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Antiaggregatory Effects Of Blood Vessels On Blood Neutrophils In Patients With Dyslipidemia.

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ABSTRACT

Improving the quality and quantity of nutrition in modern society is accompanied by the preservation of the widespread prevalence of dyslipidemia among the population of industrially developed countries. Modern researchers associate the frequent occurrence of thrombosis of various localizations in dyslipidemia with impaired vascular function, especially in terms of their control over shaped elements. the goal is to establish the features of the disaggregation capabilities of blood vessels over neutrophils in patients with dyslipidemia. We examined 41 patients of the second mature age (mean age 53.8 ± 1.6 years) with dyslipidemia of IIb type. 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 dyslipidemia 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 dyslipidemia. The persons with arterial hypertension and dyslipidemia are detected to have evident weakening of disaggregating vascular impacts of vascular wall on strengthening aggregative ability of neutrophils. 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: neutrophils, pathology, dyslipidemia, vascular wall, antiaggregation.

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INTRODUCTION

A large volume of consumption of high-calorie and fat-rich foods is accompanied by a high prevalence of dyslipidemia among the population of industrially developed countries [1,2]. Its presence provides a large part of the working population with a high incidence of vascular complications that cause disability and high mortality [3]. Modern researchers associate the frequent occurrence of thromboses of various localizations in dyslipidemia with impaired vascular function, especially in terms of their control over shaped elements [4,5]. It is known that hyperaggregation of blood elements occurs in conditions of vascular dysfunction, leading to the initiation of hemostasis and thrombosis [6,7,8]. This process is largely due to the complication of synthesis in the vessel wall of substances of disaggregants, the most physiologically important of which are prostacyclin and nitric oxide [9,10]. Given the wide prevalence of dyslipidemia and greater significance for microcirculation of neutrophils, there is great scientific and practical interest in the study of the level of vascular control over the aggregation of neutrophilic leukocytes in this contingent of patients [11].

The goal is to establish the features of the disaggregation capabilities of the vessels over neutrophils in patients with dyslipidemia.

MATERIALS AND METHODS

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

We examined 41 patients of the second mature age (mean age 53.8 ± 1.6 years) with dyslipidemia of IIb type [12]. 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.

We determined the content of common cholesterol (CS) and triglycerides (TG) in blood of all the observed persons by enzymatic colorimetric method with the help of a kit "Vital Diagnostikum" (Russia). CS level of high-density lipoproteins (HDL) was determined with the help of a kit "Olveks Diagnostikum (Russia)" by enzymatic colorimetric method. Common lipids (CL) were estimated with the help of a kit "Erba Russ" (Russia). The quantity of common phospholipids (CPL) in blood plasma was registered according to the content of phosphorus in them. CS levels of low-density lipoproteins (LDL) were established by calculation according to Freedwald V. CS concentrations of very low-density lipoproteins (VLDL) was determined according to the formula: $TG \text{ content} / 2.2$. Received indices of common CS and CS of LDL were considered as normal, borderline or high in accordance with Russian recommendations (2012) [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 (AOA) [15].

LPO activity in studied regular blood elements was determined according to the quantity of malonaldehyde (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 CPL according to the content of phosphorus in them.

Evidence of vascular wall's control over neutrophils' aggregation was detected according to its weakening in the test with temporal venous occlusion [16].

The level of vascular wall control over neutrophil aggregation was assessed in plasma obtained after temporary venous occlusion and without it on a photoelectric colorimeter. As inductors, a wheat germ lectin was used at a dose 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 $p < 0.05$.

RESULTS AND DISCUSSION

The blood of patients was noted to have levels' increase of CL and common CS which surpassed the control values in 1.6 and 1.3 times, respectively, at simultaneous lowering of plasma CPL in 2.1 times (Table). The blood of persons with dislipidemia was found to have the increase of CS LDLP, CS VLDLP and TG in 1.64, 1.61 and 1.60 times, respectively. It is combined with the lowering of CS HDLP in 1.5 times. The patients were noted to have evident plasma LPO activation – the content of AHP in it surpassed the control value in 2.1 times, TBA-active products – in 1.4 times, being accompanied by suppression of antioxidant plasma activity in 1.3 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).

