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Vascular disaggregation effects on erythrocytes in patients with arterial hypertension with abdominal obesity.

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ABSTRACT

The high incidence of thrombosis in patients with arterial hypertension with abdominal obesity is determined by the development of their manifestations of vasopathy. In view of the high prevalence in the developed countries of the combination of arterial hypertension with abdominal obesity, it is very important for science and practice to maintain the level of the state with this pathology of the level of vascular control over the process of aggregation by the most numerous population of blood cells - erythrocytes. The aim of the work is to clarify the state of this pathology of disaggregation capacity of blood vessels in relation to erythrocytes in patients with arterial hypertension with abdominal obesity. 55 patients with arterial hypertension of the 1st and 2nd degree with abdominal obesity of the second adult age were examined. The control group is represented by 26 clinically healthy persons of the second adulthood. Biochemical, hematological and statistical methods of investigation were used in the work. In patients under observation, an increase in the amount of cholesterol in erythrocyte membranes, a decrease in the level of total phospholipids in them, and an increase in the processes of lipid peroxidation were found. Increased activity of spontaneous aggregation of erythrocytes was noted in patients. This was accompanied in all patients by a decrease in vascular control over this process. The attenuation of disaggregating vascular control over spontaneous aggregation of erythrocytes should be considered as a consequence of metabolic abnormalities arising in arterial hypertension with abdominal obesity, increased vasospasm and active lipid peroxidation. The found vasopathy in this contingent of patients sharply increased their risk of thrombosis, which can lead to disability and death.

Keywords: arterial hypertension, abdominal obesity, vascular wall, aggregation, erythrocytes.

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INTRODUCTION

In modern society, there is a clear tendency to increase the prevalence and rejuvenate the combination of arterial hypertension (AH) and abdominal obesity [1,2]. The combination of these two pathologies contributes to the frequent development of vascular thrombosis in adults, which leads to widespread disability and mortality [3,4].

A higher incidence of thrombosis in patients with AH and having abdominal obesity is largely due to the formation of vasopathy [5,6]. It is recognized that the blood cells are capable of aggregation. This process strongly determines the activation of hemostasis and thrombosis [7,8,9]. Aggregation of blood cells is inhibited by substances synthesized in the vessel wall and called dezagregantov. The most active of them are prostacyclin and nitric oxide [10,11]. In view of the widespread prevalence of the combination of AH and abdominal obesity, it is of great interest to study the state of vascular control over erythrocyte aggregation in this category of patients.

The aim of the study is to clarify the state of disaggregation capacity of blood vessels in relation to erythrocytes in patients with hypertension with abdominal obesity.

MATERIALS AND METHODS

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

55 patients with AH of 1-2 degrees were examined, risk 4 [12] with abdominal obesity of the second adult age (mean age 51.2 ± 2.7 years). The control group consisted of 26 clinically healthy people of the second adulthood. All the examinees gave written information consent to participate in the study according to the generally accepted procedure [13].

The activity of lipid peroxidation (LPO) in plasma was estimated by the level of thiobarbituric acid (TBA) -active products by the Agath-Med (Russia) and acyl hydroperoxides (AHP) method by the method of [14] .The antioxidant capacity of the liquid part of the blood was determined by the method of [15].

The activity of LPO in erythrocytes was determined by the level of malonicdialdehyde (MDA) in them and the content of AHP in them in washed and resuspended cells [14]. In washed and resuspended erythrocytes, the cholesterol content was determined by the enzymatic colorimetry method using the "Vital Diagnosticum" (Russia) kit and the total phospholipids for their phosphorus content.

The state of the disaggregation effects of blood vessels on erythrocytes was assessed by its weakening in plasma taken after a temporary venous occlusion [16]. Spontaneous aggregation of erythrocytes in plasma intact and after temporary ischemia of the vessel wall was determined under a light microscope in Goryaev's chamber. The number of erythrocyte aggregates, the number of aggregates and erythrocytes not aggregated [17], was found out.

The results were processed by Student's criterion (t). Statistical processing of received information was made with the help of a program package “Statistics for Windows v. 6.0”, “Microsoft Excel”. Differences in data were considered reliable in case of $p<0.05$.

