MINISTRY OF HEALTH OF UKRAINE

ODESA NATIONAL MEDICAL UNIVERSITY

Faculty of **Medicine**

Department of **Histology, Cytology, Embryology and Pathological Morphology with a course in Forensic Medicine**

APPROVED

Vice-rector for scientific and pedagogical work

Eduard BURYACHKIVSKY

September 4, 2023

METHODOLOGICAL RECOMMENDATION FOR INDEPENDENT WORK OF STUDENTS OF HIGHER EDUCATION FROM EDUCATIONAL DISCIPLINE

Faculty of Medicine, course 2

Educational selective discipline - " THE BASICS OF GENERAL MEDICAL EMBRYOLOGY"

Approved:

At the meeting of the Department of Histology, Cytology, Embryology and Pathological Morphology with the course of Forensic Medicine of Odesa National Medical University

Protocol No. 1 of September 1, 2023

Head of the Department _____ Varvara Sytnikova

Developers:

_____ assoc. prof. O.I. Tiron

_____ assoc. prof. I.I. Kuvshynova

_____ assoc. prof. O.O. Markova

_____ senior lecturer V.E. Breus

_____ senior lecturer O.O. Liashevska

Topic: Regulation of the ovarian-menstrual cycle.

Purpose: To study the morphological and functional changes in the organs of the female reproductive system during the ovarian-menstrual cycle. To study the neuro-endocrine regulation of the ovarian-menstrual cycle.

To know Changes in the mucous membrane of the uterus and ovaries during the ovarian-menstrual cycle; the phases of the ovarian-menstrual cycle, as well as the neuro-endocrine dependence of the ovarian-menstrual cycle.

Be able.

1. Identify at the microscopic level the mucous membrane of the uterus in different phases of the ovarian-menstrual cycle.
2. Identify at the microscopic level the constituent components of the ovaries during the ovarian-menstrual cycle.
3. Determine the phase of the menstrual cycle by the structure of the endometrium.

The ovarian-menstrual cycle is the time period from the first day of the previous to the first day of the next menstruation. Depending on the duration of the period, 21-, 28-, and 31- or 32-day ovarian-menstrual cycles are distinguished. During the ovarian-menstrual cycle, cyclical changes occur in a woman's body, in particular in the ovaries (ovarian cycle), the uterus (uterine cycle) and the whole body. All these changes are subject to the menstrual function, which is organically related to childbearing. Ovarian-menstrual function is aimed at preparing the ovum for fertilization, as well as creating conditions for the development of the fertilized ovum in the uterus throughout the entire period of pregnancy (before childbirth). Therefore, reproductive function is impossible without ovarian and menstrual function.

Basic concepts: 1. **Ovarian cycle** . The ovarian cycle consists of three physiological phases: *follicular, ovulatory and luteal* , or *corpus luteum phase* .

The follicular phase of the ovarian cycle begins in a woman from the moment of the onset of menstrual bleeding. This phase varies in time from 9 to 23 days, but is relatively constant for every woman.

The ovulatory phase lasts approximately 1-3 days and ends with ovulation. The final phase of the ovarian cycle, *the luteal phase* , during which the hormonal activity of the corpus luteum remains, lasts approximately 14 days.

2. **Follicular phase** . During each ovarian cycle, the slow development of follicles begins, the number of which increases during the next two cycles. During this period, approximately 20 follicles reach a size of 2-4 mm, and in the next cycle, thanks to the appearance of follitropin receptors on the membrane of follicular cells, they begin to develop under the influence of this hormone. In approximately one week, during the follicular phase, one of the follicles, on whose membrane the density of receptors for follitropin is higher than that of other follicles, reaches an average size of 11 mm and becomes dominant (secondary follicle). This is due to the fact that more estradiol-17B is synthesized in it than in other follicles. With a high density of receptors for

follitropin on the membrane of the dominant follicle, it retains the ability to synthesize estradiol-17B, during a cyclical decrease in the secretion of follitropin in the adenohypophysis of a woman . Under these conditions, other follicles that have a low density of follitropin receptors on their membrane synthesize a small amount of estradiol-17B and undergo atresia.

The function of follitropin in the development of the dominant follicle is as follows: this hormone binds to the receptors of the membrane of granulosa cells and stimulates the synthesis of aromatase in them, which converts testosterone into estradiol-17B. Testosterone is synthesized in the inner cells of the outer shell of the follicle (theca), and diffuses into granulosa cells, where the hormone is converted into estrogens.

The amount of androgens of follicular origin in a woman is approximately 70% of their total concentration in blood plasma. Granular cells contain estrogen receptors, with which estradiol binds, forms in them, and stimulates the proliferation of these cells, increasing the size of the follicle. At the same time, estradiol-17 B through B-type estrogen receptors activates the formation of new receptors for follitropin in granulosa cells. Therefore, the more granulosa cells are formed in the follicle, the more androgens are converted into estrogens, which stimulate the production of even more estradiol-17 by the granulosa cells (a positive feedback mechanism).

The increasing synthesis of estrogens in granulosa cells leads to an increase in the concentration of female sex hormones in blood plasma. Estrogens, together with follitropin, stimulate the formation of lutropin receptors on the membrane of granulosa cells, which is the main regulator of the next stage of antral follicle development (tertiary follicle).

Lutropin binds to receptors on the membrane of granulosa cells and cells of the inner layer of the outer membrane (theca), and stimulates the accumulation of lipids and yellow pigment in them, as well as a preovulatory increase in the production of progesterone, which initiates ovulation. At the end of the follicular phase, under the influence of the increasing secretion of estrogens in the follicle, and the increase in the concentration of the ovarian cytokine inhibin in the blood plasma, the secretion of follitropin in the adenohypophysis is inhibited by a negative feedback mechanism. At the same time, a high level of estrogen in the blood plasma inhibits the secretion of gonadoliberin in the hypothalamus and follitropin in the pituitary gland. On the contrary, these same hormones (estrogens and inhibin), by a positive feedback mechanism, stimulate a sharp increase in the concentration of lutropin in the blood plasma 24-36 hours before ovulation.

3. **Luteal phase** of the ovulatory cycle. Yellow body phase. Yellow body. Functions of the yellow body. Menstrual yellow body. Yellow body of pregnancy.

After ovulation, a corpus luteum is formed at the site of the ruptured follicle, the function of which is the secretion of estradiol-17 B, estrogen and progesterone, which regulate the preparation of the endometrium of the uterus for implantation. If the egg is not fertilized, the corpus luteum functions in the luteal phase of the ovarian cycle (menstrual corpus luteum). When the egg is fertilized, the corpus luteum functions for the first half of pregnancy (corpus lutea of pregnancy), and then its function ceases.

A preovulatory sharp increase in the concentration of lutropin in a woman's blood plasma leads to luteinization of granulosa cells and theca cells, and changes steroidogenesis in them in such a way that after ovulation, the concentration of

progesterone dominates in the blood plasma of female sex hormones. The binding of lutropin to the receptors of the G-protein system on the membrane of luteal cells increases the content of secondary messengers in them, which stimulate the transport of cholesterol from the blood plasma to the cells of the corpus luteum, where it is used for the synthesis of progesterone. The concentration of this hormone in the blood plasma of a woman in the luteal phase depends on the mass of steroidogenic tissue in the corpus luteum, the intensity of blood flow and the ability of steroidogenic tissue to synthesize progesterone under the influence of lutropin.

4. **Steroidogenesis in the cells of the corpus luteum** . Steroidogenesis in the cells of the corpus luteum gradually increases and reaches its peak approximately on the 8th-9th day after ovulation. During this period, the concentration of progesterone in a woman's blood plasma is 5 times higher

higher than in other phases of the ovarian cycle. The increase in the blood plasma of estrogens and progesterone in the luteal phase by the mechanism of negative feedback inhibits the secretion of gonadotropins in the adenohypophysis, increasing from 1 to 2-3 hours the time interval between periods of impulse release of these hormones into the blood. As a result, the development of another follicle in the ovaries does not begin. Progesterone secretion in the luteal phase controls the preparation (secretory phase of the uterine cycle) of the uterine endometrium for implantation of the egg. In this phase, functional maturation of endometrial cells occurs, which is fully prepared for implantation. If the egg is not fertilized, the yellow body is preserved for about 14 days, and then undergoes luteolysis.

5. **The secretory phase of the menstrual cycle** . Menstrual bleeding.

The secretory phase of the menstrual cycle begins immediately after ovulation and lasts until the onset of menstruation (on average 12-16 days). The main role of the secretory phase is to prepare the uterine mucosa for implantation. In this phase, the corpus luteum, steroidogenic cells that secrete etsradiol-17 B, estrone and progesterone are actively functioning.

The main condition for the normal course of the secretory phase is a high concentration of progesterone in the blood plasma. Progesterone, together with estrogens, acts on the cells of the glands of the mucous membrane of the uterus, causing them to secrete. In the secret of the glands, the level of glycogen, glycoproteins, and glycolipids increases, which are necessary to support the metabolism of the fertilized egg and contribute to its immersion in the mucous membrane of the uterine wall. If fertilization of the ovum does not occur and the uterine cycle does not end with pregnancy, the menstrual corpus luteum undergoes luteolysis. This causes a decrease in the secretion of estrogen and progesterone by the cells of the corpus luteum and, as a result, a decrease in the concentration of these hormones in the woman's blood plasma.

A decrease in the concentration of estrogens and progesterone in the blood plasma causes an increase in the tone of the smooth muscle cells of the spiral arteries in the mucous membrane of the functional layer of the myometrium, their twisting and a decrease in the lumen. As a result of ischemia of the endometrium, its necrosis occurs with subsequent menstrual bleeding.

Plan

1. Theoretical questions:

1. Menstrual cycle.

2. Phases of the ovarian-menstrual cycle.

3. Peculiarities of the structure of the endometrium in different phases of the sexual cycle.

4. Peculiarities of the structure of the ovary in different phases of the cycle.

5. Peculiarities of the structure of the vagina in different phases of the ovarian-menstrual cycle.

6. Neuro-endocrine regulation of the ovarian-menstrual cycle.

7. Menarche and menopause.

Questions for self-control :

1. General plan of the structure of the endometrium.

2. The structure of the vagina and its cyclical changes.

3. What is the ovarian-menstrual cycle.

4. How long does the ovarian-menstrual cycle last.

5. Name the phases of the ovarian-menstrual cycle.

6. Under the influence of which hormones, different phases of the ovarian-menstrual cycle take place cycle

7. What is menopause. What are its reasons.

Approximate tasks for working out the theoretical material :

Dictionary of basic terms on the topic:

Ovarian-menstrual cycle – cyclical changes occurring in the functional layer of the endometrium, the manifestation of which is monthly uterine bleeding.

Regeneration phase (3-5 days of the cycle) - begins with the growth of follicles and their production of estrogens, renewal of the epithelial plate of the mucous membrane takes place.

Proliferation phase (5-11 days of the cycle) - increase in the thickness of the endometrium of the uterus by 2-3 times.

The phase of relative rest (11-15 days of the cycle) - the endometrium is completely restored, but is not exposed to the action of progesterone.

