# MORPHOLOGICAL GHANGES IN THE NERVE GANGLIA OF THE SOLAR PLEXUS AFTER CHOLECYSTECTOMY IN DOGS

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***Abstract.*** *This study investigates the morphological changes in the nerve ganglia of the solar plexus following cholecystectomy in dogs. The solar plexus, a critical nerve center involved in visceral control, may exhibit alterations in its nerve structures after the removal of the gallbladder, potentially impacting gastrointestinal function and overall neural regulation of the abdominal organs.*

***Key words:*** *celiac plexus, ganglia, neurons, synapses, experimental cholecystectomy.*

# МОРФОЛОГИЧЕСКИЕ ГАНГИ В НЕРВНЫХ ГАНГЛИЯХ СОЛНЕЧНОГО СПЛЕЧЕНИЯ ПОСЛЕ ХОЛЕЦИСТЭКТОМИИ У СОБАК

***Аннотация.*** *В работе изучены морфологические изменения нервных ганглиев солнечного сплетения после холецистэктомии у собак. Солнечное сплетение, важнейший нервный центр, участвующий в висцеральном контроле, может проявлять изменения в своих нервных структурах после удаления желчного пузыря, что потенциально влияет на функцию желудочно-кишечного тракта и общую нервную регуляцию органов брюшной полости.*

***Ключевые слова:*** *чревное сплетение, ганглии, нейроны, синапсы, экспериментальная холецистэктомия.*

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**Introduction.** In the last decade, both in Uzbekistan and abroad, despite the emergence of new drugs for the correction of functional disorders of the digestive system, there has been no decrease in the number of dysfunctions of the biliary system. When studying the biliary system, it was revealed that it is characterized by the presence of many sphincters from coordinated work, which release bile into the intestine at the time of digestion and into the gallbladder outside the moment of digestion. It has been established that there is a direct innervation connection between them. In addition, the gallbladder has innervation connections with other organs of the abdominal cavity.

Therefore, in diseases of the gallbladder, friendly violations of the functions of other organs occur, and clarification of the nervous mechanism of these friendly reactions is of certain

importance [1,2,6]. Small branches of the vagus nerve innervate the common bile duct, as well as the ampulla of Vater's papilla. At the same time, local viscero-visceral reflex interactions between the internal organs of the abdominal cavity are closed in the nodes of the celiac (solar) plexus. This proves that the impact on one of the internal organs causes morphofunctional changes in others [3,4,5]. The gallbladder has innervation connections with almost all organs of the digestive tract. Based on the foregoing, we studied the morphology of the nodes of the celiac plexus of adult dogs in the norm and after experimental cholecystectomy in the early and late periods.

**Objective:** to identify the morphofunctional features of the nerve nodes of the celiac plexus after experimental cholecystectomy in dogs.

**Materials and methods.** The nerve nodes of the celiac plexus of 15 dogs (6 of them control) after experimental cholecystectomy served as the material for our studies. It should be noted that in the structure of the ganglia of the celiac plexus of animals, we did not find any difference in terms of sex. The celiac nerve was cut under the diaphragm, at the place of its entry into the corresponding ganglia of the celiac plexus. The material was taken from 12 hours to 12 days after the operation. After unilateral transection of the celiac nerve, in some cases, the right and left celiac ganglia (or their corresponding plexus areas at node fusion) were separately fixed and examined.

Animals are euthanized under anesthesia, strictly observing the rules of bioethics. On the 3rd, 5th and 7th days after the operation, the nodes of the celiac solar plexus were taken immediately after the animals were slaughtered and fixed in 12% neutral formalin. After washing with running water, the material was dehydrated and compacted into paraffin. The preparation of histological preparations was carried out according to the generally accepted method. Paraffin sections were stained according to the Lasky method, and cryostat sections were impregnated with silver nitrate according to the Bilshovsky-Gross and Campos methods.