RESULTS AND DISCUSSION

In patients, the activation of LPO in plasma was found - its AHP content exceeded the control by 2.2 times, TBA-active products - 1.4 times, as a result of weakening of the antioxidant activity of plasma by 1.4 times (Table).

In the examined patients, an increased content of cholesterol in the erythrocyte membranes was found with a decrease in total phospholipids in them. This was accompanied by the activation of lipid peroxidation in their erythrocytes due to the weakening of their antioxidant defense (Table).

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In patients marked activation of the process of spontaneous aggregation of erythrocytes was noted (Table). This was confirmed by an increase in their total involvement in aggregates (by 61.8%), an increase in the number of these aggregates (by 44.4%) and a decrease of 58.1% in non-aggregated red blood cells.

The surveyed patients showed a decrease in the disaggregation capacity of blood vessels in relation to erythrocytes (Table). It was found that in the plasma obtained after temporary venous occlusion, the number of erythrocytes in the aggregates exceeded the control by 76.1%, the number of these aggregates was increased by 52.8%, with a decrease in the number of non-aggregated red blood cells by 65.2%.

Table: Registered indicators in the surveyed

Registrated parameters	Patients, n=55, M±m	Control, n=26, M±m
Acylhydro peroxides plasma, D_{233} /1ml	3.19±0.07	1.42±0.09 p<0.01
TBA-compounds, umol / l	5.21±0.11	3.56±0.07 p<0.01
Antioxidant activity plasma, %	22.5±0.15	32.9±0.12 p<0.01
biochemical parameters of erythrocytes		
cholesterol of erythrocytes, umol/10^{12} erythrocytes	1.32±0.009	1.04±0.004 p<0.01
common phospholipids of erythrocytes, umol/10^{12} erythrocytes	0.54±0.007	0.75±0.003 p<0.01
Acylhydro peroxides of erythrocytes, D_{233}/10^{12} erythrocytes	4.61±0.19	3.08±0.10 p<0.01
Malonicdi aldehyde of erythrocytes, nmol/10^{12} erythrocytes	1.63±0.09	1.14±0.05 p<0.01
catalase of erythrocytes, ME/10^{12} erythrocytes	7420.2±11.3	11196.0±22.4 p<0.01
Superoxi dismutase of erythrocytes, ME/10^{12} erythrocytes	1600.1±1.96	1986.0±7.01 p<0.01
aggregation of erythrocytes in intact plasma		
sum of all the erythrocytes in an aggregate	67.8±0.14	41.9±0.10 p<0.01
quantity of aggregates	13.0±0.18	9.0±0.06 p<0.01
quantity of free erythrocytes	151.8±0.95	240.0±0.23 p<0.01
aggregation of erythrocytes in plasma after temporary venous occlusion		
sum of all the erythrocytes in an aggregate	57.4±0.18	32.6±0.14 p<0.01
quantity of aggregates	10.7±0.14	7.0±0.07 p<0.01
quantity of free erythrocytes	184.8±1.16	305.3±0.18 p<0.01

Note: p - reliability of differences in the indices of a group of patients and a control group.

Great importance in the development of rheological disorders and the risk of thrombosis in individuals with AH and abdominal obesity belongs to an increase in erythrocyte aggregation [18, 19]. In the case of a combination of hypertension and abdominal obesity, depression of the antioxidant activity of the

plasma ensues, which increases the activity of LPO in it [20]. This inevitably damages the erythrocyte membranes [21]. The development of these phenomena in combination with the lipid imbalance revealed in red blood cells leads to their hyperaggregation. At the same time, the disaggregating effects of blood vessels on erythrocytes decrease [22,23]. This was observed in the patients observed for the growth of erythrocyte aggregation in plasma after temporary venous occlusion [24]. Apparently, the increase in erythrocyte aggregation in hypertensive patients with abdominal obesity is primarily caused by a weakening of the disaggregating properties of their vessels [25,26] and a decrease in the number of negative proteins on the erythrocyte membranes [27]. Depression of the antioxidant properties of plasma causes increased peroxidation processes in it and as a result oxidative damage to endotheliocytes and globular plasma proteins [28,29]. With the development of a deficiency of vascular dezagregantov, there is an intensification of the connection of erythrocytes with each other and as a result of this the growth of aggregates [30, 31]. In addition, the depression of synthesis in the vessels of prostacyclin and nitric oxide forms an imbalance in the erythrocytes of the activity of adenylatecyclase and phosphodiesterase [32,33]. This lowers the level of cyclic adenosine monophosphate in their cytoplasm and increases Ca^{2+}, which also stimulates erythrocyte aggregation [34,35].

