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MORPHOLOGICAL CHANGES IN THE OVARIES IN CONDITIONS OF HYPOTHERIOSIS

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Ziyoyeva Gulruh Pulot daughter
Assistant, Tashkent Medical Academy

Abstract
The article provides basic information about the embryogenesis of female gonads, reflects data on the morphology and histofunctional relationships of the main structures of the ovary in various periods of postnatal ontogenesis. A critical analysis of the literature in recent years has revealed controversial points, which allowed us to conclude that it is necessary to apply an integrated approach to the study of ovarian morphology.

Keywords
ovary, embryogenesis, morphology, ontogenesis

Ovarian pathology occupies an essential place in the structure of gynecological morbidity. In terms of the frequency of occurrence of tumors and tumor-like formations of the ovaries occupy the second place among neoplasms of the female genital organs and account for 8-19% of all gynecological diseases [20]. The problem of infertility currently has not only medical, socio-demographic, but also economic significance. The frequency of infertile marriage is 10-15% of the number of married couples and has no tendency to decrease. The proportion of infertility of endocrine origin is 35-40%. Impaired folliculogenesis is the basis of any pathology of the generative function of the ovaries. According to the literature, there is a relationship between the structural and metabolic organization of the follicular complex and the ability of the ovocyte to fertilize, that is, the fate of the egg largely depends on the state of the follicular histione [13]. An objective assessment of changes in the histophysiology of the ovaries in pathology requires a quantitative assessment of the parameters characterizing the most important morphological and functional structures of the organ.

The ovaries are a paired organ that performs two important functions: reproductive, expressed in the formation of female germ cells, and endocrine, realized in the production of sex hormones.

The laying of the ovary begins at the 5th week of embryogenesis, the sources of its formation are: 1) coelomic epithelium, 2) mesenchyme, 3) gonocytes migrating from the wall of the yolk sac. The derivatives of the coelomic epithelium in the ovary are the folliculocytes of ovarian follicles and part of the cells of the yellow bodies; the derivatives of the mesenchyme are the connective tissue stroma of the organ and the steroid-producing cells of the follicle flow, part of the cells of the yellow bodies; the derivatives of gonocytes are ovogonia, differentiating into ovocytes of the I and II order and then into a mature egg [7]. It should be noted that the ovary occupies one of the first places among other human organs in terms of the variety of tumors that occur in it. The diversity of ovarian tumors cannot be explained only by the difference in the degree of maturity and the directions of differentiation. Compared with other organs, where, as a rule, we are talking about two main components - the parenchyma of the organ and its stroma, from which various tumors can arise, in the ovary, already under normal conditions, we can talk about at least six components that can give rise to a tumor germ, if we take into account only its normally existing, mature components. However, in addition to functioning ones, there are always a number of rudimentary formations left over from the time of embryogenesis in the ovary or in the immediate vicinity of it. Finally, it is necessary to take into account the very real possibility of cells from neighboring organs getting on the surface of the ovary, in particular, the possibility of implantation of the epithelium of the tubes and uterus. Possible sources of ovarian tumor origin can be divided into three main groups: normal components of the ovary, embryonic remains, postnatal growths and heterotopias [19].

For the first time, the rudiments of gonads begin to be defined in the form of oval-shaped rollers in 33-day-old embryos and represent indifferent formations in the form of thickenings of the coelomic epithelium located on the ventral-medial surface of the mesonephros on both sides of the longitudinal axis of the embryo body. Migrating primordial germinogenic cells gradually accumulate among the proliferating cells as a whole-

* Orenburg State Medical Academy, Department of Pathological Anatomy

the mica epithelium of the future gonads and for 6 weeks are immersed together with the cells of the coelomic epithelium in the mesenchymal mesonephros in the form of strands. Before 7-8 weeks of embryogenesis, the ovary undergoes an "indifferent" stage, after which its structure acquires the features of the female gonad. In the developing ovaries at the age of 8-12 weeks, the outer zone of the ovary increases due to the proliferation of gonocytes, coelomic epithelial cells and pregranular cells, which lie in the mesenchyma in the form of wide bands. Pregranular cells have an irregularly rounded shape, a narrow cytoplasm, a hyperchromic nucleus with a smoothed nuclear envelope and lumpy chromatin [6].

