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REGULARITIES OF MORPHOGENESIS OF INTERNAL FEMALE GENITAL ORGANS IN THE PERINATAL PERIOD OF ONTOGENESIS

Abstract. *The thesis deals with determination of chronologic succession regularities in perinatal morphogenesis and formation of topographic-anatomical interrelations of the internal female reproductive organs. Peculiarities of a typical and variant anatomy of the uterus, vagina, ovaries and uterine tubes are studied on 160 specimens of fetuses and newborns applying a complex of morphological methods of examination: macroscopic, common and thin section, microscopic, vessel injections, making topographic-anatomical sections, radiological, computed tomography, three-dimensional computed reconstruction, morphometric and statistical. As the result of morphometric examination of the internal female reproductive organs at every stage of the perinatal period appropriate variation series are formed. The distribution for them was evaluated, arithmetic mean with standard quadratic deviation and percentile scale of values were calculated. Reliability of difference between independent quantitative values was determined by means of Mann-Whitney U-criterion. Spearman statistical test was applied to analyze correlations of the results obtained. By means of the applied methods of examination combined, the individual and age anatomical variability and spatial-temporal perinatal transformations of the internal female reproductive organs with the following determination of critical periods were determined for the first time. It is of great importance for finding morphological preconditions promoting occurrence of congenital developmental defects (CDD). Peculiarities of the structural organization of the internal female reproductive organs in fetuses of different term groups are determined.*

Key words: *ovaries, uterus, uterine tube, fetus, anatomy.*

New, unknown earlier data concerning chronological succession of topographic-anatomical interrelations of the internal female reproductive organs between themselves and adjacent organs and structures during the perinatal period of human ontogenesis were obtained by means of current and classical methods of investigation. Perinatal normative anatomical standards of the internal female reproductive organs are determined for the first time. On the basis of the results obtained the stages of a definite structure formation of the internal female reproductive organs are determined in dynamics of their development as well as the mechanisms of occurrence of their structural variants and possible CDD. It will enable to understand better the course of pathological processes, prevent possible complications, and form an anatomical basis for development of new methods of their surgical correction in fetuses and neonates [1-6].

The purpose of the study - to determine for the first time the succession of formation of the uterus, ovaries, uterine tubes and vagina during the fetal and early neonatal periods of human ontogenesis.

Materials and methods: A comprehensive statistical analysis of the morphometric parameters of the internal female reproductive organs between the objects of the study remote in time was conducted for the first time (I group – 35 specimens of fetuses deceased during 2017-2019; II group – 105 specimens of fetuses from the Museum of M.G.Turkevych Department of Anatomy, Clinical Anatomy and Operative Surgery, Bukovinian State Medical University, collected in the period 1995-2000). Differences of their fetal anatomy under a probable influence of constantly changing environmental conditions were found. For the first time differences in the structure of the internal female reproductive organs in fetuses of various terms between the

groups of morphological investigation remote in time were found.

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Results. Normative fetal parameters of the internal female reproductive organs and the periods of their slow and accelerated development were determined on the basis of the morphometric and statistical analyses conducted. Possible variants in the structure and topography of the ovaries, uterus, vagina and uterine tubes were first substantiated. New scientifically substantiated data contribute considerably current views concerning the regularities of ontogenetic chronology of the perinatal development of the internal female reproductive organs.

Perinatal changes of the uterine shape are observed, a certain shape of the uterine fundus at every stage of the perinatal development is determined. The relief of the uterine fundus is confirmed to differ by its greatest variability. It can be vallecuate, tuberculous, flat and convex. Physiological disappearance of the channel on the uterus is followed. It is confirmed by the determined reliable reverse correlations of average force between the width of the uterine fundus which parameters range from $6,0 \pm 0,21$ mm to $6,4 \pm 1,60$ mm, and parietal-calcanal length (PCL) of the fetus.

Canalization of the vagina in the caudal-cranial

direction is observed till the end of the 5th month of the intrauterine development. Variability of the vaginal cavity shape in human fetuses of different terms is determined. For example, in 5-6-month fetuses the following variants of shape in the upper and middle thirds of the vagina are found: oval, elongated-oval, stellate; the lower third is mostly of H-like and C-like shapes.

Macroscopic and microscopic methods of examination confirmed transformation of an elongated triangle shape of the ovary (at the beginning of the perinatal period of ontogenesis) to an oval one (in 8-10-month fetuses and neonates), and their transitional shapes are described: flattened, segmental and fusiform (spindle-shaped). Peculiarities of the ovarian topography for every age group are found. At the beginning of the fetal period of ontogenesis the ovaries are usually in the ascending position (86,6 %). Thus, an ascending position of both ovaries was found in 48,3 % of the examined 4-6-month fetuses, including the right ovary – 15 % of cases and the left ovary – 23,3 % of cases. Beginning with the 6th month, fetal ovaries become of a horizontal or descending position. At the end of the fetal period a horizontal or descending position of both ovaries was found in 33,3 % of cases including the right ovary – 16,6 % and the left one – 11,6 % of cases. At the same time, in 38,5 % of the examined 8-10-month fetuses both ovaries were found to be in the uterine-rectal depression.

