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Anti-aggregation Capacity Of Blood Vessels In Relation To Platelets In Patients With Impaired Glucose Tolerance.

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ABSTRACT

As before, there are a large number of patients suffering from impaired glucose tolerance in studies. They have a high incidence of thrombosis, which is associated with the development of vasopathy, the characteristics of which have not yet been adequately studied. The goal is to assess the level of disaggregation properties of blood vessels in relation to platelets in patients with impaired glucose tolerance. We examined 42 patients of the second mature age (mean age 49.6±1.7 years) with impaired glucose tolerance. The control group was composed of 26 clinically healthy people of the same age. All the examined persons gave written informed consent on participation in the research. There were applied biochemical, hematological and statistical methods of investigation. High thromboses' frequency of various localizations at impaired glucose toleranceis closely connected with angiopathy development against their background. Weakening of plasma antioxidant protection with activation of lipids' peroxidation processes in it leading to alteration of vascular wall, is noted in conditions of with impaired glucose tolerance. The persons with impaired glucose tolerance are detected to have evident weakening of disaggregating vascular impacts of vascular wall on strengthening aggregative ability of platelets. In the result of it given patients get sharply increased risk of thromboses of any localization which can lead to invalidism and lethal outcome.

Keywords: platelets, impaired glucose tolerance, vascular wall, antiaggregation.

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INTRODUCTION

It has long been noted that the prevalence of impaired glucose tolerance persists in industrially developed countries [1,2]. The presence of this condition is accompanied by a greater risk of development in these patients, especially in adulthood, the mass of vascular thrombosis leading to widespread disability and mortality [3]. It is noted that the emergence of thrombosis of any localization is always facilitated by vasopathy, which now occurs more often [4]. The formation of vasopathy is manifested by the weakening of vascular control over the processes of aggregation of blood elements, which largely stimulates various mechanisms of hemostasis, often leading to thrombosis [5,6,7]. Against the backdrop of vasopathy, there is also a pronounced weakening of the synthesis in blood vessels of deaggregant substances, the most functionally significant of which are prostacyclin and nitric oxide [8,9]. In view of the prevalence of impaired glucose tolerance, it was of great interest to evaluate the state of vascular control over platelet aggregation in these patients [10].

The goal is to assess the level of disaggregation properties in relation to platelets in patients with impaired glucose tolerance.

MATERIALS AND METHODS

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

We examined 42 patients of the second mature age (mean age 49.6±1.7 years) with impaired glucose tolerance [11]. The control group was composed of 26 clinically healthy people of the same age. All the examined persons gave written informed consent on participation in the research. All those surveyed agreed to participate in the study [12].

Intensity of lipids' peroxidation (LPO) processes in plasma was estimated according to the content of thiobarbituric acid (TBA)-active products by a kit "Agat-Med" and acylhydroperoxides (AHP) [13]. Antioxidant abilities of liquid part of blood were determined according to the level of its antioxidant activity [14].

LPO activity in studied regular blood elements was determined according to the quantity of malon dialdehyde (MDA) in reduction reaction of thiobarbituric acid in washed and resuspended cells and the content of AHP in them [13]. In studied washed and resuspended regular blood elements we estimated the levels of cholesterol by enzymatic colorimetric method with the help of a kit "Vital Diagnostikum" and CPL according to the content of phosphorus in them.

Evidence of vascular wall's control over platelets' aggregation was detected according to its weakening in the test with temporal venous occlusion [15].

Platelet aggregation activity (AP) was assessed using a visual micromethode [16] in plasma obtained without and using venous occlusion using ADP ($0.5x10^{-4}$ M), collagen (1: 2 dilution of the basic suspension), thrombin (0.125ed / ml), ristomycin (0.8 mg / ml), epinephrine (5.0×10^{-6} M) and with combinations of ADP and epinephrine; ADP and collagen; adrenaline and collagen at the same concentrations in a platelet-rich plasma standardized for platelet counts of 200×10^{9} platelets. The value of the index of antiaggregatory activity of the vascular wall (IAAVW) was calculated in the course of dividing the time of development of AP in the plasma after venous occlusion during the time of this process in intact plasma. The severity of disaggregation capacity of blood vessels with respect to intravascular aggregation of platelets was determined using a phase contrast microscope with the registration of the number of small, medium and large aggregates and the degree of platelet involvement in plasma obtained without temporal venous occlusion and in plasma obtained against its background [17,18].

