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Differentiation of the Gonads in the Early Prefetal Period of Human OntogenesisHigher educational institution of Ukraine "Bukovina State Medical University" (m. Chernivtsi, Ukraine), nata-lena1999@vandex.ua

Abstract. The peculiarities of the above have been studied by means of morphological methods of gonad differentiation features at the beginning of prefetal period of human ontogenesis. In prefetuses 14-15 mm PCL right gonad is elongated-ovally anlage and situated obliquely in the abdomen, and left gonad is bean-shaped and placed in nearly vertical position in the abdominal cavity. Length of mesonephros both right, and left, exceeds the length of the gonad. At this stage the clearly determined anlage of mesonephric paramesonephric duct are surrounded by a dense layer of mesenchyme. At the same time, the morphological characteristics of structures gonad are not possible to determine the continued differentiation of gonad on gender. It should be noted that mesenchymal bands of different lengths and thicknesses of gonad prefetus on this age group are connected to the mesonephros.

On the beginning of prefetal period (prefetuses 16,0-21,0 mm PCL) of development arise certain morphological signs of differentiation of gonad in a condensing mesenchymal cells, which form on the general background ovale cell and round groups which are separated by partitions which are loosely placed mesenchymal cells whose nuclei much smaller. Appearance in the stroma of morphological characteristics of the gonad prefetuses 16,0 mm PCL accompanied by sufficiently clear predominance lumen of duct paramesonephric mesonephric ducts. Since the beginning of the sexual differentiation of gonad in prefetuses primary female sex strands forms ovarian straps, which eventually degenerate. After the degeneration of ovarian straps is formed secondary sexual bands which are populated by the primary germ cells.

At the same time there is a clearly expressed white coat of the ovary. Secondary sexual bands are separated rapidly proliferating mesenchymal cells on apart cell clusters which surround the primordial germ cells. On this stage of development marked a slight increase in the size of the gonad and their internal structure is much more complicated. Studies have shown that only the middle area of sexual ridge is the source of the ovary. Cranial part of the crest is involved in the formation suspensory ligament of ovary and caudal – it is transformed into its own ligament of ovary.

This study completes the existing data on embryogenesis and gonad formation, its topography helps to better elucidate their structural organization during fetal development, it is important to determine the morphological peculiarities of some congenital defects. The results received is morphological basis for decisive elaborating of new methods of prediction, diagnosis and treatment of ovarian and have clinical orientation. The data can be used in screening laboratories to determine the degree of fetal development and prenatal diagnosis of deviations from normal development.

Keywords: gonad, mesonephros, paramesonephric duct, prefetus, human.

Problem introduction statement and analysis of recent research. The study of sources of scientific literature has shown that a number of issues concerning the study of complex urogenital during prenatal ontogenesis are contradictory [1, 3]. In recent years, much attention is given by researchers of ovarian folliculogenesis and their histotopography [2, 5]. The literature provides few data on syntopy gonads and size during the prenatal period of development [4-6].

The aim of the study. The characteristics of gonad morphogenesis prefetus at early period of ontogenesis and at the same time identifying the beginning of their sexual differentiation.

Material and methods

The study was carried out on 19 human prefetuses of 14-21 mm parietococcygeal length (PCL) on successive consecutive histological sections of embryos by means of microscopy methods and morphometry one.

The results

In prefetus of human 14-15 mm PCL the right gonad is elongated-ovally in its shape and obliquely placed in the abdominal cavity. The length of the right gonad is 720 ± 20 microns thickness – 280 ± 20 mm, while the length of mesonephros is $1,3 \pm 0,1$ mm,

and thickness – 260 ± 40 microns. Anlage of gonad coupled is connected by the middle area of mesonephros by mesenchyme band length 170 ± 10 mm, width 70 ± 8 microns, and the mesonephros is placed laterally to the gonad. By convex of the upper surface of the right sexual gland adjacent to anlage of liver. Anlage of the left gonad has smooth beanlike shape and is placed in the abdominal cavity of the embryo almost vertically. The length of the left gonad reaches 680 ± 30 microns thickness – 270 ± 20 mm length of mesonephros is $1,4 \pm 0,1$ mm, and its thickness – 240 ± 20 microns. Anlage gonad is connected by mesenchyme band of length 140 ± 10 microns and a width of 50 ± 6 microns with the middle area of mesonephros. Anlage mesonephros is placed parallel to gonad, adjacent to the lower surface of the gonad. Clearly defined anlagen mesonephric and paramesonephric ducts, which are surrounded by a dense layer of mesenchymal cells. Morphological features of structures of anlage gonad do not allow further differentiation in order to determine the developmental way of the gonad according to sex.