CONCLUSION

In previous studies, a high incidence of thrombosis in patients with arterial hypertension and abdominal obesity was noted. This required a survey of this contingent of patients. In the work it was revealed that in case of arterial hypertension with abdominal obesity the weakening of antioxidant protection of plasma and the increase in it of lipid peroxidation damaging all elements of the vascular wall are noted. With arterial hypertension and abdominal obesity, a decrease in the disaggregating vascular properties was found with respect to spontaneous aggregation of erythrocytes increasing under these conditions. It becomes clear that as a result of this, these patients have a dramatic increase in the risk of vascular thrombosis, which can lead to disability and mortality.

REFERENCES

[1] Kotseva K, Wood D, De Backer G. (2009) Euroaspre Study Group. Cardiovascular prevention quidelines in daily practice: a comparison of Euroaspre I, II, and III surveys in eiqht European countries. Lancet.373 : 929-940.

[2] Kotova OV, ZavalishinaSYu, Makurina ON, KipermanYaV, Savchenko AP, Skoblikova TV, Skripleva EV, Zacepin VI, Skriplev AV, AndreevaVYu. (2017) Impact estimation of long regular exercise on hemostasis and blood rheological features of patients with incipient hypertension.Bali Medical Journal. 6(3): 514-520. doi:10.15562/bmj.v6i3.552

[3] Zamorano J, Edwards J.(2011) Combining antihypertensive and antihyperlipidemic agents - optimizing cardiovascular risk factor management. Integr.Blood Press Control.4 : 55-71.

[4] VatnikovYuA, ZavalishinaSYu, Pliushchikov VG, Kuznetsov VI, Seleznev SB, Kubatbekov TS, Rystsova EO, Parshina VI. (2017) Early-changes diagnostics of erythrocytes microrheological features in the model of dyslipidemia development in rats at the late stages of ontogenesis. Bali Medical Journal. 6(1) : 216-222.doi: 10.15562/bmj.v6i1.483

[5] Gurevich VS. (2013) Correction of dyslipidemia with concomitant arterial hypertension from the perspective of an updated paradigm of cardiovascular risk.Systemic hypertension.3 : 54-59.

[6] Skoryatina IA, ZavalishinaSYu. (2017) Ability to aggregation of basic regular blood elements of patients with hypertension anddyslipidemia receiving non-medication andsimvastatin.Bali Medical Journal. 6(3): 514-520.doi:10.15562/bmj.v6i3.553

[7] ZavalishinaSYu, VatnikovYuA, Kulikov EV, Yagnikov SA, Karamyan AS, Sturov NV, Byakhova VM, Kochneva MV, Petryaeva AV. (2017) Diagnostics of erythrocytes' microrheological features and early abnormalities of rats in the model of experimental hypertension development. Bali Medical Journal. 6(3): 470-475. doi:10.15562/bmj.v6i3.589

[8] VatnikovYuA, ZavalishinaSYu, Kulikov EV, Vilkovysky IF, Nikishov AA, Drukovsky SG, Krotova EA, Khomenets NG, Bolshakova MV.(2017) Correctional abilities of regular muscle activity in relation to erythrocytes' microrheological features of rats with experimentally developed hypertension.Bali Medical Journal. 6(3): 449-456. doi:10.15562/bmj.v6i3.586

[9] Bikbulatova AA. (2018) The Impact of Daily Wearing of Medicinal-Prophylactic Clothes on The Evidence of Clinical Manifestations of Osteochondrosis Of The 2nd Degree and Platelet Activity in Persons Of The