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 $p<0.05$.

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RESULTS AND DISCUSSION

The patients were noted to have evident plasma LPO activation – the content of AHP in it surpassed the control value in 2.1 times, TBA-active products – in 1.4 times, being accompanied by suppression of antioxidant plasma activity in 1.25 times (Table).

The observed patients were noted to have increased CS content in erythrocytes' membranes which was accompanied by the decrease of CPL in them and LPO activation on behalf of weakening of their antioxidant protection (Table).

In patients with impaired glucose tolerance, acceleration of development of AP with inductors and their combinations was found (Table). The most accelerated AP developed with collagen, a little later with ADP, even later with ristomycin, thrombin and adrenaline. The onset of AP with combinations of inductors was even more accelerated. The number of platelet aggregates and the level of involvement of platelets in patients with impaired glucose tolerance exceeded the control figures.

All the patients were noted to have the decrease of vessels' disaggregative impacts on platelets (Table).

Table. Registered indicators in the surveyed

Registrated parameters	**Patients, n=42, M±m**	**Control, n=26, M±m**
acylhydroperoxides plasma, D_{233} /1ml	2.93±0.07	1.42±0.09 p<0.01
TBA-compounds, µmol/l	4.87±0.12	3.56±0.07 p<0,01
antioxidant activity plasma, %	26.2±0.16	32.9±0.12 p<0.01
biochemical parameters of platelets		
cholesterol of platelets, µmol/10^9 platelets	1.04±0.012	0.67±0.005 p<0.01
common phospholipids of platelets, µmol/10^9 platelets	0.37±0.006	0.49±0.004 p<0.01
acylhydroperoxides of platelets, D_{233}/10^9 platelets	3.25±0.07	2.20±0.04 p<0.01
malonic dialdehyde of platelets, nmol/10^9 platelets	1.24±0.19	0.68±0.02 p<0.01
catalase of platelets, ME/10^9 platelets	5750.0±20.54	9790.0±20.10 p<0.01
superoxidismutase of platelets, ME/10^9 platelets	1250.0±8.62	1650.0±3.00 p<0.01
aggregation of platelets in intact plasma		
aggregation with ADP, s	28.5±0.16	41.0±0.12 p<0.01
aggregation with collagen, s	27.6±0.14	33.2±0.10 p<0.01
aggregation with thrombin, s	39.4±0.12	55.3±0.05 p<0.01
aggregation with ristomycin, s	31.4±0.04	45.2±0.06 p<0.01

aggregation with epinephrine, s	78.5±0.17	93.0±0.07 p<0.01
aggregation with ADP and epinephrine, s	23.8±0.19	34.5±0.04 p<0.01
aggregation with ADP and collagen, s	19.6±0.11	26.6±0.05 p<0.01
aggregation with epinephrine and collagen, s	16.7±0.09	29.2±0.12 p<0.01
The number of platelets in the aggregates, %	10.3±0.10	6.5±0.07 p<0.01
Number of little aggregates (in 100 free thrombocytes)	11.4±0.14	3.1±0.03 p<0.01
Number of medium and large aggregates (in 100 free thrombocytes)	1.46±0.06	0.14±0.03 p<0.01
vascular control of platelet aggregation		
IAAVW with ADP	1.31±0.19	1.53±0.16 p<0.01
IAAVW with collagen	1.23±0.20	1.48±0.16 p<0.01
IAAVW with thrombin	1.23±0.14	1.44±0.13 p<0.01
IAAVW with ristomycin	1.29±0.15	1.56±0.11 p<0.01
IAAVW with epinephrine	1.37±0.22	1.62±0.13 p<0.01
IAAVW with ADP and epinephrine	1.32±0.13	1.49±0.12 p<0.01
IAAVW with ADP and collagen	1.31±0.17	1.51±0.10 p<0.01
IAAVW with epinephrine and collagen	1.29±0.12	1.53±0.11 p<0.01
The number of platelets in the aggregates after temporary venous occlusion, %	8.6±0.10	4.5±0.15 p<0.01
Number of little aggregates (in 100 free thrombocytes) after temporary venous occlusion	6.0±0.09	2.1±0.15 p<0.01
Number of medium and large aggregates (in 100 free thrombocytes) after temporary venous occlusion	0.14±0.006	0.02±0.005 p<0.01

