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NEW APPROACHES TO EARLY DIAGNOSIS OF MICROANGIOPATHY IN PATIENTS WITH TYPE 1 DIABETES MELLITUS

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Annotation. *Diabetes mellitus (DM) is one of the most common severe diseases, leading to early and progressive systemic vascular damage. Already at the initial stages of type 1 diabetes (T1DM), reversible functional disorders of the microvasculature are detected [1]. Subsequently, these disorders progress, becoming persistent and irreversible [2]. As practice shows, timely treatment, including normalization of glucose levels, antiplatelet agents, vasoprotectors, antioxidant drugs, can stop the development of angiopathy.*

Keywords: *diabetes mellitus, glycemia, glycosuria, glycated hemoglobin, biomicroscopy.*

Introduction. In this regard, the relevance of developing early and more effective methods for diagnosing diabetic microangiopathy is increasing [3, 4]. Currently, a number of methods are used for diagnosing damage to microvasculature vessels, for example: conjunctival biomicroscopy (studying the microvessels of the conjunctiva of the eye), laser Doppler flowmetry (allowing one to determine the level of perfusion in 1 mm3 of the skin) and computer capillaroscopy (diagnosing the state of the capillary network, more often on the nails). finger rolls using biomicroscopy). Conjunctival biomicroscopy is highly informative and sensitive. At the same time, its implementation requires expensive equipment and time resources. Performing laser Doppler flowmetry is also impossible without sophisticated and specialized equipment and specially trained medical personnel. Computer capillaroscopy is the most common method in clinical practice due to its high information content and non-invasiveness [5, 6]. Using microscopic visualization of capillary loops in vivo, objective assessment of structural abnormalities is possible. Capillaroscopy has been successfully used to diagnose angiopathy in patients with diabetes for more than 50 years [7, 8]. However, with the help of capillaroscopy it is possible to diagnose only persistent, structural changes in blood vessels; diagnosing changes in microcirculation in the early stages of the disease is quite difficult [9]. We decided to use capillaroscopy to identify early, functional vascular disorders in the initial stages of diabetes, preceding structural ones. For this purpose,

functional tests were used with physical effects on the upper limb, assessing capillaroscopic parameters before and after the test, as well as their recovery time.

Purpose of the study— development of a method for early diagnosis of microangiopathy in patients with type 1 diabetes based on capillaroscopy in combination with functional tests: cuff occlusion of the upper limb, tests with cold and thermal effects on the upper limb.

Material and methods. The study was carried out on the basis of Samarkand State Medical University SFRSNPTSE. 54 patients with T1DM were examined: 25 men and 29 women; the average age of the patients was 24.1±3.2 years. The duration of the disease averaged 5.8±1.6 years. Patients with T1DM were divided into two groups: group 1 - 28 (51.6%) patients with a disease experience of less than 5 years; Group 2 - 26 (48.4%) in whom the duration of diabetes exceeded 7 years. Patients with a disease duration of more than 10 years were not included in the study. All study participants signed informed consent. The study protocol was approved by the scientific council of Samarkand State Medical University (protocol No. 3 of 11/12/22). The patients underwent a standard comprehensive examination, according to the algorithms for providing specialized medical care to patients with diabetes [10]. The control group included 26 practically healthy people, matched by gender and age. All subjects were subjected to capillaroscopy using a Sieta CAM-04 digital microscope (China). Capillaroscopy at rest was performed after 15-20 minutes of rest in a sitting position. The following indicators were assessed: the length of the capillary loops (l cap.), the diameter of the arterial (d art), transitional (dper.), venous (dven.) sections of the capillaries. The results obtained were expressed in microns. The test with occlusion of the upper limb consisted of placing a cuff on the shoulder of the arm being tested with air injection to values exceeding 20-30 mmHg. level of disappearance of Korotkoff sounds for a period of 60 s. To conduct a cold test, the hand was placed for 5 minutes in water at a temperature of 5-7 °C. For a thermal test, the hand was immersed in water at a temperature of 42–45 °C for 5 minutes. After each test, the time for recovery of capillaroscopic parameters to initial values was recorded. The statistical significance of differences between groups was determined using the Mann-Whitney test (U test). The critical significance level (p) was taken equal to 0.05. Data analysis was carried out using the Statistica 8.0 software package.

