ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Antiaggregational Vascular Control Of Erythrocytes In Patients With Dyslipidemia.

Medvedev IN*.

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

ABSTRACT

The high incidence of vascular thrombosis in patients with dyslipidemia is largely due to the presence of vasopathy in them. Given the widespread prevalence of dyslipidemia in modern society, it is of great scientific and practical interest to assess the state of these patients in vascular control of aggregation by the most numerous group of blood cells - red blood cells. The aim of the work is to establish the features of the disaggregation effects of blood vessels on erythrocytes in patients with dyslipidemia. 41 patients with dyslipidemia IIb of the second adult age were under observation. The control group consisted of 26 clinically healthy volunteers of the same age. Biochemical, hematological and statistical methods of investigation have been applied. In the examined patients, an increase in the cholesterol erythrocyte membranes and decrease in total phospholipids in them and activation of lipid peroxidation was found. Increased spontaneous aggregation of erythrocytes was found in all the examined patients. In this case, all patients noted a decrease in vascular control over erythrocyte aggregation. The pronounced weakening of disaggregating vascular control over the enhanced aggregation capacity of red blood cells is a consequence of the dyslipidemia-induced vasopathy. As a result, in patients with dyslipidemia, the risk of thrombosis of any location increases, which can lead to disability and death.

Keywords: dyslipidemia, vascular wall, antiaggregation, erythrocytes, thrombosis risk.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

Large-scale preventive measures so far cannot contain the spread among the population of industrially developed countries of dyslipidemia [1,2]. This pathology is accompanied by a high incidence of vascular complications, very often leading to disability and mortality [3,4].

The high incidence of vascular thrombosis in patients with dyslipidemia is largely due to the development of vasopathy [5,6]. It is recognized that blood cells are capable of aggregation, which leads to activation of hemostasis and development of thrombosis [7,8,9]. These processes are constrained by the synthesis in the wall of the vessel and the release of them into the blood of the disaggregants. The most important of these are prostacyclin and nitric oxide [10,11]. Due to the widespread prevalence of dyslipidemia, it is of great scientific and practical interest to continue research into the features of vascular control over the aggregation of the most abundant blood cells - red blood cells in this patient population.

The goal is to establish the features of the disaggregation effects of blood vessels on erythrocytes in patients with dyslipidemia.

MATERIALS AND METHODS

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

41 patients with dyslipidemia IIb type [12], second adult age (mean age 53.8±1.6 years) were examined. The control group consisted of 26 clinically healthy people of similar age. All surveyed gave written information consent to participate in the study.

In the work by the enzymatic colorimetric method, the total blood cholesterol (CH) and triglycerides (TG) were determined by the "Vital Diagnosticum" kit (Russia) .The level of high-density lipoprotein (HDL) cholesterol was determined using the OlvexDiagnosticum (Russia) assay using the enzymatic colorimetric method. The total lipids (OL) were assessed by the Erba Russ kit (Russia), the total amount of phospholipids (OPL) of the blood plasma was recorded from the content of phosphorus in them. The levels of low-density lipoprotein (LDL) cholesterol were established by the formula of Friedwald B. The concentration of lipoprotein cholesterol was very low density (VLDL) was determined by the formula: the content of TG/2.2 The results of total cholesterol and LDL cholesterol were considered normal, borderline or high in accordance with the Russian recommendations (2012) [13].

Levels of lipid peroxidation (LPO) in plasma were evaluated by the content of thiobarbituric acid (TBA)-active products with the Agat-Med kit and acyl hydroperoxides (AHP). [14] The antioxidant capacity of the liquid part of the blood was determined from the level of its antioxidant activity (AOA) [15].

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 $p<0.05$.

RESULTS AND DISCUSSION

In the examined patients, an increase in the levels of OL and total cholesterol exceeding the control values of 1.6 and 1.3 times, respectively, was revealed, respectively. This was accompanied by a fall in their plasma OPL by 2.1 times (Table 1). In the blood of individuals with dyslipidemia, an increase in LDL cholesterol, LLDPE cholesterol and TG was found in 1.64, 1.61, and 1.60 times, respectively. At the same time, they had a 1.5-fold decrease in HDL cholesterol. Also, the activation of plasma LPL was revealed in patients - the content of AGP in it exceeded the control by 2.1 times, TBA-active products - 1.4 times. This was due to the weakening of the antioxidant activity of the plasma by a factor of 1.3 (Table).