Table: Registered indicators in the surveyed

Registered parameters	Patients with arterial hypertension and dyslipidemia, n=41, M±m	Control, n=26, M±m
common cholesterol, mmol/l	6.3±0.05	4.8±0.05 p<0.01
CS level of high-density lipoproteins, mmol /l	1.07±0.06	1.60±0.06 p<0.01
CS levels of low-density lipoproteins, mmol /l	3.99±0.07	2.43±0.04 p<0.01
CS concentrations of very low-density lipoproteins, mmol/l	1.24±0.04	0.77±0.05 p<0.01
triglycerides, mmol/l	2.72±0.06	1.70±0.02 p<0.01
common lipids, g/l	9.0±0.10	5.6±0.03 p<0.01
common phospholipids, mmol /l	1.70±0.06	3.54±0.09 p<0.01
acylhydroperoxides plasma, D ₂₃₃ /1ml	3.01±0.07	1.42±0.09 p<0.01
TBA-compounds, μmol / l	4.92±0.08	3.56±0.07 p<0,01
antioxidant activity plasma, %	24.2±0.13	32.9±0.12 p<0.01
biochemical parameters of neutrophils		
cholesterol of neutrophils, mkmol/10 ⁹ neutrophils	0.80±0.007	0.62±0.004 p<0.01
common phospholipids of neutrophils, mkmol/10 ⁹ neutrophils	0.39±0.003	0.51±0.003 p<0.01
acylhydroperoxides of neutrophils, D ₂₃₃ /10 ⁹ neutrophils	3.36±0.07	2.36±0.05 p<0.01
malonic dialdehyde of neutrophils, nmol/10 ⁹ neutrophils	1.37±0.06	0.73±0.03 p<0.01
catalase of neutrophils, ME/10 ⁹ neutrophils	5600.0±18.05	9950.0±19.77 p<0.01
superoxidismutase of neutrophils, ME/10 ⁹ neutrophils	1300.0±5.01	1780.0±4.21 p<0.01
aggregation of neutrophils in intact plasma		

Aggregation with lectin, %	21.3±0.07	15.6±0.07 p<0.01
Aggregation with concanavalin A, %	18.4±0.12	14.8±0.04 p<0.01
Aggregation with phytohemagglutinin, %	40.6±0.07	30.6±0.09 p<0.01
vascular control of aggregation neutrophils		
Aggregation with lectin after temporary venous occlusion, %	20.2±0.12	11.8±0.06 p<0.01
Aggregation with concanavalin A after temporary venous occlusion, %	16.8±0.03	11.0±0.07 p<0.01
Aggregation with phytohemagglutinin after temporary venous occlusion, %	38.6±0.06	24.1±0.03 p<0.01

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

In the patients enrolled, neutrophil aggregation with all tested inducers appeared earlier than in the control (with lectin at 36.5%, concanavalin A at 24.3%, with phytohemagglutinin 32.7%) (Table).

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

In plasma obtained after temporary venous occlusion, patients showed marked redundancy of neutrophil aggregation exceeding control with all tested inducers (lectin 71.2%, concanavalin A 52.7%, phytohemagglutinin 60.2%).

Important significance in the development of rheological disturbances and thrombophilia in persons with dislipidemia belongs to aggregation increase of regular blood elements and especially – neutrophils [17,18]. At dislipidemia 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].

The increase in neutrophil aggregation in patients under observation is apparently due in large part to a drop in the production of dezagregant substances in the vessel wall against the background of negative rearrangements of glycoprotein receptors of leukocytes to lectins used as inductors [24,25]. The intensification of lectin- and concanavalin A-induced aggregation of neutrophils against the background of temporary venous occlusion in patients with dyslipidemia was caused by an increase in expression on the membrane by neutrophil receptor adhesion with an increase in their composition of sites containing N-acetyl-D-glucosamine, N-acetyl-neuraminic acid and mannose [26, 27]. The redundancy of neutrophil aggregation induced by phytohemagglutinin aggregation is attributed to the authors attributed to the growth of glycoproteins containing bD-galactose [28,29] in their receptors with decreasing blood levels in patients with prostacyclin and NO [30,31,32].

CONCLUSION

High thromboses' frequency of various localizations with dislipidemia is closely connected with angiopathy development against their background. Weakening of plasma antioxidant protection with activation of LPO processes in it leading to alteration of vascular wall, is noted with dislipidemia. The persons with dislipidemia are detected to have evident weakening of disaggregating vascular impacts of vascular wall on strengthening aggregative ability of neutrophils. In the result of it given patients get sharply increased risk of thromboses of any localization which can lead to invalidism and lethal outcome [33,34,35].

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