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Aggregational Properties Of Neutrophils In Patients With Arterial Hypertension With Abdominal Obesity And Dyslipidemia.

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ABSTRACT

Excessive consumption of food and low physical activity in a large part of the population lead to a wide prevalence of a combination of arterial hypertension, abdominal obesity and dyslipidemia in different countries of the world. These patients have a high incidence of thrombosis of different locations, which is explained by increased aggregation of blood cells. The goal is to clarify the aggregation potential of neutrophils in patients with arterial hypertension with abdominal obesity and dyslipidemia. We examined 55 patients of the second adulthood (mean age 51.2 ± 2.7 years) with arterial hypertension 1-2 degrees with abdominal obesity with dyslipidemia. The control group consisted of 26 clinically healthy people of the same age. All the examined persons gave written informed consent to participate in the study. Biochemical, hematological and statistical methods of investigation were used. It became clear that a high incidence of thrombosis of various localizations in hypertension with abdominal obesity and dyslipidemia is very much associated with the development of excessive aggregation of neutrophils. Important mechanisms of its formation in conditions of a combination of arterial hypertension with abdominal obesity and dyslipidemia are the weakening of antioxidant protection of the plasma and activation of the processes of lipid peroxidation in it. It was also found that for persons with arterial hypertension and abdominal obesity with dyslipidemia, a weakening of the disaggregation of neutrophils is characteristic. As a result, patients receive a sharply increased risk of thrombosis of any location, which can lead to disability and death.

Keywords: neutrophils, arterial hypertension, abdominal obesity, dyslipidemia, vascular wall, antiaggregation.

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INTRODUCTION

Improving nutrition in the majority of the population, a high level of social stress and neglect of physical activity by the majority of the population lead to a high prevalence in the developed countries of a combination of arterial hypertension (AH) with abdominal obesity and dyslipidemia [1,2]. Its high incidence in the working population provides a significant level of vascular complications leading to disability and early mortality [3]. This fact is based on a pronounced thrombophilia in hypertension with abdominal obesity and dyslipidemia. It manifests itself first of all by the strengthening of the aggregation properties of the formed blood elements [4,5]. At the same time, activation of hemostasis develops, which forms the risk of thrombosis [6,7,8]. This is based on a decrease in the sensitivity of blood cells to vascular disaggregants, the most important of which are prostacyclin and nitric oxide [9,10]. Given the high prevalence of the combination of hypertension with abdominal obesity and dyslipidemia and a serious significance for microcirculation of neutrophil aggregation, it was of scientific interest to evaluate its level in this category of patients [11].

The goal is to find out the aggregation potential of neutrophils 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).

We examined 55 patients of the second mature age (mean age 51.2±2.7 years) with AH of the 1st-2nd degree [12] with abdominal obesity and dyslipidemia. The control group was composed of 26 clinically healthy people of the same age. All the examined persons gave written informed consent on participation in the research. All participants in the study gave their written consent to participate in it [13].

Intensity of lipids' peroxidation (LPO) processes in plasma was estimated according to the content of thiobarbituric acid (TBA)-active products by a kit "Agat-Med" and acylhydroperoxides (AHP) [14]. Antioxidant abilities of liquid part of blood were determined according to the level of its antioxidant activity [15].

LPO activity in studied regular blood elements was determined according to the quantity of malon dialdehyde (MDA) in reduction reaction of thiobarbituric acid in washed and resuspended cells and the content of AHP in them [14]. In studied washed and resuspended regular blood elements we estimated the levels of cholesterol by enzymatic colorimetric method with the help of a kit "Vital Diagnostikum" and total phospholipids (CPL) according to the content of phosphorus in them.

Neutrophil aggregation was assessed in plasma without temporal venous occlusion on a photoelectrocolorimeter. As inductors, lectin of wheat germs in a dose of 32 μg/ml, concanavalin A - 32 μg/ml and phytohemagglutinin - 32 μg/ml were used in the work.

The results were processed by Student's criterion (t). Statistical processing of received information was made with the help of a program package "Statistics for Windows v. 6.0", "Microsoft Excel". Differences in data were considered reliable in case of $p<0.05$.

