

ANATOMO-HISTOLOGICAL STRUCTURE OF THE NERVES OF THE ORBITAL PART OF THE FRONTAL BONE IN HUMANS AND THEIR CLINICAL SIGNIFICANCE

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Abstract: The article investigates the anatomico-histological structure of the nerves of the orbital part of the frontal bone in humans. The study was performed on 20 specimens obtained from 10 human cadavers of both sexes and various ages. The distribution of nerves was traced down to their finest reticular branchings using a head-mounted loupe, a binocular stand-mounted loupe, and a surgical microscope under a drop of 0.5% acetic acid solution. The diameter of nerve trunks and branches was measured with the aid of an ocular micrometer.

A considerable number of nerve twigs enter various regions of the orbital part of the frontal bone from multiple sources.

Keywords: human cadavers, orbital part of the frontal bone, specimens, macromicroscopic dissection, ocular micrometer, nerves.

АНАТОМО-ГИСТОЛОГИЧЕСКОЕ СТРОЕНИЕ НЕРВОВ ГЛАЗНИЧНАЯ ЧАСТЬ ЛОБНОЙ КОСТИ У ЧЕЛОВЕКА И ИХ КЛИНИЧЕСКОЕ ЗНАЧЕНИЕ

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Резюме: В статье изучены анатомо-гистологическое строение нерва глазничная часть лобной кости у человека. Исследование проведено на 20 препаратах от 10 трупов людей обоего пола и различного возраста. Распространение нервов прослежено до их мельчайших сетевидных разветвлений с помощью налобной и бинокулярной штативной луп и хирургического микроскопа под падающей каплей 0,5% раствора уксусной

кислоты. Диаметр нервных стволов и ветвей измерялся при помощи окуляр-микрометра. В различные участки глазничной части лобной кости от многочисленных источников вступает значительное количество нервных стволиков.

Ключевые слова: Трупов людей, глазничной части лобной кости, препараты, макромикроскопической, окуляр-микрометра, нервы.

Introduction. Detailed information about the nerves of the cranial bones is primarily essential for dentists, traumatologists, anesthesiologists, and neurologists when addressing diagnostic and prognostic tasks related to interventions in the head and face region [1,2]. The study and identification of neural connections between the nerves of the facial skull bones and the soft tissues of the face are of even greater clinical interest. The significance of innervation for the vital activity of bone is very high, since bone development and growth, regeneration processes, and metabolism in normal bone tissue, as well as a number of pathological processes occurring in it, are closely linked to the function of the surrounding soft tissues [3]. This connection of bone with other organs and tissues is realized through the vascular and nervous systems. Systematic studies of the connections between the nerves of the facial skull bones and the surrounding soft tissues have not been conducted. Data concerning age-related and comparative-anatomical characteristics are absent. Researchers have mainly focused on the morphology of cranial nerves within the soft tissues of the head and the bones covered with periosteum. A number of works are devoted to the study of nerves of the upper and lower jaws, orbit, oral cavity, and nasal cavity. However, even in the listed works, the matter usually comes down to data on the innervation of teeth and the distribution of nerves in the accessory apparatus of the eye, as well as in the mucous membrane of the oral and nasal cavities. It is interesting to note that the author attributes the topography of nerves spreading in the walls of various cranial cavities directly to the individual characteristics of the shape and size of these bone formations. In the works of [4,5] and colleagues, a detailed description is given of

the structure of nerve trunks and receptors located in the periosteum of the bones of the cerebral and facial skull.

To confirm his data, the author conducted an interesting experiment on animals, which consisted of separating the skin of the head and periosteum from the underlying tissues and performing trepanation of the skull. After such interventions, he observed degeneration of a certain portion of nerve fibers in the dura mater.

The authors suggest that the anesthetic substance, by diffusing through the bone, reduces the sensitivity of the dura mater of the brain.

Purpose of the study. We set ourselves the task of studying the nerves of the orbital part of the frontal bone and their interconnections as well as their connections with the nerves of the surrounding soft tissues.