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At 1220 weeks of intrauterine development, the cortex begins to subdivide into lobules, structures resembling sexual (weather vane) strands with proliferating gonocytes and pregranular cells, separated by vascularized connective tissue layers of the mesenchyma of the medulla. During the formation of the cortex, proliferating primordial germinogenic cells are gradually surrounded by less numerous pregranular cells. At the ultrastructural level, single cilia and few desmosome-type contacts appear in pregranular cells [11]. When the medular septa germinate the entire cortical substance, the pregranular cells surround each primary germinogenic cell, forming primordial follicles. At the ultrastructural level, fragments of the basement membrane begin to appear around the pregranular cells. In the stroma, a few primitive flakes are found, of medium size, with oval-shaped basophilic nuclei. At the ultrastructural level, mitochondria with tubular crystals and lipid inclusions are detected in the cytoplasm of these cells. With the further development of the ovaries, the death of part of the germ cells, an increase in the number of primordial follicles, the development of the stroma of the cortical layer and the appearance of maturing follicles are noted. The maturation of follicles in fruits occurs in the deep layers of the cortical layer on the border with the cerebral one. The first signs of follicle maturation are noted in the ovaries of 20-22 week-old fetuses, when granulosa cells increase in size. At the 32nd week of development, small maturing follicles appear, in which the thickness of the granulosa reaches 6-8 rows. During the same period, the inner tecal membrane of the follicles is clearly visible.

By the end of the embryonic period of ontogenesis, most of the structures that are present in the ovary of an adult woman have been formed in the ovary. By the time the fetus is born, there are few gonocytes in its ovaries, the cortical layer is filled with primordial, and in the deep sections with maturing and atresizing follicles, in places with a hyperplastic inner shell. The most numerous structures at this time are the primordial follicles. The number of primordial follicles is ultimately determined by the intensity of ovogony death through apoptosis. By the period of newness, the ovary does not contain only two components - mature (Graaf) follicles and yellow bodies [6,30]. Depending on the degree of development of follicles and connective tissue, there are euplastic, hyperplastic, hypoplastic types of ovarian structure. For many organs, the dependence of morphophysiological characteristics on the characteristics of their embryonic organogenesis has been established. The quantity and "quality" of the main structures of the ovaries, including follicles, is determined during embryogenesis, since neofolliculogenesis does not occur in the postnatal period [5]. The study of the ovaries of newborn girls revealed the dependence of their morphological structure on the pathology of the gestational period. According to the results of S.L. Bachaldin's research, the ovarian mass in full-term newborn girls (who died from birth trauma) is on average 207 mg, in premature infants - with a body weight of 15012500g - 123 mg [1]. It has been monometrically proven that the number of primordial follicles in premature girls is lower than in full-term girls: with a body weight of less than 1500 g by about 2 times, with a weight of 700-1000 g by almost 3.5 times. At the same time, it was found that the number of primordial follicles varies even in the control group (full-term, died as a result of birth trauma). In multiple malformations, the concentration of RNA in the cytoplasm of ovocytes is reduced by 20%. With prematurity, there is a decrease in the concentration of glycogen in the ovocytes, changes in the content of lectins [1]. According to a number of authors, the basis of ovarian changes in premature newborns are unfavorable conditions of embryogenesis, which cause-they lead to its premature termination [1,9,11]. In newborn girls from mothers with pathology of the cardiovascular system and nephropathy, the weight of the ovaries exceeded 1.5 times the weight of the ovaries in newborns from healthy mothers. In the ovaries of newborns from mothers with nephropathy, pronounced cystic and obliterative atresia of follicles, hyperplasia of fibrous tissue in the cortical substance, hyperthecosis were often found. The number of follicles in the ovaries of girls from mothers with infectious pathology was much smaller than those born to healthy women [2]. Thus, ovarian dysfunction in the reproductive period may be due to the pathology of their embryonic organogenesis. Fetal gonads react non-specifically to the effects of risk factors, since hypoxia and partially dishormonal factors are dominant in all pathological influences, which contributes either to the lag in the development of structures, or to the excessive and enhanced development of generative elements in the gonads of the fetus. According to modern ideas, the first trimester is a fundamental period in the development of the female gonads of the fetus. Hence, it is logical to assume the importance of the physiological course of the first trimester of pregnancy in mothers. Consequently, there is a need for reasonable preventive treatment of early and late toxicosis to preserve the pool of germ cells, taking into account the critical periods of the genesis of fetal gonads. The ovaries of the newborn are elongated to 1.5-2 cm and flattened. Their width is 0.5 cm, and the thickness (diameter) varies from 0.1 to 0.35 cm. In girls, at the beginning of menarche, the ovaries become large: their length varies from 3 to 3.5 cm, width - from 1.5 to 2 cm, and thickness - from 1 to 1.5 cm. The difference in ovarian mass in relation to the age groups under consideration is significant: in a

