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PECULIARITIES OF THE FACIAL NERVE DEVELOPMENT

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The main peculiarities of the facial nerve development, its intracerebral connections, extracranial divisions and relationship with the neighbouring morphological structures were established.

Key words: *embryo, Carnegie stage, facial nerve, geniculate ganglion, connections*

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ОСОБЕННОСТИ РАЗВИТИЯ ЛИЦЕВОГО НЕРВА

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Установлены основные особенности развития лицевого нерва, его внутримозговые связи и экстракраниальные взаимоотношения с соседними морфологическими структурами.

Ключевые слова: *эмбрион, стадия Карнеги, лицевой нерв, узел коленца, связи*

The fascinating process of the facial nerve embryology and appearance of the first branches of one of the most susceptible to harmful factors nerves, as well as obtained results, increased our believe that even the most sophisticated methods of imaging cannot provide a better understanding of the facial nerve morphology, than investigation of its development in human embryos.

Expression of the HOX genes in the neural tube and neural crest cells and expression of the code of the HOX genes in both neurogenic neural crest and branchial arches, determines the facial nerve development [5].

A distinct position of the cranial nerves roots in relation to individual rhombomeres was revealed in chick embryos by [3], thus the trigeminal nerve develops from r2 and r3, the facial from r4 and r5, the glossopharyngeal nerve from r6 and r7, the vagus and accessory nerves from r7 and r8 [3].

According to [1, 4], in the third week of gestation the facio-acoustic primordium derives from the rhombomeres of the rhombencephalon, giving rise to the facial nerve. By the fourth week of embryonic development, the facial nerve nuclei are formed and the chorda tympani nerve arises from the facial nerve [1, 4]. During the 5th-7th weeks of gestation the geniculate ganglion, intermediate nerve, greater petrosal nerve and other branches develop [1, 2, 4].

In the 7th and 8th weeks, the muscles of facial expression derive from the second branchial arch, and by the 11th week of development the facial nerve is characterized by an obvious arborization. Thus, in the newborn the facial nerve anatomy has many similarities to that of an adult, except for the mastoid region, where the nerve is located more superficially [1].

Materials and methods. This study was conducted on the base of the Bilateral Agreement between the Department of human anatomy of *Nicolae Testemitanu* State University of Medicine and Pharmacy of the Republic of Moldova and Department of normal anatomy of the Belarusian State Medical University (BSMU) from Minsk.

Twenty-seven series of sagittal, frontal and transverse cross-sections of human embryos at Carnegie stages 13-23 of the historical embryological collection of the Department of normal anatomy of the BSMU from Minsk were investigated.

For human embryos cross-sections photographs and protocols description the OLYMPUS CX31 microscope was used.

Results and discussions. The embryology as one of the main pillars of morphology is the key to many questions. According to the purpose of our study, we have investigated the changes that occurred during the facial nerve embryogenesis, and a detailed description of the main processes was given.

At the end of Carnegie stage 13 a narrow fissure split the facio-acoustic primordium into the facial and acoustic ganglia.

The facial nerve appeared from the rhombencephalon by a straight trunk consisting of loosely arranged nervous fibers, from which the chorda tympani nerve at stage 14 and the geniculate ganglion, the greater petrosal nerve at stage 15 were identified. Similar results were reported by [1, 2, 4].

On sagittal cross-sections the intracerebral connections of the facial nerve with the trigeminal and glossopharyngeal nerves were found (figure 1,2)

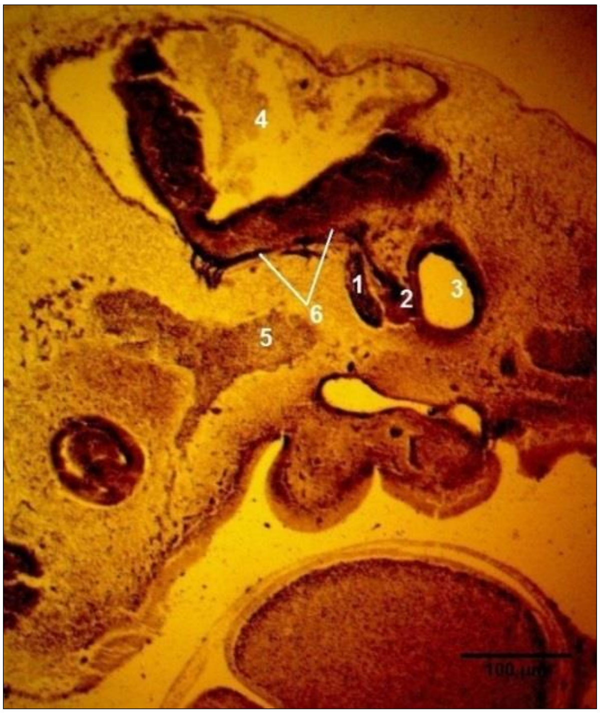

Fig. 1. Sagittal cross-section of the human embryo at (Carnegie stage 15).
1 – facial nerve; 2 – acoustic ganglion; 3 – otic vesicle; 4 – posterior cerebral vesicle; 5 – vena capitis prima*;* 6 – intracerebral connections of the facial nerve with the trigeminal

