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TOPOGRAPHY OF INTRAOCULAR PART OF THE OPHTHALMIC ARTERY BRANCHES

Abstract. *Topographic-anatomical peculiarities of the intraocular part of the ophthalmic artery branches are investigated in the article. Arterio-arterial anastomoses are found between the ethmoid arteries directly one by one and with other orbital arteries, which is the basis to form an alternative blood circulation flow. Anastomoses are found between the intraocular parts of the anterior and posterior ethmoid arteries of the same side by means of connecting branches, as well as anastomoses between the posterior ethmoid and frontal branch of the medial meningeal artery. The upper osseous walls of the ethmoid labyrinths and the mucous membrane were determined to be supplied with blood mainly at the expense of the posterior and anterior ethmoid arteries.*
Key words: *ophthalmic artery, ethmoid arteries, ethmoid bone, ontogenesis, human.*

Introduction. Internal carotid arteries are the branches of the common carotid artery, they enter the cranial cavity through the internal carotid foramen, then cavernous sinus, where they form S-shaped curve. Then it "pierces" dura mater. A short segment of the internal carotid artery (ICA) located on the basic surface of the brain in the subarachnoid space is a supraclinoid part of the ICA. Then the first branch – ophthalmic artery – emerges from it, which together with the visual nerve through the optic canal passes into the cavity of the eye socket where it is divided into the final branches [1]. Closer to the outgoing opening the artery is laterally dislocated. In the eye socket the artery make its way laterally in the ascending direction, goes round the visual nerve near the outgoing opening of the optic canal. The main branches of the ophthalmic artery are well developed, clearly determined during dissection. The lacrimal artery emerges from the initial portion of the intraorbital part of the ophthalmic artery. The supraorbital artery branches from the segment of the ophthalmic artery located above the visual nerve. On the level of the medial edge of the visual nerve the posterior ethmoid artery emerges approaching to the medial wall of the eye socket between the upper oblique and middle rectal muscles. The central retinal artery looks like a short trunk passing from the initial portion of the ophthalmic artery [2-5]. Therefore, literary data concerning topography of the intraorbital part of the ophthalmic artery branches are insufficient, especially concerning those branches supplying blood to the ethmoid bone.

Objective: to examine topographic-anatomical peculiarities of the intraorbital part of the ophthalmic artery branches and determine the sources of blood supply to the ehtmoid bone labyrinth.

Materials and methods. The study was conducted keeping to the requirements of the Declaration of Helsinki developed by the World Medical Association (WMA) "Ethical Principles for Medical Research Involving Human Subjects" (1964-2000). The research was carried out in Chernivtsi Regional Forensic Bureau and at M.G. Turkevych Department of Human Anatomy, Higher State Educational Establishment of Ukraine "Bukovinian State Medical University". The following methods were applied: vascular injections followed by transmission or radiography, embedding of vessels with fine-dispersed self-curing masses, macro- and microscopic preparation, microscopic

examination of a series of histological sections, and graphic reconstruction. After fixation in 10% formalin solution the specimens were embedded into the paraffin blocks according to the common technique. To obtain sections a sliding microtome was used. The paraffin sections 4-6 mcm thick were stained with hematoxylin and eosin by Van Gieson's staining technique, and careful microscopic examination was performed.

Results. Among the common topographic regularities of the intraorbital part of the ophthalmic artery branches including ethmoid ones there is the phenomenon of asymmetry found in 40% of cases.

Asymmetry in the topography of the ethmoid arteries is manifested in the difference of deviation angles, character of vascular passing (including convolution), diameter of arteries, and even in the point of their formation. The factors revealed are most likely connected with peculiarities of an individual development.

While characterizing the sources of blood supply to the ethmoid bone labyrinth rather high compensatory possibilities of hemodynamics in this area should be mentioned due to available arterio-arterial anastomoses between ethmoid arteries directly one by one, and with other arteries of the eye socket, which is the basis to form an alternative blood circulation flow.

