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ANATOMICAL PECULIARITIES OF THE NASAL PASSAGES IN 7-8-WEEK PRE-FETUSES

АНАТОМІЧНІ ОСОБЛИВОСТІ НОСОВОЇ ПЕРЕГОРОДКИ У 7- 8-ТИЖНЕВИХ ПЕРЕДПЛОДІВ

Резюме. Методами мікро- та морфометрії 10 препаратів носової ділянки 7-8-тижневих передплодів, досліджено закономірності розвитку, формування та морфологічні перетворення носової перегородки людини. З'ясовано, що у передплодовому періоді зачаток носової перегородки представлений мезенхімою, вкритою ззовні високим циліндричним епітелієм, ядра якого мають кулясту або овальну форму. В центральній частині закладки носової перегородки клітини мезенхіми розташовуються більш компактно, утворюючи конгломерат. Передня і середня третини носової перегородки зрощені з первинним піднебінням, а її задня частина вільно звисає в первинну ротову порожнину. У передплодів кінця 7-го тижня розвитку (довжиною 19,5-20,0 мм) підепітеліальна кровоносна сітка представлена судинними стовбурами типу капілярів діаметром 8,0±0,5 мкм. Під час восьмого тижня внутрішньоутробного життя в центральній частині носової перегородки, внаслідок диференціювання клітин мезенхіми, з'являється шар прохондральної тканини. У задній третині носової перегородки спостерігається концентрація клітин мезенхіми безпосередньо біля її нижньої частини у вигляді парного утворення, що має форму пластинок – закладка лемеша. Наприкінці восьмого тижня внутрішньоутробного розвитку прохондральна тканина носової перегородки перетворюється в незрілу хрящову тканину. Визначаються також закладка клино-піднебінної артерії (діаметр 24,0±0,5 мкм) в задньому відділі бічної стінки первинної носової порожнини.

Ключові слова: носова перегородка, передплід, анатомія, людина.

Antenatal health care requires a deep and comprehensive study of various factors influencing on the normal and pathologically changed development of the embryo and fetus, a comprehensive analysis between the norm and pathology. In Ukraine due to an increasing harmful effect of environmental factors on the human organism, especially in the period of the intrauterine development, the problem has become an important issue. Investigation of the dynamics of changes in the topography of structures of organs and complexes of organs during the prenatal period of human ontogenesis with the aim to determine the interrelations and interaction of the shape-generating processes on the spatial-temporal orientation of the anatomical structures as well as finding the time and morphological preconditions of possible occurrence of variants in their structure and congenital defects is one of the important scientific directions in anatomical field [1-2]. The information concerning syntopic correlations of the sources, causes and mechanisms of ontogenesis occurrence during the prenatal period promotes both understanding the mechanisms of normal organ formation and establishment of its topography, and determination of variants in their structure and congenital defects. Elaboration of a complex of preventive measures concerning antenatal care of the nasal area is an urgent issue nowadays when the effect of unfavourable environmental factors (ecological, chemical, physical etc.) has increased considerably. Analysis of the literature dealing with etiology, pathogenesis and treatment of congenital and acquired defects of the nasal septum is indicative of debatable opinions of scientists on the issues of modern rhinology, including the methods and time of surgical correction of the nasal septum deviation, eradication of polyp growth in its mucous membrane, treatment of chronic bleeding, post-traumatic lesions in particular [3-4]. One of the terms of a successful solution of the above issues is a comprehensive study of anatomical peculiarities at every stage of development [5-7].

Objective: to determine spatial-temporal dynamics in the establishment of structural components of

the nasal septum during the 7-8 week of the intrauterine development.

Material and methods. *This scientific work is part of a comprehensive initiative research work "Features of morphogenesis and topography systems and organs in pre- and postnatal periods ontogenesis of people" (state registration number: 0115U002769, scientific supervisor – professor O. M. Slobodian). 10 specimens of pre-fetuses, 6 series of histological specimens of pre-fetuses 20,0-22,0 mm of the parieto-coccygeal length (PCL) of the 8th week of the intrauterine development were examined. A complex of up-to-date methods of morphological investigation was applied including micro- and macroscopy, anthropometry, morphometry of the topographic-anatomical sections.*

Results and discussion. Development of the nasal cavity walls during the 7th week of the intrauterine period was studied on 5 series of histological specimens of pre-fetuses with 20,0-22,0 mm of PCL.

Secondary nostrils are found to be formed due to joining of the maxillary processes with the median nasal processes and with themselves. These nostrils are open forward and downward. They are in the shape of small slits vertically elongated. The longitudinal size of the nostrils is 550±20,0 mcm, the transversal one –250±10,0 mcm. The distance between them is no longer than 750±25,0 mcm. The nostrils continue into the vestibule of the oral cavity filled with the epithelial "plug", the walls of the vestibule are lined with 2-3-row epithelium 8 ±1,0 mcm thick.

The vestibule of the nasal cavity continues into the primary nasal cavity proper which is divided into two symmetrical halves by means of the rudiment of the nasal septum.

