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## Intensity Of Spontaneous Aggregation Of Erythrocytes In Patients With Impaired Glucose Tolerance And Abdominal Obesity.

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### ABSTRACT

The prevalence of thrombosis in patients with abdominal obesity with impaired glucose tolerance is caused by the presence of very many of them hyperaggregation of blood cells. Because of the high incidence in the world of the combination of abdominal obesity and impaired glucose tolerance, it is of great practical importance to evaluate the state of these patients in the aggregation of the most numerous red blood cells, erythrocytes. The aim of the work is to evaluate the aggregation capacity of red blood cells in patients with abdominal obesity and impaired glucose tolerance. 39 patients with abdominal obesity with impaired glucose tolerance of the second adulthood were examined. Control is represented by 26 healthy people of the same age. During the study, biochemical, hematological and statistical methods of investigation were used. In patients, activation of lipid peroxidation processes, excess cholesterol and reduction of total phospholipids in erythrocyte membranes were revealed. Patients also showed a high intensity of spontaneous aggregation of erythrocytes. The revealed enhancement of the aggregating properties of erythrocytes is a consequence of metabolic disturbances arising in abdominal obesity with impaired glucose tolerance and active lipid peroxidation. The hyperaggregation of erythrocytes, characteristic of the patients surveyed, sharply increases the risk of thrombosis threatening disability and death.

**Keywords:** abdominal obesity, violation of glucose tolerance, aggregation, erythrocytes, thrombophilia.

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## INTRODUCTION

In recent years, in many developed countries, the quality of life of the population is increasing, which inevitably leads to an increase in prevalence and rejuvenation of a combination of abdominal obesity and impaired glucose tolerance [1,2]. The combination of these two metabolic disturbances can often be complicated by vascular thrombosis, threatening disability and death [3,4].

The high incidence of thrombosis in patients with abdominal obesity and impaired glucose tolerance is largely due to the intrinsic hyperaggregation of blood cells for them [5,6]. This phenomenon greatly enhances the mechanisms of hemostasis and forms the risk of thrombosis [7,8,9]. It is known that the increase in the aggregation of blood cells occurs with a decrease in their sensitivity to vascular disaggregants-prostacyclin and nitric oxide [10,11]. Given the wide prevalence of a combination of abdominal obesity and impaired glucose tolerance, studies of the specificity of erythrocyte aggregation in this category of patients become particularly relevant.

The aim of the study is to evaluate the aggregation capacity of red blood cells in patients with abdominal obesity and impaired glucose tolerance.

## MATERIAL AND METHODS

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

39 patients with impaired glucose tolerance and abdominal obesity [12] of the second adult age (mean age  $50.1 \pm 1.8$  years) were examined. Control consisted of 26 healthy volunteers of the second adulthood. All surveyed gave written information consent to participate in the study according to generally accepted rules [13].

The activity of lipid peroxidation in plasma was evaluated by the level of thiobarbituric acid-active products by the Agat-Med (Russia) and acyl hydroperoxides by the method of [14]. The level of antioxidant protection of blood plasma was also evaluated [15].

The state of lipid peroxidation in erythrocytes was determined by the level of malonic dialdehyde and acyl hydroperoxides in them after washing and resuspension of erythrocytes [14]. Also in washed and resuspended erythrocytes, the content of cholesterol was determined by the enzymatic colorimetry method using the "Vital Diagnosticum" (Russia) kit and the level of total phospholipids in the content of phosphorus in the erythrocytes.

Spontaneous aggregation of erythrocytes was determined with the help of a light microscope in Goryaev's chamber [16]. The number of erythrocyte aggregates, the number of erythrocytes that have been aggregated and not aggregated [17] were recorded.

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

## RESEARCH RESULTS AND DISCUSSION

The patients involved in the study found activation of lipid peroxidation in plasma - the amount of acyl hydroperoxides in it exceeded the control by 2.2 times, thiobarbituric acid-active products - by 1.4 times. This was due to the weakening of the antioxidant protection of the plasma by 32.7% (Table).

In the observed patients, an excess of the cholesterol content in the erythrocyte membranes was found and the total phospholipids in them decreased. This was accompanied by activation of lipid peroxidation in their erythrocytes by weakening enzymes of antioxidant protection of red blood cells (Table).