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newborn, the ovarian mass is 0.3-0.4 g, in girls during menarche it varies from 4 to 7 g, i.e. it increases by 13-20 times. The size and weight of the ovary of women over the age of 20 years vary slightly. Their size is 4-4.5-2-2.5 cm (with a diameter of 1-2 cm), weight is about 6-7.5 g. In old age, non-functioning ovaries become small again, on average 2x1x0.5 cm; their mass ranges from 1 to 2 g [17, 18]. Anatomical asymmetry has been established in all age groups of postnatal ontogenesis, the right ovary is 70% larger than the left one. The established disparity of the right and left ovaries has not only theoretical, but also practical significance. Clinical studies show that after the removal of the right ovary, the number of infertile women increases by 3 times, and after the removal of the left one - only 1.5 times, which proves a more pronounced generative ability of the right ovary. Therefore, in practice, surgeons and gynecologists need to remember about a sparing attitude to the right ovary, since it is structurally and functionally more mature than the left one, which will ensure the prevention of neuroendocrine disorders and disorders of menstrual and generative functions in women [22].

The surface of the ovaries in newborn girls, in early and adolescence, as well as at the beginning of puberty is smooth. In the reproductive period, the surface of the ovaries becomes uneven. The convolutions on the surface of the senile ovaries turn into deep furrows.

The ovaries are located in the pelvis somewhat asymmetrically on the posterior leaf of the broad ligament. To the short part of this leaflet (mesovarium) the ovaries are attached by the lower edge. Each ovary has two ligaments: one of them (the funnel-pelvic ligament) is directed from the upper pole of the ovary to the side wall of the pelvis, the other (the ovary's own ligament) connects the ovary with the uterus, the ligament ends behind and somewhat below the fallopian tube. Blood and lymphatic vessels and nerves pass through the ligaments. In the ovaries, the bulk of them passes through the mesovarium [17].

Blood supply to the ovaries is mainly carried out by the ovarian artery and the ovarian branch of the uterine artery. During arteriography, researchers distinguish 4 types of ovarian blood supply: two biarterial and two monoarterial [10]. With the biarterial type of ovary, it receives nutrition from the ovarian branch of the uterine artery and from the ovarian artery, while there may be a slight predominance of one of them. In the monoarterial type , the ovary is supplied with blood due to the ovarian branch of the uterine

the artery that runs along the ovarian gate and gives it branches, anastomosing in the funnel-pelvic ligament with the ovarian artery; or in another variant, the ovary receives nutrition exclusively from the ovarian artery. Anatomists distinguish 3 types of ovarian blood supply: the first - in 51% of cases, the ovary is evenly supplied with blood from the uterine and ovarian arteries, the second - in 11%, mainly from the branch of the uterine artery, the third - in 38%, mainly from the ovarian artery [17]. Obviously, when crossing the fallopian tube, the full blood supply to the ovaries will depend on which artery their predominant blood supply comes from [24].

