

Research Journal of Pharmaceutical, Biological and Chemical Sciences

The Level Of Erythrocyte Aggregation In Patients With Type 2 Diabetes Mellitus.

Medvedev IN*.

Russian State Social University, st. V. Pika, 4, Moscow, Russia, 129226.

ABSTRACT

With long-term type 2 diabetes mellitus, vascular thrombosis can often occur. They are often based on hyperaggregation of blood cells. The widespread prevalence in developed countries of type 2 diabetes makes this problem very urgent. The aim of the work is to evaluate the aggregation activity of erythrocytes in patients with type 2 diabetes mellitus. 36 patients with type 2 diabetes mellitus of the second adulthood were examined. The control consisted of 26 healthy persons of the second adult age. Biochemical, hematological and statistical methods are used in the work. All the patients noted excess cholesterol in the erythrocyte membranes, a decrease in the level of phospholipids in them when lipid peroxidation was activated in them. They also showed a pronounced activation of spontaneous aggregation of erythrocytes. It was accompanied in these patients by the weakening of the disaggregating properties of erythrocytes. The changes found in the examined category of patients should be considered as a consequence of metabolic disorders, dysfunction of blood cells and activation of lipid peroxidation.

Keywords: pathology, diabetes, thrombophlelia, aggregation, erythrocytes.

**Corresponding author*

INTRODUCTION

Regular preventive examinations and examinations with the subsequent appointment of recreational activities in industrially developed countries have so far failed to reduce the prevalence of type 2 diabetes among the population [1,2]. It is noted that in patients with this pathology, thromboses of the vessels are often recorded, capable of leading to disability and early death [3,4].

The prevalence of thrombosis in patients with type 2 diabetes mellitus is largely associated with the formation of hyperaggregation of blood cells in them [5,6]. The emerging situation can strongly activate the mechanisms of hemostasis and cause thrombosis [7,8,9]. At the heart of these processes is the weakening of the ability of blood cells to disaggregate, especially to prostacyclin and nitrogen oxide [10,11]. Given the high risk of thrombosis in type 2 diabetes, it seemed important to assess the level of erythrocyte aggregation in this category of patients.

The aim of the study is to evaluate the aggregation activity of erythrocytes in patients with type 2 diabetes mellitus.

MATERIAL AND METHODS

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

36 patients with type 2 diabetes [12], the second adult age (mean age 47.4 ± 2.1 years) were examined. Control consisted of 26 healthy people of the second adulthood. The examinees gave written information consent to participate in the conducted research according to the generally accepted procedure [13].

The level of lipid peroxidation (LPO) in plasma was taken into account by the level of thiobarbituric acid (TBA) -active products with the help of the Agat-Med (Russia) and acyl hydroperoxides (AGP) kit. [14] The state of antioxidant plasma protection was estimated by the method of [15].

The expression of LPO in erythrocytes was determined by the level of malonic dialdehyde (MDA) in them and the content of AHP in them after washing and resuspension [14]. In addition, in washed and resuspended red blood cells, the cholesterol content was assessed by the enzymatic colorimetric method, using the Vital Diagnosticum kit (Russia) and taking into account the total phospholipids for phosphorus content in erythrocytes.

Activity of 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 aggregated and non-aggregated erythrocytes were taken into account [17].

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", "Microsoft Excel". Differences in data were considered reliable in case of $p < 0.05$.

RESEARCH RESULTS AND DISCUSSION

In the patients under observation, a pronounced activation of LPO in the plasma was found - the AHP content in it was 2.2 times higher than the control level. The quantity of TBA-active products is 1.5 times. This occurred as a result of the weakening of the antioxidant protection of the plasma by a factor of 1.4 (Table).

In the examined patients, an excess of the amount of cholesterol in the erythrocyte membranes was found, while the total phospholipids in them were reduced. At the same time, activation of LPO due to depression of their antioxidant protection was found in erythrocytes (Table).

The observed patients noted a strong activation of spontaneous erythrocyte aggregation (Table). This was indicated by an increase in their total inclusion in aggregates (by 46.3%), an increase in the number of these aggregates (by 44.4%) and a 34.8% decrease in non-aggregated red blood cells.

