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Aggregation Of Erythrocytes In Patients With Abdominal Obesity.

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ABSTRACT

It is recognized that abdominal obesity often causes hyperaggregation of blood cells. Due to the high frequency in the developed countries of abdominal obesity, it is very important to assess the level of the condition in this pathology of red blood cell aggregation. The aim of the work is to find out the aggregation possibilities of red blood cells in abdominal obesity. 46 patients with abdominal obesity of the second adulthood were examined. The control group is represented by 26 clinically healthy persons of the second adulthood. Biochemical, hematological and statistical methods of investigation have been applied. In the erythrocyte membranes, an increase in the amount of cholesterol, a decrease in the level of total phospholipids, and an increase in the processes of lipid peroxidation were found in the examined patients. In patients, excessive activity of spontaneous aggregation of erythrocytes was found. The revealed disturbances are in many respects connected with the weakening of the disaggregating properties of erythrocytes. This should be seen as a consequence of metabolic abnormalities that arise during abdominal obesity and the enhancement of lipid peroxidation. Increased aggregation of erythrocytes in this contingent of patients dramatically increases the risk of thrombosis, which can lead to disability and death.

Keywords: abdominal obesity, rheology of blood, aggregation, erythrocytes, pathology.

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INTRODUCTION

An increase in the standard of living in modern society has led to an increase in prevalence and rejuvenation of abdominal obesity [1,2]. This pathology is very dangerous high rate of development in adults of thrombophilia and thrombosis of the vessels, which leads to extensive disability and mortality [3,4].

The high incidence of thrombosis in patients with abdominal obesity is largely due to the formation of blood cells in them [5,6]. It is recognized that blood cells can significantly enhance aggregation. This process strongly determines the activation of hemostasis and creates the risk of thrombosis [7,8,9]. Aggregation of blood cells is inhibited by substances synthesized in the vessel wall and called dezagregantov. The most active of these are prostacyclin and nitric oxide [10,11]. In view of the widespread prevalence of abdominal obesity, it is of great interest to study the state of erythrocyte aggregation in this category of patients.

The aim of the work is to find out the aggregation possibilities of erythrocytes in abdominal obesity.

MATERIAL AND METHODS

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

We examined 46 patients with abdominal obesity [12] of the second adult age (mean age 52.7 ± 2.2 years). The control group consisted of 26 clinically healthy people of the second adulthood. All the examinees gave written information consent to participate in the study according to the generally accepted procedure [13].

The intensity of the processes of lipid peroxidation (LPO) in plasma was estimated by the level of thiobarbituric acid (TBA) -active products by the Agath-Med (Russia) and acyl hydroperoxides (AGP) kit by the method [14]. The antioxidant capacity of the liquid part of the blood was determined by the method [15].

The severity of LPO processes in erythrocytes was determined by the level of malonic dialdehyde (MDA) in them and the content of AGP in them in washed and resuspended cells [14]. In washed and resuspended erythrocytes, the cholesterol content was determined by the enzymatic colorimetry method using the "Vital Diagnosticum" (Russia) kit and the total phospholipids for their phosphorus content.

Spontaneous aggregation of erythrocytes was determined under a light microscope in Goryaev's chamber [16]. The number of erythrocyte aggregates, the number of aggregates and erythrocytes not aggregated [17], was found out.

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 patients, activation of LPO in plasma was detected - the content of AGP in it exceeded control by 2.0 times, TBC-active products - by 1.3 times, as a result of weakening of antioxidant activity of plasma by 1.3 times (Table).

In patients, an increased content of cholesterol in the erythrocyte membranes was found with a decrease in total phospholipids in them. This was accompanied by the activation of lipid peroxidation in their erythrocytes due to the weakening of their antioxidant defense (Table).

The observed patients noted a marked activation of the process of spontaneous aggregation of erythrocytes (Table). This was confirmed by an increase in their total involvement in aggregates (by 40.1%), an increase in the number of these aggregates (by 27.8%) and a decrease of 31.4% in non-aggregated red blood cells.

Table. Registered indicators in the surveyed

Registered parameters	Patients, n=46, M±m	Control, n=26, M±m
acylhydroperoxides plasma, D ₂₃₃ /1ml	2.92±0.08	1.42±0.09 p<0.01
TBA-compounds, µmol/l	4.85±0.12	3.56±0.07 p<0.01
antioxidant activity plasma, %	25.0±0.16	32.9±0.12 p<0.01
biochemical parameters of erythrocytes		
cholesterol of erythrocytes, µmol /10 ¹² erythrocytes	1.24±0.005	1.04±0.004 p<0.01
common phospholipids of erythrocytes, µmol /10 ¹² erythrocytes	0.60±0.008	0.75±0.003 p<0.01
acylhydroperoxides of erythrocytes, D ₂₃₃ /10 ¹² erythrocytes	4.15±0.14	3.08±0.10 p<0.01
malonic dialdehyde of erythrocytes, nmol/10 ¹² erythrocytes	1.44±0.10	1.14±0.05 p<0.01
catalase of erythrocytes, ME/10 ¹² erythrocytes	8850.0±9.6	11196.0±22.4 p<0.01
superoxidismutase of erythrocytes, ME/ 10 ¹² erythrocytes	1750.0±1.52	1986.0±7.01 p<0.01
aggregation of erythrocytes		
The sum of all red blood cells in the aggregate	58.7±0.17	41.9±0.10 p<0.01
Number of aggregates	11.5±0.15	9.0±0.06 p<0.01
The number of free red blood cells	182.6±0.67	240.0±0.23 p<0.01

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

Serious significance in the formation of rheological dysfunctions and the risk of thrombosis in individuals with abdominal obesity belongs to the growth of erythrocyte aggregation [18, 19]. In the presence of abdominal obesity, there is a depression of the antioxidant activity of the plasma, which ensures the growth of LPO activity in it [20]. This leads to damage to the erythrocyte membrane [21]. The development of these phenomena in combination with the lipid imbalance revealed in red blood cells leads to their hyperaggregation. At the same time, their sensitivity to the disaggregating effects of blood vessels weakens [22,23]. In the patients observed, this was judged by the growth of erythrocyte aggregation in the Goryaev chamber [24]. Apparently, the growth of erythrocyte aggregation in patients with abdominal obesity is associated with a change in the composition of their receptors [25,26] and a decrease in the number of negative proteins on the erythrocyte membranes [27]. Weakening of the antioxidant properties of the plasma causes an increase in peroxidation processes in it and as a result, oxidative damage of endotheliocytes and globular plasma proteins occurs [28,29]. In the conditions of abdominal obesity, the erythrocyte bonds are strengthened among themselves and as a result, aggregate growth [30, 31]. In addition, the depression of the sensitivity of erythrocytes to prostacyclin and nitrogen oxide forms an imbalance in the erythrocytes of the activity of adenylate cyclase and phosphodiesterase [32,33]. This lowers the level of cyclic adenosine monophosphate in their cytoplasm and increases Ca²⁺, which also stimulates erythrocyte aggregation [34,35]. All this provides a general deterioration in the condition of patients [36-38].

CONCLUSION

Patients with abdominal obesity are characterized by a high incidence of thrombosis. This required additional examination of this contingent of patients. The work revealed that with abdominal obesity, weakened antioxidant protection of the plasma and increased in it peroxide oxidation of lipids, which damages all blood cells. With abdominal obesity, a decrease in the ability to disaggregate erythrocytes and increase spontaneous aggregation of erythrocytes was found. It becomes clear that as a result of this, these patients have a dramatic increase in the risk of vascular thrombosis, which can cause disability and early death.

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