

Research Journal of Pharmaceutical, Biological and Chemical Sciences

The state of vascular disaggregation effects on neutrophils in patients with arterial hypertension with abdominal obesity.

Medvedev IN*.

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

ABSTRACT

Reducing the physical activity of a significant part of the population leads to the widespread prevalence of arterial hypertension and abdominal obesity in industrially developed countries. It becomes clear that the high incidence of thrombosis in arterial hypertension and abdominal obesity is caused by impaired vascular function, especially their disaggregation effects on blood elements. The goal is to evaluate the disaggregation properties of the vessels in relation to neutrophils in patients with arterial hypertension with abdominal obesity. We examined 55 patients of the second mature age (mean age 51.2 ± 2.7 years) with arterial hypertension of the 1st-2nd degree, with 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 arterial hypertension with abdominal obesity 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 abdominal obesity. The persons with arterial hypertension and abdominal obesity 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, abdominal obesity, vascular wall, antiaggregation.

**Corresponding author*

INTRODUCTION

Improving nutrition of the population and a high level of social stress leads to the prevalence of a combination of arterial hypertension (AH) and abdominal obesity among the population of industrially developed countries [1,2]. Very often, their combination occurs in the working population, causing a high incidence of vascular complications leading to disability and early mortality [3]. It becomes clear that the high frequency in the population of thromboses with hypertension and abdominal obesity with the weakening of the vascular functions, especially their disaggregation control over the shaped elements [4,5]. It is recognized that the strengthening of the aggregation of blood elements occurs necessarily in vascular dysfunctions, accompanied by activation of hemostasis and the development of thrombosis [6,7,8]. This process is ensured by a decrease in synthesis in the vessels of disaggregants, the most important of which are prostacyclin and nitric oxide [9,10]. In view of the high prevalence of AH with abdominal obesity and the serious significance for microcirculation of neutrophils, it was important to assess the level of vascular control over the process of aggregation of neutrophilic leukocytes in of these patients [11].

The aim of the study is to evaluate the disaggregation properties of the vessels in relation to neutrophils in patients with AH and abdominal obesity.

MATERIALS AND METHODS

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

We examined 55 patients of the second mature age (mean age 51.2 ± 2.7 years) with AH of the 1st-2nd degree [12] with 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. 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].

Vessel control over the process of neutrophil aggregation was elucidated in plasma taken after temporary venous occlusion and without it 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 2.2 times, TBA-active products – in 1.4 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).

Table: Registered indicators in the surveyed

Registered parameters	Patients, n=55, M±m	Control, n=26, M±m
acylhydroperoxides plasma, D ₂₃₃ /1ml	3.19±0.07	1.42±0.09 p<0.01
TBA-compounds, umol / l	5.21±0.11	3.56±0.07 p<0,01
antioxidantactivityplasma, %	22.5±0.15	32.9±0.12 p<0.01
biochemical parameters of neutrophils		
cholesterol of neutrophils, umol/10 ⁹ neutrophils	0.84±0.009	0.62±0.004 p<0.01
common phospholipids of neutrophils, umol/10 ⁹ neutrophils	0.35±0.005	0.51±0.003 p<0.01
acylhydroperoxides of neutrophils, D ₂₃₃ /10 ⁹ neutrophils	3.64±0.07	2.36±0.05 p<0.01
malonicdialdehyde of neutrophils, nmol/10 ⁹ neutrophils	1.47±0.08	0.73±0.03 p<0.01
catalase of neutrophils, ME/10 ⁹ neutrophils	5220.7±18.52	9950.0±19.77 p<0.01
superoxidismutase of neutrophils, ME/10 ⁹ neutrophils	1239.8±3.26	1780.0±4.21 p<0.01
aggregation of neutrophils in intact plasma		
aggregationwithlectin, %	23.9±0.11	15.6±0.07 p<0.01
aggregation withconcanavalin A, %	19.9±0.09	14.8±0.04 p<0.01
aggregationwithphytohemagglutinin, %	41.7±0.07	30.6±0.09 p<0.01
vascular control of aggregation neutrophils		
Aggregationwithlectinafter temporary venous occlusion, %	21.8±0.18	11.8±0.06 p<0.01
Aggregation withconcanavalin Aafter temporary venous occlusion, %	18.4±0.07	11.0±0.07 p<0.01
Aggregationwithphytohemagglutininafter temporary venous occlusion, %	39.9±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 the examined patients, the neutrophil aggregation in response to the tested inductors appeared earlier than in the control (with lectin by 53.2%, concanavalin A by 34.5%, with phytohemagglutinin by 36.3%) (Table).