The rudiment of the nasal septum is presented by the mesenchyme covered with the high columnar epithelium externally with the nuclei of a spherical or oval shape located in 4-6 lines. The epithelium is 36±2,0 mcm thick (in its superior portion). In the central part of the nasal septum rudiment the mesenchyme cells are located more densely forming an aggregation in the shape of a wedge with its apex turned downward. Its transverse size near the base is 220±10,0 mcm, in the median portion – 110±6,0 mcm, in the area of the apex – 80 ±5,0 mcm, and the vertical one – 880±25,0 mcm. The above aggregation of the mesenchyme cells extends in the anterior-posterior direction along the whole nasal septum. In its median third the distal extremity of the aggregation forms a club-shaped dilation. The height of the aggregation decreases near the posterior portion of the nasal septum together with decrease of the nasal septum height. A smooth layer of the mesenchyme cells is located between the epithelial layer and the above formation. It is 240±5,0 mcm thick. The rudiment of Jacobson's organ is found at the distance of 220±4,0 mcm from the inferior border of the nasal septum. The nasal septum is no more than 836±20,0 mcm thick. Its longest vertical size is 990 mcm. The posterior extremity of the septum gradually decreasing extends into the superior wall of the primary oral cavity. It should be noted that the anterior and median thirds of the nasal septum are joined with the primary palate, and its posterior portion hangs down into the primary oral cavity freely.

Further development of the blood vessels is found: the blood elements are more clearly separated from the surrounding mesenchyme by means of the endothelium. The subepithelial blood network begins to form in pre-fetuses with 15,5-16,0 mm of PCL, which at the end of the 7th week of development (pre-fetuses with 19,5-20,0 mm of PCL) is presented by the vascular columns of a capillary type 8±0,5 mcm in diameter. Larger and ingrowing externally vessels are clearly seen at this stage of the intrauterine development. The anterior ethmoid artery extends in the mesenchyme layer of the superior wall of the primary nasal cavity in a descending direction. It is 20±1,0 mcm in diameter. The posterior ethmoid artery is found near the median wall of the orbital cavity. It extends practically horizontally to the superior wall of the primary nasal cavity and branches in its mesenchyme layer. The wall of the vessels outside of the organ is little differentiated and presented by the endothelium. 2-3 lines of densely located and circulatory oriented mesenchyme cells are found externally from it. Their nuclei are elongated in shape.

Development of the nasal cavity walls during the 8th week of the intrauterine period was studied on 5 series of histological specimens of pre-fetuses with 21,0-30,0 mm of PCL.

The primary nasal cavity is divided into two symmetrical halves by means of the primary nasal septum. The layer of the subcartilaginous tissue appears in the central part of the nasal septum due to differentiation of the mesenchyme cells. The mesenchyme, covered with the epithelium from the side of the nasal cavity, is located on the periphery of this layer. Its structure and thickness do not differ from the similar one in the 7-week embryos.

At the beginning of the 8th week the subcartilaginous tissue is in the form of a lamina. Its vertical size is 1,6 mm, and thickness – 176±5,0 mm. Closer to the posterior border of the nasal septum the vertical size of the subcartilaginous tissue decreases, and it extends into the rudiment of the sphenoid bone body. The mesenchyme cells are concentrated on the posterior third of the nasal septum looking like a pair formation in the form of laminae – vomer rudiment. In frontal sections these laminae are clearly seen to be located obliquely. Their superior extremities are located at the distance of 440±5,0 mcm one from another, and the inferior ones – 220±3,0 mcm.

At the end of the 8th week of the intrauterine development the subcartilaginous tissue of the nasal septum is transformed into the immature cartilaginous tissue. The vertical size of the cartilaginous lamina of the nasal septum is no longer than 1,9±0,1 mm, and its thickness – 110±10,0 mcm. The maximum height of the nasal septum is 1,4±0,1 mm, and its thickness – 80±10,0 mm. Its anterior-posterior size increases from 1,2±0,05 mm (pre-fetuses with 22,0 mm of PCL) to 1,8 ±0,05 mm (pre-fetuses with 29,0 mm of PCL).

The distance between the nasal septum and a free border of the superior nasal concha is no longer than 220±7,0 mcm, the median one – 242±6,0 mcm and the inferior one – 154±5,0 mcm.

The branches of the major vessels, supplying the walls of the primary nasal cavity, pass in the mesenchyme layer (closer to the rudiment of the cartilaginous tissue), forming anastomosis with the wall of the own vessels. The diameter of the anterior and posterior ethmoid arteries is 24±1,0 mcm. The rudiment of the cuneopalatine artery (24±0,5 mcm in diameter) is determined at this stage of development in the posterior portion of the lateral wall of the primary nasal cavity.

In this age category (pre-fetuses with 22,0-27,0 mm of PCL) the central processes of the olfactory cells join with the olfactory bulb. They are from 4,0±0,5 mcm to 8,0±0, mcm thick.

