CONNECTIONS OF THE FACIAL NERVE IN HUMAN EMBRYOS

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At Carnegie stage 15 the intracerebral connections of the facial nerve with the trigeminal and glossopharyngeal nerves were identified. At Carnegie stage 17 the connections between the geniculate and acoustic ganglia were revealed. At Carnegie stage 21 in the infraorbital region the temporofacial division of the facial nerve formed a reticular connection with the infraorbital nerve. Two types of extracranial connections of the facial nerve were marked out: connections of the facial nerve branches with the branches of the neighbouring cranial nerves and connections among the parotid plexus branches.

Key words: *facial nerve; development; connections.*

СОЕДИНЕНИЯ ЛИЦЕВОГО НЕРВА У ЭМБРИОНОВ ЧЕЛОВЕКА

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Внутримозговые связи лицевого нерва с тройничным и языкоглоточным нервами были выявлены на 15-ой стадии Карнеги. На 17-ой стадии Карнеги были отмечены связи между коленчатым и слуховым узлами. На 21-ой стадии Карнеги в подглазничной области височно-лицевое ветвление лицевого нерва соединялось с подглазничным нервом в виде ретикулярного образования. Внечерепные связи лицевого нерва были представлены двумя видами связей: соединениями ветвей лицевого нерва с ветвями соседних черепно-мозговых нервов и соединениями ветвей околоушного сплетения между собой.

Ключевые слова: *лицевой нерв; развитие; соединения.*

Introduction. The facial nerve develops from the rhombomeres r4 and r5 of the rhombencephalon and initially it appears as the facio-acoustic primordium [1, 2, 3]. The development of the facial nerve depends on expression of the HOX genes and particularly it is characterized by a high expression of the HOXB-7 gene [4]. The first intracerebral connections of the facial nerve with the neighbouring cranial nerves were reported at Carnegie stage 15 [5, 3]. The extracranial connections of the facial nerve appear in early stages of development and during embryonic period, they become rich and various.

Aim of study. The purpose of our research was to establish the connections of the facial nerve with other cranial nerves and their ganglia in human embryos.

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

For our purpose, twenty-seven series of human embryos at Carnegie stages 13-23 of the historical embryological collection of the BSMU were investigated. The hematoxylin-eosin and Bil'shovski-Bucke methods of staining were used.

For protocol description of the sagittal, transverse and frontal cross-sections of embryos the OLYMPUS CX31 microscope (ocular 10x, objectives 4, 10, 40) was used.

Results. The first appearance of the facial nerve as a facio-acoustic primordium was marked out at Carnegie stage 13. Examining the sagittal cross-sections of the embryos at Carnegie stage 15, the intracerebral connections of the facial nerve with the trigeminal and glossopharyngeal ones were identified (figure 1).

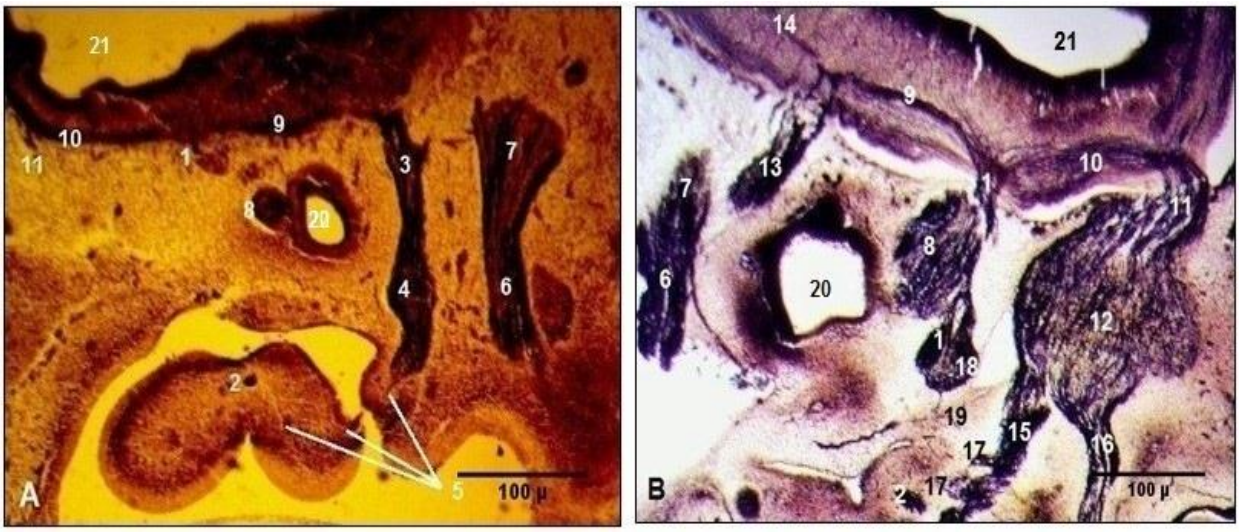

Fig. 1. Connections of the facial nerve with the trigeminal and glossopharyngeal nerves on sagittal cross-sections of human embryos at Carnegie stage 15 (A) and Carnegie stage 19 (B). Microphotographs

