ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Activity Of Vascular Disaggregation Effects On Erythrocytes In Patients With Abdominal Obesity And Dyslipidemia.

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ABSTRACT

A serious proportion of thromboses registered in the adult population occurs in patients with abdominal obesity and dyslipidemia. Their occurrence is usually associated with the development of severe vasopathy in these patients. In this regard, a great practical importance was the additional examination of patients with abdominal obesity and dyslipidemia. Of particular interest was their assessment of vascular disaggregation effects on erythrocytes. The aim of the work is to clarify the state of the disaggregation effects of blood vessels on erythrocytes in patients with abdominal obesity and dyslipidemia. 41 patients 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 was carried out with the help of biochemical, hematological and statistical research methods. Patients under observation showed an increase in cholesterol in erythrocyte membranes, a decrease in phospholipids in them, and an increase in lipid peroxidation. In all patients, the growth of spontaneous aggregation of erythrocytes was found. This was accompanied by a decrease in vascular disaggregation control over red blood cells. In the course of the study, it became clear that the weakening of disaggregating vascular effects on erythrocytes is a consequence of metabolic abnormalities and excessive lipid peroxidation arising from abdominal obesity and dyslipidemia. Severe vasopathy arising in this contingent of patients is able to greatly increase the risk of thrombosis, often leading to disability or death.

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

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ISSN: 0975-8585

INTRODUCTION

The continuous increase in the standard of living of the population of all industrially developed countries ensures a high frequency of prevalence of a combination of abdominal obesity and dyslipidemia [1,2]. It is noted that the combination of this pathology is often accompanied by the development of vascular thrombosis, dangerous disability and early death [3,4]. In view of the high incidence of thrombosis in patients with abdominal obesity and dyslipidemia, it is clear that they have vasopathy [5,6]. The development of this condition leads to increased aggregation of blood cells, which enhances the processes of hemostasis, thereby causing the risk of thrombosis [7,8,9]. It is known that the aggregation of blood cells is normally inhibited by desaggregants of vascular origin. The strongest of these are prostacyclin and nitric oxide [10,11]. The wide prevalence among the population of a combination of abdominal obesity and dyslipidemia is of great interest to the condition of these patients with vascular control over erythrocyte aggregation. The aim of the study is to clarify the state of the disaggregation effects of blood vessels on erythrocytes in patients 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).

41 patients with abdominal obesity and dyslipidemia IIb type [12] of the second adult age (mean age 49.2 ± 1.8 years) were examined. The control group consisted of 26 healthy people of the second adulthood. All the people surveyed gave written information consent to participate in the study.

The degree of intensity 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 (AHP) kit according to the generally accepted procedure [14] The antioxidant characteristics of blood plasma were determined using the method of [15] .The activity of LPO in erythrocytes was evaluated by the content of malonic dialdehyde (MDA) and AHP in them after washing and resuspension. [14] Also in washed and resuspended red blood cells, the amount olesterina enzymatic colorimetric method using "Vitthal Diagnosticum" kit manufactured (Russia) and phospholipids by the number of phosphorus in their conventional manner.

The severity of the disaggregation properties of blood vessels with respect to erythrocytes was elucidated by the weakening of their aggregation in plasma taken against the background of temporary venous occlusion [16]. The activity of erythrocyte aggregation in a plasma obtained without the application of a cuff to the vessel and its application was determined with the aid of a light microscope in the Goryaev chamber. The number of erythrocyte aggregates, the number of erythrocytes that have entered and not joined in aggregation were recorded [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 found - the amount of AHP in it was 2.3 times higher than the level of control, the content of TBA-active products was increased 1.5 times due to a 1.5-fold decrease in the antioxidant activity of their plasma (Table).

Observed patients showed an increased amount of cholesterol in the erythrocyte membranes 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).

Also, 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 53.5%), an increase in the number of these aggregates (by 66.7%) and a 39.0% decrease in the number of non-aggregated erythrocytes.

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 66.2%, the number of these aggregates was 54.3% higher than the control, and the number of non-aggregated erythrocytes was 54.9% lower than in control.

Table: Registered indicators in the surveyed

Registrated parameters	Patients, n=41, M±m	Control, n=26, M±m
acylhydroperoxides plasma, D_{233} /1ml	3.29±0.08	1.42±0.09 p<0.01
TBA-compounds, umol/l	5.38±0.09	3.56±0.07 p<0.01
antioxidant activity plasma, %	21.8±0.23	32.9±0.12 p<0.01
biochemical parameters of erythrocytes		
cholesterol of erythrocytes, umol/10^{12} erythrocytes	1.31±0.010	1.04±0.004 p<0.01
common phospholipids of erythrocytes, umol/10^{12} erythrocytes	0.54±0.006	0.75±0.003 p<0.01
acylhydroperoxides of erythrocytes, D_{233}/10^{12} erythrocytes	4.50±0.12	3.08±0.10 p<0.01
malonic dialdehyde of erythrocytes, nmol/10^{12} erythrocytes	1.68±0.11	1.14±0.05 p<0.01
catalase of erythrocytes, ME/10^{12} erythrocytes	7600.0±14.7	11196.0±22.4 p<0.01
superoxidismutase of erythrocytes, ME/10^{12} erythrocytes	1580.0±3.02	1986.0±7.01 p<0.01
aggregation of erythrocytes in intact plasma		
sum of all the erythrocytes in an aggregate	64.3±0.12	41.9±0.10 p<0.01
quantity of aggregates	15.0±0.19	9.0±0.06 p<0.01
quantity of free erythrocytes	172.6±0.81	240.0±0.23 p<0.01
aggregation of erythrocytes in plasma after temporary venous occlusion		
sum of all the erythrocytes in an aggregate	54.2±0.20	32.6±0.14 p<0.01
quantity of aggregates	10.8±0.08	7.0±0.07 p<0.01
quantity of free erythrocytes	197.1±1.15	305.3±0.18 p<0.01

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

Great importance in the development of rheological disorders and the formation of a risk of development of thrombosis in individuals with abdominal obesity and dyslipidemia increased aggregation of erythrocytes [18, 19]. Patients with abdominal obesity and dyslipidemia develop depression of the antioxidant activity of the plasma, which causes the growth of the amount of LPO products in it [20]. This contributes to damage to erythrocyte membranes [21]. This situation is aggravated 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 patients with abdominal obesity and dyslipidemia is caused by a 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 adenylate cyclase and phosphodiesterase [32,33]. This greatly reduces the amount of cyclic adenosine monophosphate in their cytoplasm and significantly increases the amount of Ca^{2+}, which also leads to increased erythrocyte aggregation [34, 35].

CONCLUSION

For patients with 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 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 abdominal obesity and dyslipidemia, a weakening of the disaggregating capacities 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, often with a fatal outcome, increases sharply in this contingent of patients [36,37,38].

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