In newborns, female gonads have a well-developed system of blood capillaries passing from the medulla to the cortex [25]. Blood capillaries do not surround numerous primordial follicles, but are located in the stroma of the cortical substance. Arterial vessels of "healthy" ovaries of women belong to vessels of muscular type of structure. Ovarian vascularization increases significantly during the late follicular phase of the cycle. When preparing an organ for ovulation, a complex of morphogenetic rearrangements is observed: general interstitial edema, blood filling, edema and disintegration of elements of the connective tissue membranes of the follicle, etc. [3]. According to M.N. Terekhova, the diameter of the vessels of the cortical and medulla increases from birth to old age with the greatest increase, starting from the reproductive period of ontogenesis. However, we should not forget that with an increase in the diameter of the vessels, there is a change in the thickness of the wall and the diameter of their lumen. The main morphological sign of an aging gonad is arterial hyalinosis, observed not only in the ovaries of menopausal women, but also in women of reproductive age with anovulatory conditions, chronic adnexitis. At the same time, the veins expand compensatorily, hyalinosis of venous vessels practically does not occur. The ratio of the diameters of the vessels of the cortical and medulla of the female gonads decreases with age, which indicates a weak blood supply to the cortical substance in old age due to sclerotic changes and desolation of the vessel lumen, as well as a decrease in the thickness of the cortical substance of the gonads. Morphological examination of blood vessels is currently carried out using immunohistochemical techniques. The immunohistochemical method allows a more accurate approach to assessing the density of the vascular wall, since some of the capillaries are not detected when stained with hematoxylin and eosin. Nevertheless, the classical histological examination of drugs stained with routine methods continues to be one of the most popular.

According to a number of authors, during the reproductive period of a woman's life, the ovaries have the size 4,0-2,5-1,5 see Cortical and cerebral matter are clearly visible in them [5,7,11,17]. The cortical substance consists of closely spaced fusiform cells resembling swollen fibroblasts, there is little intercellular substance in it, and in the thin outer zone of this substance there is a strip of collagen stroma, which contains relatively few cells. In the inner zone of the cortical substance of the ovaries, follicles are located, which are the main structural and functional unit. When studying the morphology of human ovaries, the International Histological Nomenclature (1983) is used, according to which the follicles are divided into primordial, primary (prepolar), secondary (cavity) and tertiary (mature, precancerous, graaf) [11]. The development of follicles occurs according to the scheme: primordial ^ primary ^ secondary ^ tertiary. From the period of puberty, the beginning of the development of primordial follicles and spiral arteries is noted. During the reproductive period, the follicles are located in the stroma of the cortical substance, the primordial ones are peripheral, and the maturing ones are located in deeper zones of the cortical substance. The thickness of the cortical substance from birth to the reproductive period of ontogenesis continuously increases, and then decreases at a slow pace. The thickness of the medulla is the smallest during the newborn period, and the largest during old age [21].

The primordial follicle consists of an ovocyte of the 1st order surrounded by a single layer of flat follicular cells, which stopped at the stage of diplotene of meiotic prophase before the onset of ovulation, when the first polar body resumes and forms. Primordial follicles

they can persist at this stage for decades [16]. There is evidence that the inhibition of meiosis in the primordial follicle is due to the composition of its internal environment [26,27]. The number of primordial follicles varies depending on the age of the woman. Of 2-4 million primordial follicles available at birth, approximately 400 thousand follicles remain by puberty, and only about 400 of them reach the final stages of folliculogenesis and ovulate [7]. In the primordial follicles, granulose cells are small in size. In the future, the number and size of granules increases. They become cubic, cylindrical, form several layers and single structures of Colla-Exner bodies. In addition, the number and size of the cells increase, among which a significant number of vessels appear. The depletion of the follicular reserve causes the onset of menopause [3,9,11]. The ovocyte is a key element, the basis of the structural and functional unity of the follicular complex. At the early stages of folliculogenesis, the dynamics of the size of the ovocyte is proportional to the growth of the follicle (the size of the ovocyte 80 microns corresponds to the diameter of the follicle 124 microns) [29].

