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Aggregation Of Erythrocytes In Patients With Arterial Hypertension With Abdominal Obesity And Dyslipidemia.

Medvedev IN*.

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

ABSTRACT

The high prevalence in the world of a combination of arterial hypertension with abdominal obesity and dyslipidemia indicates the need to evaluate the aggregation properties of red blood cells in this category of patients. The aim of the work is to evaluate the aggregation potential of red blood cells in patients with arterial hypertension with abdominal obesity and dyslipidemia. 47 patients with arterial hypertension of 1-2 degrees with abdominal obesity and dyslipidemia of the second adulthood were examined. Control is represented by 26 healthy volunteers of the second adult age. The work uses biochemical, hematological and statistical methods of investigation. Patients under observation showed an increase in cholesterol in erythrocyte membranes, a decrease in phospholipids in them, and an increase in lipid peroxidation. In patients, spontaneous aggregation of erythrocytes was found to increase. It can be considered that the enhancement of aggregating properties of erythrocytes is a consequence of metabolic disturbances arisen with arterial hypertension with abdominal obesity and dyslipidemia and excess lipid peroxidation. The disturbances of aggregation of erythrocytes available for this contingent of patients increase the risk of thrombosis, which can lead to disability or fatal outcome.

Keywords: arterial hypertension, abdominal obesity, dyslipidemia, aggregation, erythrocytes.

Corresponding author

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INTRODUCTION

The population of industrially developed countries remains prevalent in the combination of arterial hypertension (AH) with abdominal obesity and dyslipidemia [1,2]. This pathology is often accompanied by the development of vascular thrombosis, dangerous disability and early mortality [3,4].

The high incidence of thrombosis in patients with AH, abdominal obesity and dyslipidemia is caused by the existing situation in the body [5,6]. It is noticed that blood cells are normally able to aggregate. In conditions of pathology, this process intensifies and activates hemostasis, thereby causing a risk of thrombosis [7,8,9]. The aggregation of blood cells to the desired extent is inhibited by desaggregants of vascular origin. The strongest of these are prostacyclin and nitric oxide [10, 11]. The wide prevalence of the combination of AH with abdominal obesity and dyslipidemia causes a great interest in the state of these patients in the aggregation of erythrocytes.

The aim of the study is to evaluate the aggregation capacity of red blood cells in patients with AH with abdominal obesity and dyslipidemia.

MATERIAL AND METHODS

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

A total of 47 patients with AH of 1-2 degrees, risk 4 [12] with abdominal obesity and dyslipidemia IIb of the second mature age (mean age 53.4 ± 2.5 years) were examined. The control group was formed from 26 healthy people of the second adulthood. All the people surveyed gave written information consent to participate in the study.

The process of lipid peroxidation (LPO) in plasma was estimated by the amount of thiobarbituric acid (TBA)-active products in it, using the Agat-Med (Russia) [13] and acyl hydroperoxides (AGP) kit according to the generally accepted method. [14] Antioxidative characteristics of blood plasma were determined using the method of [15].

The level of LPO processes in erythrocytes was assessed by the content of malonic dialdehyde (MDA) and AGP in them after washing and resuspension [14]. Also, in the washed and resuspended red blood cells, the amount of cholesterol was determined by the enzymatic colorimetric method using a set of the company Vital Diagnosticum (Russia) and phospholipids in the amount of phosphorus in them.

The aggregative properties of erythrocytes were assessed using a light microscope in the Goriaev chamber. The number of erythrocyte aggregates, the number of erythrocytes that entered and not joined in aggregation was taken into account [16,17].

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

In the examined patients, activation of LPO in plasma was detected - the amount of AHP prevailed over the level of control 2.35 times, the content of TBA-active products - 1.53 times due to a 1.5-fold decrease in the antioxidant activity of their plasma (Table 1).

Patients detected an increased amount of cholesterol in the membranes of erythrocytes with a decrease in the content of phospholipids. This was accompanied by the increase in their erythrocytes of LPO processes due to depression of their antioxidant defense (Table).

