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Dynamics of the Intravascular Activity of Platelets in Young Men with High Normal Blood Pressure Regularly Practicing Physical Activity

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Abstract

The article is to reveal the influence of the graduated physical activity on the intravascular activity of platelets in young men with high normal blood pressure. Thirty four 18-yr-old men with high normal blood pressure enrolled into the research, a risk of 1-2, were administered with the regular graduated physical trainings while estimating the dynamics of the cardiovascular system responsiveness, activity of lipid peroxidation, and intravascular activity of platelets.The high responsiveness of the cardiovascular system, activation of lipid peroxidation in blood liquid components and plates, and strengthening of the platelet intravascular activity are revealed in 18-yr-old men with high normal blood pressure. Regular physical trainings during 1 yr resulted in normalization of the cardiovascular system responsiveness, blood pressure, plasma lipid peroxidation, and intravascular activity of platelets in the men suffered from high normal blood pressure at 18-yr-old. Keeping up physical activities maintained the achieved optimization of studied values in male adolescents with high normal blood pressure.

Keywords

High normal blood pressure; Physical activity; Intravascular platelet activity; Youth age

Introduction

The modern medical science progress in the developed countries laid the basis for understanding of the genetic reasons of a pathology [1,2], having essentially improved the quality of medical aid [3,4-6]; however, prevalence of different pathologies in young age [7], including an arterial hypertension (AH), is still increasing [8], negatively influencing on the working ability of the working people [9-11]. An important early predictor of AH is high normal blood pressure (HNBP) [8]. Numerous researches allow to prove that AH negatively influences on the formed blood elements [12,13], causing platelet activation, a reason for the further intravascular thrombosis [14,15]. Thus, in spite of the high scientific and practical importance of the problem of trombocytopathya formation in young males with HNBP, treating with AH, intravascular platelet activity (IPA) and approaches to its lowering are studied insufficiently yet. The previous researches showed dynamics of thrombocyte activity in healthy people [16], in overweight people [3], and in patients with AH and with metabolism at regular static and dynamic physical exercises [17,18]. At the same time, a possibility to correct functional activity of platelets in young people with HNBP is still unestimated.

Considering the above circumstances, the following goal is stated in the research: to find out expressiveness of influence of the graduated physical activity on IPA in young people with HNBP.

Materials and Methods

No conflict of interests was observed during this study. The study was conducted involving thirty four 18-yr-old people with HNBP, a risk of 1-2 [14]. The hereditary predisposition to cardiovascular and metabolic diseases, including AH, abdominal obesity, metabolic syndrome, and sometimes smoking was observed in the enrolled subjects. The control group consisted of 147 healthy young people with no bad habits and hereditary loading, regularly practicing normal physical exercises. The study was conducted according to Good Clinical Practice standards and principles of the Helsinki Declaration. The study protocol was approved by the Ethical committee of the institution. All participants provided the written informed consent before enrollment into the study. A functional responsiveness value (FRV) of the cardiovascular system (CVS) was estimated in all studied subjects [19]. The CVS responsiveness type was evaluated by its increment against psychoemotional loading: at FRV value of more than 20 standard units, the responsiveness was considered as hyperfunctional, at FRV value of less than 10 standard units, the responsiveness to loading was considered as hypofunctional, and at FRV values from 10 to 20 standard units, the type of functional responsiveness was considered as normal. The subjects demonstrated an intensity of lipid peroxidation (LP) in plasma by the thiobarbituric acid (TBA) content – active products by "Agate-Med", an antioxidant potential of blood liquid components [20], activity of intra-thrombocyte LP by malondialdehyde (MDA) concentration in reaction of the TBA restoration [12]. A number of platelets in capillary blood were counted in Goryaev chamber. Intravascular activity of platelets was defined visually with a phase-contrast microscope [21]. All young people with HNBP enrolled into the study were recommended to practice regularly physical activity, including morning exercises, medical and preventive gymnastics, and single physical exercises throughout a day [22]. The studied values in outcome and their dynamics in 1 yr (aged 19), in two (aged 20), and in four (aged 22) years of regular physical activity were evaluated, and also in three years (aged 25) at irregular training. The obtained results were statistically processed with Student's *t*-test.

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Results

Initially young men with HNBP showed systolic blood pressure equaled to 138.4 ± 2.16 mmhg, diastolic – 88.9 ± 2.01 mmhg, heart rate – 88.4 ± 2.69 per minute. Increment of FRV at loadings made 30.1 ± 2.60 SI units, being regarded as CVS hyperfunction. In 12 months of correction, the research HNBP subjects demonstrated systolic blood pressure, stably decreasing to 130.2 ± 2.74 mmhg, diastolic – to 85.2 ± 1.25 mmhg, heart rate to 84.0 ± 1.93 per minute. Increment of FRV values decreased to 11.5 ± 2.24 SI units at loading, testifying the stable elimination of CVS hyperfunction, increase of its tolerance to psychoemotional loading, and economization of the heart activity.

