicators: body weight, body mass index, waist circumference, hip circumference with the calculation of waist circumference / hip circumference. 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 with the values of the functional reactivity index from 10 to 20 used 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, and intraplatelet lipid peroxidation by the concentration of basal malondialdehyde (MDA) in the thiobarbituric acid reduction reaction. The number of platelets in capillary blood in the Goryaev chamber was counted. Platelet aggregation (AP) was studied by a visual micromethod using as inducers ADP (0.5×10^{-4} M), collagen (dilution 1:2 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 under the supervision of 27 young people with high normal blood pressure and overweight 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 against the background of 1, 2 and 4 years of regular physical activity and after 3 subsequent years of their irregular implementation. Statistical processing of the results obtained was carried out using Student's t-test.

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RESEARCH RESULTS

When included in the study, systolic blood pressure in the examined was equal to 137.6±1.84 mm. Hg Art., diastolic - 89.0±1.96 mm. Hg Art., heart rate - 90.1 ± 2.12 beats in 1 min The increment of the functional reactivity index on the load was 40.7 ± 1.46 conditional units, which was regarded as a manifestation of a pronounced hyperfunction of the cardiovascular system.

As a result of 12 months of correction in young people with high normal blood pressure and overweight, systolic blood pressure decreased to 131.3±1.92 mm. Hg Art., diastolic - up to 84.6±2.07 mm. Hg Art., heart rate decreased to 82.0±1.38 beats per 1 min. When the load was fulfilled, a decrease in the increment of the functional reactivity index by 20.1±1.16 used units was observed, which indicates the elimination of the cardiovascular system hyperfunction, increase in its tolerance to psycho-emotional stress and economization of cardiac activity. Normalization of reactivity of the cardiovascular system was noted only after 2 years of training - the increment of the functional reactivity index reached 16.4±2.07 conventional units.

In the initial state, the average body weight of the examined was 82.9±0.15 kg, with a body mass index of 29.8±0.11 kg/m^2 and a waist / hips ratio of 1.06±0.006.

After 1 year of regular dosed physical training in young people who, at the age of 18, had high normal blood pressure and overweight, their body weight decreased to 72.4±0.11 kg, while their body mass index decreased to 26.0±0.06 kg/ m^2 with a decrease in waist / hip volume to 0.85±0.006.

The observed young people with high normal blood pressure and overweight in the outcome showed a significant increase in plasma lipid peroxidation. Thus, the concentration of thiobarbituric acid-active products in their plasma was 3.61 ± 0.19 µmol/l, in the control - 3.21±0.81 µmol/l ($p < 0.05$). The level of MDA in platelets was also increased (0.69 ± 0.09 nmol / 109 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 and overweight became possible due to the weakening of the antioxidant activity of their body to 30.6±0.12%, against 38.8±0.22% in control ($p<0.01$).

Observance within 1 year of young people with high normal arterial pressure and overweight rationally measured physical activity normalized the LPO of plasma and platelets. Thus, in the plasma, the content of thiobarbituric acid-active products was 3.32±0.10 µmol/l with an increase in its antioxidant activity of 37.8±0.17%. Against the background of regular workouts in young people, a decrease in the activity of lipid peroxidation in platelets was achieved - basal MDA in them was 0.50±0.12 nmol/10^9 platelets. The content of platelets in the blood of young people with high normal blood pressure and overweight 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 - 26.9±0.16 s (in the control - 34.6±0.17 s). Somewhat slower AP developed in individuals with high normal blood pressure and overweight under the influence of ADP (37.5±0.10 s) and ristomycin (41.7±0.14 s). AP with H_2O_2 in the group of individuals with high normal arterial pressure and overweight was 43.0±0.19s. Thrombin and adrenaline antibodies also developed faster than controls ($p<0.01$) and were equal in young people with high normal arterial pressure and overweight of 47,2±0.12 s and 92.4±0.10 s, respectively.

Against the background of regular physical exertion in young people with high normal blood pressure and overweight, the AP time has 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 the continued workout by young people who had high normal blood pressure and excessive body weight at the age of 18 did not reveal the negative dynamics of all normalized functional and laboratory parameters until the end of the observation even if they were not strictly observed between 22 and 25 years

Thus, regular dosed exercise, started at 18 years of age in individuals with high normal blood pressure and overweight, can optimize the functional activity of the cardiovascular system, blood pressure, body mass

and platelet hemostasis, which can serve the basis for the prevention of development in their subsequent metabolic syndrome.

DISCUSSION

It is known that the use of rational physical exertion in cardiac patients can improve metabolism by stimulating the hidden reserves of the body [16-20].

Thus, as a result of the use of physical training in young people with high normal arterial pressure and overweight, normalization of the functional reactivity of the cardiovascular system in response to the dosed psycho-emotional stress was noted, ensuring tolerance to it, optimizing hemodynamics under stress and reducing, thereby , the degree of risk of subsequent arterial hypertension [21,22].

The use of physical training in overweight young people contributed to a decrease in body weight, thereby reducing the risk of subsequent obesity, primarily of the abdominal type, as the most unfavorable in terms of the formation of metabolic disorders [23-25].

The revealed initial increase of free-radical oxidative processes in plasma and platelets in the examined young people with high normal blood pressure and overweight indicated a decrease in the antioxidant system of the body [26,27]. In addition, the increased formation of MDA by their platelets is a marker of the beginning increase in the activity of the metabolism of membrane phosphoinositols and increasing thromboxane formation [28-30]. The positive effect of a complex of physical training on lipid peroxidation in the body of young people with high normal blood pressure and overweight is obviously mediated by its effect on the activity of the sympathetic nervous system and on thin cellular processes [31,32]. The maximum was manifested by the end of the first year of training. A decrease in the level of MDA in platelets in the observed young people with high normal blood pressure and overweight indirectly indicates a decrease in the activity of arachidonate metabolism enzymes in platelets with the achievement of the physiological level of thromboxane formation in them [33,34].

The improvement in AP levels in young individuals with high normal blood pressure and overweight during the application of metered exercise, indicates a positive effect on platelet hemostasis [35,36]. These effects are due to the improvement of metabolic processes, a decrease in hypersympathicotonia and the optimization of lipid peroxidation in plasma and platelets. The prolongation of AP time under the influence of ristomycin in observable young people with high normal blood pressure and overweight during training indicates a decrease in von Willebrand factor blood levels [37]. The positive dynamics of AP with H_2O_2 in them additionally testifies to an increase in the activity of the antioxidation system in platelets, first of all, catalase and superoxide dismutase [38–40].

Thus, rational physical exertion in young people with high normal blood pressure and overweight is preferable to apply immediately after establishing the fact of increase in blood pressure and body weight, which effectively optimizes the reactivity of the cardiovascular system, blood pressure, body mass and platelet hemostasis in during the year of training. Continued physical activity can consolidate the achieved optimization of platelet hemostasis in young people with high normal blood pressure and overweight, helping to reduce their risk of developing MS and the development of vascular complications at an older age.

CONCLUSION

The use of dosed physical loads in young people with high normal arterial pressure and overweight eliminates the increased reactivity of the cardiovascular system, the incipient obesity they have increased lipid peroxidation, bringing to normal the activity of disturbed platelet hemostasis. 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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