Thus, on our specimens in 15% of cases anastomoses were found between the intraorbital portions of the anterior and posterior ethmoid arteries of the same wall by means of connecting branches. The majority of such anastomoses are realized at the expense of the thinnest vessels.

Inside of the orbit the ethmoid arteries have anastomoses with the following branches of the ophthalmic artery: lacrimal, posterior long ciliated, anterior ciliated and supratrochlear arteries. We managed to find them by means of embedding with fine-dispersed self-curing masses with further isolation of complexes and anatomical dissection. The above methods enabled to determine anastomoses not only between the ethmoid arteries and branches of the internal carotid artery system, but with certain branches of the external carotid artery system.

Thus, in addition to the known anastomoses of the supraorbital artery with the superficial temporal one, we found anastomosis between the posterior ethmoid and frontal branch of the medial meningeal artery.

Before entrance into the canal of the same name the anterior and medial ethmoid arteries, in case the latter is available, produce from 2 to 5 thin branches that anastomose with the final branches of the arteries supplying the upper oblique eye muscle. After formation of anastomoses the arterial vessels form rather wide plexus located on the periosteum of the ocular plate.

Discussion. More careful examination of the arterial plexus on the periosteum of the ocular plate which is known to be the wall of many labyrinth cells of the ethmoid bone succeeded to determine that branches of the plexus are not limited by planar anastomosing, but form rather numerous (5-13) penetrating arterial trunks into the thickness of the ocular plate. These arteries penetrate into the periosteum mainly under a right angle, and a part of the trunks for the arterial plexus of the periosteum. It is the periosteum that consists of two layers – more expressed external one where plexus is formed, and less expressed internal one. The arteries from the external layer plexus and a part of non-branched penetrating arteries penetrate through the internal layer into very thin (often absent) compact substance of the ocular plate. Here another arterial network is formed – intraosseous, from which certain branches penetrate into the mucous membrane of the ethmoid labyrinth cells. It should be noted that the most expressed concentration of the plexus branches is located in the point of junction of the osseous walls of the adjacent cells. In the majority of cases the lacrimal bone is the anterior wall of the anterior group of the labyrinth cells of the ethmoid bone. According to our observations the main sources of blood supply of the above wall is the branch of the nasal arch artery and small vessels emerging from the supratrochlear artery.

Forming anastomoses between themselves arterial trunks from the above arteries form arterial plexuses on the periosteum of the lacrimal bone. These plexuses are not similar in certain portions. They are more developed in the posterior part, in the portion of the lacrimal fossa and lacrimal-ethmoid suture.

The plexus in the anterior portion of the

lacrimal bone is less constant. Mainly the branches of the nasal arch artery participate in its formation. Anastomoses with the branches of the supratrochlear artery are not always found. From 3 to 8 penetrating arteries emerge from the mentioned arterial plexuses mostly penetrating at a right angle into the periosteum and compact plate of the lacrimal bone. Formation of the arterial vascular plexuses is characterized mainly by the regularities similar to those in the ocular plate. Available differences are caused by the structure of the lacrimal bone.

Internal upper osseous walls of the ethmoid labyrinths similar to the mucous membrane are supplied with blood mainly at the expense of the posterior and anterior ethmoid arteries (and in case the medial one is available, after its passing into the canal of the same name).

Conclusions. 1. The determined asymmetry in the topography of the ethmoid arteries is manifested in the difference of deviation angles, character of vascular passing, diameter of arteries, and even in the point of their formation. 2. The ethmoid arteries have anastomoses with the lacrimal, posterior long ciliated, anterior ciliated and supratrochlear arteries. 3. Anastomosis is found between the posterior ethmoid and frontal branch of the medial meningeal artery. 4. The main sources of blood supply of the anterior wall of the anterior group of the ethmoid bone labyrinth cells is the branch of the nasal arch artery and small vessels emerging from the supratrochlear artery.

Prospects of further studies: further investigation of the ethmoid arteries topography in the canals of the same name.

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