Outcome revealed reliable increase of LP plasma in young men with HNBP. So, concentration of TBK-active products in their blood made 3.46 ± 0.16 mkmol/l, in the control – 3.21 ± 0.81 mkmol/l ($p < 0.05$). Level of MDA in platelets also appeared increased (0.64 ± 0.25 nmol/10^9), versus the control (0.49 ± 0.16 nmol/10^9, $p < 0.01$). Activation of free-radical oxidation became possible due to lowering of antioxidizing activity of their organism to 32.2 ± 0.20% vs. 38.8 ± 0.22% in the control ($p < 0.01$).

Rationally graduated physical activity caused stable normalization a plasma LP (3.23 ± 0.15 mkmol/l) with its strengthening anti-oxidant activity 36.9 ± 0.16%. Thus at regular trainings the subjects demonstrated decrease in LP activity in platelets – basal MDA made 0.50 ± 0.17 nmol/10^9.

Total quantitative content of platelets in blood in the studied people before and during physical activity was within norm. At the same time a number of discocytes in blood in 18-yr-old men with HNBP before physical activity made 79.2 ± 0.16%, increasing to 84.7 ± 0.16% by 19 yrs and remaining the same at continuation of trainings (aged 22 – 84.9 ± 0.07%). The termination of regular morning exercises, medical and preventive gymnastics, and single physical exercises during a day did not influence on this value in the studied subjects aged 25 (84.6 ± 0.07%). The quantity of disco-echinocytes, spherocytes, sphero-echinocytes, and bipolar platelet forms in their blood flow decreased by 19 yrs, also remaining stable throughout regular physical activity and even at irregular till the final studied age. Thereof initially raised number of active platelet forms was optimized in a year of regular physical activity, without any subsequent changes and made 15.4 ± 0.17% at the age of 22. The termination of regular physical activity, passing to irregular trainings, provided a number of active platelet forms at a level typical for young age (25 yrs – 15.4 ± 0.17) within the next 3 yrs. Levels of small and large circulating aggregates platelets in the HNBP subjects' blood flow who regularly practice physical activity at 18-22 yrs, decreased by the age of 19 to optimum values: 2.9 ± 0.10 and 0.07 ± 0.011 per 100 isolated platelets, remaining at this level during the whole youth (aged 22 – 2.9 ± 0.05 and 0.06 ± 0.003 per 100 isolated platelets). The termination of regular physical activity passing to irregular trainings did not influence on their level till the end of the study. A number of platelets, involved in aggregate formation, in HNBP people regularly practicing physical activity, decreased to normal values in a year of the study, without any further changes and made at the age of 19 – 6.0 ± 0.10% and 5.7 ± 0.07% at aged 22. At passing to irregular physical activity, this value in the subjects remained at a level typical for young age (25 yrs – 5.8 ± 0.05%).

Discussion

Currently a HNBP is often observed among the young people, and further it may cause AH in them [8]. It is clear that HNBP as well as AH are accompanied by development of platelet dysfunctions, complicating blood rheology, causing hypoxemia and metabolism disorder in tissues, worsening health state, and threatening with thromboses [23,24]. At the same time, a proper correcting influence on an organism, including by physical activity, is known to eliminate platelets from the hypersensitive state, lowering their activity [3]. However, selecting methods for correction of body overweight, high blood pressure in young people, a possibility for long regular physical exercises is not sufficiently considered yet as for their positive influence on thrombocyte hemostasis dysfunctions for the stable normalization.

Possible dynamics of thrombocyte functions remained unclear in young people with HNBP affected by overall physical activity, including regular exercises from 18 yrs passing to irregular after 22. It highlighted an unsolved problem of influence of the regular muscle activity on functional activity of platelets at preclinical conditions that could not meet the modern cardiology requirements.

The regular graduated physical activity at young age in people who had HNBP at the age of 18 yrs can normalize hemodynamics and metabolism, having reduced the external stimulation of platelets. It is grounded on the possibility of the evident positive influence of physical trainings on a sympathetic tone and metabolism. Thus, all subjects with HNBP demonstrated the stable suppression of LP in the blood, maximally revealed in a year of physical activity and remained not only till the end of regular exercises (ages 22) but also till the end of the study, i.e., at irregular physical activity between 22 and 25 yrs. It is possibly mainly caused by the stable strengthening of plasma anti-oxidant

