

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Severity Of Vascular Disaggregation Effects On Erythrocytes In Patients With Arterial Hypertension With Abdominal Obesity And Dyslipidemia.

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ABSTRACT

The high incidence of thrombosis in patients with arterial hypertension with abdominal obesity and dyslipidemia is caused by the development of pronounced vasopathy in them. Given the high prevalence in the world of a combination of arterial hypertension with abdominal obesity and dyslipidemia, it was important to assess the vascular disaggregation effects on erythrocytes in this category of patients. The aim of the work is to evaluate the disaggregation effects of blood vessels on erythrocytes 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 study was performed using 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. At the same time, they showed a decrease in vascular disaggregation control over red blood cells. We can assume that the weakening of disaggregating vascular effects on erythrocytes is a consequence of metabolic abnormalities that arisen in arterial hypertension with abdominal obesity and dyslipidemia, severe vasospasm and excess lipid peroxidation. The existing vasopathy in these patients increases their risk of thrombosis, which can lead to disability or death.

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

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INTRODUCTION

Among the population of the mature age of all industrially developed countries, the prevalence of the combination of arterial hypertension (AH) with abdominal obesity and dyslipidemia persists [1,2]. This pathology is often accompanied by the development of vascular thrombosis, dangerous disability and early mortality [3,4].

A high incidence of thrombosis in patients with AH, abdominal obesity and dyslipidemia, is caused by the available vasopathy [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 hypertension with abdominal obesity and dyslipidemia is of great interest to the state of these patients with vascular control over erythrocyte aggregation.

The aim of the study is to assess the disaggregation effects of blood vessels on erythrocytes in patients with AH with abdominal obesity and dyslipidemia.

MATERIALS 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 intensity of 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]. The antioxidant characteristics of blood plasma were determined using the method of [15].

The level of lipid peroxidation processes in erythrocytes was estimated from the content of malondialdehyde (MDA) and AGP in them after washing and resuspension. [14] Also in washed and resuspended erythrocytes, the quantity x Lesterin by an enzymatic colorimetric method using the Vital Diagnosticum kit (Russia) and phospholipids by the amount of phosphorus in them.

The disaggregation properties of blood vessels for erythrocytes were evaluated by weakening their aggregation in a plasma taken against a background of temporary venous occlusion. [16] The state of aggregation erythrocytes in plasma, obtained without overlapping cuffs on a vessel, was determined with the help of a light microscope in the Goriaev chamber. The number of erythrocyte aggregates, the number of erythrocytes who entered and did not join the aggregation was taken into account [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 $p < 0.05$.

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).

Table: Registered indicators in the surveyed

Registered 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 in intact plasma		
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
aggregation of erythrocytes in plasma after temporary venous occlusion		
sum of all the erythrocytes in an aggregate	58.9±0.24	32.6±0.14 p<0.01
quantity of aggregates	12.6±0.19	7.0±0.07 p<0.01
quantity of free erythrocytes	182.0±1.34	305.3±0.18 p<0.01

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

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. This was accompanied in patients by a decrease in the disaggregation effects on erythrocytes from the side of the vessels (Table). In the blood obtained in conditions of temporary venous occlusion, the number of erythrocytes in the aggregates exceeded the control by 80.7%, the number of these aggregates was higher than the control by 80.0%, and the number of non-aggregated red blood cells was inferior to the control by 67.7%.

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 present in these patients in the

erythrocytes, which contributes to their hyperaggregation. At the same time, there is a weakening of the disaggregating effects of blood vessels on erythrocytes [22,23]. This fact was revealed in patients with increasing erythrocyte aggregation in plasma obtained in conditions of temporary venous occlusion [24]. It is clear that the growth of erythrocyte aggregation in AH patients with abdominal obesity and dyslipidemia is caused by depression of the disaggregating capabilities of their vessels [25,26] and 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]. In conditions of deficiency of vascular dezagregantov, the strengthening of erythrocyte communication in aggregates develops [30, 31]. Depression of synthesis in the vessels of prostacyclin and nitric oxide leads to an imbalance in the erythrocytes of the activity of adenylatecyclase and phosphodiesterase [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 conduct a study of the disaggregation properties of the vessels of 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 elements of the vascular wall. In patients with arterial hypertension, abdominal obesity and dyslipidemia, a weakening of the disaggregating capacity of the vessels with respect to the increasing spontaneous aggregation of erythrocytes was found. As a result of the growth of aggregation phenomena and the weakening of disaggregation effects on erythrocytes, the risk of blood vessel thrombosis sharply increases in this contingent of patients, often with a fatal outcome.

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