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

In plasma taken after a temporary venous occlusion, the patients noted marked redundancy of neutrophil aggregation exceeding the control values with all tested inducers (with lectin by 84.7%, with concanavalin A by 67.3%, with phytohemagglutinin by 65.5%).

Important significance in the development of rheological disturbances and thrombophilia in persons with AH and abdominal obesity belongs to aggregation increase of regular blood elements and especially – neutrophils [17,18]. At combination of AH and abdominal obesity 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 the patients studied in the study was largely due to the weakening of the production in the vessel wall of physiological disaggregants against the background of an increase in the activity of glycoprotein receptors of leukocytes with respect to lectins used as inducers in the study [24,25]. Increased lectin and concanavalin A-induced neutrophil aggregation in plasma after temporary venous occlusion in patients with AH and abdominal obesity is associated with an increase in expression on the membrane of neutrophils of adhesion receptors, which include a large number of sites containing N-acetyl-D-glucosamine, N-acetyl-neuraminic acid and mannose [26, 27]. The activity of neutrophil aggregation in response to phytohemagglutinin is caused by an increase in their receptors of glycoproteins containing bD-galactose [28,29] on the background of a weakened synthesis in the vessels of patients with prostacyclin and NO [30,31,32].

CONCLUSION

The widespread prevalence in modern society of a combination of arterial hypertension with abdominal obesity requires a comprehensive study of this pathology. Particular attention to this pathology is caused by a high incidence of thrombosis in this category of patients. In the study, it was found that lipid peroxidation in plasma was significantly enhanced in these patients. Apparently, they cause the phenomenon of vasopathy with a weakening of the production in the vessels of physiological antiplatelet agents. This is due to the weakening of their vascular control over the dramatically increasing aggregation of neutrophils. The combination of weakening of the disaggregation properties of blood vessels and the strengthening of neutrophil aggregation worsens trophism of tissues and makes a significant contribution to the risk of thrombosis in patients with arterial hypertension with abdominal obesity.

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, 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] Gurevich VS. (2013) Correction of dyslipidemia with concomitant arterial hypertension from the perspective of an updated paradigm of cardiovascular risk. *Systemic hypertension*.3 : 54-59.
- [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.v6i3.553

- [7] ZavalishinaSYu, VatnikovYuA, KulikovEV, YagnikovSA, KaramyanAS, SturovNV, ByakhovaVM, KochnevaMV, PetryaevaAV. (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, Vilkovsky 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] ZavalishinaSYu. (2012) Dynamics of hemostasis system at newborn calves with iron deficiency by use ferroglycin and glicopin. *Zootekhnika*.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. *Zootekhnika*.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] 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 AA, Pochinok NB. (2017) Professional Skills Competitions for People with Disabilities as a Mechanism for Career Guidance and Promotion of Employment in People with Special Needs. *Psikhologicheskayanaukaiobrazovanie*. 22(1) : 81-87.
- [20] ZavalishinaSYu.(2010) Anticoagulative and fibrinolytic activity of plasma of blood at calves. *Veterinariya*. 11: 41-43.
- [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. *Psikhologicheskayanaukaiobrazovanie*. 22(1): 26-33.
- [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 withferroglycin. *Zootekhnika*.8 : 24-26.
- [27] ZavalishinaSYu.(2014) State regulation-vascular interactions in newborn piglets with iron with ferroglycin 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.