

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Severity Of Depression Of Vascular Disaggregation Effects On Neutrophils In Patients With Type 2 Diabetes Mellitus.

Medvedev IN*.

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

ABSTRACT

The continuous increase in the level of pathological burden in the population of industrially developed countries is accompanied by an increase in the prevalence of type 2 diabetes mellitus in persons of working age. The great danger of this disease is associated with the high incidence of thrombosis in her. The leading cause of this is considered a violation of the vascular functions, especially with regard to their disaggregation capabilities with respect to the blood elements. The goal is to assess the features of the disaggregation properties of blood vessels in relation to neutrophil aggregation in patients with arterial hypertension with type 2 diabetes mellitus. We examined 36 patients of the second mature age (mean age 47.4 ± 2.1 years) with type 2 diabetes mellitus. 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 type 2 diabetes mellitus 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 type 2 diabetes mellitus. The persons with type 2 diabetes mellitus are detected to have evident weakening of disaggregating vascular impacts of vascular wall on strengthening aggregative ability of neutrophils. 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: neutrophils, vasopathy, type 2 diabetes mellitus, vascular wall, antiaggregation.

**Corresponding author*

INTRODUCTION

The wide prevalence of type 2 diabetes mellitus among people in many countries of the world [1,2] is an important cause of the high incidence of early vascular complications leading to disability and early death [3]. It is proved that high frequency of thrombosis in type 2 diabetes mellitus is associated with pronounced weakening of vascular disaggregation control over all blood cells [4,5]. As a result, the activation of hemostasis, leading to the development of thrombosis, inevitably occurs [6,7,8]. An important starting factor in this process is a decrease in blood levels of patients with prostacyclin and nitric oxide levels [9,10]. Given the high prevalence of type 2 diabetes mellitus and the high significance of its presence for microcirculation and neutrophil aggregation, it was considered important to clarify the features of vascular control over neutrophilic leukocyte aggregation in this patient population [11]. The goal is to evaluate the features of the disaggregation properties of blood vessels in relation to neutrophil aggregation in patients with type 2 diabetes mellitus.

MATERIALS AND METHODS

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

We examined 36 patients of the second mature age (mean age 47.4 ± 2.1 years) with type 2 diabetes mellitus [12]. 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 participants in the study gave their written consent to participate in it [13].

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) [14]. Antioxidant abilities of liquid part of blood were determined according to the level of its antioxidant activity [15].

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 [14]. 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 neutrophils' aggregation was detected according to its weakening in the test with temporal venous occlusion [16].

The level of disaggregation effects of blood vessels on neutrophils was assessed in plasma taken after temporary venous occlusion and without it. Aggregation of neutrophils was recorded on a photoelectrocolorimeter. Inductors were used lectin wheat germ at a dose of $32 \mu\text{g/ml}$, concanavalin A - $32 \mu\text{g/ml}$ and phytohemagglutinin - $32 \mu\text{g/ml}$.

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 1.5 times, being accompanied by suppression of antioxidant plasma activity in 1.4 times (Table).

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

In the observed patients, the process of neutrophil aggregation with applied inducers occurred earlier than in the control (with lectin by 48.1%, with concanavalin A by 33.8%, with phytohemagglutinin by 31.7%) (Table).

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

Table: Registered indicators in the surveyed

Registered 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, umol/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 neutrophils		
cholesterol of neutrophils, umol/10 ⁹ neutrophils	0.83±0.008	0.62±0.004 p<0.01
common phospholipids of neutrophils, umol/10 ⁹ neutrophils	0.35±0.014	0.51±0.003 p<0.01
acylhydroperoxides of neutrophils, D ₂₃₃ /10 ⁹ neutrophils	3.52±0.02	2.36±0.05 p<0.01
malonic dialdehyde of neutrophils, nmol/10 ⁹ neutrophils	1.46±0.08	0.73±0.03 p<0.01
catalase of neutrophils, ME/10 ⁹ neutrophils	6100.0±18.23	9950.0±19.77 p<0.01
superoxidismutase of neutrophils, ME/10 ⁹ neutrophils	1220.0±5.21	1780.0±4.21 p<0.01
aggregation of neutrophils in intact plasma		
Aggregation with lectin, %	23.1±0.14	15.6±0.07 p<0.01
Aggregation with concanavalin A, %	19.8±0.12	14.8±0.04 p<0.01
Aggregation with phytohemagglutinin, %	40.3±0.17	30.6±0.09 p<0.01
vascular control of aggregation neutrophils		
Aggregation with lectin after temporary venous occlusion, %	20.6±0.20	11.8±0.06 p<0.01
Aggregation with concanavalin A after temporary venous occlusion, %	19.5±0.08	11.0±0.07 p<0.01
Aggregation with phytohemagglutinin after temporary venous occlusion, %	37.2±0.12	24.1±0.03 p<0.01

