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MORPHOGENESIS OF CHOROID PLEXUSES OF LATERAL VENTRICLES OF THE BRAIN IN PREFETAL PERIOD OF HUMAN ONTOGENESIS

Abstract. *Correlation between the size of the lateral ventricles and shape of choroid plexus was established. The increase in size of choroid plexuses in prefetal period is determined by more intensive development of the lateral ventricles.*

Key words: *embryo, prefetus, lateral ventricles, choroid plexuses, human.*

Introduction. The analysis of the scientific literature shows that the problem of morphogenesis of the lateral ventricles of the brain throughout the prenatal period of human ontogenesis and their morphological characteristics is not properly studied.

Objective: to determine the dynamic changes of shape and size of the lateral ventricles and choroid plexuses of the brain in prefetal period of human ontogenesis.

Materials and methods. The study was conducted on 9 consecutive series of histological sections of embryos and human prefetuses with 5,0- 80,0 mm parietal-coccygeal length (PCL) with the use of microscopy and morphometry methods.

Results and discussion. It was determined that in the fourth week of development (embryos of 5.0 mm PCL) the brain is represented by three brain vesicles. Thus, in this stage, ventricular system is being formed as cavities of the brain vesicles.

Lateral ventricles, as cavities of the forebrain, appear at the beginning of the 5th week of intrauterine development (6.0 embryos PCL) and start as the formation of lateral protrusion of the anterior brain vesicle - telencephalic vesicles, which give a further development to forebrain hemispheres. At this early stage cavities of telencephalic vesicles have

semispheric shape.

Their medial sides communicate with each other and with the dorsal part of the cavity of anterior cerebral vesicle, which later becomes the III ventricle, cavity of diencephalon. With this moment, gradual transformation of this extremely simple structure into a complex system – the definitive lateral ventricle begins. The development of cavities of the brain and lateral ventricles in particular, is closely associated with the development of the relevant parts of the brain. Thus, the accelerated development of telencephalon and hindbrain, causes a quick differentiation of the parts of the brain (formation of five brain vesicles) and their cavities; and a slow growth of the midbrain area maintains its primary tubular shape (Fig. 1).

Dependence on two processes of development of the hemispheres and differentiation of their internal structures is clearly apparent in establishing of the shape of lateral ventricles. Thus, cranio-dorsal increase of vesicles is observed in the end of embryonic period and beginning of prefetal period of development (6 - 7 weeks), and starting from 10 weeks - postero-inferior direction of growth leads to formation of elongated, and later arcuate shape of lateral ventricles cavities. The median area of the cavity becomes a central part, and anterior and posterior extremities

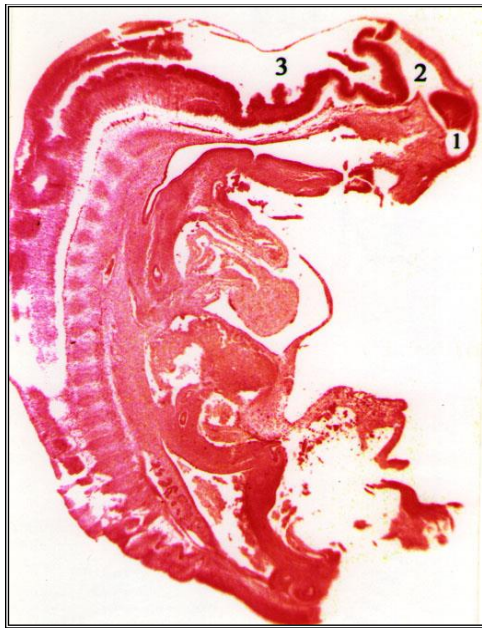


Fig. 1. Sagittal section of embryo 6,0 mm TKD, Stained with hematoxylin and eosin. Specimens. Ob. 4,0 Ok. 5,0. 1 – anterior cerebral vesicle; 2 – middle cerebral vesicle; 3 – posterior cerebral vesicle.

form the front and lower horns, which are located in the frontal and temporal lobes.

The emergence and increase of occipital lobes in the end of prefetal period (prefetuses with 61.0 - 80.0 mm PCL) gives rise to the appearance of posterior horns - a branch of the lateral ventricle's area, located at the transition of the central part into the inferior horn. So, at the end of period prefoetal period, general configuration of ventricle reaches its definitive form. Formation of structure of the walls that bound ventricular cavity, is the second component that influences on their formation.

Primary semispheric ventricular shape is bound by three walls - superior, lateral and inferior, which are formed by structures of anterior cerebral vesicle, walls are smoothly continues with each other. Medially ventricular cavities communicate with each other. But in embryo with 9.0 mm PCL a protrusion of corpus striatum bud on inferior (ventral) wall appears, which provides a spherical shape to the cavity.

