

Research Journal of Pharmaceutical, Biological and Chemical Sciences

The Level Of Erythrocyte Aggregation In Patients With Type 2 Diabetes Mellitus.

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ABSTRACT

With long-term type 2 diabetes mellitus, vascular thrombosis can often occur. They are often based on hyperaggregation of blood cells. The widespread prevalence in developed countries of type 2 diabetes makes this problem very urgent. The aim of the work is to evaluate the aggregation activity of erythrocytes in patients with type 2 diabetes mellitus. 36 patients with type 2 diabetes mellitus of the second adulthood were examined. The control consisted of 26 healthy persons of the second adult age. Biochemical, hematological and statistical methods are used in the work. All the patients noted excess cholesterol in the erythrocyte membranes, a decrease in the level of phospholipids in them when lipid peroxidation was activated in them. They also showed a pronounced activation of spontaneous aggregation of erythrocytes. It was accompanied in these patients by the weakening of the disaggregating properties of erythrocytes. The changes found in the examined category of patients should be considered as a consequence of metabolic disorders, dysfunction of blood cells and activation of lipid peroxidation.

Keywords: pathology, diabetes, thrombophlelia, aggregation, erythrocytes.

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INTRODUCTION

Regular preventive examinations and examinations with the subsequent appointment of recreational activities in industrially developed countries have so far failed to reduce the prevalence of type 2 diabetes among the population [1,2]. It is noted that in patients with this pathology, thromboses of the vessels are often recorded, capable of leading to disability and early death [3,4].

The prevalence of thrombosis in patients with type 2 diabetes mellitus is largely associated with the formation of hyperaggregation of blood cells in them [5,6]. The emerging situation can strongly activate the mechanisms of hemostasis and cause thrombosis [7,8,9]. At the heart of these processes is the weakening of the ability of blood cells to disaggregate, especially to prostacyclin and nitrogen oxide [10,11]. Given the high risk of thrombosis in type 2 diabetes, it seemed important to assess the level of erythrocyte aggregation in this category of patients.

The aim of the study is to evaluate the aggregation activity of erythrocytes in patients 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).

36 patients with type 2 diabetes [12], the second adult age (mean age 47.4 ± 2.1 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 level of lipid peroxidation (LPO) in plasma was taken into account by 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 expression of LPO in erythrocytes was determined by the level of malonic dialdehyde (MDA) in them and the content of AHP 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", "Microsoft Excel". Differences in data were considered reliable in case of $p < 0.05$.

RESEARCH RESULTS AND DISCUSSION

In the patients under observation, a pronounced activation of LPO in the plasma was found - the AHP content in it was 2.2 times higher than the control level. The quantity of TBA-active products is 1.5 times. This occurred as a result of the weakening of the antioxidant protection of the plasma by a factor of 1.4 (Table).

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

The observed patients noted a strong activation of spontaneous erythrocyte aggregation (Table). This was indicated by an increase in their total inclusion in aggregates (by 46.3%), an increase in the number of these aggregates (by 44.4%) and a 34.8% decrease in non-aggregated red blood cells.

Table. Registered indicators in the surveyed

Registrated parameters	Patients, n=36, M±m	Control, n=26, M±m
acylhydroperoxides plasma, D ₂₃₃ /1ml	3.10±0.10	1.42±0.09 p<0.01
TBA-compounds, µmol/l	5.34±0.14	3.56±0.07 p<0.01
antioxidant activity plasma, %	23.8±0.16	32.9±0.12 p<0.01
biochemical parameters of erythrocytes		
cholesterol of erythrocytes, µmol/10 ¹² erythrocytes	1.29±0.012	1.04±0.004 p<0.01
common phospholipids of erythrocytes, µmol/10 ¹² erythrocytes	0.62±0.004	0.75±0.003 p<0.01
acylhydroperoxides of erythrocytes, D ₂₃₃ /10 ¹² erythrocytes	4.50±0.23	3.08±0.10 p<0.01
malonic dialdehyde of erythrocytes, nmol/10 ¹² erythrocytes	1.61±0.16	1.14±0.05 p<0.01
catalase of erythrocytes, ME/10 ¹² erythrocytes	8500.0±12.0	11196.0±22.4 p<0.01
superoxidismutase of erythrocytes, ME/10 ¹² erythrocytes	1550.0±3.06	1986.0±7.01 p<0.01
aggregation of erythrocytes		
sum of all the erythrocytes in an aggregate	61.3±0.15	41.9±0.10 p<0.01
quantity of aggregates	13.0±0.20	9.0±0.06 p<0.01
quantity of free erythrocytes	178.0±0.75	240.0±0.23 p<0.01

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

The growth of erythrocyte aggregation plays a significant role in maintaining a high risk of thrombosis in individuals with type 2 diabetes [18, 19]. With type 2 diabetes mellitus, depression of the antioxidant protection of 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 properties of erythrocytes aggravates the situation [22,23]. This was observed in the observed patients for the growth of erythrocyte aggregation [24]. It became clear that the growth of erythrocyte aggregation in patients with type 2 diabetes was caused by the weakening of their sensitivity to the disaggregating effects of blood vessels [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 deficiency of vascular dezagregantov there is an intensification of erythrocyte communication among themselves in aggregates and an increase in their number [30,31]. At the same time, a decrease in the level in the blood of prostacyclin and nitric oxide 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 type 2 diabetes mellitus, a high incidence of thrombosis is characteristic. This required additional examination of this contingent of patients. In the work it was revealed that in the case of type 2 diabetes mellitus, the antioxidant activity of the plasma decreases and the lipid peroxidation is increased in it. This adversely affects the cells of their blood. In addition, this cohort of patients found an increase in spontaneous aggregation of erythrocytes. The expressed hyperaggregation of erythrocytes in this contingent of patients is the basis of high risk of thrombosis of any localization threatening their health [36,37,38].

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