Primary follicles are formed by an ovocyte of the 1st order, surrounded by several layers of follicular cells of cubic, cylindrical or rounded shape. Follicular cells produce mucopolysaccharides surrounding the ovocyte - zona pellucida. Electron microscopic studies have revealed that zona pellucida is the contact zone of microvilli of the plasma membrane of the ovocyte and folliculocytes. Cytochemical analysis revealed glycolipids and glycosoaminoglycans transported to the ovocyte here. Consequently, zona pellucida is a zone of trophic and informational contact of the ovocyte and folliculocytes [2,11]. Soon after the proliferation of granulosa cells begins in the primary follicle, changes begin in the stroma surrounding it. As the follicle matures, fusiform cells surround the follicle in layers, increase in volume, become epithelioid, acquire organelles characteristic of steroidogenic cells - theca interna is formed. Layers of fusiform cells remain along the periphery, merging with the stroma - theca externa. There is an increase in the number of blood vessels reaching the basement membrane. Proliferation of granulosa cells, differentiation and hypertrophy of thecells, growth of the ovocyte lead to an increase in the diameter of the follicle [3].

With a follicle diameter of 100-200 microns, fluid accumulations appear among the granulosa cells, which, increasing, form the follicle cavity [2]. From this moment on, the follicle is called secondary. The cavity of the secondary follicle is lined with granulose cells, outside it is surrounded by internal and external fluid. Several cavity follicles develop simultaneously in the ovary, but only one of them becomes dominant [5,11].

The tertiary follicle grows rapidly due to the accumulation of fluid in the cavity. It has a maximum size, a large cavity filled with follicular fluid, an eccentrically located ovocyte surrounded by 2-3 layers of granulose cells forming an egg-bearing tubercle, and high mitotic activity of folliculocytes. Its wall on the side of the protein shell is thinner than on the side of the medulla [5,6].

Atresizing follicles are also found in the ovary. Currently, two main variants of atresia of ovarian cavity follicles are known. In the first variant of atresia, the cells of the granulosa degenerate, its exfoliation occurs; the cells of the theca retain their previous sizes and nuclear cytoplasmic ratios; the basement membrane is hyalyzed and thickened. In the second variant of atresia, almost before the obliteration of the lumen, both follicular membranes are preserved and hypertrophied in the follicle; the basement membrane remains unchanged. Apparently, the existence of two morphogenetic variants of atresia is associated with differences in the initial status of the follicles: follicles closer to the preovulatory ones will switch to the path of atresia with hypertrophy of both membranes, and exfoliation of granulosa will occur in atresia in the more distant from the preovulatory follicles [2]. The outer layer of the inner theca consists of spindle-shaped cells, which are a reserve material for differentiation into epithelioid thecocytes at the late stages of folliculogenesis.

