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Expression Of Spontaneous Aggregation Of Erythrocytes In Patients With Arterial Hypertension With Type 2 Diabetes Mellitus.

Medvedev IN*.

Russian State Social University, st. V. Pika, 4, Moscow, Russia, 129226.

ABSTRACT

For patients with arterial hypertension with type 2 diabetes mellitus, hyperaggregation of blood cells is very characteristic. The prevalence in the developed countries of a combination of arterial hypertension with type 2 diabetes mellitus provides a high interest for researchers. Particular attention in this pathology attracts the aggregation of the most numerous population of blood cells - erythrocytes. The purpose of the study is to study the severity of aggregation properties of erythrocytes in patients with arterial hypertension with type 2 diabetes mellitus. 42 patients with arterial hypertension of 1-2 degrees and type 2 diabetes mellitus of the second adult age were examined. The control consisted of 26 healthy persons of the second adult age. Biochemical, hematological and statistical methods are applied. In patients, an increase in the cholesterol content in erythrocyte membranes was found, a decrease in total phospholipids in them and activation of lipid peroxidation in them. A high activity of spontaneous aggregation of erythrocytes was also noted in patients. The changes found in the examined category of patients should be considered as a consequence of metabolic abnormalities arising on the background of arterial hypertension and diabetes mellitus 2, expressed vasospasm and activation of lipid peroxidation. Patients with this contingent of vasopathy dramatically increased their risk of fatal thrombosis.

Keywords: arterial hypertension, diabetes mellitus, pathology, aggregation, erythrocytes.

**Corresponding author*

INTRODUCTION

Constant prophylactic examinations of the bulk of the population of industrially developed countries could not yet significantly affect the widespread prevalence in society of a tendency to rejuvenate the combination of arterial hypertension (AH) and type 2 diabetes mellitus [1,2]. It is believed that the combination of these two conditions greatly contributes to an increase in episodes of vascular thrombosis in persons of mature age, which often leads to disability and mortality [3,4].

The high incidence of thrombosis in patients with type 2 diabetes mellitus is largely related to the thrombophilia that forms in them [5,6]. It is based on the strengthening of aggregation processes in the blood of these patients. These conditions can strongly activate hemostasis and cause thrombosis [7,8,9]. It is known that the aggregation of blood cells is inhibited by substances of vascular origin and called desaggregants. The most powerful of these are prostacyclin and nitric oxide [10,11]. In this case, the sensitivity of blood cells of patients with AH and type 2 diabetes mellitus to them can be greatly reduced.

The aim of the study is to study the severity of aggregation properties of erythrocytes in patients with AH with type 2 diabetes mellitus.

MATERIAL AND METHODS

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

42 patients with AH of 1-2 degree, risk 4 [12] with type 2 diabetes, the second adult age (mean age 49.3 ± 2.9 years) were examined. Control consisted of 26 healthy people of the second adulthood. The examinees gave written information consent to participate in the conducted research according to the generally accepted procedure [13].

The expression of lipid peroxidation (LPO) in plasma was taken into account in terms of the level of thiobarbituric acid (TBA) -active products with the help of the Agat-Med (Russia) and acyl hydroperoxides (AGP) kit [14]. The state of antioxidant plasma protection was estimated by the method of [15].

The intensity of LPO in erythrocytes was determined by the level of malonic dialdehyde (MDA) in them and the content of AGP in them after washing and resuspension [14]. In addition, in washed and resuspended red blood cells, the cholesterol content was assessed by the enzymatic colorimetric method, using the Vital Diagnosticum kit (Russia) and taking into account the total phospholipids for phosphorus content in erythrocytes.

Activity of spontaneous aggregation of erythrocytes was determined with the help of a light microscope in Goryaev's chamber [16]. The number of erythrocyte aggregates, the number of aggregated and non-aggregated erythrocytes were 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 $p < 0.05$.

RESEARCH RESULTS AND DISCUSSION

In the examined patients, a pronounced activation of LPO in plasma was found - the content of AGP in it exceeded the level of control 2.35 times. The quantity of TBA-active products is 1.54 times. This occurred as a result of attenuation of the antioxidant protection of the plasma by a factor of 1.5 (Table).