ISSN: 0975-8585

Table: Patient survey results

Registrated parameters	Patients with dyslipidemia, n=41, M±m	Control, n=26, M±m
common cholesterol, mmol/l	6.3±0.05	4.8±0.05 p<0.01
CS level of high-density lipoproteins, mmol/l	1.07±0.06	1.60±0.06 p<0.01
CS levels of low-density lipoproteins, mmol/l	3.99±0.07	2.43±0.04 p<0.01
CS concentrations of very low-density lipoproteins, mmol/l	1.24±0.04	0.77±0.05 p<0.01
triglycerides, mmol/l	2.72±0.06	1.70±0.02 p<0.01
common lipids, g/l	9.0±0.10	5.6±0.03 p<0.01
common phospholipids, mmol/l	1.70±0.06	3.54±0.09 p<0.01
acylhydroperoxides plasma, D_{233} /1ml	3.01±0.07	1.42±0.09 p<0.01
TBA-compounds, mcmol/l	4.92±0.08	3.56±0.07 p<0,01
antioxidantactivityplasma, %	24.2±0.13	32.9±0.12 p<0.01
biochemical parameters of erythrocytes		
cholesterol of erythrocytes, mkmol/10^{12} erythrocytes	1.32±0.005	1.04±0.004 p<0.01
common phospholipids of erythrocytes, mkmol/10^{12} erythrocytes	0.56±0.006	0.75±0.003 p<0.01
acylhydroperoxides of erythrocytes, D_{233}/10^{12} erythrocytes	4.42±0.12	3.08±0.10 p<0.01
malonicdialdehyde of erythrocytes, nmol/10^{12} erythrocytes	1.60±0.14	1.14±0.05 p<0.01
catalase of erythrocytes, ME/10^{12} erythrocytes	7680.0±13.7	11196.0±22.4 p<0.01
superoxidismutase of erythrocytes, ME/10^{12} erythrocytes	1620.0±1.95	1986.0±7.01 p<0.01
aggregation of erythrocytes in intact plasma		
sum of all the erythrocytes in an aggregate	67.3±0.10	41.9±0.10 p<0.01
quantity of aggregates	12.8±0.13	9.0±0.06 p<0.01
quantity of free erythrocytes	167.3±1.52	240.0±0.23 p<0.01
aggregation of erythrocytes in plasma after temporary venous occlusion		
sum of all the erythrocytes in an aggregate	55.2±0.10	32.6±0.14 p<0.01
quantity of aggregates	10.0±0.14	7.0±0.07 p<0.01
quantity of free erythrocytes	201.3±1.06	305.3±0.18 p<0.01

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

Observed patients noted an excess of cholesterol in the erythrocyte membranes, accompanied by a decrease in them in OPL, activation of LPO and weakening of their antioxidant protection (Table).

In the blood of patients with dyslipidemia, a marked increase in spontaneous aggregation of erythrocytes was recorded (Table). This was indicated by an increased level of their total involvement in aggregates (by 60.6%), an increase in the number of aggregates themselves (by 42.2%) and a decrease of 43.4% in freely moving red blood cells.

In patients with dyslipidemia, there was a decrease in the disaggregation effects of blood vessels in relation to erythrocytes (Table). It was found that in the plasma obtained against the background of temporary venous occlusion, the total number of erythrocytes in aggregates in the aggregates exceeded the control by 69.3%, the number of these aggregates was increased by 42.8%, accompanied by a decrease in the number of free red blood cells by 51.7%.

An important role in the development of rheological disorders and thrombophilia in individuals with dyslipidemia belongs to the intensification of aggregation of blood cells and especially erythrocytes [18, 19]. With dyslipidemia, there is a depression of the antioxidant activity of the plasma, which increases the activity of LPO in it [20]. The increase in free-radical processes in the plasma inevitably contributes to damage to erythrocyte membranes [21]. The development of these phenomena in combination with the lipid imbalance found in the erythrocytes of these patients leads to their hyperaggregability. At the same time, the level of disaggregating effects from the vessels decreases in relation to erythrocytes [22,23]. This proved in the examined patients an increase in the aggregation activity of erythrocytes in plasma obtained after a temporary venous occlusion [24]. Increased spontaneous aggregation of erythrocytes in vivo in patients with dyslipidemia is caused by a weakening of the disaggregating effects of the vessels [25,26] and the developing decrease in the number of negatively charged proteins on the outer erythrocyte membrane [27]. Weakening of antioxidant activity of plasma leads to an increase in the level of active forms of oxygen in it and to oxidative damage of endotheliocytes, erythrocyte membrane proteins and plasma proteins [28,29]. With a clear deficit of physiological disaggregants, the binding of erythrocytes to each other in the already formed aggregates is enhanced [30, 31]. The weakening of production in the vessels of prostacyclin and nitric oxide leads to an imbalance in the erythrocytes of the activity of adenylatecyclase and phosphodiesterase [32,33]. Under these conditions, the amount of cyclic adenosine monophosphate decreases in their cytoplasm and the level of Ca2 + increases, further strengthening the aggregation of erythrocytes [34, 35].

CONCLUSION

The wide prevalence of thrombosis of various localizations with dyslipidemia is caused by the development of vasopathy on its background. In the presence of dyslipidemia in patients, weakened antioxidant protection of the plasma with the activation of LPO processes in it, leading to alteration of the vascular wall. For persons with dyslipidemia, the disaggregating vascular effects of the vascular wall are weakened by the aggregative capacity of erythrocytes, which increases in these conditions. For this reason, these patients have an increased risk of vessel thrombosis of any location, which can lead to disability and death [36,37,38].

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] 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.v6i3.552

[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, 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.

[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 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] 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.

[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 fibrinolitic activity of plasma of blood at calves. Veterinariya.11: 41-43.

[21] 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.

[22] 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.

[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 withferroglucin. 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] Cuspidi C, Sala C, Zanchetti A. (2008) Metabolic syndrome and target organ damage: role of blood pressure. Expert Rev CardiovascTher. 6(5) : 731-743.
[33] Vorobyeva NV, Skripleva EV., MakurinaON, 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.
[34] Skripleva EV, Vorobyeva NV, KipermanYaV, 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.
[35] 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.Psikhologicheskayanaukaiobrazovanie-psychological science and education. 23(2) : 50-58.doi: 10.17759/pse.2018230206
[36] 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.
[37] MaloletkoAN, Yudina TN.(2017) (Un)Making Europe: Capitalism, Solidarities, Subjectivities. Contemporary problems of social work. 3 (3-11) : 4-5.
[38] 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.