The secretion phase (15-28 days of the cycle) is the preparation of the endometrium for blastocyst implantation.

Desquamation phase (1-3 days of the cycle) - rejection of the functional layer of the endometrium.

2. Practical works (tasks) to be performed:

1. To be able to identify the ovary, uterus and their tissue and structural components at the microscopic level.

2. To be able to explain the histophysiological features of the endometrium of the uterus in different phases of the ovarian-menstrual cycle.

3. Test tasks for self-control :

1. How long is the average ovarian-menstrual cycle?

A. 25 days..

B. 28 days

C. From 0 days
D. 14 days

2. Under the influence of which hormone does the proliferation phase occur?
A. Progesterone.
B. Estrogen.
C. Follitropin.
D. Lutropin.

3. What day covers the secretion phase?
A. 1-5 days.
B. 15-18 days.
C. 5-14 days.
D. 20-28 days.

4. What hormone matures in the ovarian follicle?
A. Progesterone.
B. Lutropin.
C. Estrogen.
D. Follitropin.

5. What does the hormone estrogen affect?
A. On the regeneration of the functional layer of the endometrium.
V. On maturation of the corpus luteum in the ovary.
S. On maturation of follicles in the ovary.
D. For detachment of the functional layer of the endometrium.
E. on the development of uterine glands

6. The proliferation phase of the menstrual cycle is characterized by:
A. increased growth of the endometrium due to proliferation of the epithelium, functionally inactive rectal glands
B. an increase in the thickness of the endometrium due to swelling of the stroma, tortuous glands filled with mucus
C. increased growth of the endometrium due to the proliferation of epithelial and stroma cells, functionally inactive glands mainly in the form of straight tubules
D. a decrease in the thickness of the endometrium due to the deterioration of trophicity, fold glands
E. increased growth of the endometrium due to the proliferation of cells of the epithelium and stroma, filled with mucus tortuous glands

7. Endometrial glands in the secretion phase:
A. tubular, narrow, straight, filled with secretion containing glycogen and glycosaminoglycans
B. tubular, tortuous, with an expanded lumen, filled with a secretion containing glycogen and glycosaminoglycans
S. _ alveolar, filled with mucous secretion
D. alveolar-tubular, in the apical part of secretory cells - zymogen granules
E. alveolar, filled with protein secretion

8. The peculiarity of the stroma of the endometrium in the secretion phase of the menstrual cycle is:
A. reduction of swelling, a large number of fibrocytes
B. a large number of mitoses among fibroblasts
C. formation of a large number of lymph nodes
D. accumulation of plasma cells
E. edema, appearance of predecidual cells

9. The proliferation phase of the menstrual cycle is characterized by:
1A. increased growth of the endometrium due to proliferation of the epithelium, functionally inactive rectal glands
B. an increase in the thickness of the endometrium due to swelling of the stroma, tortuous glands filled with mucus
C. increased growth of the endometrium due to the proliferation of epithelial and stroma cells, functionally inactive glands mainly in the form of straight tubules
D. a decrease in the thickness of the endometrium due to the deterioration of trophic
E. increased growth of the endometrium due to the proliferation of cells of the epithelium and stroma, filled with mucus tortuous glands

10. The following layers are distinguished in the endometrium:
A. basal and covering
B. functional and basal
S. functional and covering
D. supravascular, vascular, subvascular
E. functional and intermediate

4. Individual tasks for students of higher education on the topic:

Topics for essays:

1. Hormonal regulation of the ovarian-menstrual cycle.
2. Morphofunctional characteristics of the cyclic corpus luteum.
3. Morphofunctional characteristics of the functional layer of the endometrium, its changes
4. Morphofunctional characteristics of the cervix
5. Morphofunctional characteristics of the endometrium in the secretion phase

List of recommended literature

Main :
Additional:

GUIDELINES
TO THE INDEPENDENT WORK OF STUDENTS OF HIGHER EDUCATION
FROM THE ACADEMIC DISCIPLINE

Faculty, second year medical course
Educational discipline of histology, cytology and embryology

With approved:
Meeting of the Department of Histology, Cytology and Embryology
Odessa National Medical University

Protocol No. ___ of "___" _____ 20__

Head of the department
Ph.D., associate professor _____ Tiron O.I.

Developers:

Ph.D., associate professor Tiron O.I.
Ph.D., Associate Professor Kuvshinov I.I.
Ph.D., Ph.D. Markova O.O.
art.excl. Lyashevska O.O.

Topic: Causes of male and female infertility.

Purpose: The male reproductive system performs two interconnected functions - the

formation of male germ cells-sperms - and the secretion of male sex hormones, which ensure the preservation of the biological species, the formation of secondary sexual characteristics, the sexual characteristics of an individual's behavior. Violation of the regulation and structural and functional state of the testicles can lead to the development of male infertility, congenital and acquired diseases of the offspring. Diseases of the male reproductive system are the subject of an independent science - andrology. In the case of infertility, a qualitative and quantitative study of the spermogram is of great medical importance in andrological practice in order to find out the causes of possible defects in the development of the testicles, disorders of spermatogenesis.

Basic concepts: Until now, the criterion for making a diagnosis of "infertility" remains a subject of discussion. According to the recommendation of the WHO, a marriage in which the woman does not become pregnant within one year, provided that she has regular sex life without the use of contraceptives, is infertile. At the same time, at the ESHRE seminar in 1992, it was declared that fertility should be considered normal when pregnancy occurs in a woman of childbearing age within 2 years of regular sexual life without the use of contraceptives. It was found that in the general population of married couples, pregnancy develops within 6 months in 70%, after 12 months - in 80% of couples, and after 2 years - in approximately 86% of cases. Those couples in which pregnancy does not occur within 2 years include sterile members of the population, for whom the possibility of natural pregnancy is excluded, and the rest, in which there is reduced fertility (subfertility). Together they constitute an infertile population. **The term "sterility"** refers to both men and women, and "subfertility" refers only to a married couple. Let's dwell on the demographic terms used in reproductive science **: fertility** – the ability to have children, indicates the results or product of reproduction; fecundity - the ability to achieve a live birth during one gestation cycle; fertility ability - the possibility of becoming pregnant, which depends on the pattern of sexual and pregnancy-preventing behavioral reactions; sterility – impossibility of natural pregnancy; subfertility – reduced capacity for natural pregnancy; infertility - reduced ability and impossibility of natural pregnancy. Direct determinants of fertility are biological and behavioral factors through which social and economic environmental conditions affect procreation. Epidemiological studies conducted at the end of the 20th century established a decrease in the quality and quantity of sperm and an increase in the number of infertile couples, which, however, did not affect the general indicators of human reproduction. The problem of infertility is given attention in highly developed countries, while in developing countries there is not even a proper assessment of the prevalence of this condition. The biological reliability of offspring reproduction in men is ensured by the constantly functioning hypothalamic-pituitary system and the daily production of several tens of millions of spermatozoa. The time cycle of male germ cell development is stable, has species specificity and is not affected by hormones. However, the initiation, reinitiation and maintenance of spermatogenesis are hormonally determined processes that are controlled by the hypothalamus,

pituitary gland, and papillary glands. Adequate reaction of metabolic and other physiological processes, which are constantly changing, maintaining the stability of the body's internal environment depends on the state and functioning of the extremely dynamic neuroendocrine system, which is characterized by a high degree of integration of individual links. The relationship between the nervous and endocrine systems determines the double protection of numerous functions of the body, including the reproductive one. The male germ cell goes through three stages of development - spermatogenesis (from primary spermatogonia to first-order spermatocyte), spermatocytogenesis (from first-order spermatocyte to spermatid) and spermatogenesis (from spermatid to spermatozoon). The entire process of spermatogenesis in men lasts 73-75 days. The duration of spermatogenesis and its stages is genetically programmed for each species and does not change under the influence of body and environmental factors. The necessary substrates and microenvironment for the development of germ cells are created by Sertoli cells, which also participate in the creation of the blood-testicular barrier. Mature spermatozoa are deposited in the epididymis, from where, during ejaculation, they are released into the urinary canal through the vas deferens. Testicular cells of five types are involved in spermatogenesis, transport and maturation of spermatozoa: Leydig cells; myoepithelial cells; Sertoli cells; developing germ cells; epithelial cells of the efferent duct system. Each cell exerts a direct or indirect influence on the activity of other cells, interacting through direct cell contact or through the secretion of chemical mediators. The hypothalamic-pituitary reproductive system provides neurohumoral control of the functioning of the reproductive system. The testicles perform a double function - they produce male sex hormones and male germ cells. The formation of gametes and steroids takes place in separate morphological structures, between which intensive interaction is carried out. Germ cell regulation is provided by two mechanisms: hormonal factors of hypothalamic, pituitary, and testicular origin (classic endocrine action) and locally produced factors with local action (paracrine regulation). The normal functioning of the hypothalamic-pituitary reproductive system ensures: the initiation of spermatogenesis – the full course of spermatogenesis is launched for the first time during puberty; maintenance of spermatogenesis – hormones necessary for maintenance of intact gametogenesis in adult men; re-initiation of spermatogenesis - hormones are necessary to restore gametogenesis after a temporary stop; maintenance of qualitatively normal spermatogenesis - hormones are necessary for the existence of all types of germ cells; maintenance of quantitatively normal spermatogenesis - hormones are necessary to ensure all germ cells in a normal amount. The hypothalamus affects spermatogenesis indirectly by stimulating the production of gonadotropic hormones and testosterone. Both follicle-stimulating hormone (FSH) and luteinizing hormone (LH) are necessary for normal spermatogenesis, but the action of LH is mediated by testosterone. FSH and testosterone act directly on the seminiferous tubules. Initiation, reinitiation and maintenance of spermatogenesis are controlled by separate and independent mechanisms. FSH, LH and testosterone are necessary for the initiation of spermatogenesis. FSH and testosterone must be administered to reinitiate spermatogenesis. Maintenance of spermatogenesis can be carried out only by testosterone, if the germinal epithelium is prepared. Spermatogenesis is regulated mainly by FSH, and spermatogenesis by LH and testosterone. FSH controls the

