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THE ROLE OF CARBOHYDRATE DETERMINANTS IN THE STRUCTURAL COMPONENTS OF THE RAT MYOCARDIUM UNDER EXPERIMENTAL ISCHEMIA

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Introduction. Diseases of the cardiovascular system are the leading causes of death and disability in most developed countries. Every year in Ukraine more than 50 thousand new cases of myocardial infarction with a high mortality rate are registered [1-4].

Main part. Using routine histological methods and 8 lectins of different carbohydrate specificities (Con A, GNA, PNA, HPA, CNFA, WGA, SBA, LABA) labeled with horseradish peroxidase, the effects of experimental adrenalin-induced myocardial infarction on the morphological characteristics and carbohydrate determinants of rat myocardium were studied. In the affected tissues it were detected local dystrophic changes of cardiomyocytes, edema and desaggregation of myofibrils in within individual cells, rupture of some intercalated disks. In the arterioles was documented formation of red blood cell aggregates with their adhesion to endothelium. Some cardiomyocytes demonstrated signs of karyopyknosis associated with formation of condensed chromatin demilunes apparently encompassing their apoptotic conditions.

Lectin histochemistry studies revealed certain specificity of lectin binding to structural components of normal rat myocardium and that affected with hypoxia. In particular, Con A binding in the myocardium of control animals was restricted to nuclei of cardiomyocytes, myofibrils, nuclei of connective tissue cells and to the inner lining of blood vessels, while in experimental group animals intensity of Con A binding to nuclei and myofibrils of cardiomyocytes significantly reduced, inner layer of microcirculatory bed being completely negative. Intercalated disks and internal elastic membrane of arterioles of control group rats exposed strong reactivity with CNFA lectin, while experimental animals myocardium demonstrated enhanced exposure of this lectin receptor sites in within the nuclei of cardiomyocytes, intercalated disks, inner membranes of blood vessels and aggregates of erythrocytes being attached to endothelial cells.

Intense exposure of the WGA receptors sites was detected in the endothelium of microcirculatory bed of control group rats, whereas myocardium of experimental animals demonstrated significant decrease in this lectin binding; under the conditions of myocardial ischemia WGA intensely labeled blood plasma fibrin in within the dilated blood vessels. LABA reactivity was characteristic for myofibrils of control group animals cardiomyocytes and for individual connective tissue cells, which morphologically resembled macrophages. It is noteworthy that number of these cells increased in ischemia affected myocardium, and was associated with dystrophic changes of cardiomyocytes. Under the experimental conditions LABA also labeled endothelium of arteries, erythrocytes and white blood cells being with this lectin completely areactive.

Mannose-specific GNA lectin faintly labeled microcirculatory bed endothelium of control group animals, this binding slightly enhanced under ischemic conditions. HPA binding was documented with the myofibrils and nuclei of the cardiomyocytes of control rats, this reactivity decreased in the experimental group animals. SBA and PNA label exposed rather homogeneous distribution in within the myocardium of control and experimental animals.

Conclusions. The obtained data demonstrate significant modifications of carbohydrate determinants of rat myocardium structural components induced by experimental myocardial infarction. In particular, changes in lectin reactivity of vascular endothelium, formed elements of blood apparently indicate changes of their adhesive properties, which may be an important diagnostic sign of blood clots formation. Lectin CNFA can be recommended for selective labeling of intercalated disks in rat myocardium, while WGA can be used as a reliable marker of this same organ vascular endothelium. An increased count of LABA-positive macrophages indicates activation of the macrophage system under conditions of experimental myocardial infarction.

Key words: myocardial ischemia, lectin histochemistry, cardiomyocytes, endothelium.

References

1. Braunwald E. The Simon Dack lecture. Cardiology: The past, the present, and the future. J Am Coll Cardiol. 2003;42:2031-41.
2. Stanek V. Progress in the therapy of ischemic heart disease. Kapitoly z kardiologie. 2002;4:3-11.
3. Kovalenko VM, Havrysh OS. Pato- i morfohenez ishemichnoyi kardiomiopatiyi. Zhurnal Natsional'noyi akademiyi medychnykh nauk Ukrayiny. 2015;21(1):21-27. [in Ukrainian].
4. Vaidya Y, Cavanaugh SM, Dhamoon AS. Myocardial Stunning and Hibernation. StatPearls Publishing; 22 p. Available from: https://www.ncbi.nlm.nih.gov/books/ NBK537026/.