Values	Outcome [M ± m]	Regular physical exercises [M ± m]			Terminated the regular physical exercises [M ± m]	Control, n = 147 [M ± m]
	18 year old, n = 34	19 year old, n = 34	20 year old, n = 34	22 year old, n = 34	25 year old, n = 34	
Discocytes [%]	79.2 ± 0.16	84.7 ± 0.16 $p_1 < 0.05$	84.9 ± 0.11	84.9 ± 0.12	84.6 ± 0.07	85.1 ± 0.10 $p < 0.01$
The sum of active forms [%]	20.8 ± 0.17	15.3 ± 0.13 $p_1 < 0.01$	15.1 ± 0.17	15.1 ± 0.12	15.4 ± 0.17	14.9 ± 0.15 $p < 0.01$
Quantity of small aggregates, per 100 isolated platelets	4.5 ± 0.12	2.9 ± 0.10 $p_1 < 0.01$	3.0 ± 0.04	2.9 ± 0.05	2.8 ± 0.02	2.8 ± 0.14 $p < 0.01$
Quantity of average and large aggregates, per 100 isolated platelets	0.16 ± 0.014	0.07 ± 0.011 $p_1 < 0.01$	0.06 ± 0.006	0.06 ± 0.003	0.06 ± 0.004	0.06 ± 0.012 $p < 0.01$

p – reliability of outcome and control difference; p_1 – reliability of dynamics of values during correction.

Table 1: Dynamics of IPA in 18- to 25-yr-old people, suffered from HNBP aged 18

activity at oxidase depression, developing at physical activity. Decreased MDA formation with platelets in practicing physical activity allows to assume in them the stable normalization of arachidonate exchange in blood plates with optimization of thromboxane formation within a year of trainings [25].

A positive effect of regular trainings on thrombocyte homeostasis *in vivo* in 18 people with hemostasis disorders were based besides the stable normalization of hemodynamics, CVS reactance, optimization of humoral effects, but also on achievement of a strict balance between catabolism and anabolism in fat tissues [6]. Receptor reorganizations of blood plate membranes reduced a number of activated platelets isolated in the blood channel and their aggregates of all sizes. It decreases endothelium damaged by them, levelling an expression of subendothelial structures and their contacts to blood, lowering IPA expressiveness. Thus, IPA reduction decreases microcirculation, including in vasa vasorum, reducing a risk of atherogenesis at elder age [18].

The reduced influence on the blood plates of lowering levels of catecholamines, glucocorticoid and thyroid hormones is important in the mechanisms of reduction of functional activity of platelets at regular physical activity [26,27]. Decreasing of their combined influence on functional platelet activity mainly contributes to returned values of their adhesion and aggregation to a level of physiological standard. Besides, a condition of thrombocyte link in the hemostasis is positively affected by measured hypoxia, regulating the LP processes in platelet membranes, thereby normalizing a level of IPA at adaptation to an effect of regular reasonable physical activity [17].

Expressiveness of IPA correction by regular physical activity allows to consider it preferable in the people with a history of HNBP at the age of 18, to decrease a risk of microthromboses. In the absence of the direct disaggregating action, the graduated physical trainings reduce IPA through the stabilization of hemodynamics, the CVS reactance and easing of peroxidation in an organism with microcirculation optimization. Considering maintaining of the reached positive effect of the regular physical activity influence on the thrombocyte hemostasis in the subjects with a history of HNBP at the age of 18 yrs, when they passed to irregular trainings after 22 yrs, it is reasonable to recommend regular physical activity exactly at young age.

Conclusion

The 18-yr-old subjects with HNBP demonstrated high reactance of the CVS, activated LP in a liquid part of blood and blood plates and strengthening of the IPA. The regular graduated physical activity started at 18-yr-old age in young men with HNBP, may stably optimize a functional activity of CVS, blood pressure, and IPA that may provide prophylaxis of AH and thrombotic symptoms. Continuation of physical exercises maintains the achieved optimization of considered values in young men with a history of HNBP at the age of 18 yrs.