maturation of seminiferous tubules, plays a significant role in the quantitative regulation of spermatogenesis as a primary inducer of spermatogonia proliferation, which determines its primary effect on the quantitative side of spermatogenesis. FSH not only determines the number of cells capable of division, but also reduces the number of cells that degenerate during spermatogenesis (Matsumoto et al., 1986). It also participates in the regulation of the last stage of spermatogenesis, affecting sperm maturation. FSH increases the number of androgen receptors in Sertoli and Leydig cells, the number of LH receptors in Leydig cells, the concentration of androgen-binding protein in the seminiferous tubules, which leads to an increase in the local concentration of testosterone in the testicles. However, the effect of FSH on spermatogenesis is still debatable. Currently, the influence of FSH and LH on the initiation of spermatogenesis is undeniable. Studies conducted on prepubertal monkeys have shown that the administration of FSH alone, even for 2 years, is unable to initiate spermatogenesis, while in combination with testosterone it induces the early appearance of primary spermatocytes after 3 months and the start of the spermatogenesis process during the following 12 months. A similar effect in prepubertal monkeys in the form of completed spermatogenesis was obtained after the appointment of both gonadotropins. Thus, experimental studies have established that FSH does not have an independent effect on the initiation and maintenance of spermatogenesis, but its presence is the basic link of these processes, provided its high concentration in the blood. FSH and testosterone should provide a synergistic effect to achieve normal quantitative indicators of spermatogenesis. During the fetal and neonatal periods, FSH activates the proliferation of Sertoli cells, and during puberty it affects the mitotic activity of spermatogonia. The role of the male factor in the reproduction of offspring in humans consists in the fertilization of a mature egg and the transfer of hereditary characteristics of a male individual by the introduction of half a set of genetic material by a spermatozoon, which, when fused with a half set of chromosomes of an egg cell, gives rise to the development of a new organism and ensures differentiation to the round spermatid stage during meiosis . Prolactin also plays a role in spermatogenesis, acting synergistically with LH and testosterone. It controls the level of testosterone precursors in the testicles, stimulates the energy exchange of spermatozoa, their metabolism, enhances the effect of LH on steroidogenesis in Leydig cells, the number of androgen receptors in the tissue of additional gonads, and exerts a stimulating effect on the epididymis. LH affects spermatogenesis indirectly through the secretion of testosterone. The germinal epithelium does not have androgen receptors, so testosterone, which is secreted by Leydig cells, acts on germ cells through Sertoli cells. Androgens provide quantitative indicators of spermatogenesis, increase sperm motility and their ability to penetrate the zona pellucida. Testosterone controls almost all stages of spermatogenesis. Androgens are necessary for the differentiation of the gonads and the central nervous system, the development of the genitals and accessory gonads, gametogenesis, and the processing of immature spermatozoa. Testosterone acts through androgen receptors without further aromatization (Singh, 1995). Testosterone also plays a significant role in the paracrine regulation of spermatogenesis, which is carried out by local regulators of intratesticular processes. Paracrine regulators are factors that are produced by one cell type in an organ and exert an effect on a second cell type in the same organ. It is believed that the level of testosterone is critical for the final stages

of spermatogenesis. High intratesticular concentrations of it (100 times higher than in peripheral blood) are necessary for normal spermatogenesis. It should be noted that, in addition to the above-mentioned hormones, a number of locally secreted peptides and proteins (cytokines, activin, inhibin, follistatin), as well as some hormones: estrogens, growth hormone, leptin, insulin-like growth factor 1, and thyroid hormones are involved in the paracrine and autocrine regulation of spermatogenesis. glands The influence of the latter on spermatogenesis is currently little studied, but in the last decade it has attracted the attention of many researchers. Thyroidectomy in sexually mature male rats leads to pronounced suppression of gametogenesis. There is evidence of impaired sperm motility in thyroid dysfunction. In patients with clinical manifestations of hypothyroidism, the appointment of thyroid hormones leads to the improvement of most sperm parameters (V.O. Bondarenko et al., 2013). An epidemiological study involving 380 male partners of infertile couples clearly demonstrated a correlation between T4 and sperm concentration (Meeker et al., 2007). Prolactin has a direct stimulating effect on the epididymis, stimulates the energy exchange of spermatozoa, which leads to an increase in their survival and mobility. Thus, prolactin stimulates the metabolic processes in spermatozoa, increasing their efficiency, and also enhances the synthesis of testosterone due to the effect on LH, increases the effect of testosterone on the prostate gland. Classification of male infertility There is no generally accepted classification of male infertility. WHO experts distinguish 16 factors of male infertility: psychosexual disorders; infertility of unclear origin; isolated pathology of seminal plasma; estrogenic causes; systemic diseases; congenital anomalies; acquired lesions of the testicles; varicocele; infections of accessory glands; immunological factor; endocrine causes; idiopathic oligozoospermia; idiopathic asthenozoospermia; idiopathic teratozoospermia; obstructive azoospermia; idiopathic azoospermia. In Ukraine, the classification of male infertility proposed by I.F. Yundoy (1979): – secretory infertility; a) secretory-endocrine b) secretory-toxic – excretory infertility; a) excretory-toxic b) excretory-obstructive – combined infertility; – immunological infertility; - other forms. We consider it appropriate to focus on the classification of male infertility (Y. Lipshultz, S. Howards, 1986): I. Pretesticular forms (secondary testicular insufficiency - 8%) A. Hypogonadism 1. Pubertal development a) organic disorders in or near the pituitary gland (tumors , cysts, injuries) b) genetic defects of gonadotropin secretion 2. Postpubertal development a) organic disorders (pituitary tumors, injuries in the pituitary region) B. Estrogen excess 1. Endogenous a) estrogen-producing tumors (including adrenal cortex) b) liver cirrhosis 2. Exogenous B. Excess of androgens 1. Endogenous a) adrenogenital syndrome b) androgen-producing tumors 2. Exogenous D. Hyperprolactinemia D. Excess of glucocorticoids 1. Endogenous a) Itsenko-Cushing syndrome 2. Exogenous a) treatment of ulcerative colitis b) treatment of bronchial asthma E. Hypothyroidism G. Diabetes mellitus C. Hyperthyroidism II. Testicular disorders (primary testicular insufficiency - 80%) A. Chromosomal disorders 1. Klinefelter syndrome 2. XYY syndrome B. Varicocele B. Orchitis 1. epidemic parotitis 2. others - bacterial, chlamydial D. Cryptorchidism D. Chemical substances and drugs E Radiation G. Germinative aplasia (Sertoli cell syndrome), obesity, sickle cell anemia, uremia, chronic liver disease) C. Aging K. Idiopathic oligospermia and/or testicular insufficiency III. Posttesticular disorders (obstruction of the vas deferens - 12%) A. Blockage of the pathways leading from the testicles 1.

Congenital a) aplasia of the vas deferens b) aplasia of the appendages 2. Acquired a) infections b) tubule ligation B. Violation of sperm motility (with normal concentration and testicular biopsy) 1. Violation of maturation or violation of preservation of spermatozoa in the appendages 2. Biochemical abnormalities of the seminal fluid 3. Genetic defects of the sperm head 4. Immunological factors. Pretesticular forms of male infertility are due to endocrine causes, primarily secondary hypogonadism, both congenital (Kallmann syndrome, Pasqualini syndrome, isolated FSH deficiency, Lawrence-Moon-Biddle syndrome, Prader-Willi syndrome, Maddock syndrome, craniopharyngioma) and acquired (as a result of destructive injuries of the hypothalamohypophyseal area due to injuries, tumors, infectious and inflammatory processes, surgical interventions, hyperprolactinemic syndrome). In the pathogenesis of endocrine infertility in men, the central nervous system, pituitary gland, testicles, target organs, other endocrine glands - adrenal gland and thyroid gland - are involved. Primary hypogonadism develops as a result of damage to the testicles. It can be congenital or acquired. The development of clinical symptoms of hypogonadism depends on the age of the man who developed testosterone deficiency and the degree of gonadal insufficiency. If hypogonadism develops in prepubertal age, there is no or weak development of secondary sexual characteristics, underdevelopment of external genitalia, formation of eunuchoid syndrome and development of infertility. Postpubertal hypogonadism is characterized by decreased potency, disappearance of secondary sexual characteristics, and infertility. Testicular biopsy revealed hyalinosis of seminiferous tubules, growth of connective tissue, absence of spermatogenesis cells. Laboratory studies indicate a decrease in the concentration of testosterone and an increase in the levels of LH and FSH in the blood. Secondary hypogonadism develops as a result of damage to the hypothalamic-pituitary region by a pathological process. It can be congenital or acquired. The clinical picture in men with hypogonadotropic hypogonadism also depends on the age and degree of testicular insufficiency. Histological analysis of seminiferous tubules reveals undifferentiated germinal epithelium with early spermatogonia and insufficient development of interstitial tissue. A laboratory test reveals reduced levels of testosterone, LH, and FSH. Delay in sexual development in boys deserves special attention, the frequency of which is, according to various authors, 4-6%. Normogonadotropic hypogonadism develops in men with burdened heredity, with damage to the testicles in patients with hypothalamic-pituitary dysfunction. Some authors believe that some men with idiopathic infertility have normogonadotropic hypogonadism, which is manifested by slightly reduced levels of testosterone and normal concentrations of LH and FSH. Hyperprolactinemic hypogonadism develops in men with prolactinomas, prolactin-secreting microadenomas. The level of testosterone in the blood is reduced, the concentration of gonadotropins is normal or low. Testosterone deficiency condition (late hypogonadism), which is observed more often in men at a more mature age and is caused by the age factor, as well as other risk factors (hypodynamia, stress, irrational nutrition, chronic diseases, bad habits, burdened heredity), can also lead to a violation of spermatogenesis . The cause of complete or partial suppression of spermatogenesis is some genetic disorders (aneuploidy, structural abnormalities of chromosomes) and much more common abnormalities of the testicle, which are caused not by genetic disorders, but by the influence of physical, chemical and hormonal factors during the

intraperitoneal period, during puberty and in adulthood a man's body Chemical substances that cause transient endocrine disorders in adults can lead to the development of abnormalities in the fetus. Any action on the fetus during the 16th week of development suppresses the growth of the number of Sertoli cells and reduces the number of produced spermatozoa, which subsequently leads to a decrease in the activity of spermatogenesis in the reproductive period. Prenatal exposure to chemicals, especially those that have estrogenic or antiandrogenic effects, leads to an increase in the frequency of cryptorchidism, the development of hypospadias, and testicular cancer. Substances that mimic the effects of estrogens (phytoestrogens, antiandrogenic chemical compounds: polycyclic carbohydrates, dioxins, alkyphenolic compounds, pesticides, fungicides, insecticides) are capable of interfering with the natural ways of endocrine regulation of the processes of gametogenesis and steroidogenesis in the male body. Heavy metals, neurotropic poisons (phenol, toluene, gasoline, ammonia) cause a harmful effect on all links of the hypothalamus-testicular pituitary system. Medicines have a toxic effect on spermatogenesis - antihypertensive drugs, hormones, a number of antibiotics, sulfonamides, nitrofurans; sedative drugs, antidepressants, anti-ulcer, hypolipidemic, chemotherapeutic agents. According to Vogt (2004), approximately 30% of cases of male infertility are caused by chromosomal aberrations or mutations in genes that regulate the male germline. Physical factors (ionizing radiation, high temperature, vibration) also cause an adverse effect on spermatogenesis. Ionizing radiation affects the spermatogenic epithelium both directly and indirectly, affecting hypothalamic-pituitary regulation. Permanent sterility occurs when exposed to a single dose of 600-800 rads, and a dose of less than 100 rads causes temporary azoospermia for up to 9-18 months. Prolonged exposure to small doses of ionizing radiation also leads to disruption of spermatogenesis - oligo-, anteno- and teratozoospermia, decrease in ejaculate volume. Gonads, especially germinal epithelium, are among the most sensitive to radiation, second only to bone marrow in this respect. An increase in body temperature, heat can inhibit spermatogenesis. Even moderate local overheating of the testicles, increased intratesticular temperature with cryptorchidism, varicocele has a harmful effect on spermatogenesis. Vibrating disease accompanied by hyperproduction of corticosteroids can lead to oligo- and azoospermia, anteno- and teratozoospermia. Molecular genetic research made it possible to significantly improve the understanding of the role of the hereditary factor in the genesis of reproductive function disorders in men (A.V. Kopteva, 2000). Disruption of sexual differentiation and reproduction can be caused by various defects, mutations in genes, which are the cause of central violations of the endocrine regulation of spermatogenesis and gametogenesis in the testes. Autosomal mutations can be either recessive or dominant. Genetic heteromorphism in the genes encoding lutropin and its receptor cause the development of various clinical forms of reproductive disorders. Genes encoding gonadoliberin, LH, FSH and their receptors have been identified. As a result of gene mutation, which leads to the inactivation of the gonadoliberin receptor, the absence of its pulsatile secretion and the development of hypogonadotropic hypogonadism are observed. Inactivation of the LH receptor leads to the development of pseudohermaphroditism. Activation of the lutropin receptor leads to premature sexual development in men. Oligo- or azoospermia develops if the β-subunit of follitropin is unable to bind to the α-subunit, while the concentration of