Conclusions.1. During the 7th week of the intrauterine development the rudiment of the nasal septum was found to be presented by the mesenchyme covered externally with the high columnar epithelium with the nuclei of a spherical or oval shape. 2. The mesenchyme cells are located more densely in the central part of the nasal septum rudiment forming an aggregation. 3. The anterior and median thirds of the nasal septum are merged with the primary palate, and its posterior part freely hangs down into the primary oral cavity. 4. In pre-fetuses at the end of the 7th week of development (19,5-20,0 mm long) the subepithelial blood network is presented by the vascular columns of a capillary type 8±0,5 mcm in diameter. 5. During the 8th week of the intrauterine life a layer of the subcartilaginous tissue appears in the central part of the nasal septum due to differentiation of the mesenchyme cells. 6. The mesenchyme cells are concentrated directly near the lower part of the posterior third of the nasal septum looking like a pair formation in the form of laminae – vomer rudiment. 7. At the end of the 8th week of the intrauterine development the subcartilaginous tissue of the nasal septum is transformed into the immature cartilaginous tissue. 8. The rudiment of the cuneopalatine artery (24±0,5 mcm in diameter) is also determined in the posterior portion of the lateral wall of the primary nasal cavity.

Prospects of further studies: to investigate peculiarities in the development of the nasal septum during pre-fetal period of human ontogenesis, and during 9-11 weeks of the intrauterine development in particular.

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АНАТОМИЧЕСКИЕ ОСОБЕННОСТИ НОСОВОЙ ПЕРЕГОРОДКИ 7-8-НЕДЕЛЬНЫХ ПРЕДПЛОДОВ

Резюме. Методами микро- и 7-8-недельных передплодов, морфометрии исследовано 10 препаратов носового участка, закономерности развития, формирования и морфологические преобразования носовой перегородки человека. Установлено, что в передплодового периоде зачаток носовой перегородки представлен мезенхимой, покрытой извне высоким цилиндрическим эпителием, ядра которого имеют шаровидную или овальную форму. В центральной части закладки носовой перегородки клетки мезенхимы располагаются более компактно, образуя конгломерат. Передняя и средняя трети носовой перегородки сросшиеся с первичным небом, а ее задняя часть свободно свисает в первичную ротовую полость. У передплодов к концу 7-й недели развития (длиной 19,5-20,0 мм) подэпителиальном кровенос-

ная сеть представлена сосудистыми стволами типа капилляров диаметром 8,0±0,5 мкм. Во время восьмой недели внутриутробной жизни в центральной части носовой перегородки, в результате дифференцировки клеток мезенхимы, появляется слой прохондральнои ткани. В задней трети носовой перегородки наблюдается концентрация клеток мезенхимы непосредственно у ее нижней части в виде парного образования, имеет форму пластинок – закладка сошника. В конце восьмой недели внутриутробного развития прохондральна ткань носовой перегородки превращается в незрелую хрящевую ткань. Определяются также закладка клинонебной артерии (диаметр 24 ± 0,5 мкм) в заднем отделе боковой стенки первинной носовой полости.
Ключевые слова: носовая перегородка, передплод, анатомия, человек.

ANATOMICAL PECULIARITIES OF THE NASAL PASSAGES IN 7-8-WEEK PRE-FETUSES

Abstract. In Ukraine due to an increasing harmful effect of environmental factors on the human organism, especially in the period of the intrauterine development, the problem has become an important issue. Investigation of the dynamics of changes in the topography of structures of organs and complexes of organs during the prenatal period of human ontogenesis with the aim to determine the interrelations and interaction of the shape-generating processes on the spatial-temporal orientation of the anatomical structures as well as finding the time and morphological preconditions of possible occurrence of variants in their structure and congenital defects is one of the important scientific directions in anatomical field. 10 specimens of the nasal area of 7-8-week pre-fetuses, regularities of their development, formation and morphological transformations of the human nasal septum were examined by means of micro- and morphometry. During the pre-fetal period the rudiment of the nasal septum was found to be presented by the mesenchyme covered externally with the high columnar epithelium with the nuclei of a spherical or oval shape. The mesenchyme cells are located more densely in the central part of the nasal septum rudiment forming an aggregation. The anterior and median thirds of the nasal septum are merged with the primary palate, and its posterior part hangs down into the primary oral cavity. In pre-fetuses at the end of the 7th week of development (19,5-20,0 mm long) the subepithelial blood network is presented by the vascular columns of a capillary type 8,0±0,5 mcm in diameter. During the 8th week of the intrauterine life a layer of the subcartilaginous tissue appears in the central part of the nasal septum due to differentiation of the mesenchyme cells. The mesenchyme cells are concentrated directly near the lower part of the posterior third of the nasal septum looking like a pair formation in the form of laminae – vomer rudiment. At the end of the 8th week of the intrauterine development the subcartilaginous tissue of the nasal septum is transformed into the immature cartilaginous tissue. The rudiment of the cuneopalatine artery (24,0±0,5 mcm in diameter) is also determined in the posterior portion of the lateral wall of the primary nasal cavity.
Key words: nasal septum, pre-fetus, anatomy, human.

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