NON-INVASIVE DIAGNOSIS OF VASCULAR LESIONS OF THE LOWER EXTREMITIES IN DIABETIC PATIENTS BY LASER DOPPLER FLOWMETRY IN CONJUNCTION WITH POLYMAGNETOTHERAPY

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Vascular lesions of the lower limbs (ischemic and mixed form of diabetic foot syndrome) is one of the most severe complications of diabetes mellitus (DM), the cause of infringement of quality of life and high mortality of patients with this pathology. Growing rate of emergency admissions — more than 90%, indicates the lack of effective outpatient care these patients. This makes any attempt to improve current diagnosis and treatment of angiopathy, especially with the use of non-invasive techniques very essential.

The processes of plasma exudation and their soaking, basal membrane damage precapillaries, capillaries and venules, basal membrane thickening precapillaries due to the accumulation in them Schick-positive glycoproteins and mucopolysaccharides neutral are the basis of the morphological changes of the walls microvascular diabetic angiopathy. Desquamation of vascular endothelium proliferation of endothelium and peritelium euroconnector, formation of aneurysmal expansion of the walls of capillaries is observed.

Severity and consequences of tissue ischemia are determined by hemodynamic impairment (impaired microcirculation) and developing tissue damage. The methods of diagnosis allowing to assess the state of microhemodynamics are of particular interest. The resolving ability of existing ultrasonic devices does not allow direct visualization of microvascular. Laser Doppler flowmetry (LDF) use allowing indirectly but objectively assess the microhemodynamics state in superficial tissues, rhythmic activity of microvasculature is effective in this case.

The study was conducted in the form of non-randomized prospective observation of 82 patients with diabetic foot syndrome, diabetic angiopathy vessels of the lower limbs and chronic arterial insufficiency of I-III A stage for Fontain-Saveliev. Microcirculation in the tissues of the lower limbs was evaluated during the LDF with a laser analyzer LAK-01 ("LAZMA", Moscow) with one transcutaneous sensor under standard conditions at two points with different structural features of the microvasculature: in the inner ankle (zone with a strong network of arteriovenous anastomoses) and on the dorsum of the foot in the first interdigital spaces (anastomoses are practically absent). Obtained by analyzing data LDF perfusion parameters and amplitude-frequency characteristics of the MC are shown in Table 1. Reliably determined that patients with diabetic foot syndrome KHAN I-IIIA stage reduced microcirculation index. Moreover, this decrease is more pronounced in the first interdigital

spaces on the dorsum of the foot than in the inner ankle. Relatively more intense perfusion at the ankle there is most likely due to increased tone of precapillary sphincters and smooth muscle cells in the wall of microvessels, the opening of arteriovenous shunts and shunt in the venous bed, bypassing the capillary network. This phenomenon, referred to as just "steal syndrome" is a criterion specific nature of diabetic vascular lesions associated with the parallel development of diabetic polyneuropathy. Changes in myogenic activity, FLACSO and neurogenic microvascular tone in the same match the specified violations of microcirculation.

To assess the functional reserve of microcirculation limbs in our study as a load test very physiotherapy procedure of polymagnetotherapy was used. PMT is a method of influencing energy-running pulsed magnetic field (BIMP) and the background magnetic field. In conducting the PMT in order to optimize the impact the biosynchronization principle is used: control algorithm synchronizes the rhythmic characteristics of created magnetotherapeutic environment with normal rhythmic activity of the lower limbs microvasculature of a healthy person according to LDF (the resonance effect).

Real growth in the level of perfusion during PMT was 102.4% in the inner ankle and 203.6% in the dorsum of the foot, the increase in value of the myogenic activity indicator amounted to 46.2% in the inner ankle and 32% on the rear surface and an increase in the coefficient variation was respectively 37.5% and 50.5%. The increase in the amplitude vasomotions, indicating that maintaining the ability to actively reduce microvascular was marked (Table 2). The appearance and increase of the amplitude of the pulse oscillation, which is a sign liquidation spasm of capillary sphincters, vasodilation and increased blood flow in the MC. The increase in pulse volume and blood flow in the microvasculature is possible in the case of maintaining sufficient functional reserve and mechanisms of tissue blood flow regulation, the presence of predominantly functional changes under the influence of MC polyneuropathy, not only in the area of arteriovenous anastomoses, but also at the level of true tissue capillaries. The results obtained in the study data show the feasibility and effectiveness of using LDF and PMT methods to adequately assess the nature and extent of the violation microhemodynamics, predicting possible outcomes of the process and the selection of the most efficient treatment program. Timely (to the lack of critical ischemia) application of PMT BIMP enables to improve microcirculation and to compensate for ischemic disorders in these patients.

Table 1. *Data of a laser Doppler fluogramm in normal state and at a chronic arterial insufficiency with a diabetes mellitus, (M± σ), p=0,05*

Data of a laser Doppler fluogramma	Internal anklebone		Interdigital interval	
	Healthy people (n=30)	Patients with CAI (n=82)	Healthy people (n=30)	Patients with CAI (n=82)
M (perfuzion units)	6,623±0,923	4,132±0,2497*	11,849±2,601	2,279 ±0,2277*
σ (perfuzion units)	0,95±0,321	1,59±0,088	2,12±1,013	1,77±0,101*
ALF/M*100%	209,3±63,51	202,9±30,22*	271,7±98,26	304,6±15,60
σ/ALF*100%	6,87±0,498	15,69±1,444*	5,67±1,115	18,83±2,293*

* — reliable distinctions at the level of significance p=0,05

Table 2. *Change of an indicator of microcirculation (M), coefficient of variation (Cv) and miogenny activity (ALF/M) during sessions of polymagnetotherapy, (M± σ), p=0,05*

Data of a laser Doppler fluogramma		The tested area	
		Internal anklebone	Foot sole
M (perfuzion units)	input data	4,11±0,108	2,20±0,244*
	during sessions	8,32±0,156	6,68±0,192*
ALF/M* 100%	input data	211,6±3,67	315,7±4,72*
	during sessions	309,4±4,11	416,8±49,0*
Cv	input data	22,75±8,675	21,94±8,081*
	during sessions	31,27±6,327	33,02±2,852*

* — reliable distinctions at the level of significance p=0,05

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