A mature, or vesicular, follicle is a bubble with a diameter of 15-20 mm, filled with liquid and containing in the thickness of its multilayer epithelium - granulosa - an ovocyte of the first order, which after the first division becomes an ovocyte of the second order. The follicle has a connective tissue membrane (teka), which divides into an inner teka containing numerous tecocytes or teka cells and an outer teka formed by fibrous tissue. Teka cells that accumulate the yellow pigment lutein during the formation of the yellow body are called tekaluteocytes. The wall of a mature ovarian follicle consists of three layers: the granulosa, the inner teka and the outer teka. Their coordinated changes ensure the course of the stages of gameto-, follicular- and steroidogenesis, as well as ovulation and the formation of yellow bodies [2,5,11]. The granulosa in the mature follicle is multilayered, there are folliculocytes of the egg-bearing tubercle and parietal. Cumulus folliculocytes have supporting, trophic and regulatory functions. glycosaminoglycans. It was found that the folliculocytes most distant from the ovocyte have the maximum steroidogenic activity: they have an increased activity of steroidogenic enzymes (Sp-steroid dehydrogenase, etc.) [26,30]; a large number of gonadotropin receptors have been found, it is in them that signs of luteinization appear. The external theca, which performs a supporting function, consists mainly of fibrocytes, sometimes includes myoid cells. Three functionally different layers can be conditionally distinguished in the internal tech of the cavity follicles. The inner layer, which performs a trophic function in relation to folliculocytes, is located at the basement membrane of the follicle and consists of spindle-shaped cells characterized by a developed granular endoplasmic network, a large number of ribosomes and micropinocytose vesicles. The middle layer of the inner theca consists of an epithelioid type of thecocytes having an ultrastructural organization typical of steroid cells. In each menstrual cycle, one mature vesicular follicle filled with follicular fluid protrudes the surface of the ovary and tears its protein membrane. Further, under the action of luteinizing hormone, it ruptures itself, releasing a second-order ovocyte into the abdominal cavity. Morphogenetic transformations in the ovary are accompanied by changes in its hemodynamics. In the ovary, there is a high gradient in the distribution of blood vessels with their predominant localization in the deep layers of the cortex and the medulla. It is assumed that the contact of the primordial follicle with the vessels is important in the initiation of follicle growth: the follicles that have entered into growth move from the surface to the deeper layers of the cortex, since they need good vascularization to continue their development [2]. There is a thicker vascular network around large follicles than in

the cortical substance of the ovaries. The dynamism of the vascular bed is preserved even with follicle atresia, but their vascularization rates are significantly lower.

Yellow bodies in human ovaries are formed after ovulation of a mature follicle from luteinized cells of the inner theca and peripheral cells of the granular layer. The corpus luteum is an organ with abundant vascularization and intense sterogenesis [16]. Its maximum activity occurs on 7-8 days after the peak of LH secretion, functional regression - 2-3 days before the onset of menstruation. Like the dominant follicle, the corpus luteum dominates, inhibiting the growth of follicles in both ovaries [3]. This is a kind of endocrine gland that produces the steroid hormone progesterone. It is formed from the cells of the granular layer of the follicle that has undergone ovulation. Cells accumulate the yellow lipochromic pigment lutein, which gradually fills the cytoplasm. The menstrual yellow body is 3-4 times smaller than the menstrual body of pregnancy. In the cortical substance of the ovaries of a sexually mature woman, many yellow bodies of varying degrees of maturity can be found, as well as white bodies representing scars at the site of the reverse development of yellow bodies.

The medulla of the ovaries is constructed of loose connective tissue. Small bundles of rounded or polygonal epithelioid cells are often detected around the vessels and nerve stems. These cells, called "hilus", are presumably rudimentary remnants of gonads undergoing a primitive bisexual phase of development. They

they produce steroids and therefore resemble the interstitial elements of the testicles. Steroid-producing ovarian cells are folliculocytes of the granulosa, thecocytes of the inner theca, thecocyte-like stroma cells [26,27,28]. Thecocytes of the inner theca and thecocyte-like stroma cells are characterized by a low nuclear cytoplasmic ratio, a centrally located rounded nucleus, a light ("foamy") cytoplasm with a high concentration of sudanophilic lipids and cholesterol in it. Electron microscopy revealed in these cells a developed smooth endoplasmic network, many mitochondria with vesicular or tubular crystals, lipid inclusions; it was found that steroidogenesis reactions are associated with these structures.