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

In plasma of patients obtained after temporary venous occlusion, a significant increase in neutrophil aggregation was found. It exceeded the control values with all the inducers used (lectin 74.6%, concanavalin A 77.3%, phytohemagglutinin 54.3%).

Important significance in the development of rheological disturbances and thrombophilia in persons with type 2 diabetes mellitus belongs to aggregation increase of regular blood elements and especially – neutrophils [17,18]. At type 2 diabetes mellitus the depression of plasma antioxidant activity is formed which provides the increase of LPO activity in it [19]. The increase of freely radical processes in liquid part of blood

inevitably promotes the damage of neutrophils' membranes [20]. The development of these manifestations in combination with found in these patients' neutrophils lipid imbalance leads to their hyperaggregability. The level of disaggregating impacts from the side of vascular wall [21,22] lowers simultaneously with it in respect of neutrophils [23].

The intensification of neutrophil aggregation in type 2 diabetes mellitus is largely due to the weakening of the production in the vessel wall of physiological disaggregants. This is exacerbated by an increase in the density of receptors on leukocytes capable of interacting with lectins used in the work as aggregation inducers [24,25]. The amplification of lectin- and concanavalin A-induced aggregation of neutrophils in plasma taken against a background of temporary venous occlusion in patients with type 2 diabetes mellitus is associated with an increase in the number of adhesion receptors on neutrophils, including many sites with N-acetyl-D-glucosamine, N-acetyl-neuraminic acid and mannose [26, 27]. The growth of neutrophil aggregation with phytohemagglutinin is caused by an increase in the area of their receptors with bD galactose [28,29] with a marked decrease in the formation of prostacyclin and NO patients in the vessels [30,31,32].

CONCLUSION

The frequent occurrence among the population of many countries of type 2 diabetes requires further study of this pathology. Its great danger is associated with a high incidence of thrombosis on its background. In the conducted study, it was established that in these patients lipid peroxidation in plasma was sharply increased. It causes the progression of vasopathy with a weakening of vaginal antiplatelet production. This is associated with the weakening of vascular control in these patients over the excessive aggregation of neutrophils. Simultaneous depression of the disaggregation capacity of blood vessels and active aggregation of neutrophils severely impairs trophism of tissues and increases the risk of thrombosis in individuals with type 2 diabetes [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] 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
- [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 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, Drukovskiy 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] 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.
- [11] Zavalishina SYu. (2012) Dynamics of hemostasis system at newborn calves with iron deficiency by use ferroglicin 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] Zavalishina SYu. (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] Zavalishina SYu.(2012) Vascular hemostasis at calves in milk-and-vegetable phase of feeding. Zootekhniya. 2 : 21.
- [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) 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.
- [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] Zavalishina SYu.(2012) Vascular hemostasis at calves in milk-and-vegetable phase of feeding. Zootekhniya. 2 : 21.
- [22] 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.
- [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] Zavalishina S.Yu. (2012) Hemostatic activity of a vascular wall at newborn calfs. Russian Agricultural Sciences. 1 : 37-39.
- [25] Zavalishina SYu. (2013) State of the system in neonatal calves in hemostasis with iron deficiency. Russian Agricultural Sciences. 3 : 43-46.
- [26] Zavalishina SYu. (2013) Vascular hemostasis in newborn calves with ferrum deficiency treated with ferroglicin. Zootekhniya. 8 : 24-26.
- [27] Zavalishina SYu.(2014) State regulation-vascular interactions in newborn piglets with iron with ferroglicin and glikopin. Russian Agricultural Sciences. 1 : 57-59.
- [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] 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.
- [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.