

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Severity Of Neutrophil Aggregation In Patients With Arterial Hypertension With Impaired Glucose Tolerance.

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ABSTRACT

The growing efforts of medicine can not contain the growth among the population of industrially developed countries of arterial hypertension and the violation of glucose tolerance. Particularly dangerous is the high prevalence of arterial hypertension and impaired tolerance to glucose, thrombosis is associated with development primarily through the activation of blood cells. The goal is to clarify the aggregation potential of neutrophils in patients with arterial hypertension with impaired glucose tolerance. We examined 49 patients of the second adulthood (mean age 52.4 ± 1.9 years) with grade 1 hypertension of the 2nd degree with impaired glucose tolerance. The control group consisted of 26 clinically healthy people of the same age. All examined persons gave written informed consent to participate in the study. Biochemical, hematological and statistical methods of investigation were used. As a result of the study, we can assume that the frequency of thrombosis of various localizations in hypertension with impaired glucose tolerance is closely related to the development of neutrophil hyperaggregation. At the heart of this disorder in conditions of a combination of arterial hypertension with impaired glucose tolerance is the weakening of antioxidant protection of the plasma with the activation of lipid peroxidation processes in it. It was found that people with hypertension and impaired glucose tolerance have an obvious weakening of neutrophil disaggregation. 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, impaired glucose tolerance, vascular wall, antiaggregation.

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INTRODUCTION

The active aspiration of modern medicine preserves the health of the population in industrially developed countries and faces the widespread prevalence of a combination of arterial hypertension (AH) and impaired glucose tolerance [1,2]. Very often, their combination develops in working age, causing serious vascular complications leading to disability and early death [3]. It becomes clear that a high frequency in the population of thrombosis in hypertension and impaired glucose tolerance is associated with increased aggregation of blood cells [4,5]. It is recognized that the strengthening of the aggregation of blood cells occurs necessarily with the activation of hemostasis and an increased risk of thrombosis [6,7,8]. This is largely due to a decrease in the sensitivity of blood cells to disaggregants, including prostacyclin and nitric oxide [9,10]. In view of the high prevalence of hypertension with a violation of glucose tolerance and serious significance for microcirculation of neutrophils, it was important to assess the level of aggregation of neutrophilic leukocytes in these patients [11].

The aim of the work is to clarify the aggregation potential of neutrophils in patients with hypertension with impaired glucose tolerance.

MATERIAL AND METHODS

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

We examined 49 patients of the second mature age (mean age 51.2 ± 2.7 years) with AH of the 1st-2nd degree [12] with impaired glucose tolerance. 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 according to the content of phosphorus in them.

Aggregation of neutrophils was assessed on a photoelectrocolorimeter [16]. Inductors were the lectin of wheat germ at a concentration of 32 $\mu\text{g/ml}$, concanavalin A - 32 $\mu\text{g/ml}$ and phytohemagglutinin - 32 $\mu\text{g/ml}$.

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 2.3 times, TBA-active products – in 1.5 times, being accompanied by suppression of antioxidant plasma activity in 1.43 times (Table).

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

In the observed patients, neutrophil aggregation in response to applied inductors appeared earlier than in the control group (with lectin at 48.7%, concanavalin A 35.8%, with phytohemagglutinin 34.9%) (Table).

Table. Registered indicators in the surveyed

Registered parameters	Patients, n=49, M±m	Control, n=26, M±m
acylhydroperoxides plasma, D ₂₃₃ /1ml	3.25±0.08	1.42±0.09 p<0.01
TBA-compounds, µmol/l	5.27±0.15	3.56±0.07 p<0,01
antioxidant activity plasma, %	23.0±0.18	32.9±0.12 p<0.01
biochemical parameters of neutrophils		
cholesterol of neutrophils, µmol/10 ⁹ neutrophils	0.85±0.010	0.62±0.004 p<0.01
common phospholipids of neutrophils, µmol/10 ⁹ neutrophils	0.36±0.009	0.51±0.003 p<0.01
acylhydroperoxides of neutrophils, D ₂₃₃ /10 ⁹ neutrophils	3.62±0.04	2.36±0.05 p<0.01
malonic dialdehyde of neutrophils, nmol/10 ⁹ neutrophils	1.46±0.05	0.73±0.03 p<0.01
catalase of neutrophils, ME/10 ⁹ neutrophils	5150.0±12.09	9950.0±19.77 p<0.01
superoxidismutase of neutrophils, ME/10 ⁹ neutrophils	1200.0±4.12	1780.0±4.21 p<0.01
aggregation of neutrophils		
Aggregation with lectin, %	23.2±0.16	15.6±0.07 p<0.01
Aggregation with concanavalin A, %	20.1±0.13	14.8±0.04 p<0.01
Aggregation with phytohemagglutinin, %	41.3±0.06	30.6±0.09 p<0.01

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

Important significance in the development of rheological disturbances and thrombophilia in persons with AH and impaired glucose tolerance belongs to aggregation increase of regular blood elements and especially – neutrophils [17,18]. At combination of AH and impaired glucose tolerance 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. At the same time, the level of sensitivity to disaggregating influences from the side of the vascular wall decreases in neutrophils [21,22, 23].

The increased neutrophil aggregation observed in the examined patients is largely due to the depression of their ability to disaggregate against the background of an increase in the number of glycoprotein receptors to lectins used in the study as inducers [24,25]. The intensification of lectin- and concanavalin A-induced aggregation of neutrophils in plasma after temporary venous occlusion in patients with hypertension with impaired glucose tolerance is associated with an increase in the expression level on the membranes of their neutrophils, the adhesion receptors, which contain a significant number of sites containing N-acetyl-D - glucosamine, N-acetyl-neuraminic acid and mannose [26, 27]. The increase in neutrophil aggregation in response to the appearance of phytohemagglutinin in the plasma is caused by the growth in their receptors of sites of glycoproteins containing bD-galactose [28,29] under the conditions of depression of synthesis in the vascular endothelium of prostacyclin and NO patients [30,31,32].

CONCLUSION

The frequent occurrence in modern people of a combination of arterial hypertension with a violation of glucose tolerance requires a comprehensive study of this pathology. Particular attention to neutrophils is due to the high incidence of thrombosis in this category of patients. In the study, it was found that lipid peroxidation in plasma was significantly enhanced in these patients. This contributes to the formation of neutrophil dysfunction with a weakening of their sensitivity to vascular antiaggregants. This increases the aggregation of neutrophils. The resulting increase in neutrophil aggregation disrupts tissue trophism and makes a significant contribution to the risk of thrombosis in patients with arterial hypertension with impaired glucose tolerance.

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