There is no consensus in the literature about the structure of the ovarian stroma. According to Borova T.G., the ovarian stroma is represented by the "simplest variant" of loose connective tissue, almost the only cellular elements of which in the cortical and cerebral substance are fibroblasts and fibrocytes. In addition, smooth muscle and mast cells and a number of different forms of leukocytes are present in the brain matter. According to other researchers , the human ovarian stroma is represented by two types of cells: 1) fusiform, with scanty cytoplasm, similar to fibroblasts, located in a dense network of fibers with various amounts of collagen; 2) polygonal, with eosinophilic cytoplasm, characteristic of steroid-producing cells with ultrastructural features, rich in lipid inclusions [2]. A number of authors, investigating the subcellular features of stromal cells, conclude that poorly differentiated stromal cell elements can differentiate in two directions - fibroblastic and steroidogenic. Borovaya T.G. believes that steroid-producing stroma cells are remnants of atretic follicles that have ended their existence; at those stages when one hyalinized basement membrane remains from the atretic follicle, separate steroid-producing cells and those belonging to this follicle remain next to it in the stroma. Ovarian stroma is hormone dependent. With fibroids and uterine cancer, breast cancer, accompanied by a change in the level of secretion of gonadotropins and ovarian steroids, focal or diffuse stroma hyperplasia is often observed [19,20]. It is more likely that in the surface zone of the ovarian cortex, where the primordial and primary ovarian follicles are located, the stroma looks very compact and there are practically no blood vessels in it. In other words, the features of architectonics and a small degree of vascularization of the surface layers of the cortex

the human ovary is in no way able to provide the conditions for the progressive development of the resting follicles located here. In the deeper layers of the cortex and the medulla of the human ovary, the arrangement of cells and fibers of connective tissue becomes looser, and the arrangement of ovarian follicles becomes more "free". An amorphous substance becomes the predominant component of the stroma, collagen fibers are replaced by elastic ones and a sufficiently large number of labrocytes appear, which control the degree of permeability of vessels and intercellular matter of connective tissue, contributing to the diffusion of trophic compounds from vessels to follicles. Smooth muscle cells in the stroma of the ovarian medulla are arranged in the form of their characteristic structural and functional groups oriented in different directions. Perhaps they are involved in the movement into the deep layers of ovarian follicles that have entered the growth, in the case of ovulation, they actively participate in the rupture of the follicle wall. Together with fibroblasts, myocytes participate in the synthesis of elastin. The structure of the ovaries is highly dynamic, changing not only during the cycle, but literally hourly due to the continuous entry into growth of new and new populations of ovarian follicles and atresia of the majority of growing ones, thus, the hemo-support system of this organ should also be highly dynamic.

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Vessels are the most important structurally-a functional element of the follicular histione. Capillaries of growing follicles are characterized by high transport capacity. The appearance of fenestra and pores in the vascular wall is a characteristic sign of the onset of follicle atresia. The histohematic barrier of the follicle refers to non -tumor-

the follicular wall is permeable to most plasma molecules, however, the follicular fluid differs from blood plasma in its composition due to the metabolic and secretory activity of granulosa cells [25]. It is proved that with various changes in the endocrine status, the capillaries and the tecocytes directly in contact with them undergo the most pronounced changes.

Recent studies have shown that the period of puberty is characterized by an increase in the mass of the ovary with the predominance of the cortical substance over the cerebral. The volume and structure of the cortical substance changes significantly during certain phases of the menstrual cycle in women with a physiological menstrual cycle [12]. With the age of a woman, the functional and morphological structure of the ovary changes: from 20 to 30 years, there is a focal proliferation of collagen fibers and by about 30 years, gradual fibrosis of the stroma of the cortical substance of the ovary begins. These changes in the structure of the ovary cannot but affect the function of the ovary [20]. Changes up to obliteration affect, first of all, the "large arteries". The lumen of the veins, at the same time, remains wide, there is no hyalinosis in them. Investigating the intra-organ rearrangement of the ovary, L. E. Etingen discovered the formation of compensatory vascular loci in the cortical layer of the ovary from the age of thirty [25]. It was found that with an increase in the age of a woman in the ovary, along with fibrosis, thickening of the protein membrane, changes in the location of the ovaries, there are: obliterating sclerosis, a small number of follicles predominant in the medulla.