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

In patients with impaired glucose tolerance, a decrease in IAAVW with individual inducers was found (for adrenaline 1.32±0.13, for ADP 1.31±0.19, for ristomycin 1.29±0.15, for collagen and thrombin 1.25±0.20 and 1.23±0.14, respectively) and with their combinations (for ADP and adrenaline 1.32±0.13, for ADP and collagen – 1.31±0.17, for adrenaline and collagen - 1.29±0.12). In the blood of patients, taken after a temporary venous occlusion, the number of platelet aggregates of various sizes and the degree of involvement of platelets in them decreased slightly.

Important significance in the development of rheological disturbances and thrombophilia in persons with impaired glucose tolerance belongs to aggregation increase of regular blood elements and especially – platelets [19,20]. At impaired glucose tolerance the depression of plasma antioxidant activity is formed which

provides the increase of LPO activity in it [21,22]. The increase of freely radical processes in liquid part of blood inevitably promotes the damage of platelets' membranes. The development of these manifestations in combination with found in these patients' platelets lipid imbalance leads to their hyperaggregability. The level of disaggregating impacts from the side of vascular wall [23,24] lowers simultaneously with it in respect of platelets.

Reduction IAAVW with inductors and their combinations is caused not only by the enhancement of AP, but also by the weakening of the disaggregation capacity of the vessels [25,26]. Apparently, an important role in this is the activation of LPO in plasma [27,28]. Acceleration of the process of AP with ristomycin in patients is associated with increased synthesis in the walls of the vessels of von Willebrand factor and growth of its content in their plasma [29,30]. A rapid onset in patients with AP in response to combinations of two inducers and the presence of a large number of platelet aggregates in their blood before and after venous occlusion is a consequence of severe depression of the disaggregation mechanisms of their vessels [31, 32].

CONCLUSION

Functional characteristics of platelet hemostasis - an indicator is extremely important for maintaining homeostasis in the body. A serious manifestation of its disorders is the weakening of disaggregation capacity of blood vessels in relation to platelets. This phenomenon is very common in many variants of pathology, including the violation of glucose tolerance. Its wide prevalence dictates the need to assess the disaggregation capacity of blood vessels in relation to platelets in this contingent of patients. It has been established that when there is a violation of glucose tolerance, there is a pronounced weakening of the disaggregation effects of the blood vessels on the thrombocytes. These disorders in this contingent of patients are a serious cause of activation of hemostasis and the development of thromboses of any localization in them [33,34,35].

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, Zavalishina SYu, Makurina ON, Kiperman YaV, Savchenko AP, Skoblikova TV, Skripleva EV, Zacepin VI, Skriplev AV, Andreeva VYu. (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] Bikbulatova AA. (2018) Comparative analysis of rehabilitation efficiency in persons of the second mature age with spinal column osteochondrosis with the help of regular medicinal physical trainings and daily wearing of medicinal prophylactic clothes. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(2) : 997-1007.

[5] Vatnikov YuA, Zavalishina SYu, 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

[6] Skoryatina IA, Zavalishina SYu. (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.v6i3.552

[7] Zavalishina SYu, Vatnikov YuA, 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] Vatnikov YuA, Zavalishina SYu, 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] Diagnosis and treatment of hypertension. In the book: National Clinical Recommendations. 3rd edition. Moscow: Silicea-Polygraph, 2010: 463-500.

[12] 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.

[13] Zavalishina SYu. (2012) Dynamics of hemostasis system at newborn calves with iron deficiency by use ferroglucin and glicopin. Zootekhniya. 7 : 14-16.

[14] Zavalishina SYu. (2012) Platelet activity in newborn calves with iron deficiency anemia. Veterinariya. 2 : 51-52.

[15] Zavalishina SYu.(2012) Vascular hemostasis at calves in milk-and-vegetable phase of feeding. Zootekhniya. 2 : 21.

