# ANATOMO-TOPOGRAPHIC STRUCTURE OF THE NERVES OF THE COSTOVERTEBRAL JOINTS IN HUMANS

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**Summary:** This article examines the sources of innervation of the costovertebral joints in humans and describes the pattern of nerve distribution within these joints. The study was conducted on human cadavers of various ages and sexes. The greatest number of branches to the costovertebral joints is provided by the ganglia of the thoracic sympathetic trunk. The complexity of the innervation of all the listed structures is associated with the coordination of the functional activity of these systems during respiratory excursions of the thoracic cage.

**Keywords:** human cadavers, costovertebral joints, innervation, acetic acid solution, intercostal nerve, interganglionic branch.

# АНАТОМО-ТОПОГРАФИЧЕСКОЕ СТРОЕНИЕ НЕРВОВ РЕБЕРНО-ПОЗВОНОЧНЫХ СУСТАВОВ У ЧЕЛОВЕКА

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**Резюме:** В данной статье изучены источников иннервации позвоночно-реберных соединений у человека и описание способа распространения нервов в пределах этих соединений. Исследование проведено на трупах людей различного возраста и пола. Наибольшее количество ветвей позвоночно-реберные соединения получают от узлов грудного отдела симпатического ствола. Комплексность иннервации всех перечисленных образований стоит в связи с координированием функциональной

деятельности всех этих систем во время дыхательных экскурсий грудной клетки.

**Ключевые слова:** Трупах людей, реберно-позвоночных суставов, иннервация, раствор уксусной кислоты, межреберного нерва, межузловой ветви.

**Introduction.** The costovertebral joints in humans belong to the type of articulations where movements occur continuously throughout life. The most pronounced morphological changes in these joints are observed during the first 5 years of a child's life [1,2,3]. During these years, the processes of establishing respiration and voice production take place in the child. The associated changes in the frequency and depth of breathing lead to alterations in the shape of the thoracic cage. Studies have shown that, parallel to the intensive growth of the thoracic cage in the early years of life, there is an increase in its volume [4,5]. Changes in the shape and volume of the thoracic cage are reflected in the morphology of the costovertebral joints. Investigations into the development of the ligamentous apparatus of these joints have convincingly demonstrated a direct dependence of changes in the joints and their ligamentous structures on the expiratory function, which supports the increasingly complex formation of vocal intonations [6,7]. While information on the morphology and function of the costovertebral joints is quite extensively represented in the literature, data regarding the nature of their innervation are largely limited to the scope of textbooks and teaching manuals.

**Aim of the study.** The purpose of our research is to investigate the sources of innervation of the costovertebral joints in humans and to describe the patterns of nerve distribution within these joints.

**Materials and Methods.** The study was conducted on human cadavers of various ages and sexes. To achieve more complete isolation of all nerves supplying the costovertebral joints, the following preparation protocol was employed. The isolated thoracic spine segment, including adjacent portions of the ribs (up to the angles), was immersed in a 3–5% acetic acid solution for 15–20 days. Following

sufficient maceration and softening of the abundant adipose tissue surrounding the costovertebral joints, the specimen was placed under a strong stream of water to remove a portion of the fat. Subsequently, direct dissection was performed to isolate the ganglia and interganglionic branches of the thoracic sympathetic trunk, as well as the main trunks of the intercostal nerves. The nerve branches arising from these sources and directed toward the costovertebral joints were carefully dissected using magnifying loupes and a surgical microscope. The diameter of the nerve branches was measured with an ocular micrometer.

**Results.** Our observations indicate that the innervation of the costovertebral joints involves branches from the intercostal nerves, ganglia and communicating rami of the sympathetic trunk, branches from perivascular plexuses of the intercostal vessels, and branches originating from muscular nerves. The greatest number of branches to the costovertebral joints is supplied by the ganglia of the thoracic sympathetic trunk. In the majority of specimens, 2–3 nerve trunks (diameter 0.2–0.5 mm) arise from the medial (internal), and less frequently from the lateral (external), periphery of the ganglion located at the level of the corresponding rib head articulation. One of these trunks curves in an arc-like manner across the capsule surface at its attachment to the vertebra. From this described nerve trunk, small nerve branches constantly arise and penetrate the thickness of the capsule as well as the periosteum of the vertebral body. Other branches, after departing from the ganglion, course transversely across the surface of the costovertebral joint capsule; their ramifications spread between the fibers of the radiate ligament of the rib head joint. Together with the fibers of this ligament, the nerve trunks reach the lateral margin of the anterior longitudinal ligament of the spine and penetrate into it. Nerves supplying the costovertebral joints that arise from the intercostal nerves typically originate from the nerve passing below the corresponding costovertebral joint. The nerve branch ascends toward the joint, crossing anteriorly over the intercostal vessels en route. At the points of crossing with the vessels, 2–3 small nerve trunks detach from the described branch and join the perivascular plexus of

