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Disaggregation Properties Of Blood Vessels In Relation To Platelets In Patients With Arterial Hypertension With Impaired Glucose Tolerance.

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ABSTRACT

Modern researchers note the increase in the number of patients suffering from arterial hypertension and impaired glucose tolerance. They are characterized by a high incidence of thrombosis, directly related to the presence of their vasopathy, the severity of which has so far not been adequately studied. The goal is to assess the disaggregation capacity of blood vessels in relation to platelets in patients with arterial hypertension with impaired glucose tolerance. We examined 49 patients of the second mature age (mean age 52.4±1.9 years) with arterial hypertension of the 1st-2nd degree, risk 4 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. There were applied biochemical, hematological and statistical methods of investigation. High thromboses' frequency of various localizations at arterial hypertension with impaired glucose tolerance is closely connected with angiopathy development against their background. Weakening of plasma antioxidant protection with activation of lipids' peroxidation processes in it leading to alteration of vascular wall, is noted in conditions of arterial hypertension combination with impaired glucose tolerance. The persons with arterial hypertension and impaired glucose tolerance are detected to have evident weakening of disaggregating vascular impacts of vascular wall on strengthening aggregative ability of platelets. In the result of it given patients get sharply increased risk of thromboses of any localization which can lead to invalidism and lethal outcome.

Keywords: platelets, arterial hypertension, impaired glucose tolerance, vascular wall, antiaggregation.

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INTRODUCTION

According to modern statistics in civilized countries, high prevalence of arterial hypertension (AH), combined with a violation of glucose tolerance, is preserved [1,2]. This combination provides a great risk of development in these patients, especially in adulthood, the mass of vascular thrombosis leading to widespread disability and mortality [3]. It is noted that the emergence of thrombosis of any localization is always facilitated by vasopathy, which now occurs more often [4]. The formation of vasopathy is accompanied by the weakening of vascular control over the processes of aggregation of blood elements, which strongly stimulates various mechanisms of hemostasis, sometimes leading to thrombosis [5-7]. Against the backdrop of vasopathy, there is often a pronounced weakening of the synthesis of desaggregant substances in the vessels, the most functionally significant of which are prostacyclin and nitric oxide [8, 9]. In view of the prevalence of hypertension with the violation of glucose tolerance, it was very important to assess the state of vascular control over platelet aggregation in these patients [10].

The goal was to assess the disaggregation capacity of blood vessels in relation to platelets in hypertensive patients with impaired glucose tolerance.

MATERIALS AND METHODS

Hhe 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 1^{st}-2^{nd} degree [11] 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 those surveyed agreed to participate in the study [12].

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) [13]. Antioxidant abilities of liquid part of blood were determined according to the level of its antioxidant activity [14].

LPO activity in studied regular blood elements was determined according to the quantity of malondialdehyde (MDA) in reduction reaction of thiobarbituric acid in washed and resuspended cells and the content of AHP in them [13]. 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 CPL according to the content of phosphorus in them.

Evidence of vascular wall's control over platelets' aggregation was detected according to its weakening in the test with temporal venous occlusion [15].

Platelet aggregation (AT) was assessed using a visual micromethode [16] in plasma obtained without and using venous occlusion using ADP ($0.5x10^{-4}$ M), collagen (1: 2 dilution of the base suspension), thrombin (0.125ed/ml), ristomycin (0.8 mg / ml), epinephrine (5.0×10^{-6} M) and with combinations of ADP and epinephrine; ADP and collagen; adrenaline and collagen at the same concentrations in a platelet-rich plasma standardized for platelet counts of 200×10^9 platelets. The value of the index of antiaggregatory activity of the vascular wall (IAASC) was calculated in the course of dividing the time of development of AT in the plasma after venous occlusion during the time of this process in intact plasma. The level of disaggregation capacity of blood vessels with respect to intravascular aggregation of platelets was determined using a phase contrast microscope with the registration of the number of small, medium and large aggregates and the degree of involvement of platelets in plasma obtained without temporal venous occlusion and in plasma obtained against its background [17,18].

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 $p<0.05$.

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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 erythrocytes' membranes which was accompanied by the decrease of CPL in them and LPO activation on behalf of weakening of their antioxidant protection (Table).

In patients with hypertension and impaired glucose tolerance, acceleration of development of AT with inductors and their combinations was revealed (Table). The most accelerated AT developed with collagen, a little later with ADP, even later with ristomycin, thrombin and adrenaline. The onset of AT with combinations of inductors was even more accelerated. The number of platelet aggregates and the level of platelet involvement in patients with hypertension and impaired glucose tolerance exceeded the control figures.

All the patients were noted to have the decrease of vessels' disaggregative impacts on platelets (Table).