In the beginning of prefetal period, the specified enlargement of ventral wall becomes more definite and is seen as a protrusion of both ventral and part of lateral wall. The upper and medial walls of lateral ventricles, in the 8th week of intrauterine development, are formed by pallium. The anterior part of the region, which is

the caudate nucleus' germ, invaginates into anterior part of the cavity of the ventricle, as a rounded ridge, due to its intensive increase in 7 weeks old prefetuses. This formation causes the narrowing of the mentioned area of the ventricle, and establishment of its crescent configuration. Described shape of lateral ventricle persists during 8th week of intrauterine development.

On 10th week hemispheres begin to grow in anterior and dorso-inferior direction, that leads to formation of germs of the frontal and temporal lobes and cavities of the lateral ventricle in these lobes with complete allocation of the lateral ventricle into central, front (anterior horn) and bottom (inferior horn); structures limiting their walls also change. Thus, medial, superior and lateral walls are formed by pallium, i.e. medulla, that forms the mass of the forebrain. The components, that form inferior (ventral) wall, compose lateral part of corpus striatum, which completely transforms into the caudate nucleus, due to uneven growth of hemispheres and their slight rotation, and its lateral inferior position according the medial part. There are insignificant changes in the walls of the anterior horn. The presence of choroid plexus in the anterior horn is insignificant. The surface texture is uneven, it forms many processes of different widths and lengths, which are represented by many vessels of different caliber, located in the loose connective tissue (Fig. 2).

Inferior horn, which gradually becomes conical in shape, bound superiorly with caudate nucleus' tail, medially – by formed gyrus of the hippocampus, and laterally and inferiorly - by medullary substance of temporal lobes.

The germ of posterior horn, which emerged in the late prefetal period, is surrounded by medullary substance of occipital lobes. During the prefetal period the structures that bound lateral ventricles, gradually become similar to the definitive.

Choroid plexus – a part of the lateral ventricles – occurs as an invagination of medial ventricular wall in the end of embryonic period as a simple fold. During the 7th week this fold is located dorsally to interventricular opening and is connected to the wall with a wide root. On the

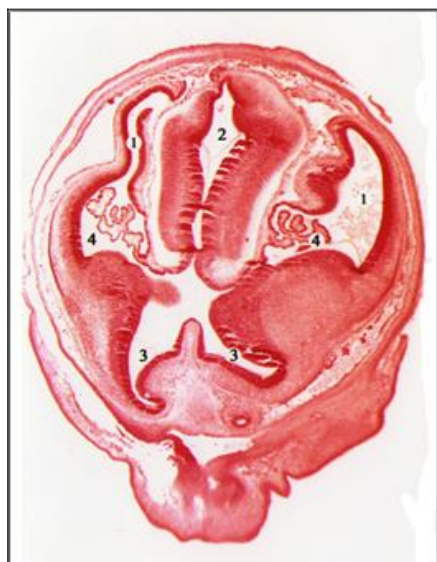


Fig. 2. Horizontal section of the head of the pre-fetus TKD 26,0 mm. Stained with hematoxylin and eosin. Ob. 4,0 Ok. 5,0. 1 – cavity of anterior horns of the lateral ventricles; 2 – cavity of third ventricle; 3 – cavity of posterior horns of the lateral ventricles; 4 – vascular plexus.

periphery there are few protrusions of folds, which are the origin of further branchy structure of plexus. During 8th week significant changes, determined by great amount of protrusions along the whole length of the ventricle in the structure of plexus are observed. Within 9 weeks in medial portion of the temporal bone germ, a fissure is formed, its bottom thins and sags towards the cavity of the temporal lobe. In the specified fissure a fold of vascular mater penetrates, it is covered with ependymal layer of the ventricular cavity wall and initiates the formation of a second, posterior part of plexus. Anterior part of the plexus of the lateral ventricle increases in size. Multiple processes facing different directions change the surface, and protrusions, typical to the previous stage of the anterior part of the plexus development, are observed. In the end of the pre-fetal period the vascular plexus of the lateral ventricles is quite a complex formation. Its plot, located in the central part, fills almost the entire cavity in both longitudinal and transverse directions. The back of it contacts with the plexus of inferior horn of the lateral ventricle. Connection of these plexuses in transition site of central part into inferior horn is determined at the end of pre-fetal period.

Conclusions. 1. In pre-fetal period the intensive development of frontal, parietal, UDC 616.61.- 091.8:616.441- 089.87

temporal and occipital lobes of cerebral hemispheres, which is accompanied by formation of lateral ventricles and their choroid plexuses occurs.

2. At the end of the pre-fetal period no clear distinction between the parts of the lateral ventricles was found, internal relief of their walls is mostly smooth. Choroid plexuses are mainly formed in the central part and in the inferior horns of the ventricles, forming numerous processes of medium height and width.

Prospects for further research It is advisable to study the development of vascular plexus and lateral ventricles of the brain in fetal period of human ontogenesis.

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