The observed patients showed a marked activation of spontaneous aggregation of erythrocytes (Table). This was indicated by an increase in their total inclusion in aggregates (by 65.9%), an increase in the

number of these aggregates (by 78.9%) and a decrease of 65.4% in the number of non-aggregated red blood cells.

Table. Registered indicators in the surveyed

Registrated parameters	Patients, n=47, M±m	Control, n=26, M±m
acylhydroperoxides plasma, D_{233} /1ml	3.34±0.09	1.42±0.09 p<0.01
TBA-compounds, umol/l	5.47±0.12	3.56±0.07 p<0.01
antioxidant activity plasma, %	21.2±0.15	32.9±0.12 p<0.01
biochemical parameters of erythrocytes		
cholesterol of erythrocytes, umol/10^{12} erythrocytes	1.37±0.012	1.04±0.004 p<0.01
common phospholipids of erythrocytes, umol/10^{12} erythrocytes	0.52±0.009	0.75±0.003 p<0.01
acylhydroperoxides of erythrocytes, D_{233}/10^{12} erythrocytes	4.90±0.15	3.08±0.10 p<0.01
malonic dialdehyde of erythrocytes, nmol/10^{12} erythrocytes	1.87±0.07	1.14±0.05 p<0.01
catalase of erythrocytes, ME/10^{12} erythrocytes	7200.0±12.5	11196.0±22.4 p<0.01
superoxidismutase of erythrocytes, ME/10^{12} erythrocytes	1500.0±2.19	1986.0±7.01 p<0.01
aggregation of erythrocytes		
sum of all the erythrocytes in an aggregate	69.5±0.16	41.9±0.10 p<0.01
quantity of aggregates	16.1±0.17	9.0±0.06 p<0.01
quantity of free erythrocytes	145.1±0.92	240.0±0.23 p<0.01

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

It is very important in the development of rheological dysfunctions and the risk of thrombosis in patients with AH, abdominal obesity and dyslipidemia, an increase in erythrocyte aggregation [18, 19]. In patients with AH, abdominal obesity and dyslipidemia, depression of the antioxidant activity of plasma develops, which causes the growth of the amount of LPO products in it [20]. This contributes to damage to erythrocyte membranes [21]. This is exacerbated by the lipid imbalance in the erythrocytes present in these patients, which contributes to their hyperaggregation [22,23]. It is clear that the growth of erythrocyte aggregation in AH patients with abdominal obesity and dyslipidemia is caused by the presence of pathology in the body [24,25,26] with a decrease in the number of proteins with a negative charge on the erythrocyte surface [27]. Weakening of antioxidant protection of plasma promotes the enhancement of peroxidation in it. Due to this, oxidative damage of endotheliocytes and plasma globular proteins also develops [28,29]. Under these conditions, the strengthening of the connection of erythrocytes in aggregates develops [30, 31]. At the same time there is an imbalance in erythrocytes of adenylate cyclase and phosphodiesterase activity [32,33]. This greatly reduces the amount of cyclic adenosine monophosphate in their cytoplasm and significantly increases the amount of Ca2 +, which also leads to increased erythrocyte aggregation [34, 35].

CONCLUSION

For patients with arterial hypertension, abdominal obesity and dyslipidemia, a high incidence of thrombosis is characteristic. In this connection, it was very important to study the aggregation properties of erythrocytes in this contingent of patients. It was revealed that with arterial hypertension with abdominal obesity and dyslipidemia, antioxidant protection of plasma is attenuated and the amount of products of lipid peroxidation is increased in it. This creates a situation leading to damage to all blood cells. In patients with arterial hypertension, abdominal obesity and dyslipidemia, an increase in spontaneous aggregation of erythrocytes was found. As a result of the growth of aggregation activity of erythrocytes, the risk of blood vessel thrombosis sharply increases in this contingent of patients, often with a fatal outcome.

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