RESEARCH RESULTS AND DISCUSSION

The patients were noted to have evident plasma LPO activation – the content of AHP in it surpassed the control value in 2.35 times, TBA-active products – in 1.53 times, being accompanied by suppression of antioxidant plasma activity in 1.5 times (Table).

The observed patients were noted to have increased cholesterol (CS) content in neutrophils membranes which was accompanied by the decrease of CPL in them and LPO activation on behalf of weakening of their antioxidant protection (Table).

Patients showed an increase in neutrophil aggregation in response to all tested inductors (with lectin by 58.3%, concanavalin A by 43.9%, phytohemagglutinin by 42.1%) (Table).

Important significance in the development of rheological disturbances and thrombophilia in persons with AH, abdominal obesity and dyslipidemia belongs to aggregation increase of regular blood elements and especially – neutrophils [17,18]. At combination of AH, abdominal obesity and dyslipidemia the depression of plasma antioxidant activity is formed which provides the increase of LPO activity in it [19]. The increase of freely radical processes in liquid part of blood inevitably promotes the damage of neutrophils' membranes [20]. The development of these manifestations in combination with found in these patients' neutrophils lipid imbalance leads to their hyperaggregability. The level of disaggregating impacts from the side of vascular wall [21,22] lowers simultaneously with it in respect of neutrophils [23].

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, mcmol / l	5.47±0.12	3.56±0.07 p<0,01
antioxidant activity plasma, %	21.2±0.19	32.9±0.12 p<0.01
biochemical parameters of neutrophils		
cholesterol of neutrophils, mkmol/10^9 neutrophils	0.87±0.012	0.62±0.004 p<0.01
common phospholipids of neutrophils, mkmol/10^9 neutrophils	0.34±0.007	0.51±0.003 p<0.01
acylhydroperoxides of neutrophils, D_{233}/10^9 neutrophils	3.87±0.09	2.36±0.05 p<0.01
malonic dialdehyde of neutrophils, nmol/10^9 neutrophils	1.62±0.11	0.73±0.03 p<0.01
catalase of neutrophils, ME/10^9 neutrophils	4900.0±16.45	9950.0±19.77 p<0.01
superoxidismutase of neutrophils, ME/10^9 neutrophils	1150.0±2.92	1780.0±4.21 p<0.01
aggregation of neutrophils in intact plasma		
Aggregation with lectin, %	24.7±0.12	15.6±0.07 p<0.01
Aggregation with concanavalin A, %	21.3±0.11	14.8±0.04 p<0.01
Aggregation with phytohemagglutinin, %	43.5±0.09	30.6±0.09 p<0.01

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

The increase in neutrophil aggregation in the examined patients revealed in the study was associated with a weakening of their sensitivity to disaggregants, while the activity of glycoprotein receptors of leukocytes increased with respect to lectins capable of inducing neutrophil aggregation [24,25]. The amplification of lectin- and concanavalin A-induced aggregation of neutrophils in plasma in patients with AH with abdominal obesity and dyslipidemia is associated with an increase in expression on the membrane of neutrophils of adhesion receptors, which include in their composition many sites containing N-acetyl-D-glucosamine, N-acetyl-neuraminic acid and mannose [26, 27]. Redundancy of neutrophil aggregation in response to phytohemagglutinin is caused by an increase in their receptors of glycoproteins containing bD-galactose [28,29] under conditions of weakening the neutrophil susceptibility to prostacyclin and NO [30,31,32].

CONCLUSION

The high incidence in the world of a combination of arterial hypertension with abdominal obesity and dyslipidemia requires further comprehensive study of this pathology. In the study, it was found that lipid peroxidation in plasma was significantly enhanced in these patients. This is accompanied by a marked increase in the aggregation of neutrophils. The weakening of their disaggregation capabilities strengthens aggregation in vivo, weakens trophism of tissues and creates a serious risk of thrombosis in patients with arterial hypertension with abdominal obesity and dyslipidemia.

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