Second Mature Age. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(1) : 677-683.
[10] Folsom AR.(2013) Classical and novel biomarkers for cardiovascular risk prediction in the United States. J Epidemiol.2013; 23: 158-162.
[11] ZavalishinaSYu. (2012) Dynamics of hemostasis system at newborn calves with iron deficiency by use ferroglucin and glicopin. Zootekhniya.7 : 14-16.
[12] Diagnosis and treatment of hypertension. In the book: National Clinical Recommendations. 3rd edition. Moscow: Silicea-Polygraph, 2010: 463-500.
[13] Diagnostics and correction of lipid disorders for the prevention and treatment of atherosclerosis. Russian guidelines (V revision).Cardiovascular Therapy and Prevention. 2012; 4(1) : 31.
[14] ZavalishinaSYu. (2012) Platelet activity in newborn calves with iron deficiency anemia.Veterinariya.2 : 51-52.
[15] Volchegorskiy IA, Dolgushin II, Kolesnikov OL, Tseilikman VE. (2000) Experimental modeling and laboratory evaluation of adaptive reactions of the organism.Chelyabinsk, 167.
[16] ZavalishinaSYu.(2012) Vascular hemostasis at calves in milk-and-vegetable phase of feeding. Zootekhniya.2 : 21.
[17] ZavalishinaSYu, Nagibina EV.(2012) Dynamics of microrheology characteristics of erythrocyte in children 7-8 years with scoliosis with therapeutic physical training and massage // Technologies of Living Systems. 9(4) : 29-34.
[18] Carrizzo A, Puca A, Damato A. (2013) Resveratrol improves vascular function in patients with hypertension and dyslipidemia by modulating NO metabolism. Hypertension.62 : 359-366.
[19] Bikbulatova AA, Pochinok NB. (2017) Professional Skills Competitions for People with Disabilities as a Mechanism for Career Guidance and Promotion of Employment in People with Special Needs.Psikhologicheskayanaukaiobrazovanie. 22(1) : 81-87.
[20] ZavalishinaSYu.(2010) Anticoagulative and fibrinolitic activity of plasma of blood at calves. Veterinariya. 11: 41-43.
[21] Bikbulatova AA, Karplyuk AA, Tarasenko OV.(2017) Model of Activities of the Resource Training Center of the Russian State Social University in Terms of Professional Orientation and Employment of Persons with Disabilities.Psikhologicheskayanaukaiobrazovanie. 22(1): 26-33.
[22] ZavalishinaSYu. (2011) Functional condition of system of a hemostasis at newborn calves.Veterinariya.6 : 42-45.
[23] ZavalishinaSYu.(2012) Activity of a vascular hemostasis at calfs of a dairy food. Russian Agricultural Sciences. 4 : 49-51.
[24] ZavalishinaS.Yu. (2012) Hemostatic activity of a vascular wall at newborn calfs.Russian Agricultural Sciences.1 : 37-39.
[25] ZavalishinaSYu. (2013) State of the system in neonatal calves in hemostasis with iron deficiency. Russian Agricultural Sciences. 3 : 43-46.
[26] ZavalishinaSYu. (2013) Vascular hemostasis in newborn calves with ferrum deficiency treated withferroglucin. Zootekhniya.8 : 24-26.
[27] ZavalishinaSYu.(2014) State regulation-vascular interactions in newborn piglets with iron with ferroglucin and glikopin. Russian Agricultural Sciences.1 : 57-59.
[28] ZavalishinaSYu. (2013) Hemostatic activity of thrombocytes in calves during the phase of milk feeding. Agricultural Biology.4 : 105-109.
[29] ZavalishinaSYu. (2013) Gemostatical activity of vessels piglets vegetable nutrition. Veterinariya.8 : 43-45.
[30] ZavalishinaSYu. (2010) Activity of curtailing of blood plasma in calves of a dairy feed.Veterinariya. 8 : 49-51.
[31] ZavalishinaSYu. (2010) Activity of blood coagulation system at healthy calves at phase of milk-vegetable feeding.Zootekhniya. 9 : 13-14.
[32] Cuspidi C, Sala C, Zanchetti A. (2008) Metabolic syndrome and target organ damage: role of blood pressure. Expert Rev CardiovascTher. 6(5) : 731-743.
[33] Epel ES, Lin J, Wilhelm FH. (2006) Cell aging in relation to stress arousal and cardiovascular disease risk factors.Psychoneuroendocrinology. 31(3) : 277-287.
[34] Koniari I, Mavrilas D, Papadaki H. (2011) Structural and biochemical alterations in rabbit thoracic aorta are associated with the progression of atherosclerosis. Lipids in Health and Disease. 10: 125-134.
[35] ZavalishinaSYu. (2011) Fibrinolysis blood activity at calves in the first year of life.Zootekhniya.2 : 29-31.