[16] Zavalishina SYu. (2013) State of the system in neonatal calves in hemostasis with iron deficiency. Russian Agricultural Sciences. 3 : 43-46.

[17] Zavalishina SYu, 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] Vorobyeva NV, Skripleva EV, Makurina ON, Mal GS. (2018) Physiological Reaction of The Ability of Erythrocytes to Aggregate to Cessation of Prolonged Hypodynamia. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(2) : 389-395.

[19] Bikbulatova AA. (2018) Restoration Of Microcirculatory Processes In Persons Of The Second Mature Age With Osteochondrosis Of Lumbar Spine In The Course Of Daily Wearing Of Medicinal Prophylactic Clothes For Half A Year. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(2) : 620-630.

[20] Skripleva EV, Vorobyeva NV, Kiperman YaV, Kotova OV, Zatsepin VI, Ukolova GB. (2018) The Effect Of Metered Exercise On Platelet Activity In Adolescents. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(3) : 1150-1154.

[21] Bikbulatova AA.(2018) The Impact Of Medicinal-Prophylactic Trousers' Daily Wearing On Pregnancy Course In The Third Term Of Women With Habitual Miscarriage Of Fetus. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(3) : 663-671.

[22] Bikbulatova AA. (2018) Formation Of Psychological Comfort In Women With Habitual Miscarriage Of Pregnancy Against The Background Of Their Daily Wearing Of Medicinal Prophylactic Trousers. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018; 9(3) :1417-1427.

[23] Zavalishina SYu.(2012) Activity of a vascular hemostasis at calfs of a dairy food. Russian Agricultural Sciences. 4 : 49-51.

[24] Zavalishina S.Yu. (2012) Hemostatic activity of a vascular wall at newborn calfs. Russian Agricultural Sciences. 1 : 37-39.

[25] Zavalishina SYu. (2013) Vascular hemostasis in newborn calves with ferrum deficiency treated with ferroglucin. Zootekhniya. 8 : 24-26.

[26] Zavalishina SYu.(2014) State regulation-vascular interactions in newborn piglets with iron with ferroglucin and glikopin. Russian Agricultural Sciences. 1 : 57-59.

[27] Zavalishina SYu. (2013) Hemostatic activity of thrombocytes in calves during the phase of milk feeding. Agricultural Biology. 4 : 105-109.

[28] Zavalishina SYu. (2013) Gemostatical activity of vessels piglets vegetable nutrition. Veterinariya. 8 : 43-45.

[29] Zavalishina SYu. (2010) Activity of curtailing of blood plasma in calves of a dairy feed. Veterinariya. 8 : 49-51.

[30] Bikbulatova AA, Karplyuk AA, Parshin GN, Dzhafar-Zade DA, Serebryakov AG. (2018) Technique for Measuring Vocational Interests and Inclinations in High-School Students with Disabilities. Psikhologicheskaya nauka i obrazovanie-psychological science and education. 23(2) : 50-58.doi: 10.17759/pse.2018230206.

[31] Skorjatina IA (2018) Therapeutic Possibilities Of Rosuvastatin In The Medical Complex In Relation To Disaggregation Vascular Control Over Erythrocytes In Persons With

Arterial Hypertension And Dyslipidemia. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(2) : 977-983.

[32] Zavalishina SYu. (2011) Fibrinolysis blood activity at calves in the first year of life. Zootekhniya. 2 : 29-31.

[33] Apanasyuk LA, Soldatov AA. (2017) Socio-Psychological Conditions for Optimizing Intercultural Interaction in the Educational Space of the University. Scientific Notes of Russian State Social University. 16(5-144) : 143-150. doi: 10.17922/2071-5323- 2017-16-5-143-150.

[34] Maloletko AN, Yudina TN.(2017) (Un)Making Europe: Capitalism, Solidarities, Subjectivities. Contemporary problems of social work. 3 (3-11) : 4-5.

[35] Pozdnyakova ML, Soldatov AA. (2017) The Essential and Forms of the Approaches to Control the Documents Execution. 3 (1-9): 39-46. doi: 10.17922/2412-5466-2017-3-1-39-46.