testosterone in the blood and virilization remain normal. Hypospermia is observed in men who are homozygous carriers of a mutation in the FSH receptor gene. Mutation of the gene encoding LH and its receptor leads to a decrease in the activity of Leydig cells, which is manifested in the development of secondary hypogonadism. In boys, homo- or heterozygous carriers of allelic beta-subunits of LH, insufficient pubertal development is observed in the form of delayed growth and sexual development. Activating dominant mutations of the LH receptor gene cause premature sexual development in boys, while inactivating mutations lead to the development of male hermaphroditism or pseudohermaphroditism. Autosomal dominant or recessive disruption of genes encoding gonadotropin-releasing hormone can cause the development of idiopathic hypogonadotropic hypogonadism or premature sexual development. The hereditary nature of reproductive function disorders in men justifies the need for a medical genetic examination and prenatal diagnosis, which can help in determining the prognosis of treatment effectiveness. Recently, studies of the integrity of spermatozoa's DNA have become especially relevant, in order to exclude, first of all, the possibility of fertilization of an egg cell with defective genetic material when using assisted reproductive technologies (ART). Violations of the sperm DNA integrity index are often associated with microdeletions of the Y-chromosome, gene mutations and epigenetic disorders. It is believed that the DNA fragmentation index >30% is a universal marker of male infertility (I.S. Chornokulskyi, 2014). According to current recommendations, karyotype analysis and cytogenetic studies of spermatozoa are indicated for all men with pronounced pato and oligospermia.

Plan

Theoretical questions:

1. Testicle. Source of development. Cryptorchidism. General plan of structure and function.

2. The structure of the wall of the tortuous seminiferous tubule. Two populations of cells

in its epithelio-spermatogenic layer, sustentocytes and cells

spermatogenic series, their microscopic characteristics and functions.

3. Hematotesticular barrier and its functions. The role of changes in the permeability of the blood-testicular barrier in the pathogenesis of autoimmune infertility.

4. Spermatogenesis. Periods of reproduction, growth, maturation and formation, their morphological characteristics are normal.

5. Structure and functions of interstitial endocrinocytes-Leydig cells.

6. Hormonal regulation of spermatogenesis.

7. Morphological and molecular manifestations of impaired spermatogenesis at the basis of the development of male infertility.

Questions for self-control:

1. What is the general structure of the testicle?
2. What is the structure of the tortuous seminiferous tubule?
3. What components make up the hematotesticular barrier and their significance?

4. What are the main periods of spermatogenesis?
5. What are the features of reduction division?
6. What is the structure of sperm according to light electron microscopy?
7. What factors affect spermatogenesis?
8. What are the possible disorders of spermatogenesis?
9. What is the significance of additional glands and seven reproductive tracts?
10. What are the structural criteria for diagnosing male infertility?
11. What are the molecular criteria for diagnosing male infertility?

Approximate tasks for working out the theoretical material :

Normally after dilution at room temperature within 20-30 minutes. sperm indicators are as follows: 1) volume of ejaculate at least 2 ml; 2) pH from 72 to 78; 3) the total number of spermatozoa in the ejaculate is not less than 40 million or 20 million in 1 ml; 4) at least 50% of spermatozoa are motile; 5) more than 50% of morphologically normal spermatozoa or more than 30% with normal head morphology; 6) absence of antisperm antibodies; 7) the fructose content in the ejaculate is more than 13 mmol. Ejaculate that meets the specified requirements is classified as "normozoospermia". There is a generally accepted classification (WHO, 1992) of various violations of sperm parameters: oligozoospermia - sperm concentration less than 20 million/ml

- **asthenozoospermia** - less than 50% of spermatozoa are motile;
- **teratozoospermia** - less than 50% of spermatozoa with normal morphology or less than 30% with normal head morphology;
- **azoospermia** - absence of spermatozoa in the ejaculate;
- **aspermia** - absence of ejaculate;
- **oligoasthenoteratozoospermia** - violation of indicators of the number, mobility and morphology of sperm.

-forms of female infertility : 1) endocrine, 2) caused mainly by anatomical factors, 3) immunological, 4) tubal, 5) peritoneal, 6) infertility of unclear origin.

-endocrine infertility - such a state of the female body, when the process of ovulation is disturbed as a result of a pathological change in the function of the glands of internal secretion.

As a result, the inability of the ovum to fertilize occurs, the insufficiency of secretory transformations in the endometrium, which make implantation of the fetal egg impossible. The specific gravity of endocrine forms of infertility is 20-50%.

Groups of ovulation disorders :

Group 1 - hypothalamic-pituitary insufficiency, in which there is underdevelopment of the genitals, amenorrhea, a sharp decrease in the level of FSH, LH, estrogens;

group 2 – hypothalamic-pituitary dysfunction with various disturbances of the menstrual cycle (anovulatory cycles, luteal phase insufficiency, amenorrhea), significantly increased estrogen content and low levels of HTH and prolactin; patients with sclerocystic ovaries belong to the same group;

Group 3 - ovarian insufficiency, characterized by amenorrhea against the background of a significant decrease in the level of estrogens, inhibition of progesterone

production with increased secretion of HTG;
group 4 - congenital and acquired disorders of the reproductive system, such as obliteration of the uterine cavity as a result of abortion, replacement of the endometrium with connective tissue, in which the trophic function of nervous elements is disturbed, which further contributes to the development of a pathological process in the endocrine and higher departments of the nervous system;
Group 5 – hyperprolactinemia in the presence of a tumor in the hypothalamic-pituitary region, as a result of which the hypothalamus does not produce a prolactin-inhibiting factor and the required amount of releasing hormones, which leads to increased secretion of prolactin and low HTH;
Group 6 – hyperprolactinemia without damage to the hypothalamic-pituitary region in women with various disorders of the menstrual cycle, clear production of estrogens of ovarian origin and elevated prolactin levels;
Group 7 - amenorrhea with a tumor in the hypothalamic-pituitary region, a decrease in the production of prolactin-inhibiting factor, releasing hormones, HTG, a secondary decrease in the level of estrogens and suppression of ovulation against the background of normal prolactin production .
Endocrine infertility can be caused by damage to the cortex of the adrenal glands, a tumor process or congenital hyperplasia of the thyroid gland, diabetes, chronic infections, intoxications, hypo- and vitamin deficiency, occupational hazards, metabolic disorders, alcoholism, smoking abuse, neurogenic disorders
In the development of endocrine infertility, insufficiency of the function of the corpus luteum is of great importance. At the same time, the amount of progesterone in the body decreases, which causes fallopian tube spasm, disruption of their peristalsis, the process of egg transport from the ovary to the uterus, in which there is no secretion phase. The possibility of normal reproduction in most healthy fertile women exists due to the presence of immunological barriers, as well as the action of immunosuppressive factors and special immunoregulatory mechanisms of tissues of the reproductive system at all its levels. It is generally accepted that immune forms of infertility, the specific weight of which among all types of infertility is about 10%, are mainly due to the occurrence of antisperm antibodies, more often in men and much less often in women. The female body can also form antibodies to the hormone of pregnancy - ionic gonadotropin chorus, to membrane phospholipids, glycoproteins of the glistening membrane, and even to endogenous LH and FSH and their receptors.
Antisperm immunity can be manifested by the following reactions: 1) emergence of humoral antibodies; 2) formation of tissue antibodies; 3) enhanced phagocytosis of spermatozoa by sensitized monocytes in the cervix and uterine cavity; 4) a delayed sensitization reaction in the form of inhibition of blastocyst implantation or its destruction as a result of an allergic reaction that occurred due to the contact of spermatozoa with sensitized tissue of the uterine cavity; 5) ejection of ejaculate from the sperm-sensitized uterine cavity through increased contractions. These reactions can be provoked by the action of factors that increase the immune aggression of the ejaculate. These include: infection in the vagina, which has its own antigenic activity, the presence in the ejaculate of infection or lymphocytes that increase the sensitization of the female body to the ejaculate, as well as the presence in the ejaculate of such immunosuppressors as IgE and glycoprotein fractions. Among the types of immune reactions of the female body listed above, local immunity plays a

role, and the cervix is the main link of local immunity, and the endometrium and fallopian tubes have these properties to a much lesser extent. It is known that significant insemination of ejaculate with bacteria, especially Escherichia coli, causes sperm agglutination. In addition, a genital infection, such as epididymitis, can lead to partial obstruction. vas deferens and sperm stasis in the testicle network. There is also a hypothesis that the seminal plasma contains inhibins of the immune response, that is, substances that inhibit the reaction of the female genital organs to spermatozoa. In some men, these inhibin secretions may be disrupted due to infection, trauma, or other reasons. The absence of inhibins leads to an increase in the immune response to ejaculate.

Practical works (tasks) to be performed:

1. To be able to determine the organs of the reproductive system and their tissue elements at the level of world microscopy.
2. Explain the content and essence of the phases of spermato- and oogenesis and the mechanism of regulation of the generative and endocrine functions of the gonads.