Fig. 2. Intracerebral connections of the facial nerve (Carnegie stage 19).
1 – facial nerve; 2 – double facial trunk: 3 – chorda tympani nerve; 4 – acoustic ganglion; 5 – trigeminal ganglion; 6 – second branch of the trigeminal nerve; 7 – third branch of the trigeminal nerve; 8 – glossopharyngeal nerve; 9 – intracerebral connections of the facial nerve with the glossopharyngeal nerve; 10 – intracerebral connections of the facial nerve with the trigeminal nerve; 11 – intracerebral connections of the glossopharyngeal nerve with the vagus nerve; 12 – cavity of the fourth ventricle; 13 – eye; 14 – connections between the anterior and posterior trunks of *n. facialis*.

On transverse cross-sections through the rhombencephalon of the embryos at Carnegie stage 16, an anterior and a posterior root of the facial nerve, that joined to form the facial nerve trunk, were observed.

The geniculate ganglion was of an avoid shape and preponderantly formed by nervous fibers, among which neuroblasts in growth were distinguished.

At stage 17 the facial nerve left the rhombencephalon as a dark impregnated trunk that externally surrounded the otic capsule resembling a flexure, from which the chorda tympani nerve, by a sharp angle, ascended between the auditory ossicles. The origin of the greater petrosal nerve from the geniculate ganglion and its course became more obvious.

At Carnegie stage 18 the fibers within the facial nerve trunk were arranged more loosely and the trunk obviously increased in thickness in comparison with its diameter at stage 15. On sagittal cross-sections both the primary and the secondary divisions of the facial nerve were well seen. At Carnegie stage 18 the intracerebral connections between the facial nerve with the trigeminal and glossopharyngeal ones, increased in thickness, and appeared as dark impregnated arcuate structures (fig 2).

At stage 20 all the main components of the facial nerve were formed and distally the trunk divided into its temporofacial and cervicofacial divisions. The geniculate ganglion preserved its oval shape and it was located ventrally towards the external knee of the facial nerve, resuming an elongated ovoid-triangular shape. There was mentioned a higher argentophilia of the nervous fibers, compared to previous stages. More fibers were involved in formation of the intracerebral connections between the VII nerve with the IX and X cranial nerves. The chorda tympani and the greater petrosal nerves were clearlly distinguished. The chorda tympani nerve, getting out from the geniculate ganglion, continued its course between the auditory ossicles, and it had almost the same diameter along its entire length being much more impregnated than the greater petrosal nerve. At its origin from the geniculate ganglion, the greater petrosal nerve was thicker, but distally it became thinner ending within the surrounding mesenchyme.

As the embryo grew, the temporofacial and the cervicofacial divisions of the facial nerve became longer and thicker. The temporofacial division usually gave off more secondary branches than the cervicofacial one. Another peculiarity of the temporofacial division was formation of a plexiform structure in the infraorbital region.

Danilo, emphasized that the external knee of the facial nerve started its formation during the sixth week of development. The changes of the facial nerve trajectory and its bending around the otic capsule in the current study were marked out in the same period of gestation [1].

At Carnegie stage 20 the fibers of the facial nerve were located above the germs of the parotid gland, but towards stage 22 the branches of the facial nerve were revealed below and between the parotid gland germs.

In the literature, we did not find any data about terms of formation of the internal knee of the facial nerve. In the current study, the internal knee of the facial nerve was observed at Carnegie stage 23.

The facial nerve derived at stage 13 from the facio-acoustic primordium. At stage 15 the geniculate ganglion, chorda tympani nerve and the greater petrosal nerve were well distinguished. The first intracerebral connections of the facial nerve with the trigeminal and glossopharyngeal ones were identified at stage 15, and by stage 18 those connections were clearly manifested. At stage 15 both primary and secondary divisions of the facial nerve were well differentiated. The plexiform character of the peripheral divisions of the facial nerve and its connections in the infraorbital region were highlighted at stage 21. A changeable character of the geniculate ganglion was revealed in our study. At stage 23 the internal knee of the facial nerve was obviously distinguished.

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