References

1. Amelina IV, Medvedev IN (2008) Evaluation of the dependence of mutagenesis intensity on activity of nucleolus organizer regions of chromosomes in Aboriginal population of Kursk region. Bulletin of Experimental Biology and Medicine 145(1): 68-71.
2. Amelina IV, Medvedev IN (2009) Relationship between the chromosome nucleoli-forming regions and somatometric parametres in humans. Bulletin of Experimental Biology and Medicine 147(1): 77-80.
3. GromnatskiĬ NI, Medvedev IN (2003) Non-pharmacological correction of impaired platelet hemostasis in hypertensive patients with metabolic syndrome. Klinicheskaia Meditsina 81(4): 31-34.
4. Medvedev IN, GromnatskiĬ NI, Golikov BM, Al'-Zuraiki EM, Li VI (2004) Effects of lisinopril on platelet aggregation in patients with arterial hypertension with metabolic syndrome. Kardiologiia 44(10): 57-59.
5. Medvedev IN, GromnatskiĬ NI (2005) Normodipin in correction of platelet rheology in hypertensive patients with metabolic syndrome. Terapevticheskii Arkhiv 77(6): 65-68.
6. Medvedev IN (2007) Correction of primary hemostasis in patients suffering from arterial hypertension with metabolic syndrome. Klinicheskaia Meditsina 85(3): 29-33.
7. Medvedev IN, Lapshina EV, Zavalishina SYu (2010) Activity of platelet hemostasis in children with spinal deformities. Bulletin of Experimental Biology and Medicine 149(5): 645-646.
8. Gogin EE (2010) Hypertension Yesterday and Today. Moscow, p. 117.
9. Medvedev IN, Skoryatina IA (2010) Effect of lovastatin on adhesive and aggregation function of platelets in patients with arterial hypertension and dislipidemia. Klinicheskaya Meditsina 88(2): 38-40.
10. Simonenko VB, Medvedev IN, Mezentseva NI, Tolmachev VV (2007) The antiaggregation activity of the vascular wall in patients suffering from arterial hypertension with metabolic syndrome. Klinicheskaia Meditsina 85(7): 28-30.
11. Simonenko VB, Medvedev IN, Tolmachev VV (2011) Dynamics of primary hemostasis activity in patients with arterial hypertension and metabolic syndrome treated with candesartan. Klinicheskaya Meditsina 89(3): 35-38.
12. Kubatiev AA, Avtandilov AG, Rudko IA, Dzhamelashvili SV (2004) Impaired platelet hemostasis in arterial hypertension and possibility of correction of these disorders with angiotensine transforming enzymes. Patogenez 2(2): 12-17.
13. Medvedev IN, Skoryatina IA (2012) Dynamics of microrheologic properties of erythrocytes in patients with arterial hypertension and dyslipidemia treated with atorvastatin. Klinicheskaya Meditsina 90(6): 42-45.
14. Diagnostics and treatment of an arterial hypertension. In National Clinical Recommendations. 3rd Edition, Moscow: Silitseya-Polygraph, 2013 pp. 463-500.
15. Medvedev IN, Skoryatina IA (2013) Fluvastatin effects on blood cell aggregation in patients with arterial hypertension and dyslipidemia. Cardiovascular Therapy and Prevention 12(2): 18-24.
16. Tkachenko IE (2007) Platelet involvement in adaptation of hemostasis. Achievements in the Modern Natural Science 7(8): 64-66.
17. Simonenko VB, Medvedev IN, Kumova TA (2008) Effect of eprosartan on thrombocytes aggregative capacity in patients with arterial hypertension and metabolic syndrome. Klinicheskaia Meditsina 86(4): 19-21.
18. Sushkevich GN (2010) Pathological Systems of Hemostasis and Principles of Their Correction. Krasnodar: Soviet Kuban, p. 240.
19. Lebedeva OD, Radzievsky SA, Bugaiev SA (2003) Estimation of functional reactiveness of the cardiovascular system. Patent No.: RU 2207044 (27.06.2003).
20. Volchegorsky IA, Dolgushin II, Kolesnikov OL, Tseilikman VE (2000) Experimental Modelling and Laboratory Evaluation of Adaptive Reactions of an Organism. Chelyabinsk: Chelyabinsk State Pedagogical University, p. 167.
21. Medvedev IN, Zavalishina SYu, Krasnova EG, Kutafina NV (2014) Methodical approaches to estimation of aggregation and superficial properties of platelets and erythrocytes. Fundamental Studies 10(part 1): 117-120.
22. Medvedev IN, Savchenko AP, Zavalishina SYu, Krasnova EG, Bespartochny BD (2009) The method of optimisation of activity of blood plates in high normal arterial pressure at young age. The Industrial Patent No.: RU 2442557 (25.12.2009).
23. Ofozu FA (2002) Platelets as a regulation model for blood coagulation in cellular membranes and its value. Biochemistry 67(1): 56-66.

24. Simonenko VB, Medvedev IN, Bryukhovetsky AG (2012) Effect of therapy with diuretics on the functional activity of platelets in patients with arterial hypertension and abdominal obesity. Klinicheskaya Meditsina 90(11): 54-56.

25. Shitikova AS (2000) Thrombocyte Hemostasis. Publishing House of SPb: SMU, p. 227.

26. Shitikova AS (2008) Trombocytopathya Congenital and Acquired. St. Petersburg: Information and Publishing Center at the WMA, 320 pp.

27. Simonenko VB, Medvedev IN, Gamolina OV (2011) Primary hemostasis activity in patients with arterial hypertension and impaired glucose tolerance treated with trandolapril. Klinicheskaya Meditsina 89(2): 29-31.

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