**Results and discassion.** As our studies have shown, the celiac plexus of animals consists mainly of two (rarely three or more) ganglia and many visceral branches. On each side of the celiac artery was a separate, or to some extent fused ganglion. In some cases, accumulations of chromaffin tissue are found inside the celiac ganglia and near their capsule. The celiac ganglia are externally covered with a connective tissue capsule. This shell is expressed to varying degrees - depending on age. A layer of connective tissue capsules penetrates the ganglion, dividing the neurons into relatively limited clusters (islets). Some researchers attribute a special role to these islands: they consider them as peripheral centers of any abdominal organ.

The capsule of neurons of the celiac ganglia in animals is weakly expressed. The severity of the capsule of celiac plexus neurons depends on the amount and age of glia, the presence of

connective tissue between cells, and, as our studies have shown, on the state of the neuron itself. Under certain unfavorable conditions, as a response to violations of neurohumoral factors, a reaction occurs from the glial and connective tissue elements located around the neuron. The foregoing is confirmed by the fact that in most cases in the experiment and in pathology the capsule of neurons is comparatively better expressed.

The size of the nerve cells of the celiac ganglia ranged from 20-50 microns. Occasionally there were giant neurons, the size of which is 2-3 times larger than the size of adjacent nerve cells. The nerve cells of the celiac ganglia have one nucleus, rarely two or three. The nucleus contains a variable number of nucleoli. Their shape and size are not the same. The number of nucleoli is usually 2-3, but can be up to 10 or more.

Removal of the gallbladder in all cases is accompanied by changes in the nerve elements. In the early stages (3 days after surgery), changes in nerve fibers and nerve endings come to the fore. In some cases, it is found that some nerve fibers in the bundle have varicose swellings or are fragmented.

In other cases, fragments of already disintegrated nerve fibers and unchanged intact synaptic nerve endings are visible. In some preparations, various stages of degeneration and decay of nerve fibers are noted. In the later periods of observation (5-7 days) after removal of the gallbladder, changes in nerve fibers intensify, more and more late stages of degeneration are encountered, that is, lumpy and granular decay.

The synaptic nerve endings on the neurons of the solar plexus nodes also undergo certain changes. Already on the 3rd day after cholecystectomy, they hypertrophy and acquire an elongated oval shape. The preterminals of these endings are also hyperimpregnated and have small varicose swellings. On the 5th and 7th days of the experiment, in the nodes of the celiac plexus, sharply hypertrophied synaptic endings of an irregularly spherical shape are found, along the edges of which small notches are determined.

The preterminals of such endings have pronounced varicose swellings and are hyperimpregnated; a sharp expansion of the perifibrillar space is also noted.We did not find similar changes in the nerve ganglions of the celiac plexus in control animals.

After removal of the gallbladder, certain metabolic changes occur in the nodes of the celiac plexus. If in control animals chromatophilic substance (tigroid substance) in the form of basophilic lumps is detected in all nerve cells, then after experimental cholecystectomy a significant decrease in tigroid substance is observed in some cells. These cells are distinguished by a pale color. The process of focal and total tigrolysis is observed in them. In these cells, when stained with Lasky, clumps of basophilic substance are not visible.

**Conclusion.** The results of our studies indicate that the experimental removal of the gallbladder is accompanied by certain morphological changes in some structural components of the nerve nodes of the celiac plexus. The severity of these changes depends on the period of observation after the experiment. Apparently, the processes of some neurons of the gallbladder wall reach the nodes of the celiac plexus and form synapses with their neurons. After removal of the gallbladder, they undergo reactive changes in the early stages and degenerative changes in the later stages.

These data once again confirm the position that the nodes of the celiac plexus are those peripheral centers where the reflex arcs of viscero-visceral reflexes are closed, which are the material substrate of functional interactions and concomitant diseases of the abdominal organs. Also, this information will be useful in elucidating the pathogenesis of concomitant diseases of internal organs and in evaluating the results of experimental studies.

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