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Aggregational Properties Of Erythrocytes In Patients With Dyslipidemia.

Medvedev IN*.

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

ABSTRACT

The wide prevalence of thrombosis in patients with dyslipidemia is largely due to the presence of hyperaggregating blood cells in them. Given the widespread prevalence of dyslipidemia among the population, it is of great interest to assess the state of this pathology of aggregation of the most numerous group of red blood cells. The aim of this work is to establish the activity of erythrocyte aggregation in patients with dyslipidemia. Under observation, 41 patients with dyslipidemia IIb of the second adult age were taken. 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 cholesterol and a decrease in total phospholipids in the activation of lipid peroxidation were found in erythrocyte membranes. Increased spontaneous aggregation of erythrocytes was found in all the examined patients. The pronounced increase in the aggregating properties of erythrocytes is a consequence of metabolic disturbances that arise during dyslipidemia. As a result, in patients with dyslipidemia, the risk of thrombosis of any location increases, which can lead to disability and death.

Keywords: dyslipidemia, pathology, aggregation, erythrocytes, thrombosis risk.

Corresponding author

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INTRODUCTION

Planned medical preventive measures in different countries have not yet been able to contain the spread of dyslipidemia among the population [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 hyperaggregation of their blood cells [5,6]. It is recognized that this process leads to activation of hemostasis and development of thrombosis [7,8,9]. He comes very actively when their ability to disaggregate weakens. 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 numerous red blood cells - the erythrocytes in this contingent of patients.

The goal is to establish the activity of erythrocyte aggregation in patients with dyslipidemia.

MATERIAL AND METHODS

The 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 and triglycerides were determined by the "Vital Diagnosticum" kit (Russia) .The level of high-density lipoprotein cholesterol was determined using the Olvex Diagnosticum (Russia) assay using the enzymatic colorimetric method. The total lipids were assessed by the Erba Russ kit (Russia), the total amount of phospholipids of the blood plasma was recorded from the content of phosphorus in them. The levels of low-density lipoprotein cholesterol were established by the formula of Friedwald B. The concentration of lipoprotein cholesterol was very low density was determined by the formula: the content of triglycerides/2.2 The results of total cholesterol and cholesterol low density lipoprotein 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 [15].

The expression of lipid peroxidation in erythrocytes was determined from the amount of malonic dialdehyde (MDA) in the reduction reaction of thiobarbituric acid after washing and resuspension and the content of AHP in them [14]. In washed and resuspended erythrocytes, cholesterol levels were evaluated by an enzymatic colorimetric method using the "Vital Diagnosticum" and total phospholipids-containing phosphorus.

The state of aggregation of erythrocytes was determined with the help of a light microscope in Goryaev's chamber [16], recording the number of erythrocyte aggregates, the number of aggregates and erythrocytes not aggregated [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”, “MicrosoftExcel”. Differences in data were considered reliable in case of $p<0.05$.

RESEARCH RESULTS AND DISCUSSION

The examined patients showed an increase in the levels of total lipids and total cholesterol exceeding the control values by 1.6 and 1.3 times, respectively. This was accompanied by a decrease in their total plasma

phospholipids by a factor of 2.1 (Table 1). In the blood of individuals with dyslipidemia, an increase in low-density lipoprotein cholesterol, low-density lipoprotein cholesterol and a triglyceride of 1.64, 1.61 and 1.60 times, respectively, was found. In this case, they have a decrease in the cholesterol of high-density lipoproteins by a factor of 1.5. Also, the activation of plasma LPL was revealed in patients - the content of AHP 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).

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, µmol/l	4.92±0.08	3.56±0.07 p<0.01
antioxidant activity plasma, %	24.2±0.13	32.9±0.12 p<0.01
biochemical parameters of erythrocytes		
cholesterol of erythrocytes, µmol/10^{12} erythrocytes	1.32±0.005	1.04±0.004 p<0.01
common phospholipids of erythrocytes, µmol/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
malonic dialdehyde 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		
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

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 erythrocyte membranes, accompanied by a decrease in total phospholipids in them, activation of LPO, and weakening of their antioxidant defense (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.

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. In this case, the level of their disaggregating properties in the erythrocytes weakens [22,23]. This was proved in the examined patients by the stability of the formed aggregates of erythrocytes [24]. The increase in spontaneous aggregation of erythrocytes in vivo in patients with dyslipidemia is caused not only by the weakening of their disaggregating properties [25,26], but also by 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]. It becomes clear that with dyslipidemia, there is an increase in the binding of erythrocytes among themselves in already formed aggregates [30, 31]. The weakening of their sensitivity to disaggregants causes an imbalance in the erythrocytes of the activity of adenylate cyclase and phosphodiesterase [32,33]. Under these conditions, the amount of cyclic adenosine monophosphate decreases in their cytoplasm and the level of Ca^{2+} increases. This additionally enhances the aggregation of erythrocytes [34,35].

CONCLUSION

The wide prevalence of thrombosis of various localizations in dyslipidemia is caused by the development of hyperaggregation of blood cells against its background. In the presence of dyslipidemia in patients, weakened antioxidant protection of the plasma with the activation of LPO processes leading to the alteration of erythrocyte membranes, which enhances their aggregation ability. For this reason, these patients have a high risk of vascular 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, 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] 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, 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.v6i3.553

[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, 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. Psikhologicheskaya nauka i obrazovanie. 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] 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] 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.
[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. Psikhologicheskaya nauka i obrazovanie. 22(1) : 81-87.
[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 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] 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. Zootekhniya. 9 : 13-14.
[26] 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.

[27] 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

[28] 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

[29] 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

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

[31] Zavalishina SYu. (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 Cardiovasc Ther. 6(5) : 731-743.

[33] 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.

[34] 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.

[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. Psikhologicheskaya nauka i obrazovanie-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] Maloletko AN, 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.