ANATOMICAL AND HISTOLOGICAL STRUCTURE OF THE CELIA PLEXUS GANGLIA IN RABBIT

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Abstract: This article experimentally studied the neuronal-glial-capillary relationships in the celiac plexus ganglia of rabbits. Nervous tissue was stained using Nissl staining and silver impregnation using the Bielschowsky-Gross method. The nerve cell, glia, and capillary form a single anatomical and histological complex. Quantitative changes in their relationships can serve as a subtle indicator of the functional state of extramural autonomic ganglia under biological experimental conditions.

Keywords: experiment, rabbit, celiac plexus, neuron, glial cell, neurohistological methods, nerve ganglia.

АНАТОМО-ГИСТОЛОГИЧЕСКОЕ СТРОЕНИЕ ГАНГЛИЕВ ЧРЕВНОГО СПЛЕТЕНИЯ У КРОЛИКОВ

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Резюме: В данной статье экспериментально изучены нейроно-глиально-капиллярные взаимоотношения в ганглиях чревного сплетения у кроликов. Нервные ткани окрашивались с помощью нейрогистологических методов по Нисслю и импрегнацией серебром по методу Бильшовского-Гросса. Нервная

клетка, глия и капилляр образуют единый анатомо-гистологический комплекс. Количественные изменения в их взаимоотношениях могут служить тонким индикатором функционального состояния экстрамуральных вегетативных ганглиев в условиях биологического эксперимента.

Ключевые слова: эксперимент, кролик, чревное сплетение, нейрон, глиоцит, нейрогистологические методы, нервные ганглии.

Introduction. Comparative morphological studies of various animal species allow us to uncover previously unidentified patterns of development and adaptation of these animals to various anthropogenic factors. Data from modern research allow us to consider the celiac plexus as a peripheral nerve center, at the level of which various functions of the digestive organs can be regulated [1,2]. Despite the significant number of studies devoted to the structural organization of the celiac plexus ganglia [3,4,5], information on the morphometric analysis of the cellular composition of the ganglia is insufficiently complete. Despite the significant number of studies and extensive information in the morphological literature on the innervation and vascularization of the nerve plexus in humans, domestic and laboratory animals, this section on the morphology of nerves and vessels in vertebrates remains poorly studied in comparative morphology [6,7,8]. Considering the need for a systematic approach to studying the structure and function of nervous tissue, we undertook a comprehensive study of neurons, along with their surrounding glia and capillaries, to gain a deeper understanding of the functioning of these complex extramural ganglia of the autonomic nervous system.

Purpose of the study: To study the anatomical and histological structure of the celiac plexus ganglia in rabbits.

Materials and methods. The study was performed on 20 sexually mature rabbits of both sexes. Combined detection of capillaries, neurons, and glial cells was performed by intravital injection of vessels with a suspension of Paris blue in chloroform with ether in combination with Nissl staining of histological sections and silver impregnation using the Bielschowsky-Gross method. Morphometry of

capillaries, neurons, and glial cells was performed using an MOB-15 screw ocular micrometer. In each animal (n = 5), 200 neurons with surrounding glia and capillaries were measured. The profile area of neurons and glial cell nuclei was determined as the product of two mutually perpendicular cell diameters. Quantitative assessment of nerve cell blood supply was performed according to E. P. Melman.

Research results. Our research has yielded the following findings. The main sources of vascularization of the celiac plexus ganglia in rabbits are the celiac artery, aorta, and suprarenal-lumbar trunks. Arteries approach the ganglion capsule, from which arterioles with a diameter of 26.51±1.16 μm branch off. The latter, anastomosing with each other, form an extraganglionic arterial network, from which arterioles and precapillaries with a diameter of 17.36±0.49 μm extend along connective tissue septa into the deeper layers of the ganglion. The latter form coarsely looped networks with dimensions of 182.9±3.58-116.33±2.33 μm, encompassing the islets of nerve cells on all sides. Capillaries with a diameter of 7.29±0.2 μm form a dense, finely serrated capillary network with loop sizes of 87.25±1.62-61.89±1.99 μm. Each loop contains 1-2 neurons with surrounding glial cells. Together, they form functionally complex neuronal-glial-capillary assemblies. Neurons of the celiac plexus ganglia average in size (35.68±0.83-25.15-0.5 μm), are rounded to oval in shape, with a large, light, centrally or slightly eccentrically located nucleus. A morphometric study of the cellular composition of the celiac ganglia made it possible to distinguish three groups of neurons: the first consisted of cells with a profile field area of 400-800 μm², the second 801-1200 μm², and the third 1201-1600 μm². Neurons of the second group were numerically predominant. 0t it follows that the cellular composition of neurons in the ganglia of the celiac plexus in rabbits is morphologically heterogeneous. As has been established, 4-6% of nerve cells in the ganglia of the celiac plexus in rabbits contain a high concentration of acetylcholinesterase, which is characteristic of parasympathetic neurons. It can be assumed that large neurons with a profile field

of 1201-1600 μm² (6.50%) located in the ganglia of the celiac plexus are cholinergic, and neurons of the first and second groups are efferent and intercalary. There are 4-5 gliocytes located around the cell body (within a 25 μm zone). 65% of the gliocytes (perineuronal), 2-3 in number, are located at a distance of 25±0.8 μm from the cell body, mainly at the base of the dendrites and the axon hillock, where the activity of metabolic processes is highest. 35% of the gliocytes (free) are located at a distance of 5.1-20.0 μm from the cell body. Morphometry has established that the size and area of the profile field of neurons and gliocytes of the right and left celiac ganglia are equal. The area of the profile field of free gliocytes, which may indicate a greater functional significance of the former. The study of neuronal microvascularization indicates a wide variety of relationships between neurons, glia, and capillaries. Most often, capillaries run parallel to the surface of the neuron body, forming open loops containing 1-2 neurons. Capillaries may branch into a fork-like pattern, and then nerve cells located at the fork come into close contact with the capillaries over a significant distance. Within the alimentary zone of a neuron, which is 25 μm, there is an optimal vascularization belt up to 10 μm wide. Only a few capillaries (4.3%) are located 20-25 μm from the cell body of the nerve cell. It has also been established that the number of perineuronal gliocytes, capillary diameter, and the area of neuronal-capillary contacts increase with increasing area of the nerve cell profile field.

Conclusion. Thus, the use of a combined quantitative study method of neuron-glial-capillary relationships allowed us to establish certain patterns of microvascularization of neurons in the celiac plexus ganglia in rabbits. The nerve cell, glia, and capillary constitute a single morpho-functional complex, and quantitative changes in the relationships between these complexes can serve as a subtle indicator of the functional state of extramural autonomic ganglia in biological experiments.

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