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## Antiaggregatory Characteristics Of Blood Vessels In Relation To Platelets In Patients With Impaired Glucose Tolerance And Abdominal Obesity.

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### ABSTRACT

The prevalence of a combination of abdominal obesity and impaired glucose tolerance is noted throughout the world. For this category of patients, there is a high incidence of thrombosis, largely due to the presence of vasopathy, the characteristics of which have not yet been fully investigated. The goal is to find out the level of disaggregation capacity of blood vessels in relation to platelets in patients with abdominal obesity with impaired glucose tolerance. We examined 39 patients of the second mature age (mean age  $50.1 \pm 1.8$  years) with impaired glucose tolerance and abdominal obesity. 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 abdominal obesity with impaired glucose tolerance is 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 abdominal obesity combination with impaired glucose tolerance. The persons with abdominal obesity and 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, abdominal obesity, impaired glucose tolerance, vascular wall, antiaggregation.

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## INTRODUCTION

It has long been noted that in civilized countries, despite the efforts of medicine, there is a high prevalence of abdominal obesity, combined with a violation of glucose tolerance [1,2]. The presence of this combination in the patient provides him with a high risk of developing vascular thrombosis, which can cause disability and premature death [3]. It is recognized that the basis for the onset of thrombosis of any localization often is vasopathy, which occurs in this category of patients [4]. The formation of vasopathy is accompanied by the weakening of vascular control over the processes of aggregation of blood cells, which can strongly stimulate the mechanisms of hemostasis, promoting thrombosis [5,6,7]. The development of vasopathy is largely due to the pronounced weakening of synthesis in the walls of the vessels of deaggregant substances, the most functionally significant of which is considered to be prostacyclin and nitric oxide [8,9]. In view of the prevalence of abdominal obesity and the violation of glucose tolerance, it is especially important to assess the status of vascular control over platelet aggregation in this category of patients [10]. The goal is to find out the level of disaggregation capacity of blood vessels in relation to platelets in patients with abdominal obesity 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 39 patients of the second mature age (mean age  $50.1 \pm 1.8$  years) with impaired glucose tolerance and abdominal obesity [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].

The severity of platelet aggregation (AP) was assessed using a visual micromethode [16] in plasma obtained without venous occlusion and against its background using ADP ( $0.5 \times 10^{-4}$  M), collagen (1: 2 dilution of the base suspension), thrombin 0.125 units / ml), ristomycin (0.8 mg / ml), epinephrine ( $5.0 \times 10^{-6}$  M) and with combinations of ADP and epinephrine; ADP and collagen; adrenaline and collagen at the same concentrations. The study was conducted in a platelet-rich plasma standardized for the number of platelets  $200 \times 10^9$  platelets. The value of the index of antiaggregatory activity of the vascular wall (IAASC) 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 level 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 involvement of platelets 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  $p < 0.05$ .

**RESULTS AND DISCUSSION**

The patients were noted to have evident plasma LPO activation – the content of AHP in it surpassed the control value in 2.2 times, TBA-active products – in 1.4 times, being accompanied by suppression of antioxidant plasma activity in 1.32 times (Table).

**Table. Registered indicators in the surveyed**

<b>Registrated parameters</b>	<b>Patients, n=39, M±m</b>	<b>Control, n=26, M±m</b>
acylhydroperoxides plasma, D <sub>233</sub> /1ml	3.10±0.06	1.42±0.09 p<0.01
TBA-compounds, mcmol/l	5.08±0.12	3.56±0.07 p<0,01
antioxidant activity plasma, %	24.8±0.17	32.9±0.12 p<0.01
<b>biochemical parameters of platelets</b>		
cholesterol of platelets, mkmol/10 <sup>9</sup> platelets	1.01±0.016	0,67±0,005 p<0,01
common phospholipids of platelets, mkmol/10 <sup>9</sup> platelets	0.39±0.005	0,49±0,004 p<0,01
acylhydroperoxides of platelets, D <sub>233</sub> /10 <sup>9</sup> platelets	3.20±0.09	2,20±0,04 p<0,01
malonic dialdehyde of platelets, nmol/10 <sup>9</sup> platelets	1.21±0.10	0,68±0,02 p<0,01
catalase of platelets, ME/10 <sup>9</sup> platelets	5600.0±26.18	9790,0±20,10 p<0,01
superoxidismutase of platelets, ME/10 <sup>9</sup> platelets	1200.0±8.73	1650,0±3,00 p<0,01
<b>aggregation of platelets in intact plasma</b>		
aggregation with ADP, s	27.4±0.14	41,0±0,12 p<0,01
aggregation with collagen, s	28.2±0.15	33,2±0,10 p<0,01
aggregation with thrombin, s	39.4±0.08	55,3±0,05 p<0,01
aggregation with ristomycin, s	31.0±0.05	45,2±0,06 p<0,01
aggregation with epinephrine, s	75.4±0.12	93,0±0,07 p<0,01
aggregation with ADP and epinephrine, s	23.6±0.12	34,5±0,04 p<0,01
aggregation with ADP and collagen, s	19.5±0.09	26,6±0,05 p<0,01
aggregation with epinephrine and collagen, s	15.8±0.16	29,2±0,12 p<0,01
The number of platelets in the aggregates, %	10.1±0.15	6,5±0,07 p<0,01
Number of little aggregates (in 100 free thrombocytes)	12.3±0.17	3,1±0,03 p<0,01
Number of medium and large aggregates (in 100 free thrombocytes)	1.39±0.09	0,14±0,03 p<0,01