In the examined patients activation of the process of spontaneous aggregation of erythrocytes was found (Table). This was indicated by an increase in their total involvement in aggregates (by 53.5%), an increase in the number of these aggregates (by 38.9%) and a 40.9% decrease in red blood cells that did not join the aggregation.

**Table. Hematologic parameters in the examined**

Registrated parameters	Patients, n=39, M±m	Control, n=26, M±m
acylhydroperoxides plasma, D <sub>233</sub> /1ml	3.10±0.06	1.42±0.09 p<0.01
TBA-compounds, µmol/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
biochemical parameters of erythrocytes		
cholesterol of erythrocytes, µmol/10 <sup>12</sup> erythrocytes	1.30±0.012	1.04±0.004 p<0.01
common phospholipids of erythrocytes, µmol/10 <sup>12</sup> erythrocytes	0.58±0.010	0.75±0.003 p<0.01
acylhydroperoxides of erythrocytes, D <sub>233</sub> /10 <sup>12</sup> erythrocytes	4.50±0.14	3.08±0.10 p<0.01
malonic dialdehyde of erythrocytes, nmol/10 <sup>12</sup> erythrocytes	1.64±0.13	1.14±0.05 p<0.01
catalase of erythrocytes, ME/10 <sup>12</sup> erythrocytes	7540.0±16.2	11196.0±22.4 p<0.01
superoxidismutase of erythrocytes, ME/10 <sup>12</sup> erythrocytes	1690.1±3.16	1986.0±7.01 p<0.01
aggregation of erythrocytes		
sum of all the erythrocytes in an aggregate	64.3±0.14	41.9±0.10 p<0.01
quantity of aggregates	12.5±0.18	9.0±0.06 p<0.01
quantity of free erythrocytes	170.3±0.74	240.0±0.23 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 formation of the risk of thrombosis in individuals with abdominal obesity and impaired glucose tolerance has an increase in erythrocyte aggregation [18, 19]. With the combination of abdominal obesity and impaired glucose tolerance, depression of the antioxidant activity of plasma occurs, which causes the growth of LPO activity in it [20]. This inevitably damages the structure of red blood cells [21]. The development of these disorders in combination with the lipid imbalance that occurs in the erythrocytes of the examined patients ensures their hyperaggregation. At the same time, the possibility of disaggregation weakens in erythrocytes [22,23]. This was diagnosed in the examined patients for increased erythrocyte aggregation [24]. Apparently, the increase in erythrocyte aggregation in patients with abdominal obesity and impaired glucose tolerance is primarily caused by an increase in the density of receptors on erythrocytes [25,26] and a decrease in the density of negative proteins on the erythrocyte surface [27]. Depression of the antioxidant properties of plasma entails increased lipid peroxidation processes in it, as well as damage to erythrocytes and globular plasma proteins [28,29]. With a low sensitivity of erythrocytes to vascular disaggregants, there is inevitably an increase in the connection of erythrocytes in aggregates and their number in the blood increases [30, 31]. The resulting disorder creates an imbalance in the erythrocytes of the activity of adenylate cyclase and phosphodiesterase

[32,33]. This leads to a decrease in the level of cyclic adenosine monophosphate in their cytoplasm and increases  $Ca^{2+}$ , which is an intracellular basis for enhancing erythrocyte aggregation [34, 35].

### CONCLUSION

In patients with abdominal obesity and impaired glucose tolerance, thromboses of blood vessels are common. This required additional testing of this contingent of patients. It has been revealed that abdominal obesity with violation of glucose tolerance indicates weakening of antioxidant protection of the plasma and intensification of lipid peroxidation damaging the membranes of blood cells in it. In patients with abdominal obesity and impaired glucose tolerance, a decrease in the ability of red blood cells to disaggregate was found. The resulting risk of vascular thrombosis can lead to vascular occlusion, resulting in disability and early death [36,37,38].