Table. Registered indicators in the surveyed

Registrated parameters	Patients, n=36, M±m	Control, n=26, M±m
acylhydroperoxides plasma, D ₂₃₃ /1ml	3.10±0.10	1.42±0.09 p<0.01
TBA-compounds, µmol/l	5.34±0.14	3.56±0.07 p<0.01
antioxidant activity plasma, %	23.8±0.16	32.9±0.12 p<0.01
biochemical parameters of erythrocytes		
cholesterol of erythrocytes, µmol/10 ¹² erythrocytes	1.29±0.012	1.04±0.004 p<0.01
common phospholipids of erythrocytes, µmol/10 ¹² erythrocytes	0.62±0.004	0.75±0.003 p<0.01
acylhydroperoxides of erythrocytes, D ₂₃₃ /10 ¹² erythrocytes	4.50±0.23	3.08±0.10 p<0.01
malonic dialdehyde of erythrocytes, nmol/10 ¹² erythrocytes	1.61±0.16	1.14±0.05 p<0.01
catalase of erythrocytes, ME/10 ¹² erythrocytes	8500.0±12.0	11196.0±22.4 p<0.01
superoxidismutase of erythrocytes, ME/10 ¹² erythrocytes	1550.0±3.06	1986.0±7.01 p<0.01
aggregation of erythrocytes		
sum of all the erythrocytes in an aggregate	61.3±0.15	41.9±0.10 p<0.01
quantity of aggregates	13.0±0.20	9.0±0.06 p<0.01
quantity of free erythrocytes	178.0±0.75	240.0±0.23 p<0.01

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

The growth of erythrocyte aggregation plays a significant role in maintaining a high risk of thrombosis in individuals with type 2 diabetes [18, 19]. With type 2 diabetes mellitus, depression of the antioxidant protection of plasma develops, which ensures the growth of LPO processes in it [20]. This inevitably worsens the structure and function of erythrocyte membranes [21]. All this leads to hyperaggregation of erythrocytes. The oncoming weakening of the disaggregating properties of erythrocytes aggravates the situation [22,23]. This was observed in the observed patients for the growth of erythrocyte aggregation [24]. It became clear that the growth of erythrocyte aggregation in patients with type 2 diabetes was caused by the weakening of their sensitivity to the disaggregating effects of blood vessels [25,26] and a decrease in the level of negatively charged proteins on erythrocytes [27]. Weakening of antioxidant plasma parameters promotes intensification of lipid peroxidation processes in it, and, consequently, marked oxidative damage of endotheliocytes and plasma proteins [28,29]. In conditions of deficiency of vascular dezagregantov there is an intensification of erythrocyte communication among themselves in aggregates and an increase in their number [30,31]. At the same time, a decrease in the level in the blood of prostacyclin and nitric oxide forms a functional imbalance in the erythrocytes of adenylate cyclase and phosphodiesterase [32,33]. As a result, the amount of cyclic adenosine monophosphate decreases and the level of Ca²⁺ increases, which additionally stimulates the expression of erythrocyte aggregation [34,35].

CONCLUSION

For patients with type 2 diabetes mellitus, a high incidence of thrombosis is characteristic. This required additional examination of this contingent of patients. In the work it was revealed that in the case of type 2 diabetes mellitus, the antioxidant activity of the plasma decreases and the lipid peroxidation is increased in it. This adversely affects the cells of their blood. In addition, this cohort of patients found an increase in spontaneous aggregation of erythrocytes. The expressed hyperaggregation of erythrocytes in this contingent of patients is the basis of high risk of thrombosis of any localization threatening their health [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] 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.
- [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] Folsom AR.(2013) Classical and novel biomarkers for cardiovascular risk prediction in the United States. *J Epidemiol*. 2013; 23: 158-162.
- [11] 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.
- [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) 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.
- [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, 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.
- [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] 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 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) 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.
- [21] 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.
- [22] Zavalishina SYu. (2011) Functional condition of system of a hemostasis at newborn calves. Veterinariya. 6 : 42-45.
- [23] Zavalishina SYu. (2013) Gemostatical activity of vessels piglets vegetable nutrition. Veterinariya. 8 : 43-45.
- [24] Zavalishina SYu. (2010) Activity of curtailing of blood plasma in calves of a dairy feed. Veterinariya. 8 : 49-51.
- [25] Zavalishina SYu. (2010) Activity of blood coagulation system at healthy calves at phase of milk-vegetable feeding. Zootekhnika. 9 : 13-14.
- [26] 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.
- [27] 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.
- [28] 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.
- [29] 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.
- [30] 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
- [31] 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
- [32] 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.
- [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] 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
- [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.