In patients, an excess of the amount of cholesterol in the erythrocyte membranes was found while reducing the total phospholipids in them. At the same time, activation of LPO due to depression of their antioxidant protection was found in erythrocytes (Table).

In patients, a strong activation of spontaneous erythrocyte aggregation was noted (Table). This was indicated by an increase in their overall inclusion in aggregates (by 66.8%), an increase in the number of these aggregates (by 74.4%) and a decrease in 64.8% of non-aggregated red blood cells.

Table. Registered indicators in the surveyed

Registered parameters	Patients n=42, 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±0.16	3.56±0.07 p<0.01
antioxidant activity plasma, %	21.3±0.18	32.9±0.12 p<0.01
biochemical parameters of erythrocytes		
cholesterol of erythrocytes, μmol /10 ¹² erythrocytes	1.35±0.011	1.04±0.004 p<0.01
common phospholipids of erythrocytes, μmol /10 ¹² erythrocytes	0.53±0.009	0.75±0.003 p<0.01
acylhydroperoxides of erythrocytes, D ₂₃₃ /10 ¹² erythrocytes	4.79±0.27	3.08±0.10 p<0.01
malonic dialdehyde of erythrocytes, nmol/10 ¹² erythrocytes	1.72±0.10	1.14±0.05 p<0.01
catalase of erythrocytes, ME/10 ¹² erythrocytes	7210.0±14.7	11196.0±22.4 p<0.01
superoxidismutase of erythrocytes, ME/ 10 ¹² erythrocytes	1450.0±2.12	1986.0±7.01 p<0.01
aggregation of erythrocytes		
The sum of all red blood cells in the aggregate	69.9±0.17	41.9±0.10 p<0.01
Number of aggregates	15.7±0.22	9.0±0.06 p<0.01
The number of free red blood cells	145.6±0.99	240.0±0.23 p<0.01

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

Growth of erythrocyte aggregation plays a significant role in increasing the risk of thrombosis in people with AH and type 2 diabetes mellitus [18,19]. When AG is combined with type 2 diabetes mellitus, depression of the antioxidant protection of the plasma develops, which ensures the growth of LPO processes in it [20]. This inevitably worsens the structure and function of erythrocyte membranes [21]. All this leads to hyperaggregation of erythrocytes. The oncoming weakening of the disaggregating effects of blood vessels on erythrocytes aggravates the situation [22,23]. This was observed in the patients observed for the growth of erythrocyte aggregation in plasma after temporary venous occlusion [24]. It is clear that the growth of erythrocyte aggregation in patients with AH with type 2 diabetes is caused by the weakening of their disaggregating abilities [25,26] and a decrease in the level of negatively charged proteins on erythrocytes [27]. Weakening of antioxidant plasma parameters promotes intensification of lipid peroxidation processes in it, and, consequently, marked oxidative damage of endotheliocytes and plasma proteins [28,29]. In conditions of low sensitivity of erythrocytes to vascular disaggregants, the erythrocytes bind to one another in aggregates and their number increases [30, 31]. At the same time, a decrease in the effect of prostacyclin and nitric oxide on erythrocytes forms a functional imbalance in the erythrocytes of adenylate cyclase and phosphodiesterase [32,33]. As a result, the amount of cyclic adenosine monophosphate decreases and the level of Ca²⁺ increases, which additionally stimulates the expression of erythrocyte aggregation [34,35].

CONCLUSION

For patients with arterial hypertension and type 2 diabetes mellitus, a high platelet count is characteristic. This required a detailed examination of this contingent of patients. It was found that in arterial hypertension with type 2 diabetes mellitus, the antioxidant activity of the plasma is weakened and lipid peroxidation, which damages the blood cells, increases in it. In this contingent of patients, the aggregating properties of erythrocytes were found to increase. Expressed erythropium in this contingent of patients is an important basis for the high danger in them of thromboses of any localization, sometimes with fatal consequences.

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