### 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 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
- [5] 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.
- [6] Skoryatina IA, Zavalishina SYu. (2017) Ability to aggregation of basic regular blood elements of patients with hypertension and dyslipidemia receiving non-medication and simvastatin. *Bali Medical Journal*. 6(3): 514-520. doi:10.15562/bmj.v6i3.553
- [7] Glagoleva TI, Zavalishina SYu, Mal GS, Makurina ON, Skorjatina IA. (2018) Physiological Features Of Hemo-coagulation In Sows During Sucking. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(4) : 29-33.
- [8] Zavalishina SYu, Makurina ON, Vorobyeva NV, Mal GS, Glagoleva TI. (2018) Physiological Features Of Surface Properties Of The Erythrocyte Membrane In Newborn Piglets. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(4) : 34-38.
- [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] 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.
- [11] Skripleva EV, Vorobyeva NV, Kiperman YaV, Kotova OV, Zatselin 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.
- [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] 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.
- [15] Volchegorskiy IA, Dolgushin II, Kolesnikov OL, Tseilikman VE. (2000) Experimental modeling and laboratory evaluation of adaptive reactions of the organism. *Chelyabinsk*, 167.
- [16] 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.
- [17] Bikbulatova AA, Karplyuk AV. (2018) Professional And Labor Orientation Of Persons With Disabilities In The Resource Educational And Methodological Center Of The Russian State Social University. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(4) : 1648-1655.
- [18] 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*. 2018; 9(2) : 620-630.
- [19] 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*. 2018; 9(2) : 997-1007.
- [20] Bikbulatova AA. (2018) Bioregulatory Effects Of The Daily Wearing Of Medical And Preventive Pants On The Body Of Pregnant Women Suffering From Habitual Miscarriages Of The Fetus. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(4) : 889-896.
- [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. *Psikhologicheskaya nauka i obrazovanie*. 22(1): 26-33.
- [22] Bikbulatova AA, Andreeva EG. (2018) Restoration Of The Profile Of Bioregulators Of Blood Plasma In People Of Second Adulthood With Osteochondrosis Of The Spine Against The Background Of Daily Wearing Of Medical And Preventive Clothing. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(4) : 413-419.
- [23] 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.
- [24] Vorobyeva NV, Mal GS, Skripleva EV, Skriplev AV, Skoblikova TV. (2018) The Combined Impact Of Amlodipin And Regular Physical Exercises On Platelet And Inflammatory Markers In Patients With Arterial Hypertension. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(4) : 1186-1192.
- [25] Bikbulatova AA. (2018) Peculiarities of abnormalities of locomotor apparatus of children at preschool age with scoliosis of I-II degree living in Central Russia. *Bali Medical Journal*. 7(3): 693-697. DOI:10.15562/bmj.v7i3.738
- [26] Bikbulatova AA, Andreeva EG. (2018) Achievement of psychological comfort in 5-6-Year-Old children with scoliosis against the background of daily medicinal-prophylactic clothes' wearing for half a year. *Bali Medical Journal*. 7(3): 706-711. DOI:10.15562/bmj.v7i3.947
- [27] Vatnikov YuA, Zavalishina SYu, Seleznev SB, Kulikov EV, Notina EA, Rystsova EO, Petrov AK, Kochneva MV, Glagoleva TI. (2018) Orderly muscle activity in elimination of erythrocytes microrheological abnormalities in rats with experimentally developed obesity. *Bali Medical Journal*. 7(3): 698-705. DOI:10.15562/bmj.v7i3.739
- [28] Zavalishina SYu. (2013) Hemostatic activity of thrombocytes in calves during the phase of milk feeding. *Agricultural Biology*. 4 : 105-109.
- [29] Zavalishina SYu. (2013) Gemostatical activity of vessels piglets vegetable nutrition. *Veterinariya*. 8 : 43-45.
- [30] Zavalishina SYu. (2010) Activity of curtailing of blood plasma in calves of a dairy feed. *Veterinariya*. 8 : 49-51.
- [31] Zavalishina SYu. (2010) Activity of blood coagulation system at healthy calves at phase of milk-vegetable feeding. *Zootekhnika*. 9 : 13-14.

- [32] Cuspidi C, Sala C, Zanchetti A. (2008) Metabolic syndrome and target organ damage: role of blood pressure. *Expert Rev Cardiovasc Ther.* 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] 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.
- [35] 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.