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**Original Article: MORPHOGENESIS OF THE ETHMOID BONE IN HUMAN FETUSES**

**Citation**

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**Abstract.** We have carried out a morphological study of the ethmoid bone on the 27 specimens in 4-10 month old human fetuses. It was found that the nasal septum, cribriform plate and ethmoidal labyrinth are all made of cartilage. At the end of the gestational period, they have ossification areas and clearly seen 3-6 ethmoid cells.

**Key words:** ethmoid bone, fetus, anatomy, ontogenesis, human being.

**Introduction.** Practical health care considers the exact time of any uterine fetal changes, providing systemic fetal genesis, extremely important [1,2]. Though the period of fetal growth is relatively short, the changes in the body are much more essential than those of the rest of its further life. That is why it is important to learn the structure of organs and systems in connection with the main process in morphogenesis [3]. According to WHO 140 million children are born annually in the world and many of them are born disabled. That is why one of the major tasks of perinatology currently is justification of effective methods of prevention and early diagnosis of congenital pathology[4]. In recent years the problem of congenital defects is of particular relevance because

under the conditions of declining fertility we observe a significant increase in their frequency [4,6]. A significant percentage of congenital defects is accounted for the facial area. Increased frequency and variety of congenital malformations is associated with disturbances in normal organogenesis, which requires a comprehensive study of the process of formation and topography of organs and systems, identification of critical periods of development and justification of prevention methods[7]. Depending on their severity and type anomalies of the face are or may be the cause of a number of pathological conditions and diseases both in the nasal area and in the organism as a whole [8]. About 7% of adults in developed countries suffer from chronic diseases of paranasal sinuses. Due to this fact an effective diagnosis and treatment of this disease depend largely on the awareness of formation and growth of the paranasal sinuses and is a rather topical issue [9].

An analysis of the literature shows that the data on features of formation and development of topography of human ethmoidal labyrinth secondary formations during the prenatal period are fragmentary and do not reveal the sequence of transformations.

**Objective.** To study the process of formation of the ethmoid bone in the fetal period of human ontogenesis.

**Material and methods.** The study was conducted on 27 specimens of corpses of 4-10-month-old fetuses using methods of macro-, microsliding, manufacturing serial histological sections, plastic and graphic reconstruction and morphometry.

**Results of our own study.** Most of the internasal septum in the fetuses during the fourth month of their growth with 81.0-134.0 of crown-rump length (CRL) was cartilaginous tissue except its posteroinferior portion which is osseous. The part which is near the nasal cavity is covered with the mucous membrane. The cartilaginous part of the septum is the plate, which forms the moving part of the septum and it is cartilaginous in structure and perpendicular to the plate of the ethmoid bone. There is no boundary between these formations and they merge, forming a coherent plate. Anteroposterior diameter of the septum at the beginning of the 4th month is 7.4 mm, at the end of the 4th month it increases to 13.5 mm, the largest vertical diameter of the nasal septum - from 5.8 to 8.7 mm. The cartilage plate is 0.5 - 1.2 mm thick.

The cribriform plate of the ethmoid bone in this period is presented by the cartilaginous tissue. Its anteroposterior diameter increases from 4.9 to 7.8 mm, and the transverse one from 1.5 to 2.2 mm.

The labyrinth of the ethmoid bone is also presented by cartilaginous tissue. Its anteroposterior diameter increases from 4.7 to 6.2 mm, and the vertical one from 2.5 to 3.2 mm.

Fetuses with 135.0-185.0 mm of CRL (the fifth month of fetal life), have the nasal septum which is presented by the cartilage plate. Anteroposterior diameter of the septum increases from 12.7 to 17.6 mm, the largest vertical one from 8.7 to 10.9 mm. The cartilage plate is 0.9-1.1 mm thick.

The ethmoid plate is still cartilaginous. Its anteroposterior diameter reaches 11.5 mm and the transverse one 2.7 mm.

This period of growth is characterized by well-expressed ethmoidal bulla in the middle nasal duct, it is 3.4 mm long and 1.7 mm wide. The hook-like process is 4.4-5.1 mm long and 1.4 mm wide and it demarcates in front the crescent slot which reaches 4.3mm.

At this stage there are the beginnings of ethmoid cells as epithelial ingrowth into the lateral wall of the nasal cavity directly above the ethmoidal bulla.

While studying the fetuses aged six months (186.0-230.0 mm of CRL) we noticed that the nasal septum was presented by the cartilaginous and osseous tissues. There was no border between the septum cartilage and the perpendicular plate of the ethmoid bone in the cartilaginous part. Anteroposterior diameter of the perpendicular plate in the ethmoid bone reaches 13.2 mm and the transverse one 3.3 mm.

The labyrinth of the ethmoid bone is already osseous. The anteroposterior diameter is 6.9-8.4 mm, and the vertical one reaches 4.4-5.2 mm. During the sixth month of the growth the cartilaginous capsule of the nose is gradually getting thinner. It forms the ethmoidal labyrinth. The crescent slot reaches 4.3-4.9 mm. The ethmoidal bulla looks like a roller (3.7 × 1.4 mm), the hook-like process is 5.1 mm long and 1.9 mm wide. Above the ethmoidal bulla open anterior ethmoidal cells.

Based on the study of fetuses aged seven-eight months (231.0-310.0 mm of CRL) it was established that the structure of the nasal septum is not different from that in the fetuses of the previous stage. The labyrinth of the ethmoid bone has anteroposterior diameter 11.2-12.4 mm, and it is 5.4-6.2 mm high. The crescent slot is 7.7 mm long. The ethmoidal bulla still looks like a roller (5,1×2,2mm). The hook-like process is not more than 7.2 mm long and 2.4 mm wide.

The fetuses of the described age have well pronounced cells of the ethmoidal labyrinth, but their number is small – from 3 to 6. The cells are lined with mucous

membrane which is 0.24-0.35 mm thick, are oval in shape and of different sizes. The biggest of them is  $1.4 \times 1.12$  mm and the smallest one—  $0.83 \times 0.55$  mm.

While studying the fetuses with 311.0-378.0 mm of CRL (the ninth- tenth months of growth), we noticed that the cartilaginous part of the nasal septum is homogenous cartilaginous tissue, it is still impossible to differentiate between the cartilage of the nasal septum proper and the perpendicular plate of the ethmoid bone. We can see some areas of osseous tissue in the perforated cribriform plate of the ethmoid bone. Its anteroposterior diameter increases to 17.2-18.5 mm and the vertical one to 6.7 mm. Posterior ethmoidal cells open in the posterior third part of the upper nasal duct. The crescent slot is not more than 8.6 mm long. The ethmoidal bulla is 6.2 mm long and 2.3 mm wide. The hook-like process is 8.1-8.7 mm long and 2.2 mm wide.

The ethmoidal cells are well pronounced, their number ranges from 4 to 6. They are oval shaped and of different sizes. The biggest of them is  $1.7 \times 1.5$  mm, and the smallest one is  $1.0 \times 0.7$  mm.

**Conclusion.** In the fetal period of ontogenesis the nasal septum is clearly differentiated between cartilaginous and osseous parts, the ethmoidal labyrinth gets ossified, the perforated cribriform plate with further ossification and a number of olfactory filaments.

**Prospects for the research.** Results of the study indicate the need for a comprehensive study of topographic and anatomical

features of the ethmoid bone in further stages of human ontogenesis.

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