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TOPOGRAPHIC PECULIARITIES OF THE ANTERIOR CEREBRAL VESICLE ON THE 4TH WEEK OF THE EMBRYONIC PERIOD

Abstract. *In the article a conducted embryological investigations is described with the aim to understand and clarify causes and time of possible occurrence of congenital diseases, variants and abnormalities in the development of organs and structures of the body. We have figured out that by the end of the first month of the intrauterine development the brain is represented by the three cephalic vesicles: anterior, middle and rhomboid (prosencephalon, mesencephalon and rhombencephalon). We consider that at this period the ventricular system is visible as the cavity of these vesicles, and the lateral and third ventricles in particular as a part of the cavity of the anterior cephalic vesicle.*
Key words: *cerebral vesicle, embryonic period, human.*

Introduction: the necessity to conduct embryological investigations for correct understanding and clarification of causes and time of possible occurrence of congenital diseases, variants and abnormalities in the development of organs and structures of the body is universally recognized and promotes detection of real directions concerning the processes of organogenesis.

According to the WHO data 3-4 million out of 140 million newborns born annually have serious abnormalities, a part of which belongs to defects of the nervous system [1, 2, 3]. Congenital developmental abnormalities in Ukraine according to the data of the state reports occupy the second position among the causes of death of newborns.

Introduction of artificial fertilization, grafting of embryos, screening of the embryonic material, ultrasound examination of the fetal development, prenatal diagnostics of defects from the normal human ontogenesis into the world laboratories [4] and other modern methods of examination of medical embryology enable to conduct antenatal prevention of disorders of normal development [5] and surgical correction of certain defects of the human fetus during intrauterine development [6, 7, 8].

Objective: the topicality of the study is explained by the necessity to conduct a comprehensive investigation of the peculiarities of morphological regularities in the prenatal period of human ontogenesis, formation of its organs and systems for correct understanding of the essence of processes occurring in the period of intrauterine life, investigation of peculiarities of different periods of the embryonic development that can be used to find out etiology, pathogenesis, to carry out antenatal prevention in order to substantiate radical methods of treatment of various diseases after childbirth.

Materials and methods: the study was conducted on 15 dead human embryos by means of histological examination, dissection and morphometry.

Results of the study and their discussion: the central nervous system including its cephalic portion is known to look like a tubular formation at the initial stages of development. Therefore, all further stages of development are associated with changes of the shape and differentiation of the wall of this formation into the portions, are accompanied by delimitation and further division of the lumen into the cavities of various sizes (ventricles, canals). The brain develops from the anterior, major end of the neural tube. This portion growth considerably and at the beginning of the 4th week of the intrauterine life it is divided into the three convex dilations – cephalic vesicles – anterior (prosencephalon), middle (mesencephalon) and rhomboid (rhombencephalon). Due to uneven growth of separate parts of the neural tube its head end, that was previously practically straight, forms a number of flexures. The border between these portions is caused by irregular rates of growth and availability of flexures: cervical and mesencephalic occurring first of all. It is turned with its convexity outside, its apex forms parietal tuber well seen from the dorsal side. Due to the formation of flexures the prosenecephalon or forebrain is located at an angle to the rhomboid one. At the same time, on the border between the spinal cord and brain the cervical flexure is formed. Simultaneously the cervical tuber occurs, well seen in the embryos of the early period of development. Later the pontine flexure appears directed ventrally. This flexure divides the posterior cephalic vesicle into the proper posterior cephalic vesicle (myelencephalon) – posterior portion and the germ of the pons and cerebellum (metencephalon) – the anterior portion (Fig. 1).

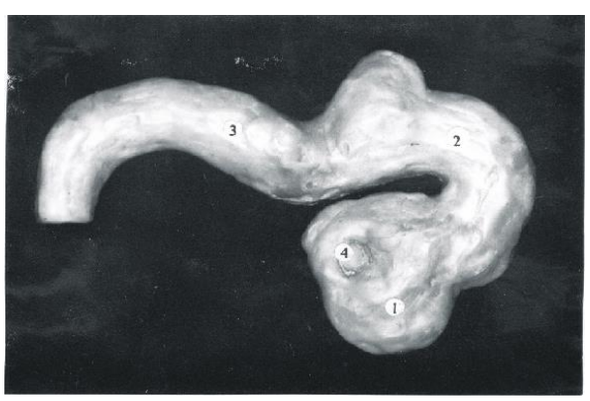

Fig. 1 Plastic reconstruction of the embryonic brain 5,0 mm PCL. 1 – anterior cephalic vesicle; 2 – middle cephalic vesicle; 3 – posterior cephalic vesicle; 4 – eyecup; 5 – ventral cephalic fold

Investigation of a number of histological sections is indicative of the fact that at the end of the 4th week of the embryonic development (in embryos of 5,00 mm PCL) the brain consists of three cephalic vesicles forming an arch embracing the oral part of the embryo. The anterior cephalic vesicle is located on the level of the heart germ.

This period is the beginning of formation of the ventricular system in the form of cavities connected together. The junction between the future third and lateral ventricles is practically solid, therefore at this stage it can be considered as one cavity. This formation is dilated on the sides, anteriorly and inferiorly it is closed with the thin final plate formed due to the closure of the anterior neuropore.

Two layers are differentiated in the embryos of the 4th week of development in the cephalic tube. The first of them, internal, is wide. It is also termed ependymal. The second one, external, or nuclear is rather narrow. The cells of this layer are closely adjusted to each other. The ventral wall of the cephalic vesicles is marked better than the dorsal one. The dorsal wall for a long time remains thin and consists of only 1-2 layers of cells.

Due to intensive growth of the ventral wall of the cephalic vesicles the ventral cephalic fold is formed (Fig. 2). This fold is short and passes practically horizontally between the rhomboid and anterior cephalic vesicles. The isthmus between these cephalic vesicles is relatively wide. Thus, the forebrain is rather lowered.

Conclusions: therefore, at the end of the first month of the intrauterine development the brain is represented by the three cephalic vesicles: anterior, middle and rhomboid (prosencephalon, mesencephalon and rhombencephalon). We

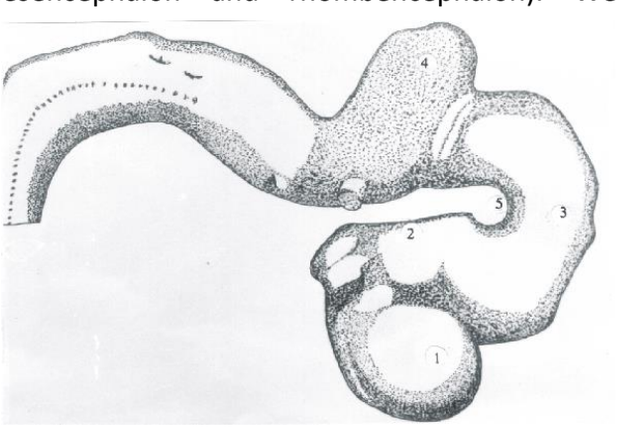

Fig. 2 Graphic reconstruction of the brain of the embryo 5,0 mm PCL. 1, 2 – anterior cephalic vesicle; 3 – middle cephalic vesicle; 4 – posterior cephalic vesicle; 5 – ventral cephalic fold.

consider that at this period the ventricular system is available as the cavity of these vesicles, and the lateral and third ventricles in particular as a part of the cavity of the anterior cephalic vesicle.

Prospects of further studies: further investigations should focus their attention on the development of the cephalic cavities at the following terms to find critical periods, possible developmental defects and elaboration of new methods of the study.

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