1 – facial nerve; 2 – chorda tympani nerve; 3 – superior ganglion of the glossopharyngeal nerve; 4 – inferior ganglion of the glossopharyngeal nerve; 5 – lingual branches of the glossopharyngeal nerve; 6 – vagus nerve; 7 – superior ganglion of the vagus nerve; 8 (A) – acoustic ganglion; 8 (B) – vestibular ganglion; 9 – intracerebral connections of the facial nerve with the glossopharyngeal nerve; 10 – intracerebral connections of the facial nerve with the trigeminal nerve; 11 – cerebral roots of the trigeminal nerve; 12 – trigeminal ganglion; 13 – glossopharyngeal nerve; 14 – connections of the glossopharyngeal nerve with the vagus nerve; 15 – mandibular nerve; 16 – maxillary nerve; 17 – connections of the mandibular nerve with the chorda tympani nerve; 18 – geniculate ganglion; 19 – greater petrosal nerve; 20 (A) – otic vesicle; 20 (B) – labyrinth of the inner ear; 21 – posterior cerebral vesicle

Among the peculiarities of the facial nerve at Carnegie stage 16 it should be mentioned the appearance of the greater petrosal nerve and of a connecting branch of the facial nerve with the tympanic plexus (figure 2 A).

The main divisions of the facial nerve derived from its trunk at Carnegie stage 17. Another specific feature of this stage was the plexiform character of the extracranial branches of the facial nerve.

At the level of their origin, those five divisions of the facial nerve used to form some intraplexual connections and then they spread in a fan-like fashion, characteristic for the parotid plexus branches (figure 2 B).

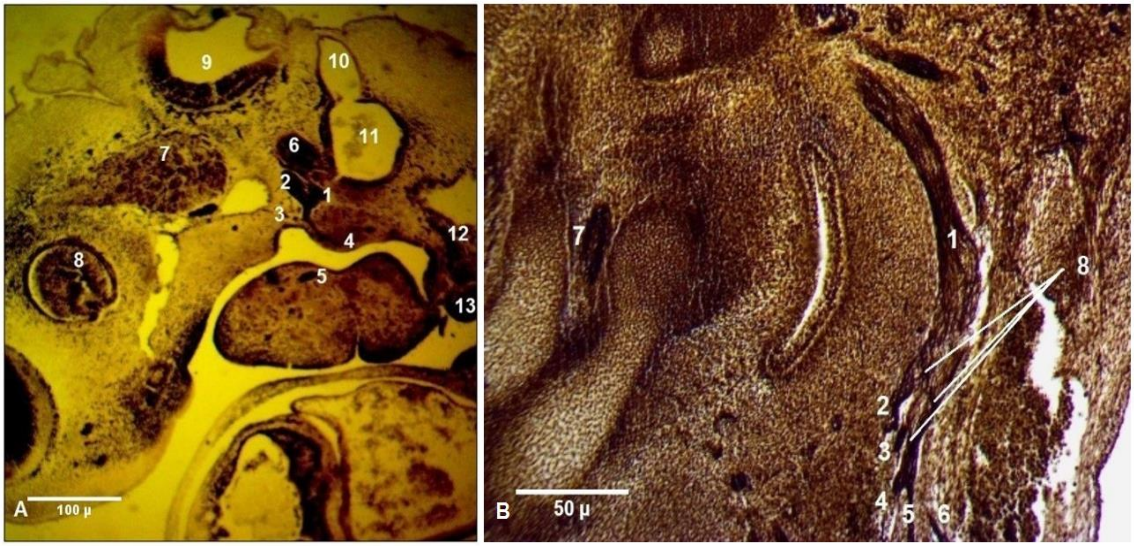

Fig. 2. Connections of the facial nerve at Carnegie stage 16 (A) and Carnegie stage 17 (B). Microphotographs
(A) 1 – facial nerve; 2 – geniculate ganglion; 3 – greater petrosal nerve; 4 – communicating branch of the facial nerve with the tympanic plexus; 5 – chorda tympani nerve; 6 – vestibular ganglion; 7 – trigeminal ganglion; 8 – eyeball; 9 – posterior cerebral vesicle; 10 – endolymphatic duct; 11 – otic vesicle; 12 – glossopharyngeal nerve; 13 – hypoglossal nerve.
(B) 1 – facial nerve; 2 – temporal branch: 3 – zygomatic branch: 4 – buccal branch; 5 – marginal mandibular branch; 6 – cervical branch; 7 – chorda tympani nerve; 8 – intraplexual connections of the parotid plexus branches

In the next stages of development, new intra- and extraplexual connections of the facial nerve were established.

Connections between the geniculate and vestibular ganglia were marked out at early stages of development, but only at Carnegie stage 20 those connections obtained a fibrillar character and became more obvious (figure 3 A). At Carnegie stage 20 the connections among the parotid plexus branches were clearly distinguished (figure 3 B).

Multiple extracranial branching and complex plexiform connections of the facial nerve were pointed out at Carnegie stage 21.

The temporofacial division was twice thicker than the cervicofacial one and in the infraorbital region it used to form a compound reticular structure that denoted connections of the buccal branches of the facial nerve with the infraorbital branch of the maxillary nerve.

Fig. 3. Connections of the facial nerve at Carnegie stage 20. Microphotographs.
1 – facial nerve; 2 – temporofacial division; 3 – cervicofacial division; 4 – intermediate nerve; 5 – geniculate ganglion; 6 – vestibular ganglion; 7 – interganglionic connections; 8 – trigeminal ganglion; 9 – intraplexual connections between the ramifications of the temporofacial division

Conclusions. The intracerebral and extracerebral connections of the facial nerve form during the embryonic period of development and their genetic substrate would result in adults into a specific type of the facial nerve branching.

At Carnegie stage 15 both intracerebral and extracranial connections of the facial nerve are distinguished and during the following stages of development, they become more complex and diverse.

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