Test tasks for self-control:

1. Spermatogenesis is carried out in the structural component. It
A. Straight tubules
B. Tortuous seminiferous tubules
C. Egg grid
D. Appendicular duct
E. Outgoing tubules of the appendix

2. Spermatogenic cells correspond to the formation phase. It-
A. Spermatogonia
B. Speratocytes of the 1st order
C. Spermatocytes of the 2nd order
D. D. Spermatids
E. Sperm

3. In the formation phase occurs. IT-
A. Morphological differentiation of spermatids
B. Exchange of regions between homologous chromosomes
C. In the creation of synaptonemal complexes
D. Duplication of chromosomes
E. Despiralization of chromosomes

4. The structure is not part of the blood-testicular barrier. It-
A. Hemocapillary endothelium
B. Dense contacts between processes of sustentocytes
C. A layer of myoid cells of the own shell of the convoluted seminiferous tubule
D. Perivascular connective tissue interstitium
E. Interlobular connective tissue

5. Does not apply to structural disorders of spermatozoa. It-
A. Formation of giant cells
B. Formation of polyploid gametes
C. Decrease in the number of cells
D. _ Formation of gametes with a stationary tail
E. Formation of cells with abnormal acrosome

6. The molecular criteria for the diagnosis of infertility are not included. This-
A. Violation of reception to Z RZ
B. Deficiency of acrosome enzymes
S. Dynein protein defect
D. Defect of cytoskeleton organization
E. Low level of ATPazidynein

7. The epithelium of the epididymal duct contains the following types of cells:
A. Basal and covering
B. Microvillous with stereocilia and basal
S. Basal, ciliated, goblet-shaped
D. Microvillous and goblet-like
E. Basal, spiky and flat

8. The prostate gland has the following composition:
A. Epithelium of the celonephrodermal type, loose connective tissue, smooth muscle tissue
B. Epithelium of the celonephrodermal type, loose connective tissue
C. Epithelium of the ependymoglial type, loose connective tissue, smooth muscle tissue
D. Epithelium of celonephrodermal type, smooth muscle tissue of epidermal type.
E. Enterodermal type epithelium, loose connective tissue, smooth muscle tissue

9. Types of cells in the epithelium of the terminal parts of the prostate gland
A. Basal, main, endocrinocytes
B. Basal, spiky, covering
S. Microvillous and flat basal
D. High secretory and basal
E. Microvillous with stereocilia and flat basal

10. The stroma of the prostate gland is represented by:
A. Fibrous cartilaginous tissue and mesenchymal smooth muscle tissue
type
In _ Connective tissue with a large number of elastic fibers and smooth muscle fabric
C. Reticular tissue and smooth muscle tissue of the mesenchymal type
D. Connective tissue and smooth muscle tissue of the epidermal type
E. Connective tissue and striated muscle tissue of the somatic type

Individual tasks for students of higher education on the topic:

Hormonal regulation of spermatogenesis.

Morphological and molecular manifestations of impaired spermatogenesis at the basis of male infertility. Material for self-control.

Causes of male infertility, existing means of prevention.

List of recommended literature

Main :

Additional:

GUIDELINES
TO THE INDEPENDENT WORK OF STUDENTS OF HIGHER EDUCATION
FROM THE ACADEMIC DISCIPLINE

Faculty, second year medical course
Educational discipline of histology, cytology and embryology

With approved:
Meeting of the Department of Histology, Cytology and Embryology
Odessa National Medical University

Protocol No. ___ of "___" _____ 20__

Head of the department
Ph.D., associate professor _____ Tiron O.I.

Developers:
Ph.D., associate professor Tiron O.I.
Ph.D., Associate Professor Kuvshinov I.I.
Ph.D., Ph.D. Markova O.O.
art.excl. Lyashevska O.O.

Topic: Anovulation, failed implantation, ectopic pregnancy

Purpose Implantation of a human embryo into the uterine cavity is a complex, multi-step process that is regulated by a large number of humoral factors and various intermolecular and intercellular interactions. There are two phases of implantation - adhesion and invasion. The fertilized egg enters the uterine cavity at the morula stage, where it develops into a blastocyst. During adhesion, numerous microprotrusions are formed on the outer membrane of the blastocyst, with the help of which it comes into close contact with the uterine epithelium, this process is inhibited by estrogen and activated by progesterone, at this time the highest receptivity of the endometrium is manifested. Invasion is a process mediated by the activity of the cytoskeleton, specific proteins - enzymes of trophoblasts and their receptors. All molecules that take part in these processes are cell surface receptor proteins and there are 4 main groups of them: integrins, cadherins and selectins. The study of the main mechanisms of implantation and their regulation is necessary to understand the occurrence of the main forms of violations and processes in the treatment of female infertility.

Basic concepts: _____ _____ _____

Plan

5. Theoretical questions:

1. Biological significance of implantation in embryo development.
2. Phases of implantation.
3. Timing of implantation phases.
3. The structure of the uterine wall at the time of the beginning of the implantation phases is normal.
4. The structure of the blastocyst before the beginning of the adhesion phase.
5. Nutrition of the embryo during the implantation phases.
6. The concept of the critical period of contact between the blastocyst and the mucous membrane of the uterine body. Timing of its occurrence and mechanisms.
7. The role of secretion of uterine glands and their hormonal dependence in the implementation of adhesion.
8. Principles of passage and general biological significance of intermolecular and intercellular interactions and their regulation by humoral factors between the blastocyst and the mucous membrane of the uterine body in the adhesion phase.
9. The principles of intermolecular and intercellular interactions and their regulation by humoral factors between the embryo and the mucous membrane of the uterine body in the invasion phase.

Questions for self-control:

1. What is the biological significance of implantation in the development of a human embryo?

2. What are the phases of implantation, their terms of passage?
3. What are the possible violations of the implantation phases and the possible consequences of these critical periods?
4. Describe the histological structure of the uterine wall at the time of the first phase of implantation?
5. Describe the structure of the blastocyst before the beginning of adhesion?
6. Clarity mechanisms of embryo nutrition in the phases of adhesion and invasion?
7. Describe the essence of hormonal dependence in the implementation of implantation phases?
8. What is the functional significance of uterine secretions in the adhesion phase?
9. Describe the principles of passage and the general biological significance of intermolecular and intercellular interactions and their regulation by humoral factors between the blastocyst and the mucous membrane of the uterine body in the adhesion phase?
10. What are the principles of intermolecular and intercellular interactions and their humoral regulation between the embryo and the mucous membrane of the uterine body in the invasion phase?

Indicative tasks for studying the theoretical material .

Practical works (tasks) to be performed:

1. To identify structural parts of the mucous membrane of the uterus, which are involved in the processes of embryo implantation, on a histological micro-preparation.
2. Determine the morphological manifestations in the mucous membrane of the adhesion phase on a histological micro-preparation.
3. Determine the morphological manifestations in the mucous membrane of the uterus of the invasion phase on a histological micro-preparation.

Test tasks for self-control:

1. A woman fell ill with acute respiratory infections on the 7-8th day of pregnancy. Violation of which process should be expected:

A. Implantation
B. Fragmentation
C. Fertilization
D. Acrosome reaction
E. Compactification

2. Against the background of hormonal changes in the patient's body, the process of ingrowth of the blastocyst into the mucous membrane of the uterine wall

became impossible. Name the process that was missing:

A. Invasion
B. Adhesion
S. neurulation
D. _ histogenesis
E. compactification

3. According to the theory of P.G. Svetlova, during the implantation of a human embryo, there is a critical period. Specify the period of implantation:

A. 1-5 days
B. 7-8 week
C. 1-2 months
D. 7-8 days
E. 10-12 days

4. On the 7th-8th day of embryogenesis, the embryo was implanted in one of the areas of the fallopian tube. What will happen as a result of such a deviation:

A. Normal development of pregnancy
B. Violation of the neurulation process
C. Termination of pregnancy due to rupture of the fallopian tube
D. Violation of the process of histogenesis
E. Crushing disorder

5. On the 7-8th day of embryogenesis, a woman's hormonal background was examined to reveal a decrease in the concentration of hormones in the blood. Name the hormones, the insufficiency of which will make implantation processes impossible:

A. Progesterone
B. Testosterone
C. Adrenalin
D. Estrogen
E. Gonadotropin

6. The implantation process takes place in two stages: adhesion and invasion. The morphological manifestation of the blastocyst adhesion process is:

A. Attachment of the blastocyst to the endometrium
B. Endometrial epithelium destruction
C. Destruction of endometrial connective tissue
D. _ Destruction of endometrial vessels
E. Formation of lacunae

7. The implantation process takes place in two stages: adhesion and invasion. The morphological manifestation of the invasion process is:

A. Attachment of the blastocyst to the endometrium
B. Endometrial epithelium destruction
C. Destruction of endometrial connective tissue
D. _ Destruction of endometrial vessels

E. Formation of lacunae

Individual tasks for students of higher education on the topic:

6. The role of secretion of uterine glands and their hormonal dependence in the implementation of adhesion.
7. Principles of passage and general biological significance of intermolecular and intercellular interactions and their regulation by humoral factors between the blastocyst and the mucous membrane of the uterine body in the adhesion phase.
8. The principles of intermolecular and intercellular interactions and their regulation by humoral factors between the embryo and the mucous membrane of the uterine body in the invasion phase.

List of recommended literature

Main :
Additional:

GUIDELINES
TO THE INDEPENDENT WORK OF STUDENTS OF HIGHER EDUCATION FROM THE ACADEMIC DISCIPLINE

Faculty, second year medical course
Educational discipline of histology, cytology and embryology

With approved:
Meeting of the Department of Histology, Cytology and Embryology
Odessa National Medical University

Protocol No. ___ of "___" _____ 20__

Head of the department
Ph.D., associate professor _____ Tiron O.I.

Developers:

Topic: Neural tube defects. Causes of occurrence, existing means of prevention.

Purpose: The development of the human nervous system is a process that begins in the embryonic period and continues throughout childhood and adolescence.

The nervous system begins to form in the third week of embryonic development from the dorsal part of the ectoderm. Passes through the stages of: neural plate; neural groove; closed neural tube, along the edges of which glial plates are formed;

formation of the spinal cord and brain.

In the process of development, three primary brain vesicles are formed from the anterior part of the neural tube: anterior, middle, and posterior – the three vesicular stages of brain development. At the 5th week of embryonic development, it is clearly visible that the anterior and posterior vesicles are divided by a transverse septum into two more parts - the fifth stage of vesicle development. The first medulla forms the terminal medulla, the second medulla, the third medulla, the fourth medulla (pons and cerebellum), and the fifth medulla oblongata. All parts of the brain are clearly expressed already at 6 months of prenatal development of the fetus. The brain has four cavities called ventricles. They are formed from brain bubbles. Two lateral ventricles are formed in the area of the cerebrum hemispheres, the third ventricle is in the diencephalon, the Sylvian aqueduct passes through the midbrain, and the fourth ventricle is contained in the posterior and medulla oblongata. Spinal and cranial nerves and nerve nodes are formed from glial plates.

Elucidation of the regularities of the main stages of development of the central and peripheral nervous systems, as well as anomalies of their development, is a prerequisite for studying the peculiarities of the course of physiological and pathological processes.

Basic concepts:

Plan

Theoretical questions:

1. Stages of neural tube development.
2. Development, change of position and histological reconstruction of the spinal cord
3. Brain development: sources; the stage of three brain vesicles.
4. Development of the brain: the stage of five cerebral vesicles and their derivatives.
5. Anomalies of brain development.
6. Brain: embryological classification - rhomboid, posterior, middle, forebrain and their derivatives.
7. Neural tube defects.
8. Development of the rhomboid brain.
9. Development of the medulla oblongata.
10. Development of the hindbrain.
11. Development of the cerebellum.

Questions for self-control:

1. When does the nervous system begin to develop?
2. How does the neural tube develop?
3. What and how does it develop from neural crests?
4. Name and describe the stages of brain development?
5. Which develops from the basal, wing-like, dorsal and ventral plates.
6. How are neurons formed in the spinal cord?