vascular control of platelet aggregation		
IAAVW with ADP	1.30±0.14	1,53±0,16 p<0,01
IAAVW with collagen	1.23±0.25	1,48±0,16 p<0,01
IAAVW with thrombin, s	1.25±0.13	1,44±0,13 p<0,01
IAAVW with ristomycin, s	1.28±0.16	1,56±0,11 p<0,01
IAAVW with epinephrine	1.37±0.28	1,62±0,13 p<0,01
IAAVW with ADP and epinephrine	1.29±0.14	1,49±0,12 p<0,01
IAAVW with ADP and collagen	1.28±0.19	1,51±0,10 p<0,01
IAAVW with epinephrine and collagen	1.23±0.22	1,53±0,11 p<0,01
The number of platelets in the aggregates after temporary venous occlusion, %	9.7±0.14	4,5±0,15 p<0,01
Number of little aggregates (in 100 free thrombocytes) after temporary venous occlusion	6.5±0.17	2,1±0,15 p<0,01
Number of medium and large aggregates (in 100 free thrombocytes) after temporary venous occlusion	0.14±0.008	0,02±0,005 p<0,01

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

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 abdominal obesity and impaired glucose tolerance, a pronounced 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 occurred even more rapidly. The number of platelet aggregates and the level of platelet involvement in patients with abdominal obesity and impaired glucose tolerance were significantly higher than the control numbers.

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

In patients with abdominal obesity and impaired glucose tolerance, a decrease in IAAWW was found with individual inducers (for adrenaline 1.37±0.28, for ADP 1.30±0.14, for ristomycin 1.28±0.16, for collagen and thrombin 1.23±0.25 and 1.25±0.13, respectively) and with their combinations (for ADP and adrenaline 1.29±0.14, for ADP and collagen 1.28±0.19, for adrenaline and collagen – 1.23±0.22). In the blood of patients, taken against the background of temporary venous occlusion, the number of thrombocyte aggregates of various sizes and the degree of involvement of platelets in them decreased to a small extent.

Important significance in the development of rheological disturbances and thrombophilia in persons with abdominal obesity and impaired glucose tolerance belongs to aggregation increase of regular blood elements and especially – platelets [19,20]. At combination of abdominal obesity and 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.

The decrease in IAAVW with inductors and their combinations is caused not only by the increase in AP, but also by the weakening of the disaggregation capacity of the vessels [25,26]. A very important role in this is the activation of LPO in plasma [27,28]. Acceleration of the course of the process of AT with ristomycin in patients is associated with increased synthesis in the walls of the vessels of von Willebrand factor and an increase in its content in their plasma [29,30]. Early development in patients with AT 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

The disaggregation properties of the vessels are extremely important for maintaining homeostasis in the body. An important element of its violation is considered to be their weakening in respect of platelets. This condition is now very common in patients with any metabolic pathology, including with abdominal obesity and impaired glucose tolerance. The high incidence of this pathology dictates the need for a detailed assessment of the disaggregation capacity of blood vessels in relation to platelets in this patient population. It was found that with abdominal obesity with violation of glucose tolerance there is a pronounced weakening of the disaggregation capacity of blood vessels in relation to platelets. These manifestations of vasopathy in this contingent of patients are a serious cause of hemostasis activation and formation of a risk of thrombosis development in any localization [33,34,35].

### REFERENCES

- [1] Kotseva K, Wood D, De Backer G. (2009) Euroaspre Study Group. Cardiovascular prevention guidelines in daily practice: a comparison of Euroaspre I, II, and III surveys in eight 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 A.A. 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*. 2018; 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, Vilkovskiy 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 ferroglicin 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 A.A. 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*. 2018; 9(2) : 620-630.
- [20] 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.
- [21] 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*. 9(3) :1417-1427.
- [22] Zavalishina SYu. (2011) Functional condition of system of a hemostasis at newborn calves. *Veterinariya*. 6 : 42-45.
- [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 ferroglicin. *Zootekhniya*. 8 : 24-26.
- [26] Zavalishina SYu.(2014) State regulation-vascular interactions in newborn piglets with iron with ferroglicin 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] 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.
- [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.