Table: Registered indicators in the surveyed

Registrated 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, mcmol/l	5.27±0.15	3.56±0.07 p<0,01
antioxidantactivityplasma, %	23.0±0.18	32.9±0.12 p<0.01
biochemical parameters of platelets		
cholesterol of platelets, mkmol/10^9 platelets	1.07±0.011	0.67±0.005 p<0.01
common phospholipids of platelets, mkmol/10^9 platelets	0.35±0.009	0.49±0.004 p<0.01
acylhydroperoxides of platelets, D_{233}/10^9 platelets	3.40±0.08	2.20±0.04 p<0.01
malonicdialdehyde of platelets, nmol/10^9 platelets	1.32±0.12	0.68±0.02 p<0.01
catalase of platelets, ME/10^9 platelets	5100.0±23.62	9790.0±20.10 p<0.01
superoxidismutase of platelets, ME/10^9 platelets	1120.0±7.94	1650.0±3.00 p<0.01
aggregation of platelets in intact plasma		
aggregation with ADP, s	25.9±0.12	41.0±0.12 p<0.01
aggregation with collagen, s	24.0±0.13	33.2±0.10 p<0.01
aggregation with thrombin, s	36.9±0.10	55.3±0.05 p<0.01
aggregation with ristomycin, s	28.1±0.07	45.2±0.06 p<0.01
aggregation with epinephrine, s	72.0±0.15	93.0±0.07 p<0.01
aggregation with ADP and epinephrine, s	21.2±0.14	34.5±0.04 p<0.01

aggregation with ADP and collagen, s	17.8±0.08	26.6±0.05 p<0.01
aggregation with epinephrine and collagen, s	13.4±0.14	29.2±0.12 p<0.01
The number of platelets in the aggregates, %	12.6±0.18	6.5±0.07 p<0.01
Number of little aggregates (in 100 free thrombocytes)	16.1±0.20	3.1±0.03 p<0.01
Number of medium and large aggregates (in 100 free thrombocytes)	1.54±0.07	0.14±0.03 p<0.01
vascular control of platelet aggregation		
IAAVWwith ADP	1.27±0.17	1.53±0.16 p<0.01
IAAVWwith collagen	1.19±0.23	1.48±0.16 p<0.01
IAAVWwith thrombin, s	1.18±0.16	1.44±0.13 p<0.01
IAAVWwith ristomycin, s	1.26±0.12	1.56±0.11 p<0.01
IAAVWwith epinephrine	1.34±0.25	1.62±0.13 p<0.01
IAAVWwith ADP and epinephrine	1.27±0.15	1.49±0.12 p<0.01
IAAVWwith ADP and collagen	1.26±0.16	1.51±0.10 p<0.01
IAAVWwithepinephrine and collagen	1.20±0.19	1.53±0.11 p<0.01
The number of platelets in the aggregatesafter temporary venous occlusion, %	10.2±0.11	4.5±0.15 p<0.01
Number of little aggregates (in 100 free thrombocytes) after temporary venous occlusion	7.0±0.12	2.1±0.15 p<0.01
Number of medium and large aggregates (in 100 freethrombocytes)after temporary venous occlusion	0.18±0.009	0.02±0.005 p<0.01

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

In patients with hypertension and impaired glucose tolerance, a decrease in IAAWW with individual inducers was found (for adrenaline 1.34±0.25, for ADP 1.27±0.17, for ristomycin1.26±0.12, for collagen and thrombin 1,19±0,23 and 1,18±0,16, respectively) and with their combinations (for ADP and adrenaline 1,27±0,15, for ADP and collagen - 1,26±0,16, for adrenaline and collagen - 1,20 ± 0,19). In the blood of patients, taken after a temporary venous occlusion, the number of platelet aggregates of various sizes and the degree of involvement of platelets in them decreased slightly.

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 – platelets [19,20]. 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 [21,22]. The increase of freely radical processes in liquid part of blood inevitably promotes the damage of platelets' membranes. The development of these manifestations in combination with found in these patients' platelets lipid imbalance

leads to their hyperaggregability. The level of disaggregating impacts from the side of vascular wall [23,24] lowers simultaneously with it in respect of platelets.

Reduction IAAVW with inductors and their combinations is caused not only by the enhancement of AT, but also by the weakening of the disaggregation capacity of the vessels [25,26]. Apparently, an important role in this is the activation of LPO in plasma [27,28]. Acceleration of the process of AT with ristomycin in patients is associated with increased synthesis in the walls of the vessels of von Wille brand factor and growth of its content in their plasma [29,30]. A rapid onset in patients with AT in response to combinations of two inducers and the presence of a large number of platelet aggregates in their blood before and after venous occlusion is a consequence of severe depression of the disaggregation mechanisms of their vessels [31, 32].

CONCLUSION

The activity of vascular hemostasis is extremely important for maintaining homeostasis in the body. A serious manifestation of its disorders is the weakening of disaggregation capacity of blood vessels in relation to platelets. This phenomenon is very common in any cardiac pathology, including arterial hypertension. Often it is combined with a violation of glucose tolerance, which dictates the need to assess the disaggregation capacity of blood vessels in relation to platelets in this patient population. It is established that in arterial hypertension with impaired glucose tolerance there is a pronounced weakening of the disaggregation effects of blood vessels on the platelets. These disorders in this contingent of patients are a serious cause of activation of hemostasis and the development of thromboses of any localization in them.

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