7. How is neuroglia formed in the spinal cord?
8. When and how are spinal nerves formed?
9. How does myelination of nerve fibers occur?
10. How does the position of the spinal cord change during embryonic development?
11. What are the malformations of the spinal cord?
12. What are brain malformations?
13. How does the medulla develop?
14. How does the hindbrain develop?
15. How does the cerebellum develop?
16. How does the middle brain develop?
17. How does the midbrain develop?
18. How does the terminal brain develop?
19. What factors are involved in molecular regulation of spinal cord development?
20. What factors are involved in the molecular regulation of brain development?

9. Practical works (tasks) to be performed:

Know the histological structure, cyto- and myeloarchitectonics of the cortex of the hemispheres, the cerebellum, the spinal cord, the structure of the peripheral nerve, spinal ganglia. Determine the principles of the organization of the autonomic nervous system.

10. Test tasks for self-control:

1. How many thickenings form the cranial end of the neural tube in the 4th week?

A. 2
B. WITH
C. 4
D. _ 5
E. 6

2. How many thickenings forms the cranial end of the neural tube in the 5th week?

A. 2
B. WITH
C. 4
D. _ 5
E. 6

Q. From what do the motor cells of the ventral horns of the spinal cord develop?

A. Basal plates of the mantle layer
B. Wing-shaped plates of the mantle layer
C. Ventral plates of the mantle layer
D. _ Basal plates of the marginal layer
E. Wing-shaped plates of the boundary layer

3. From what do the sensitive areas of the dorsal horns of the spinal cord develop?

A. Basal plates of the mantle layer
B. Wing-shaped plates of the mantle layer
C. Ventral plates of the mantle layer
D. _ Basal plates of the marginal layer
E. Wing-shaped plates of the boundary layer

1. What does the rhomboid brain consist of?

A. End and intermediate brain
B. Cerebellum and bridge
C. Oblong and posterior
D. _ Terminal and Cerebellum

2. What does the forebrain consist of?

A. End and intermediate brain
B. Cerebellum and bridge
C. Oblong and posterior
D. Terminal and Cerebellum

7. During the study of biopsy material from a patient with a degenerative disease of the nervous system, cells that developed from the neural crest were studied. Which of the following cells are these?

1. Neurons of the cerebral cortex
2. Neurons of the cerebellum
3. Neurons of the spinal cord
4. Astrocytes
+5. Neurons of the sympathetic ganglion

8. The patient has damaged trophic centers of neurons of the anterior horns of the spinal cord. Which of the following structures can be damaged?

1. Synapse
2. Dendrite
3. Axon
+4. Neuron body
5. Axonal tubercle

9. A tumor of the gray matter of the spinal cord was found in a newborn. What embryonic germ is it connected with?

1. Ependyma
+2. Cloak zone
3. Edge veil
4. Nervous comb
5. A ganglion plate

10 The patient's anterior roots of the spinal cord are damaged as a result of the injury. Specify which structures were affected?

1. Axons of sensory neurons of spinal nodes
+2. Axons of motoneurons and axons of lateral horn neurons

3. Axons of lateral horn neurons
4. Dendrites of neurons of spinal nodes
5. Central processes of sensitive neurons of spinal nodes

Individual tasks for students of higher education on the topic:

Development of the middle brain.
Development of the intermediate brain.
Development of the terminal brain.
Molecular regulation of the spinal cord and brain.
Malformations of the spinal cord and brain.
Development of cranial nerves.
Development of the autonomic nervous system.

List of recommended literature (main, additional, electronic information resources) :

Main :

_____ _____

Continuation of add. 5

Additional:

_____

GUIDELINES
TO THE INDEPENDENT WORK OF STUDENTS OF HIGHER EDUCATION FROM THE ACADEMIC DISCIPLINE

Faculty, second year medical course
Educational discipline of histology, cytology and embryology

With approved:
Meeting of the Department of Histology, Cytology and Embryology
Odessa National Medical University

Protocol No. ___ of "___" _____ 20__

Head of the department
Ph.D., associate professor _____ Tiron O.I.

Developers:

Topic: Congenital malformations of the organs of the female reproductive system. Possible causes and existing means of prevention.

Purpose: The establishment of the reproductive system in the female and male body occurs in the same way - through the indifferent stage and in close contact with the excretory system. The stage of sexual differentiation (dimorphic stage) begins at 7-8 weeks of embryogenesis. Oogenesis begins in parallel with the development of the

ovaries and is closely related to it. Knowledge of these processes is necessary for understanding the structure and functions of the organs of the female reproductive system, diagnosis and treatment of ovarian-menstrual cycle disorders, female infertility, some endocrine diseases, and operative treatment of embryonic development defects.

Basic concepts: _ Anomalies of the female reproductive system

These anomalies can be divided into several groups. Many anomalies of the uterus are due to incomplete fusion of the paramysonephric ducts in the early fetal period. Such defects are usually caused not only by the arrest of development: a bicornuate uterus and two cervixes, for example, are not normally an intermediate stage of development.

Uterine aplasia occurs when the paramesonephric ducts do not develop caudally enough. Uterine hypoplasia, i.e. underdevelopment of the organ, is common.

A unicornuate uterus is formed when the development of one of the paramesonephric ducts is disrupted.

A bicornuate uterus is often called a double uterus and develops when both paramesonephric ducts are preserved. A two-horned unicervical uterus has a similar mechanism of formation. An arcuate uterus is a frequent defect that is the result of an abnormal fusion of the ducts in the body of the uterus.

A septate uterus is characterized by a larger or smaller internal median septum between the confluent paramesonephric ducts.

Endometriosis is the presence of ectopic tissue that has a histological structure (endometrial glands and/or stroma) and the function of the uterine mucosa. The main areas in which ectopic endometrium is detected are: ovaries, uterine ligaments, rectal-vaginal septum, pelvic peritoneum, umbilicus, and surgical scars. Endometriosis centers are under the influence of ovarian hormones and are prone to cyclical changes. The origin of the vice has been debated for a long time, but still no consensus has been reached. The two main theories, which are not mutually exclusive, suggest 1) retrograde implantation (endometrium is pushed through the fallopian tubes and implants anywhere) and 2) serous metaplasia (pathological differentiation of the coelomic epithelium).

Vaginal agenesis is usually accompanied by uterine and urinary abnormalities. Absence or atresia of the vaginal cavity is due to a violation of drainage, which occurs normally in the fertile period. Vaginal septa and vaginal stenosis are formed in the same way.

Plan

11. Theoretical questions:

12. Formation of the primary kidney and Wolffian duct.
13. Indifferent gonads, gonads, primary gonads.
14. Primary germ cells, their migration and transformation into oogonia.
15. Formation of ovaries.
16. Initial stages of oogenesis in the embryonic period.
17.Müller's ducts, formation of fallopian tubes, uterus and vagina.
18. Development of external genitalia.
19. Transformation in the area of the cloaca.

20. Defects in the development of the female reproductive system.

Questions for self-control:

1. Name the germ leaves, show them on the diagram. Which of them participate in the formation of organs of the female reproductive system?
2. What is the source of the development of the Wolffian body, Wolffian and Müllerian ducts?
3. How are indifferent gonads formed?
4. What are primary sex drives?
5. What is the migration path of gonoblasts?
6. What morphological changes occur during the transformation of indifferent gonads into ovaries?
7. What is the mechanism of formation of fallopian tubes, uterus and vagina?
8. Name the components of the rudiment of the external genitalia at the indifferent stage of development and explain their subsequent transformations during development according to the female type.
9. Name the malformations of the female reproductive system.

Approximate tasks for working out the theoretical material :

aplasia occurs when the paramesonephric ducts do not develop caudally enough. Uterine hypoplasia, i.e. underdevelopment of the organ, is common.

A unicornuate uterus is formed when the development of one of the paramesonephric ducts is disrupted.

A bicornuate uterus is often called a double uterus and develops when both paramesonephric ducts are preserved. A two-horned unicervical uterus has a similar mechanism of formation. An arcuate uterus is a frequent defect that is the result of an abnormal fusion of the ducts in the body of the uterus.

A septate uterus is characterized by a larger or smaller internal median septum between the confluent paramesonephric ducts.

Endometriosis is the presence of ectopic tissue that has a histological structure (endometrial glands and/or stroma) and the function of the uterine mucosa. The main areas in which ectopic endometrium is detected are: ovaries, uterine ligaments, rectal-vaginal septum, pelvic peritoneum, umbilicus, and surgical scars. Endometriosis centers are under the influence of ovarian hormones and are prone to cyclical changes. The origin of the vice has been debated for a long time, but still no consensus has been reached. The two main theories, which are not mutually exclusive, suggest 1) retrograde implantation (endometrium is pushed through the fallopian tubes and implants anywhere) and 2) serous metaplasia (pathological differentiation of the coelomic epithelium).

agenesis is usually accompanied by uterine and urinary abnormalities. Absence or atresia of the vaginal cavity is due to a violation of drainage, which occurs normally in the fertile period. Vaginal septa and vaginal stenosis are formed in the same way.

21. Practical works (tasks) to be performed:

22. Identify the primary kidney, Wolffian and Müllerian ducts, genital ridges on the tables and histological preparations.

23. Identify follicular epithelium, primordial follicles and oocytes on histological preparations of the ovary.

24. Determine the structural components of the oocyte and its membranes on electron micrographs.

25. Show on the diagram the ways of migration of gonoblasts into the germ of the gonads.

26. Test tasks for self-control:

1. The primary kidney develops from
A. Segmental legs of the intermediate mesoderm
B. Dermatomes of the dorsal mesoderm
C. Sclerotomes of the dorsal mesoderm
D. Visceral leaf of splanchnotome
E. Parietal sheet of splanchnotome

2. The follicular epithelium of the ovaries is formed from
A. Ventral mesoderm
B. Endoderms
C. Ectoderms
D. Dorsal mesoderm
E. Mesenchyme

3. The ingrowth of the coelomic epithelium into the mesenchyme of the primary kidney has a name
A. Sexual pressure
B. Sex rollers
C. Genital folds
D. Genital tubercles
E. Oviparous balls

4. The epithelium of the uterus is formed from
A. Müller ducts
B. Wolf channels
C. Primary intestine
D. Allantois
E. Prorenal ducts

5. Gonoblasts migrate to the primary gonads with
A. Endoderm of the yolk sac
B. Allantois mesenchyme
C. Skin ectoderm
D. Intestinal endoderm

E. Neural crest

6. In which phase of the ovarian-menstrual cycle is it most active are the uterine glands functioning?
+1. premenstrual phase
2. menstrual phase
3. postmenstrual phase
4. phase of relative rest

7. Endometrial glands in the secretion phase:
1. tubular, narrow, straight, filled with secretion containing glycogen and glycosaminoglycans
+2. tubular, tortuous, with an expanded lumen, filled with a secretion containing glycogen and glycosaminoglycans
3. alveolar, filled with mucous secretion
4. alveolar-tubular, in the apical part of secretory cells - zymogen granules
5. alveolar, filled with protein secretion

27. Individual tasks for students of higher education on the topic:
28. Defects in the development of the female reproductive system.

