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## Severity Of Vascular Control Over Erythrocyte Aggregation In Patients With Hyperuricemia.

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### ABSTRACT

The high incidence of thrombosis in patients with hyperuricemia is largely due to the presence of vasopathy. The widespread prevalence in developed countries of hyperuricemia dictates the need for a detailed evaluation of the disaggregation properties of blood vessels in relation to the most abundant population of blood cells - erythrocytes. The aim of the work is to evaluate the severity of violations of the disaggregation properties of blood vessels in relation to erythrocytes in patients with hyperuricemia. In this study, 32 patients with hyperuricemia of the second adulthood were examined. The control consisted of 26 clinically healthy people of the second adulthood. In the work performed, biochemical, hematological and statistical methods of investigation were applied. In the examined patients, an excess of cholesterol content in erythrocyte membranes was found, a decrease in the level of total phospholipids in them when lipid peroxidation processes were activated in them. In the examined patients, spontaneous aggregation of erythrocytes was found to increase. In all patients, a reduction in vascular disaggregation control over erythrocytes was found. The revealed weakening of the disaggregation properties of blood vessels in relation to erythrocytes should be considered as a consequence of activation of lipid peroxidation, metabolic disturbances, increased vasospasm and changes in the ratio of biologically active substances in the blood. The presence of vasopathy in patients with hyperuricemia dramatically increases the risk of thrombosis, often leading to persistent disability to them fatal.

**Keywords:** vasopathy, hyperuricemia, vascular wall, aggregation, erythrocytes.

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## INTRODUCTION

In all countries of the world there is a wide prevalence of hyperuricemia [1,2]. Its presence in humans can increase the likelihood of development in adulthood of thrombosis of any localization, threatening disability and early death [3,4].

It is recognized that the high incidence of thrombosis in patients suffering from hyperuricemia is due to the development of their vasopathy [5,6], which is manifested by the weakening of vascular control over the aggregation of blood cells. This circumstance strongly stimulates hemostasis and is an important factor in the development of thrombosis [7,8,9]. It is known that the aggregation of blood cells is inhibited by substances by disaggregants synthesized in the vessel wall. The most active of these are prostacyclin and nitric oxide [10, 11]. The wide prevalence of hyperuricemia provides a great interest to her researchers, especially regarding the condition of this category of patients with vascular control over erythrocyte aggregation.

The aim of the work is to evaluate the severity of violations of the disaggregation properties of blood vessels in relation to erythrocytes in patients with hyperuricemia.

## MATERIALS AND METHODS

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

32 patients with hyperuricemia [12] of the second adulthood (mean age  $51.3 \pm 2.3$  years) were examined. The control group included 26 clinically healthy people of the second adulthood. All persons involved in the study gave written information consent to participate in it, according to the generally accepted procedure [13].

The activity of lipid peroxidation (LPO) in plasma was determined by the level of thiobarbituric acid (TBA) -active products by the Agat-Med kit (Russia) and the amount of acyl hydroperoxides (AHP) [14]. The level of antioxidant capacity of plasma was determined by the method of [15].

The state of LPO in erythrocytes was determined by the number of malonic dialdehyde (MDA) in them and the content of 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 colorimetry method by the kit of the company Vital Diagnosticum (Russia) and the total phospholipids by the phosphorus content in them by the conventional method.

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 patients under observation, the activation of LPO in plasma was found - the amount of AHP in it exceeded the control by 2.1 times, the concentration of TBA-active products - 1.4 times, as a result of weakening of the antioxidant activity of the plasma by 1.3 times (Table).

The examined patients showed an increase in the content of cholesterol in the erythrocyte membranes with a decrease in total phospholipids in them. At the same time, in red blood cells, LPO was enhanced due to the weakening of their antioxidant defense (Table).

Spontaneous aggregation of erythrocytes was increased in all patients (Table). This was judged by an increase in the level of their total involvement in aggregates (by 49.4%), an increase in the number of these aggregates (by 23.3%) and a decrease of 33.7% in non-aggregated red blood cells. In this case, all patients showed a decrease in the disaggregation effects of blood vessels on erythrocytes (Table). Thus, in the plasma of patients obtained after temporary venous occlusion, the number of erythrocytes in aggregates exceeded

the control by 54.3%, the number of these aggregates was increased by 37.1%, with a decrease in the number of non-aggregated red blood cells by 51.7%.