According to modern ideas, the main morphological sign of an aging gonad is arterial hyalinosis, which is observed not only in the ovaries of menopausal women, but also in women of reproductive age with anovulatory conditions, chronic adnexitis. At the same time, the veins expand compensatorily, hyalinosis of venous vessels practically does not occur. For the involutional type of ovarian structure (50-60 years old) characteristic features are: a coarse-grained surface of this organ, thickening of the albuminous membrane, sclerosis of the stroma, a small number of different forms of follicles, a large number of fibrous and white bodies, a predominance of coarse-fibrous connective tissue in the medulla, sometimes the presence of focal hyalinosis of its stroma, vascular sclerosis of varying degrees. In elderly women, the ovaries undergo complete atrophy and turn into fibrous plates weighing 3-4 g [8].

As can be seen from the presented review, the study of the regularities of the development of female gonads in postnatal ontogenesis has not only theoretical, but also great practical significance, since the choice of the volume of surgical intervention in various ovarian pathology is a very urgent problem of modern operative gynecology [15]. In the 30s of the last century, there was an idea that after resection, the ovary can take its former shape and retain its function. This led to the unjustifiably widespread use of ovarian resection, as a result of which, until now, according to V.N. Serov. and co-authors, in almost 10% of cases, normal ovaries are subjected to surgical aggression [22]. However, recent studies have shown that surgical trauma of the ovary is not as harmless as it was previously thought. It can lead to fibrous atrophy of the ovaries and a change in menstrual function of the hypoestrogenic type [14]. The modern concept of surgical intervention on the ovaries includes minimizing the risk of surgical injury to the ovaries, restoring their architectonics necessary for the normal functioning of the organs of the reproductive system, as well as ensuring adequate sensitivity of the relevant hormone-independent structures to endo- and exogenous influences. Working out the optimal least traumatic methods of surgical treatment, issues related to suture material, rational rehabilitation of the functional abilities of the internal genitals allows for more widespread use of organ-preserving operations [23].

An analysis of the literature has shown that most works on the study of ovarian pathology contain, as a rule, a characteristic of the clinical picture, an intraoperative description of the ovaries, the results of laboratory studies, but are devoid of analysis of the relationship of these indicators with the morphological and histofunctional characteristics of the ovaries. Besides,the vast majority of morphometric and quantitative histoenzymological studies of the ovaries are of an experimental nature. There are only isolated studies that more or less fully describe the morphology of the human ovary and quantify the activity of enzymes [5,26,28], which is due to objective difficulties in obtaining material for research. Indeed, when taking autopsy material, it is not always possible to obtain data on somatic health and reproductive function, allowing to assess the ovary under study as healthy, therefore, at best, only the age of the woman is taken into account. When studying the histophysiology of the human ovary, it is much more difficult than in animal experiments to use the entire arsenal of immuno-histochemical techniques, which allows you to get maximum information about the organ, so only 1-2 techniques are often used. Difficulties are also created by the established autopsy deadlines, which make it almost impossible to study the enzyme systems of the human ovary at the tissue and cellular levels. The poor knowledge of the normal morphology and histoenzymology of the ovaries of women does not allow to adequately assess the morphofunctional changes of the ovaries in pathology and to choose the optimal amount of surgery. At the same time, with the introduction of laparoscopy, it became possible to perform a biopsy of the ovary without affecting its further functioning [12,23]. The above makes it necessary to apply an integrated approach to the study of the state of the ovaries: lifetime macroscopic examination; analysis of blood flow; morphometric and quantitative histoenzymological examination of ovarian biopsies; assessment of the endocrine function of the ovaries and determination of the content of gonadotropins in the blood controlling the function of the ovaries.

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