During caudal transition of the ovaries their morphometric parameters increase relatively slow (5-8-month fetuses), which is evidenced by the determined reliable correlations of an average force between the ovarian width and PCL of the fetus. Morphometric parameters of the right ovary width in the fetuses during this term of development range from $3,4 \pm 0,82$ mm to $4,1 \pm 0,64$ mm, and the left one – from $3,2 \pm 0,59$ mm to $3,7 \pm 0,25$ mm. During the fetal period certain changes in the microscopic organization of the ovarian parenchyma are found which is manifested in gradual migration of the medullary substance and cortical cords from the center with their gradual disappearance in the portal portion in 8-month fetuses and their simultaneous substitution by the blood vessels. The differences found in the anatomical structure of the ovaries in

fetuses of various terms differ totally from those in the postnatal period of human ontogenesis. Considering prevailing triangular shape of the ovaries in 4-6-month fetuses (87 % of cases), and the fact that one of its borders is directed to the uterine tube and is the point of attachment of its mesentery, we suggest to term it "tubular border" of the ovary. The border and surface passing in the caudal direction from the uterine tube and tubular border should be termed the lower border and ovarian surface. The border and surface directed to the cranial part should be termed upper ones. The surface located opposite to the tubular border of the ovary should be reasonably termed anterior one. Therefore, the ovary with a triangle shape might have mesenteric or tubular border and two free borders – upper and lower one, and the surface determined opposite to the tubular border and located between the free borders might be termed the anterior one.

For the first time, morphometric parameters of the internal female reproductive organs in the group of fetuses, remote in time, were analyzed. The length of the left ovary of present 7-month fetuses ($9,4 \pm 1,06$ mm) and the length of the right ovary of present 8-month fetuses ($12,9 \pm 1,23$ mm) were evidenced to be reliably shorter ($p < 0,05$) than that of the archival specimens ($11,6 \pm 1,87$ mm and $14,7 \pm 1,44$ mm respectively). The width of the left ovary of present 4-month fetuses ($0,9 \pm 0,06$ mm) appeared to be reliably shorter ($p < 0,05$) than that of the archival specimens ($1,2 \pm 0,22$ mm). The thickness of the right ovary of present 7 and 10-month fetuses ($1,8 \pm 0,25$ mm and $3,8 \pm 0,36$ mm) appeared to be reliably smaller than that in the appropriate groups of the archival specimens ($2,3 \pm 0,59$ mm and $4,6 \pm 0,8$ mm respectively). The thickness of the left ovary of present fetuses at the end of the perinatal period is marked to be reliably smaller ($p < 0,05$) than that of the archival specimens ($3,3 \pm 0,36$ mm and $4,2 \pm 0,83$ mm respectively).

Changes of the structural organization of the uterine tubes were found for the first time, and the dynamics of formation of their shape and topography during the fetal period of development was observed. Stages of formation of the uterine tube convolution during the perinatal period of human ontogenesis are described. Changes of their position from the

ascending to descending one are confirmed to be associated with a relative delay in growth of their morphometric parameters, which is evidenced by the reliable reverse correlations of an average force found ($r = -0,16$ and $-0,32$) between the length of the uterine tubes and fetal PCL. Morphometric parameters of the right uterine tube length in the period from 7 to 10 months of the intrauterine development were found to increase from $14,5 \pm 3,77$ mm to $22,4 \pm 3,38$ mm, and the left uterine tube – from $12,9 \pm 3,78$ mm to $21,0 \pm 3,38$ mm. The stages of the uterine tube formation are determined – from curved (at the beginning of the fetal period), zigzag and spiraled (in the middle of the fetal period) to the curved spiraled shape (at the end of the fetal period and in neonates). The regularities found are evidenced by the analysis of morphometric parameters of the uterine tubes by means of Mann-Whitney U-criterion, and they are indicative of a reliable difference in their parameters ($p < 0,05$) in 8-month fetuses ($16,0 \pm 0,79$ mm – of the right uterine tube, $14,9 \pm 1,34$ mm – of the left one) and in 9-month fetuses ($22,6 \pm 1,51$ mm – of the right uterine tube, $20,8 \pm 1,83$ mm – of the left one).

On the basis of regularities found in the morphogenesis of the internal female reproductive organs their critical periods and morphological preconditions of occurring variant and congenital developmental defects were determined. Critical periods coincide with the period of an intensive enlargement of morphometric parameters of the internal female reproductive organs: uterus – 4-5 month, ovaries – 5-6 and 9-10 month, uterine tubes – 5-6 and 8-9 month, vagina – 4-5 and 7-9 month. Certain nonsynchronous descending of the right and left uterine tubes into the minor pelvic cavity is found. Topographic changes of the uterine tubes are found to coincide with that of the ovaries, which is stipulated by their close syntopogenous relations.

Close interrelations between perinatal morphological transformations of the internal female reproductive organs and the processes of their histogenesis are determined. The periods of an intensive growth of hollow structures of the internal female reproductive organs are found to coincide with the periods of an intensive growth of their intra-parietal vessels and muscular layers.

At the beginning of the fetal period (4-5 month) the circular muscle fibers of the uterine tubes begin to grow to the center from the ampulla to the isthmus (diameters of these parts correlate as 1:3) with appropriate gradual increase of their diameter to the end of the 10th month of the intrauterine development. At the end of the perinatal period of human ontogenesis the circular muscle fibers of a part of the uterine tubes develop evenly. Intensive periods of ovarian growth coincide with accelerated enlargement in the size of the glandular parenchyma cells without considerable increase of their amount.

Conclusion.

Thus, the anatomical study conducted has solved an urgent issue of modern morphology – to determine morphological regularities of organs and structures of the female reproductive system. It forms the foundation to develop preventive, diagnostic and therapeutic methods concerning their perinatal pathology.

Prospects of researches. In further it is planned to investigate correlation and dynamics of morphometric parameters of internal female genital organs in adult people.

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