In prefetus 16-21 mm PCL anlagen gonad are of certain morphological features that indicate at the beginning of sexual differentiation. In the peripheral and central areas of the gonads appear isolated mesenchymal cells which resemble islands of round, ovalround, in shape are separated from each other by connective partitions of varying thickness. Anlage of the left gonad are of elongated length $1,8 \pm 0,1$ mm and a width of 420 ± 10 microns. To the posterior end of the anlage gonad adjoining cranial part of mesonephros, most of which is located laterally relative to the anlage of gonad. To the medial surface of the anlage gonad adjoining to anlage of the permanent kidney. The anterior end of the anlage gonad is adjacent to mesentery of the small intestine. It should be noted that along the lateral edge of the mesonephros are placed mesonephric duct, which is located slightly laterally the paramesonephric duct. Lumen of the latter prevails lumen of mesonephric duct. In the middle and caudal portions of the gonad are connected by mesenchymal legs with mesonephros. It is interesting that the lower end of the anlage gonad mesenchymal stem from his bed that surrounds mesonephric and paramesonephric ducts. On the other hand the second leg of the mesenchyme cells which are placed tightly connects the mesenchymal layer that surrounds mesonephric and paramesonephric ducts with mesenchymal layer of the anterior wall of his abdomen of embryo near anlage of pubic bone. The thickness of the mesenchymal legs ranges from 90 to 120 mm and length from 120 to 160 microns. Mesenchymal band that connects the anlage of gonad of mesenchymal sheath of the paramesonephric ducts in the further development are transformed in its own ligament of ovary, and mesenchymal band connecting mesenchymal sheath of paramesonephric duct mesenchyme of the anterior abdominal wall is transformed into the round ligament of the uterus. So assume that the female gonads lead into transformed in the above ovarian ligament and uterine round ligament inappropriate. We believe that true lead female gonad is the mesenchymal stem, which connects the lower end of gonad with the mesenchymal sheath paramesonephric duct. In all studied serial histological sections prefetuses of the human of early stages of fetal development (16-21 mm PCL) we have not found a lead of female gonad, which is to the lower end of the anterior wall of the abdominal cavity of embryo without contacting it with the mesenchymal sheath paramesonephric duct. A marked predominance lumen of paramesonephric duct over on one mesonephric duct in the early stages of fetal development in different persons has reason to believe that further development of the gonad will be the female type.

In this age group the prefetuses right gonad has an elongated

oval shape, obliquely placed in the abdominal cavity. Length gonad reaches $1,9 \pm 0,1$ mm, width - 390 ± 10 microns. Parallel and laterally relative to the gonad is mesonephros. Laterally to mesonephros are mesonephric and paramesonephric duct. The middle surface mesonephros is adjacent to permanent the kidney. The lower end gonad is adjacent to the mesentery of small intestine. In middle and caudal sections laying gonad is connected using mesenchymal band with mesonephros. The thickness of the mesenchymal band ranges 84 microns to 118 microns and in length from 120 microns to 160 microns.

Discussion

The morphological specific characteristics of the structure, form and position of the gonad in human fetuses has been established. The authors detected a variability of them was mentioned above. According to different authors the results of the analysis and research can weigh various factors differently affecting the functional and structural changes in the genital system.

Conclusions

1. The process of differentiation of the gonad of the female begins in early ontogenesis in the pre-fetase period (pre-fetuses of 16-17 mm PCL) appearance in the peripheral area of mesenchymal cells in a variety forms islands.

2. Prevalent lumen diameter of the paramesonephric duct and the duct of lumen of mesonephric are indifferent at the stage of fetal development is a sign that further development of the gonads will be the female type.

Perspective for further research in this problem

Prudent research on the timing of gonadal sex differentiation demonstrates the need to further clarify the correlative relationships of gonad anlage with adjacent organs and structures in the early period of human ontogenesis.

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Диференціація гонад на початку предплодового періоду онтогенезу людини

Резюме. За допомогою морфологічних методів вивчені особливості диференціації гонад на початку предплодового періоду онтогенезу людини. У предплідів 14-15 мм ТКД права гонада має видовжено-овальну форму і розташована косо в черевній порожнині, а для лівої статеві залози характерна зглаженна бобоподібна форма і майже вертикальне розташування в черевній порожнині. Довжина мезонефроса як справа, так і зліва, переважає над довжиною гонад. На цій стадії розвитку чітко визначається закладка мезонефричних і парамезонефричних проток, які оточенні щільним шаром мезенхіми. В той же час, за морфологічними ознаками структур статевих залоз немає можливості визначити процес подальшої диференціації гонад за статевію приналежністю. Слід зазначити, що мезенхімними ніжками різної довжини і товщини гонади у предплідів даної вікової групи з'єднуються з мезонефросом.

На початку передплодового періоду (передплідди 16,0-21,0 мм ТКД) розвитку виникають певні морфологічні ознаки диференціації гонад у вигляді конденсації клітин мезенхіми, які утворюють на загальному фоні стромі гонад округлі клітинні групи, розмізовані перегордками пухко розміщених клітин мезенхіми, ядра яких значно менших розмірів. Поява морфологічних ознак у стромі гонад передплідді 16,0 мм ТКД супроводжується достатньо чітким переважанням просвіту парамезонефричних проток над просвітом мезонефричних проток. Із початком статевої диференціації гонад у передплідді жіночої статі первинні статеві тяжі утворюють яєчникову сітку, яка з часом дегенерує. Після дегенерації яєчничкової сітки формуються вторинні статеві тяжі, які заселяються первинними зародковими клітинами. Одночасно з'являється нечітко виражена білкова оболонка яєчника. Вторинні статеві тяжі розмежовуються інтенсивно проліферуючими мезенхімними клітинами на окремі клітинні кластери, які оточують первинні зародкові клітини. На цій стадії розвитку відзначається незначне збільшення розмірів гонад, а їх внутрішня будова значно ускладнюється. Дослідження показали, що тільки середня ділянка статевого гребеня є джерелом розвитку яєчника. Краніальний відділ статевого гребеня бере участь у формуванні підвшу вальної зв'язки яєчника, а каудальний – трансформується у власну зв'язку яєчника.

Виконане дослідження доповнює існуючі відомості про ембріогенез і становлення топографії гонад, повніше висвітлює їх структурну організацію в період внутрішньоутробного розвитку, що важливо для з'ясування морфологічних передумов виникнення деяких природжених вад. Результати, які одержані є морфологічною основою для розробки нових методів прогнозування, діагностики та лікування захворювань яєчників і мають клінічне спрямування. Одержані дані можуть бути використані в лабораторіях скринінгу для з'ясування ступеня розвитку плода, а також пренатальної діагностики відхилень від нормального їх розвитку.

Ключові слова: гонада, мезонефрос, парамезонефрична протока, предплід, людина.

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