29. List of recommended literature (main, additional, electronic information resources) :

Main :

_____ _____

Continuation of add. 5

Additional:

_____

GUIDELINES
TO THE INDEPENDENT WORK OF STUDENTS OF HIGHER EDUCATION FROM THE ACADEMIC DISCIPLINE

Faculty, second year medical course
Educational discipline of histology, cytology and embryology

With approved:
Meeting of the Department of Histology, Cytology and Embryology
Odessa National Medical University

Protocol No. ___ of "___" _____ 20__

Head of the department
Ph.D., associate professor _____ Tiron O.I.

Developers:

Topic: Congenital malformations of the organ of vision and inner ear. Causes of occurrence, existing means of prevention.

Purpose: To study and analyze the main stages of development of the organ of vision and the inner ear. Know **the** stages of evolution of the organ of sight and the organ of hearing. Mechanisms of embryonic development of the eyeball, the auxiliary

apparatus of the organ of vision and the human inner ear. Developmental defects.

The main causes of blindness and low vision since childhood are pathology of the optic nerve and retina, congenital eye diseases (cataract, glaucoma, developmental anomalies). Congenital pathology of the organ of vision in students of schools specialized in vision is observed in 88-92% of cases. A special problem of ophthalmo-pediatrics is eye diseases of premature children who are born with incomplete formation of various structures of the eye, in particular the retina. This is the risk of developing such a serious disease as retinopathy of prematurity. Diagnosis of such conditions requires knowledge of embryogenesis and the main stages of development of the organ of vision from an ophthalmologist.

Congenital anomalies of the development of the organ of hearing are often accompanied by varying degrees of impaired hearing function, which leads to speech delay and disability of patients. In 15% of cases, congenital pathology of the outer and middle ear is one of the manifestations of severe hereditary syndromes (Tricher, Pender, Moebius, etc.).

For diagnosis, selection of adequate treatment and prevention of hearing disorders, the doctor needs to know not only the structure, but also the patterns of development of the organ of hearing.

–

Basic concepts: _____ _____ _____

Plan

30. Theoretical questions:

31. Stages of embryogenesis of the human eyeball.

32. Formation of eye vesicles and eye glasses.

33. Differentiation of cells of the lens of the eye. Formation of ten layers of the retina.

34. Formation of the optic nerve.

35. Lens placodes and lens vesicles. Differentiation of cells, formation of lens fibers and lens capsule.

36. Development of the cornea.

37. Sources of development of ciliary muscle and iris muscles.

38. Development of the auxiliary apparatus of the organ of vision.

39. Development of the vitreous body.

40. Anomalies of the embryonic development of the organ of vision.

41. Development of the eye in phylogeny.

1. Sources of development and the main stages of ear development.
2. Development of the external ear, sources, mechanisms.
1. Development of the middle ear, sources, mechanism, stages.
2. Development of the inner ear, sources, mechanisms, stages.
3. Topography of auditory placodes, auditory pits, auditory vesicles.

4. Differentiation of auditory vesicle cells.
5. Causes of congenital hearing impairment. Prevention and methods of correction.
6. Anomalies of the development of the auricle and the external auditory canal.
7. Anomalies of the development of the middle and inner ear.
8. Phylogeny of the organ of hearing and balance.

42.

Tests

6. In which layer of the retina are bipolar neurons located?
+1) Inner nuclear layer
2) Outer nuclear layer
3) Outer mesh layer
4) Inner mesh layer
5) Ganglion layer

7. In which layer of the retina are horizontal neurons located?
1) Inner nuclear layer
2) Outer nuclear layer
3) Outer mesh layer
4) Inner mesh layer
5) Ganglion layer

8. In which layer of the retina are amacrine neurons located?
+1) Inner nuclear layer
2) Outer nuclear layer
3) Outer mesh layer
4) Inner mesh layer
5) Ganglion layer

9. What structures are related to the receptor apparatus of the eye?
1) Retina
2) Cornea
3) Iris
4) Lens
5) Vitreous body

10. What structures belong to the receptor apparatus of the eye?
1) Retina
2) Cornea
3) Iris
4) Lens
5) Vitreous body

1. In the conditional experiment, the auditory placodes were damaged. What parts of the ear will be affected?

A. Epithelium of the membranous labyrinth
B. Auditory ossicles
C. External auditory canal
D. Bone labyrinth
E. Drum membrane

2. It develops from the ventral part of the auditory vesicle
A. curl
B. Semicircular tubules
C. Auditory ossicles
D. Drum cavity
E. External auditory canal

3. The cavity of the middle ear is formed from
A. 1st gill pocket
B. 1st gill arch
C. 1st gill slit
D. 2nd gill pockets
E. Auditory bubble

4. Auditory ossicles develop from
A. 1st and 2nd gill arches
B. 2-nd and 3-joint arches
C. 1st and 2nd gill pockets
D. 1st gill pocket
E. 2nd gill pocket

5. The wall of the bony labyrinth develops from
A. Mesenchyme
B. Auditory placodes
C. Ectoderms
D. Neural tube
E. Nerve crests

6. In experimental animals, the receptor cells of the combs of the ampoules of the semicircular canals of the membranous labyrinth are damaged. Which function is broken?
1) Perception of sound vibrations
2) Perception of the position of the body in relation to the gravitational field
3) Perception of linear acceleration
+4) Perception of angular acceleration
5) Perception of vibration

7. In humans, the perception of stimuli is disturbed, related to the position of the body in relation to the gravitational field. Loss of functions of which cells is possible?
+1) Hair sensory cells of spots
2) Hair sensory cells of ampoules
3) Supporting cell spots
4) Ampoules of supporting cells
5) Hair cells of the spiral organ

Questions for self-control:

1. From what embryonic source are eyeballs formed?
2. What is the structure of the eye glass and what are the ways of differentiation of its cells?
3. How is the beginning of the lens formed?
4. How are lens fibers and lens capsule formed?
5. From what sources are the layers of the cornea formed?
6. How is the optic nerve formed?
7. From what sources and at what time are rod and cone photosensory cells formed?
8. How does the vitreous body develop?
9. What structures of the eyeball develop from mesenchyme?
10. What structures of the eyeball develop from the ectoderm?
11. What is the source of the development of myocytes of the iris and ciliary body?
12. Explain the occurrence of abnormalities in the development of the organ of vision.
13. Explain the evolution of the organ of vision.
14. From what embryonic sources does the outer and middle ear develop and what are the stages of their development?
15. What are the anomalies of the development of the outer and middle ear?
16. What are the sources of inner ear development?
17. Where are the auditory pits and auditory vesicles?
18. Into what parts is the auditory vesicle divided and what is the further differentiation of its cells?
19. How does the mesenchyme differentiate around the membranous labyrinth?
20. What are the possible causes of congenital hearing disorders, methods of their prevention and treatment.
21. How does the organ of hearing and balance develop in phylogeny?
22.

Approximate tasks for working out the theoretical material :

43. Practical works (tasks) to be performed:

44. Recognize the components of the rudiment of the organ of vision on diagrams and

histological preparations.

45. Explain the process of transformation of eyeballs into eyeglasses. Recognize the layers of the lens of the eye and name the ways of their further differentiation.

46. Identify the lens cyst on the preparations and diagrams. Explain the differentiation of its cells with the formation of lens fibers and lens capsule.

47. Determine the mesenchyme in the composition of the embryonic embryo of the eyeball on the preparation and explain what membranes it will form.

48.

49.

50.

51.

52.

53. Test tasks for self-control:

1. Eye blisters are formed:

A. In the 3rd week of embryogenesis
B. On the 4th week of embryogenesis
C. On the 5th week of embryogenesis
D. In the 6th week of embryogenesis
E. In the 7th week of embryogenesis

2. The pigment epithelium of the retina is formed from:

A. The outer layer of the eye glass
B. The inner layer of the eye glass
C. Eyeball
D. Ectoderms
E. Mesenchyme

3. The muscles of the iris are formed from:

A. Edges of the eye glass
B. The inner layer of the eye glass
C. The outer layer of the eye glass
D. Mesenchyme
E. Ectoderms

4. Crystalline fibers are formed from:

A. Ectoderms
B. Edges of the eye glass
C. The inner layer of the eye glass
D. _ The outer layer of the eye glass
E. Mesenchyme

5. The ciliary muscle is formed from:

A. Mesenchyme
B. Edges of the eye glass
C. The inner layer of the eye glass

D. _ The outer layer of the eye glass
E. Ectoderms

8. Receptor cells located in the combs of the ampoules of the semicircular canals of the membranous labyrinth are disturbed by the pathological process in the patient. What are these cells called?
1) Purkinje cells
2) Outer hair cells
3) Inner hair cells
4) Supporting cells
+5) Hair sensory cells

9. The patient has impaired perception of irritations related to the position of the body in relation to the gravitational field. Loss of function of which receptor cells can be allowed?
+1) Hair sensory cells of the macula of the membranous labyrinth
2) Supporting cells of the macula of the membranous labyrinth
3) Hair sensory cells of the combs of the membranous labyrinth.
4) Hair sensory cells of the spiral organ
5) Pillar cells of the spiral organ

54. Individual tasks for students of higher education on the topic:

55. Anomalies of the embryonic development of the organ of vision.

56. Development of the eye in phylogeny.

57. Differentiation of auditory vesicle cells.

58. Causes of congenital hearing impairment. Prevention and methods of correction.

59.

60. List of recommended literature (main, additional, electronic information resources) :

Main :

_____ _____

Continuation of add. 5

Additional:

_____

GUIDELINES
TO THE INDEPENDENT WORK OF STUDENTS OF HIGHER EDUCATION FROM THE ACADEMIC DISCIPLINE

Faculty, second year medical course
Educational discipline of histology, cytology and embryology

With approved:
Meeting of the Department of Histology, Cytology and Embryology
Odessa National Medical University

Protocol No. ___ of "___" _____ 20__

Head of the department
Ph.D., associate professor _____ Tiron O.I.

Developers:

Topic: Congenital malformations of the organs of the respiratory system.

Purpose: The supply of oxygen to the fetus is carried out using the vascular system of the umbilical cord. After the birth of a child, the respiratory system performs the functions of breathing.

The respiratory organs arise as a result of protrusion from the ventral wall of the endodermal tube of the primary intestine. their epithelial lining is thus of endodermal

origin, while all • other components arise from the surrounding mesenchyme of the future mediastinum. The lining of the respiratory organs grows into a more cranially located part of the body cavity, from which the pleural cavity is later formed.

The respiratory system (synonymous with the external breathing system) is a set of organs and anatomical formations that ensure the movement of air from the atmosphere to the pulmonary alveoli and back (respiratory cycles of inhalation - exhalation) and gas exchange between air and blood entering the lungs. The respiratory organs are the lungs and respiratory tract: upper (nose, paranasal sinuses, pharynx) and lower (larynx, trachea, bronchi, including terminal bronchioles). Knowledge of the patterns of embryogenesis of the respiratory system is necessary for the diagnosis and treatment (especially operative) of patients.

