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The State Of Vascular Disaggregation Effects On Neutrophils In Patients With Arterial Hypertension With Type 2 Diabetes Mellitus.

Medvedev IN*.

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

ABSTRACT

The growth of pathological complications in the population of industrially developed countries leads to a wide prevalence in different ages of arterial hypertension and type 2 diabetes. This contingent of patients has a high incidence of thrombosis. It is revealed that the basis of this is most often the disturbance of the vascular functions, especially their disaggregation capabilities with respect to the blood constituents. The goal is to assess the disaggregation capacity of the vessels in relation to neutrophil aggregation in patients with arterial hypertension with type 2 diabetes mellitus. We examined 42 patients of the second mature age (mean age 49.3±2.9 years) with arterial hypertension of the 1st-2nd degree, 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 arterial hypertension with 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 arterial hypertension combination with type 2 diabetes mellitus. The persons with arterial hypertension and 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, arterial hypertension, type 2 diabetes mellitus, vascular wall, antiaggregation.

Corresponding author

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INTRODUCTION

The presence of frequent occurrence of hereditary complications in the violation of carbohydrate metabolism provides a high level of prevalence of type 2 diabetes mellitus against arterial hypertension (AH) [1,2]. Often, their combination is present in the working population, leading to early vascular complications with subsequent disability and early death [3]. It is recognized that a high incidence of thrombosis, incl. with AH and type 2 diabetes mellitus is associated with a pronounced weakening of vascular disaggregation control over different blood elements [4,5]. This condition is inevitably accompanied by activation of hemostasis, which causes the development of thrombosis [6,7,8]. It is believed that the decrease in blood levels of prostacyclin and nitric oxide is triggered by this process [9,10]. In view of the high prevalence of combination of AH and type 2 diabetes mellitus and great importance for microcirculation processes of neutrophil aggregation, it was important to clarify the features of vascular control over the aggregation of neutrophil leukocytes in this contingent of patients [11].

The aim of the study is to assess the disaggregation capacity of the 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 42 patients of the second mature age (mean age 49.3±2.9 years) with AH of the 1st-2nd degree [12] 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. 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 malondialdehyde (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 disaggregation effects of the vessels on neutrophils were evaluated 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 μg / ml, concanavalin A - 32 μg / ml and phytohemagglutinin - 32 μg / 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 2.35 times, TBA-active products – in 1.54 times, being accompanied by suppression of antioxidant plasma activity in 1.5 times (Table).

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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 patients, the process of neutrophil aggregation with applied inducers occurred earlier than in control (with lectin 60.2%, with concanavalin A 43.9%, with phytohemagglutinin 43.1%) (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=42, M±m	Control, n=26, M±m
Acylhydro peroxides plasma, D_{233} /1ml	3.34±0.09	1.42±0.09 p<0.01
TBA-compounds, mcmol / l	5.47±0.16	3.56±0.07 p<0,01
Antioxidant activity plasma, %	21.3±0.18	32.9±0.12 p<0.01
biochemical parameters of neutrophils		
cholesterol of neutrophils, mkmol/10^9 neutrophils	0.88±0.007	0.62±0.004 p<0.01
common phospholipids of neutrophils, mkmol/10^9 neutrophils	0.33±0.012	0.51±0.003 p<0.01
acylhydroperoxides of neutrophils, D_{233}/10^9 neutrophils	3.78±0.05	2.36±0.05 p<0.01
malonicdialdehyde of neutrophils, nmol/10^9 neutrophils	1.55±0.07	0.73±0.03 p<0.01
catalase of neutrophils, ME/10^9 neutrophils	5050.0±22.70	9950.0±19.77 p<0.01
superoxidismutase of neutrophils, ME/10^9 neutrophils	1110.0±4.85	1780.0±4.21 p<0.01
aggregation of neutrophils in intact plasma		
Aggregationwithlectin, %	25.0±0.16	15.6±0.07 p<0.01
Aggregation withconcanavalin A, %	21.3±0.11	14.8±0.04 p<0.01
Aggregationwithphytohemagglutinin, %	43.8±0.15	30.6±0.09 p<0.01
vascular control of aggregation neutrophils		
Aggregationwithlectinafter temporary venous occlusion, %	22.9±0.22	11.8±0.06 p<0.01
Aggregation withconcanavalin Aafter temporary venous occlusion, %	20.6±0.06	11.0±0.07 p<0.01
Aggregationwithphytohemagglutininafter temporary venous occlusion, %	40.6±0.10	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 obtained after a temporary venous occlusion, a significant increase in neutrophil aggregation was found in patients. It exceeded the control values with all the applied inducers (from lectinon 94.1%, from concanavalin A on 87.3%, from phytohemagglutininon 68.5%).

Important significance in the development of rheological disturbances and thrombophilia in persons with AH and type 2 diabetes mellitus belongs to aggregation increase of regular blood elements and especially

– neutrophils [17,18]. At combination of AH and 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 increase in neutrophil aggregation in hypertension with type 2 diabetes mellitus revealed in the study is largely due to the weakening of the production in the vessel wall of physiological disaggregants against the background of an increase in the density of leukocyte receptors interacting with lectins used as aggregation inducers [24,25]. The intensification of lectin- and concanavalin A-induced aggregation of neutrophils in plasma taken against a background of temporary venous occlusion in patients with AH 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 portion of their receptors with bDgalactose [28,29], with pronounced weakening of the formation in the vessels of prostacyclin and NO patients [30,31,32].

CONCLUSION

The high frequency of occurrence in a modern society of a combination of arterial hypertension with type 2 diabetes requires further study of this pathology. The greater danger of this combination 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 vessels and active aggregation of neutrophils weakened trophism of tissues and increased the risk of thrombosis in people with arterial hypertension and type 2 diabetes.

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, ZavalishinaSYu, Makurina ON, KipermanYaV, Savchenko AP, Skoblikova TV, Skripleva EV, Zacepin VI, Skriplev AV, AndreevaVYu. (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] VatnikovYuA, ZavalishinaSYu, 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 OfRosuvastatin 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, ZavalishinaSYu. (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] ZavalishinaSYu, VatnikovYuA, 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] VatnikovYuA, ZavalishinaSYu, 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] 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.

[11] ZavalishinaSYu. (2012) Dynamics of hemostasis system at newborn calves with iron deficiency by use ferroglucin 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] ZavalishinaSYu. (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] ZavalishinaSYu.(2012) Vascular hemostasis at calves in milk-and-vegetable phase of feeding. Zootekhniya.2 : 21.

[17] ZavalishinaSYu, 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 secondmature 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] ZavalishinaSYu.(2010) Anticoagulative and fibrinolitic activity of plasma of blood at calves. Veterinariya. 11: 41-43.

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

[22] ZavalishinaSYu. (2011) Functional condition of system of a hemostasis at newborn calves.Veterinariya.6 : 42-45.

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

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

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

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

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

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

[29] ZavalishinaSYu. (2013) Gemostatical activity of vessels piglets vegetable nutrition. Veterinariya.8: 43-45.

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

[31] ZavalishinaSYu. (2010) Activity of blood coagulation system at healthy calves at phase of milk-vegetable feeding.Zootekhniya. 9 : 13-14.

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