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**MORPHOLOGICAL CHANGES
OF THE HEMOMICROCIRCULATORY FLOW
OF THE MYOCARDIUM IN CASE OF COMORBID PATHOLOGY**

**МОРФОЛОГІЧНІ ЗМІНИ ГЕМОМІКРОЦИРКУЛЯТОРНОГО
РУСЛА МІОКАРДА ЗА УМОВ КОМОРБІДНОЇ ПАТОЛОГІЇ**

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On 24 February 2022, Russia invaded Ukraine. Constant shelling of the territory of our country and the occupation of some regions have led to the fact that the majority of the population of Ukraine is under constant stress [1]. No person can live in constant stress, because its long-term influence imperceptibly undermines the health and causes chronic pathological processes, one of which can be diabetes mellitus (DM), which causes great social and economic damage. DM is associated with serious complications, and cardiomyopathy is one of them. Mortality due to myocardial infarction in people with DM is twice as high as in other patients [2]. DM increases the absolute risk of coronary death in men by 2.5 times and in women – by 4.7 times [2, 3].

Therefore, the aim of our work was to investigate changes in the myocardium of sexually mature male rats with streptozotocin (STZ)-induced diabetes mellitus under conditions of chronic immobilization stress (CIS).

Material and methods. 20 sexually mature white male rats (body weight 150-180 g) were used for the study; they were equally divided into 4 groups: group 1 – with simulated STZ-induced DM and chronic immobilization stress;

group 2 – with STZ-induced DM, group 3 – with chronic immobilization stress, group 4 – intact animals. STZ-induced DM was simulated by a single intraperitoneal injection of streptozotocin “SIGMA” (USA), which was diluted in 0.1 M citrate buffer with a pH of 4.5 (at the rate of 6 mg per 100 g of body weight). Simulation of CIS was carried out by placing the animal in a closed plastic container for 5 hours a day (Ukrainian patent for the invention No. 125623). In group 1 of animals, STZ-induced DM was simulated and starting from the 14th day of the experiment, CIS was simulated. The material was collected on the 56th day after the start of the experiment. Histological, electron-microscopic, biochemical and statistical research methods were used.

Results. On the 56th day of the experiment, the level of glucose and HbA1c in the blood of the rats of group 1 is the highest, compared to group 4 and is, respectively, 18.61 ± 3.23 mmol/l ($p < 0.001$) and $7.25 \pm 0.72\%$ ($p < 0.01$); in group 2 – 14.55 ± 2.13 mmol/l ($p < 0.001$) and $6.34 \pm 0.48\%$ ($p < 0.01$); in group 3 – 5.15 ± 0.56 mmol/l ($p > 0.05$) and $2.34 \pm 0.37\%$ ($p > 0.05$), while in animals of group 4 the indicators are the following ones – 3.58 ± 0.56 mmol/l and $2.18 \pm 0.17\%$. Such biochemical changes in groups 1 and 2 indicate the development of decompensated diabetes.

In the groups 1 and 2, on the background of hyperglycemia in the myocardium of rats, pronounced microangiopathy is observed, which is manifested by an increase in the area of the walls and a decrease in the area of the lumen of arterioles and capillaries, which is accompanied by an increase in the Wagenworth index; erythrocyte sludge, microthrombi, adhesion of erythrocytes and platelets in all microhemovessels; thickening and proliferation of the basal membrane of capillaries. Ultrastructural examination of the lumen of microhemovessels reveals micro- and macroclasmotosis. Complete desquamation of endotheliocytes and exposure of the basement membrane can be observed in some capillaries. In light-colored endotheliocytes, a colliquation necrosis is noted, and in dark-colored endotheliocytes the karyopyknosis and karyorrhesis, destruction of membrane organelles are revealed. The basal membrane of the capillaries is significantly thickened in some places and consists of several plates. The growth of collagen fibers and an increase in the number of fibroblasts are noted around the capillaries. Smooth myocytes of arteries and arterioles contain small vacuoles. Tight contacts between neighboring myocytes are lost. Ultrastructural changes, as a rule, are specific for diabetic microangiopathy and are generalized.

In female rats of group 3, ultrastructural changes in the hemomicrocirculatory flow are usually nonspecific, but are of a generalized nature and are manifested by vacuolar dystrophy of endotheliocytes of all

microhemovessels and myocytes of arterioles. At the light-optical level, a decrease in the permeability of arterioles and capillaries, due to the swelling of their walls and a decrease in the area of the lumen of the vessels and an increase in the Wagenworth index by 2.3 times, compared to intact animals, are found.

Conclusions. In STZ-induced DM, signs of severe diabetic microangiopathy are noted in the hemomicrocirculatory flow of the myocardium in groups 1 and 2. Such signs are characterized by: an increase in the area of the walls and a decrease in the area of the lumen of arterioles and capillaries, which is accompanied by an increase in the Wagenworth index; erythrocyte sludge, microthrombi, adhesion of erythrocytes and platelets in all microhemovessels; thickening and proliferation of the basal membrane of capillaries, capillarosclerosis. The most pronounced changes in the hemomicrocirculatory flow of the myocardium were revealed in animals with comorbid pathology and DM, which is a morphological marker of an unfavorable prognosis regarding the completion of structural transformations in the myocardium in these pathologies.

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