the intercostal artery. On the surface of the costovertebral joint capsule, the nerve branch originating from the intercostal nerve begins to divide into secondary branches. Some secondary branches reach the anterior longitudinal ligament of the spine, while others spread within the capsule and ligaments of the rib head. In some specimens, a communicating branch located on the surface of the rib head capsule can be isolated. This communicating branch establishes a connection between branches arising from the ganglion or interganglionic branch of the thoracic sympathetic trunk and the branch originating from the intercostal nerve. As a rule, this communicating branch courses longitudinally along the capsule surface. While traversing the joint capsule, the described branch gives off small nerve trunks bilaterally, which penetrate the joint capsule, the radiate ligament of the joint, and the periosteum of the vertebra. In our material, the simultaneous participation of the intercostal nerve in the innervation of the intercostal muscles and elements of the costovertebral joints is clearly evident. In such cases, a nerve trunk (diameter 0.2–0.4 mm) arising from the proximal portion of the intercostal nerve gives off a lateral branch before entering the thickness of the intercostal muscles. This branch has a diameter of 0.1–0.15 mm and a length of 5–8 mm. The described branch is directed toward the rib head joint and divides into finer secondary branches on the capsule surface.

**Conclusion.** Our observations on the pattern of distribution and origin of nerves in the costovertebral joints allow us to conclude that these joints exhibit complex (multisource) innervation involving the surrounding muscles and vessels. This complexity of innervation of all the listed structures is associated with the coordination of the functional activity of these systems during respiratory excursions of the thoracic cage. The greatest number of nerves is identified in the capsule and ligaments of the costovertebral joints of ribs VII–X. Such concentration of nerves in these joints can be explained by the fact that the middle ribs participate most actively in the respiratory movements of the thoracic cage.

## References


1. Абдуллаева Д. Р., Исмати А. О., Маматалиев А. Р. Особенности гистологического строения внепеченочных желчных протоков у крыс //golden brain. – 2023. – Т. 1. – №. 10. – С. 485-492.
2. Афаунов, А. А. Анализ технических вариантов декомпрессивно-стабилизирующих операций при повреждениях нижнегрудного и поясничного отделов позвоночника: систематический обзор литературы / А. А. Афаунов, Н. С. Чайкин // Хирургия позвоночника. - 2022. - Т. 19, № 3. - С. 22-37. DOI 10.14531/ss2022.3.22-37.
3. Берснев, В.П. Хирургическое лечение повреждений грудопоясничного отдела позвоночника / В.П. Берснев, В.М. Драгун, А.Л. Шакуров // Российский нейрохирургический журнал имени профессора А.Л. Поленова. - 2013. - Том V, № 4. - С. 6-12.
4. Зохидова С., Маматалиев А. Морфофункциональная и гистологическом строении эпителия языка крупного рогатого скота //евразийский журнал медицинских и естественных наук. – 2023. – Т. 3. – №. 2. – С. 133-139.
5. Орипов Ф. С. и др. Адренергические нервные элементы и эндокринные клетки в стенке органов среднего отдела пищеварительной системы в сравнительном аспекте //Современные проблемы нейробиологии. Саранск. – 2001. – С. 46-47.
6. Маматалиев А. Р. нейрогистологические изменения блуждающего нерва под влиянием колхицина в эксперименте //Экономика и социум. – 2025. – №. 11-1 (138). – С. 1011-1014.
7. Маматалиев А. Р. Нарушение иннервации и мутационный процесс в ткани //Экономика и социум. – 2025. – №. 4-2 (131). – С. 876-880.