Materials and Methods. The study was conducted on 20 specimens obtained from 10 human cadavers of both sexes and various ages. The nerves of the soft tissues and the above-mentioned bone were examined using the macromicroscopic dissection method, which included drilling of bone substance and softening of bones with glycerin, acids, and pepsin. The distribution of nerves was traced down to their finest reticular branchings with the aid of a head-mounted loupe, a binocular stand-mounted loupe, and a surgical microscope under a drop of 0.5% acetic acid solution. The diameter of nerve trunks and branches was measured using an ocular micrometer.

Results. In order to achieve the most complete possible demonstration of nerves and their connections in the corresponding regions, we employed various approaches.

Nerves of the orbital part of the frontal bone. The nerves directed to the orbital parts of the frontal bone arise from the following sources: from the frontal, supraorbital, and supratrochlear nerves; from the medial branch of the frontal nerve. After emerging from the superior orbital fissure and before dividing into

branches, the frontal nerve sends 1 to 4 nerve twigs (diameter 0.01–0.1 mm) toward the superior orbital wall. In two specimens, a nerve twig (diameter 0.18 mm) arises from a communicating branch present between the initial segments of the frontal and trochlear nerves and enters the posteromedial part of the superior orbital wall. In both cases, these twigs penetrate the bone through independent bone foramina with diameters of 0.25–0.5 mm. From the supraorbital nerve in the middle parts of the orbit, nerve twigs separate to the superior oblique muscle, levator palpebrae superioris, mucous membrane of the frontal sinuses, and walls of branches of the ophthalmic artery. In turn, from the described branches and from the trunk of the supraorbital nerve, up to three nerve twigs (length 1.6–2.5 mm, diameter 0.01–0.09 mm) proceed to the periosteum and bony substance of the floor of the anterior cranial fossa. In the orbital cavity, the frontal nerve with its main branches passes in close proximity to the branchings of the ophthalmic artery. It is more difficult to isolate nerve twigs arising from the lacrimal and supratrochlear nerves. Several such branches are directed to the medial and lateral parts of the superior orbital wall from a communicating branch present between the supra- and infratrochlear nerves, and between the lacrimal nerve and the zygomatic nerve branch. Thus, in 7 specimens, one to three such nerve twigs, perforating the bone, penetrate into the cranial cavity, where they enter the outer surface of the dura mater. Sometimes some of these nerve twigs connect with the finest branchings of meningeal nerves or, following along one of the branches of the middle meningeal artery, enter its wall. Thus, a considerable number of nerve twigs enter various regions of the orbital part of the frontal bone from multiple sources. In turn, from these intraosseous nerves and their connections, branches arise to vessels passing within the bone thickness, to the periosteum, to the adipose pad of bony canaliculi, and to elements of bone marrow. Our observations indicate that the innervation of the bony substance of the frontal bone and its periosteum is closely related to the innervation of the surrounding soft tissues (muscles, adipose tissue, fasciae), blood vessels (arteries and veins), lymph nodes, and mucous membrane of the paranasal

sinuses (frontal sinus, ethmoidal cells). Nodular thickenings on the nerves of various parts of the frontal bone were encountered by us 5 times in 36 specimens. Nodular thickenings were present 3 times on the right side and 2 times on the left side of the cadaver. Once, a nodular thickening was located deep in the supraorbital canal on the trunk of a nerve penetrating the superior orbital margin. Two nodular thickenings were located on the trunk of a nerve lying within the thickness of the spongy substance of the frontal bone. Two oval nodular thickenings were found on the trunk of the supraorbital nerve within the bone thickness, before its exit from the supraorbital canal.

Conclusion. Our observations indicate that the nerves of the orbital part of the frontal bone are in close relationship with the nerves of other nearby cranial bones as well as with the nerves of the surrounding soft tissues (skin coverings, muscular elements, subcutaneous tissue, dura mater, etc.), periosteum, branchings of blood vessels, and paranasal sinuses. It should be assumed that excitation arising during puncture spreads not only along the nerves of the soft tissues of the frontal region but also along the nerves of the frontal bone, as well as along the course of branches of the frontal and supraorbital arteries.

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