Results and discussion.A clinical examination of patients with diabetes revealed that all patients were in the decompensation phase. The average level of glycated hemoglobin was 10.8±0.9%, which is a very high risk factor for the development of diabetic microangiopathy [11, 12]. In 5 patients of the 1st group and in 21 patients of the 2nd group ($p = 0.025$), there was an increased level of albumin in the urine. Albumin excretion in these patients was 44.3±3.8 and 156±10.3 mg/day, respectively ($p=0.002$). Signs of diabetic retinopathy were detected in 4 patients of group 1 and in 20 patients of group 2 ($p = 0.015$). During capillaroscopy, 15 (58.7%) patients in group 1 showed a

tendency to narrowing of the arterial sections of the capillaries, and in 18 (64.3%) patients perivascular edema was detected (p = 0.022 compared with the control), which was determined by the presence of whitish turbid zone surrounding the capillary loop. However, similar changes were noted in the control group. In 6 (23.1%) practically healthy people, perivascular edema was detected, and in 5 (19.2%) - moderate spasm of the arterial sections of the capillaries. In group 2, perivascular edema was observed in all patients. At the same time, a statistically significant shortening of the capillary loops was recorded (p = 0.014 compared to the control), a decrease in the diameter of the arterial loops (p = 0.008) and a moderate expansion of the transitional sections of the capillaries (p = 0.022). Such indicators as the length of capillary loops and the diameter of the arterial sections of the capillaries were also less than in patients of group 1 (p = 0.028 and p = 0.011, respectively). Thus, using capillaroscopy at rest, microangiopathy is diagnosed only in patients with a history of the disease of more than 7 years. Persistent structural changes in the capillaroscopic picture in patients in this group make it possible to diagnose diabetic microangiopathy without the use of functional tests. At the same time, in patients with a short history of the disease there is no convincing evidence for the development of microangiopathies. Therefore, we carried out functional tests with physical effects on the upper limb and compared the indicators of group 1 with those in the control group. First, an occlusion test was performed. In the 1st study group, after exposure, a shortening of the capillary loops, a narrowing of the arterial and venous sections of the capillaries was observed (p = 0.026 and p = 0.01), while an expansion of the transition links of the capillaries was noted (p = 0.032). The diameters of the venous and transitional sections also differed from those in the control group(p=0.021 and p=0.002, respectively). After the cold test, patients in group 1 showed a significant reduction in the length of capillaries and the diameters of their arterial sections (p = 0.012). In a number of cases, measuring the size of the arterial sections in patients was impossible due to their severe spasm and desolation. After cold exposure in patients of group 1, expansion of the transitional sections was also noted, and this indicator also differed from the control (p = 0.005). Thermal test in patients led to lengthening of the visible part of the capillary loop (p=0.041). However, in the control group after exposure, this indicator increased more significantly (p = 0.008). Both in the control group and in the patients, dilatation of all parts of the capillary loops was noted (to the greatest extent - venous and transitional). In this case, linear-shaped capillaries were recorded with unclear visualization of their sections. Conclusions

1. In patients with T1DM with a disease experience of more than 7 years in the presence of clinical manifestations of microangiopathies (albuminuria, signs of retinopathy), changes in the vessels of the microvasculature are noted: shortening of capillary loops, arterial spasm, expansion of the transitional and venous sections of capillaries, perivascular edema.2. With diabetes experience of less than 5 years, patients in some cases are diagnosed with moderate spasm of the arterial sections of the

capillaries and perivascular edema; similar changes are recorded in healthy people and, thus, cannot be reliable criteria for diabetic microangiopathy.

3. Carrying out functional tests with occlusion, cold and heat effects on the upper limb makes it possible to identify differences between

capillaroscopic indicators in patients with a short history of diabetes and in the control group.

4. In patients with T1DM, there is an increase in the recovery time of capillaroscopic parameters after functional tests. And this indicator can be used as a diagnostic criterion for diabetic microangiopathy already in the early stages of the disease.

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