**Table: Registered indicators in the surveyed**

Registered parameters	Patients, n=32, M±m	Control, n=26, M±m
acylhydroperoxides plasma, D <sub>233</sub> /1ml	3.06±0.14	1.42±0.09 p<0.01
TBA-compounds, umol / l	5.01±0.18	3.56±0.07 p<0.01
antioxidant activity plasma, %	24.5±0.15	32.9±0.12 p<0.01
biochemical parameters of erythrocytes		
cholesterol of erythrocytes, umol/10 <sup>12</sup> erythrocytes	1.27±0.005	1.04±0.004 p<0.01
common phospholipids of erythrocytes, umol/10 <sup>12</sup> erythrocytes	0.60±0.012	0.75±0.003 p<0.01
acylhydroperoxides of erythrocytes, D <sub>233</sub> /10 <sup>12</sup> erythrocytes	4.42±0.16	3.08±0.10 p<0.01
malonic dialdehyde of erythrocytes, nmol/10 <sup>12</sup> erythrocytes	1.53±0.03	1.14±0.05 p<0.01
catalase of erythrocytes, ME/10 <sup>12</sup> erythrocytes	8600.0±12.5	11196.0±22.4 p<0.01
superoxidismutase of erythrocytes, ME/10 <sup>12</sup> erythrocytes	1700.1±1.86	1986.0±7.01 p<0.01
aggregation of erythrocytes in intact plasma		
sum of all the erythrocytes in an aggregate	62.6±0.12	41.9±0.10 p<0.01
quantity of aggregates	11.1±0.14	9.0±0.06 p<0.01
quantity of free erythrocytes	179.5±0.95	240.0±0.23 p<0.01
aggregation of erythrocytes in plasma after temporary venous occlusion		
sum of all the erythrocytes in an aggregate	50.3±0.12	32.6±0.14 p<0.01
quantity of aggregates	9.6±0.14	7.0±0.07 p<0.01
quantity of free erythrocytes	201.3±0.72	305.3±0.18 p<0.01

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

Serious importance in the development of violations of hemostasis and rheology of blood and the formation of a risk of thrombosis in persons with hyperuricemia has an increase in erythrocyte aggregation [18, 19]. In patients with hyperuricemia, the antioxidant activity of the plasma decreases, which causes an increase in LPO activity [20]. This strongly damages the erythrocyte membranes [21] and is burdened by the development in the erythrocytes of these patients of the lipid imbalance that promotes their hyperaggregation. At the same time, the disaggregating effects of blood vessels on erythrocytes weakens [22,23]. This pathology forms in the patients observed the growth of erythrocyte aggregation in plasma taken after temporary venous occlusion [24]. The increased amplification of erythrocytes in patients with hyperuricemia is largely due to the weakening of the disaggregating effects of their vessels [25,26] and to a

decrease in the number of negative proteins on the erythrocyte membranes [27]. The onset of depression of the antioxidant properties of the plasma forms an intensification of peroxidation processes in it and as a result of it pronounced oxidative damages of endotheliocytes and globular plasma proteins arise [28,29]. In conditions of a persistent deficit of vascular dezagregantov, the strengthening of erythrocyte communication among themselves increases, leading to an increase in the number of their aggregates [30, 31]. At the same time, the depression of synthesis in the vessels of prostacyclin and nitric oxide forms an imbalance in the erythrocytes of the activity of adenylate cyclase and phosphodiesterase [32,33]. This contributes to a decrease in the level of cyclic adenosine monophosphate in their cytoplasm and an increase in the amount of free  $Ca^{2+}$ , which additionally strongly stimulates the aggregation of erythrocytes [34, 35].

### CONCLUSION

For patients with hyperuricemia characterized by a fairly high incidence of thrombosis. This was an important reason for the survey of this contingent of patients. The study revealed that with hyperuricemia there is a decrease in the level of antioxidant protection of the plasma and an increase in the processes of lipid peroxidation, which adversely affects all layers of the vascular wall. It was found that for patients with hyperuricemia, weakening of the disaggregation capacity of the vessels with respect to excessive spontaneous aggregation of erythrocytes is characteristic. The emerging situation in the aggregation-disaggregation relationship between blood cells and blood vessels creates the basis for the development of vascular complications in these patients [36,37,38].

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