Elucidation of the main forms of abnormalities in the development of respiratory pathology is a prerequisite for studying the peculiarities of the course of a number of pathological processes.

Basic concepts: Anomalies of the development of the respiratory system

Defects of the respiratory system occur in most cases in the process of its formation and only occasionally there is a genetic factor in their formation. Some of them have not yet been studied and lead to a fatal outcome.

Abnormalities of the nose

Congenital choanal atresia can be unilateral or

bilateral and is an occlusion of the lower nasal passage, which is rare. It usually develops as a result of the persistence of the nasal membrane, but it is also possible to disrupt the direction of migration of ectomesenchymal cells.

Anomalies of the larynx

Laryngeal atresia refers to incomplete drainage.

One of the forming factors is also incomplete division of the epithelial plate.

Laryngeal membrane - the presence of a covering membrane

language and blocks air access. It may be associated with atresia, but its true origin remains to be determined.

Stenosis of the larynx can be a consequence of thickening of sublingual structures.

Posterior laryngeal or laryngeal-esophageal cleft refers to a defect of the back wall (annular plate) of the larynx and can reach the trachea. It is formed as a result of a violation of the formation of the rostral end of the tracheoesophageal tube

partitions

Anomalies of the trachea

Tracheoesophageal fistula is the most complex abnormality of tracheal development. In addition, the most common developmental defect - esophageal atresia - is combined with tracheoesophageal fistula. All in all, this is the result of a pathological epithelial connection between two separate tubes. Perhaps, in the formation of the defect, a violation of the direction of ectomesenchymal migration is important

cells Esophageal atresias without tracheoesophageal fistulas and tracheoesophageal fistulas without esophageal atresia are less common. Widespread defects caused by abnormalities of the spine, especially the presence of additional vertebrae. Half of affected children often have other abnormalities, such as anorectal malformations and persistent ductus arteriosus. The frequency of tracheoesophageal fistulas is 1:1000 births.

Plan

61. Theoretical questions:

62. Stages of gastrulation in humans.

63. Development of mesenchyme and various parts of the mesoderm and laying of primary organs.

64. Development of the laryngo-tracheo-pulmonary rudiment.

65. Formation of the esophagotracheal membrane.

66. The formation of the lung bud of the embryo and the formation of the bronchial tree.

67. Surfactant: formation, functions.

68. Stages of lung differentiation

69. Lung growth in the postnatal period.

70. The main developmental defects of the respiratory system.

71. Types of cartilaginous and epithelial tissue in the respiratory system.

Questions for self-control:

1. What epithelium lines the respiratory tract?
2. What are the types of cartilage tissue in the respiratory system? '

Q. What are the different airways?

1. What refers to the respiratory department of breathing?
2. How does the laryngo-tracheo-pulmonary embryo develop?

6 How is the esophagotracheal membrane formed?

7. How is the formation of the lung bud of the embryo and the formation of the bronchial tree?
8. At what month of intrauterine development of the fetus is the formation of surfactant?
9. What are the stages of lung differentiation?
10. What changes in lung growth after birth?
11. The main developmental defects of the respiratory system?

Approximate tasks for working out the theoretical material :

— Compile a dictionary of basic concepts on the topic.

72. Practical works (tasks) to be performed:

73. Identify the main phases of gastrulation on microscopic preparations.

74. Determine the morphological beginnings of the primary gut mesenchyme, different departments of the mesoderm on microscopic preparations.

75. Draw diagrams: development of lungs and respiratory system.

76. Test tasks for self-control:

_1. At what age does the formation of respiratory organs end in children?

A. Up to 1 year.

B. Up to 3 years.

C. Up to 7 years.
D. Up to 10 years.
E. Up to 15 years.

2 . At what week of embryonic development does the development of the respiratory system begin?

A. 1 week.
B. 10 weeks.
C. 4 weeks.
D. 22 weeks.
E. 36 weeks.

3. A derivative of which primary organ is the respiratory system?

A. Neural tube
B. Primary intestine.
C. Chords
D. In general
E. Mesoderm.

4. *In* a conditional experiment, the tracheoesophageal membrane was damaged. What pathology will develop in the future?

A. Diaphragmatic hernia.
B. Laryngomalacia
C. Tracheoesophageal fistula
D. Congenital partial emphysema

5. During what weeks does the glandular stage of lung differentiation [1 take place] ?

A. 2-4 week
B. 16-25 week
C. 5-15 week
D. 26-40 week

6. During what weeks does the alveolar stage of lung differentiation [1 take place] ?

A. 2-4 week
B. 16-25 week
C. 5-15 week
D. 26-40 week

7. What is the embryonic source of the development of the epithelium of the nasal cavity? 1. endoderm of the foregut
2. mesenchyme
3. mesoderm
+4. ectoderm of the oral cavity
5. nerve plate

8. What is the embryonic source of development of the larynx and trachea?
1. dorsal surface of the foregut
+2. ventral surface of the foregut
3. caudal part of the foregut
4. mouth bay

5. middle intestine

9. What is the structural and functional unit of the respiratory department of the lungs?
1. alveola
2. bag
+3. acinus
4. alveolar course
5. respiratory bronchiole

10. Tracheal epithelium:
1. single-layer cubic
2. multi-layered flat non-keratinized
+3. many-rowed prismatic ciliated
4. multi-layered flat keratinized
5. single-layer flat

77. Individual tasks for students of higher education on the topic:
78. What changes in lung growth after birth?
79. The main developmental defects of the respiratory system?

80. List of recommended literature (main, additional, electronic information resources) :

Main :

_____ _____

Continuation of add. 5

Additional:

_____

GUIDELINES
TO THE INDEPENDENT WORK OF STUDENTS OF HIGHER EDUCATION FROM THE ACADEMIC DISCIPLINE

Faculty, second year medical course
Educational discipline of histology, cytology and embryology

With approved:
Meeting of the Department of Histology, Cytology and Embryology
Odessa National Medical University

Protocol No. ___ of "___" _____ 20__

Head of the department
Ph.D., associate professor _____ Tiron O.I.

Developers:

Topic: Neurohumoral regulation of the mucociliary apparatus. Surfactant. Properties. Chemical composition

Purpose: The mucociliary system is one of the most important parts of the local protection of the mucous membrane of the respiratory organs against external influences. It provides cleansing of the lungs from pathogenic factors of a physical,

chemical, biological nature and metabolic products.

The mucociliary system is a close relationship of ciliated cells and goblet cells and tubular-alveolar glands of the submucosal base, which produce mucoprotein secretion (mucus). The mucus that covers the epithelium from the nasal cavity to the terminal bronchioles moisturizes the mucous membranes, preventing them from drying out. , mechanical, chemical influences, corpuscular particles, pathogenic microorganisms, and is able to absorb aggressive gaseous impurities.

The speed of mucociliary transport, including, and first of all, depends on the state of the ciliated epithelium - the frequency and nature of the oscillations of its cilia, on the stability of its structure and the synchronicity of the movement of the bronchial wall as a whole, as well as on the amount of mucus and its rheological properties. Thus, mucociliary transport and motor activity of the bronchial wall are interrelated processes that determine the concept of bronchokinetics as a whole. Many mechanisms are involved in the regulation of bronchokinetics, including neuro-reflex ones.

The study of the violation of regulatory systems makes it possible to study not only local, but also systemic reactions of the body, which can become the basis of the diagnosis of diseases of the respiratory organs and contribute to a better understanding of pathogenetic compensatory mechanisms.

Basic concepts:

Complex effective protection of the respiratory tract is carried out with the help of natural mechanisms (aerodynamic filtration, mucociliary transport system, cough) and factors of non-specific and specific anti-infective protection. The coordinated functioning and protection mechanisms allow to ensure the cleaning and drainage function of the respiratory tract, the sterility of the respiratory departments, and the restoration of broken structures and functions of the respiratory system.

The epithelium of the mucous membrane of the upper respiratory tract is one of the main protective barriers. Under the influence of cytokines and products of microbial origin, epithelial cells express adhesion molecules, cytokines and other molecules important for the implementation of immune processes. The mucous membrane of the respiratory tract has local immunity - MALT (Mucosal Associated Lymphoid Tissues). Lymphocytes activated in the lymphoid tissue of the mucous membranes migrate through the regional lymph nodes and return through the thoracic duct and blood stream back to the mucous membranes. Mononuclear and phagocytes, the complement system, interferon (IFN), lysozyme, the concentration of which in the tonsils is 300 times higher than in the blood serum, etc., are involved in the formation of local immunity . The lymphoepithelial complex in the general system of immunocompetent organs takes an active part in the formation of local and systemic immunity, producing antibodies, forming immune memory cells (small lymphocytes with large nuclei that are carriers of encoded information), performs informative, protective, neuroreflex and hematopoietic functions.

The mucus covering the epithelium from the nasal cavity to the terminal bronchioles moisturizes the mucous membranes, protecting them from drying out, mechanical

and chemical influences, corpuscular particles, pathogenic microorganisms, and is able to absorb aggressive gaseous impurities.

The mucociliary system is a close contact between goblet and goblet cells of the ciliated epithelium and tubular-acinous bronchial glands of the submucous layer. Coordination intercellular interaction with soluble secret substances is the most important factor in the effective functioning of the airways and lower airways, lung parenchyma and surfactant system in physiological conditions.

Mucociliary clearance (MCC) (English Clearance - cleaning) is the removal of rhinobronchial secretion, caused by the oscillatory movements of the cilia of the single-layered multi-row ciliated epithelium of the mucous membrane.

Mucociliary transport is the most important mechanism that ensures sanitation of the respiratory tract, one of the main mechanisms of the local defense system and provides the necessary potential of the barrier, immune and cleansing function of the respiratory tract. Cleaning of the respiratory tract from foreign particles and microorganisms occurs due to their deposition on the mucous membranes and subsequent removal together with the mucus.

The composition of the rhinobronchial secretion is of diagnostic and clinical importance, which according to its physical and chemical structure is a multicomponent colloidal solution that ensures the efficiency of mucociliary transport.

The secret should be seen as a constantly updating filter. The upper layer of the secretion is formed mainly due to mucins - a group of highly glycosylated proteins. 5-10% of bronchial mucus consists of neutral and acidic glycoproteins, which determine the viscosity of bronchial secretion, which largely depends on intra- and intermolecular disulfide and hydrogen bonds, the destruction of which leads to a decrease in viscosity. Lipids, which make up 0.3-0.5%, are represented mainly by phospholipids from alveoli and bronchioles.

Secretory immunoglobulins (Ig) are products of transudation of plasma components. IgA exhibits functional activity in the proximal parts of the respiratory tract: it inhibits the adhesion of a number of bacteria to the cells of the respiratory epithelium and prevents massive microbial colonization of the mucous membranes, reducing the risk of developing respiratory infections; takes an active part in the regulation of the immune response; enhances phagocytosis; activates the complement system via an alternative pathway; potentiates the antibacterial effects of lysozyme and lactoferrin; suppresses NK cell activity and antibody-dependent cellular cytotoxicity. An important biological effect of IgA is its ability to prevent viral replication. IgA molecules have the ability to connect with tissue and foreign protein agents, eliminating them from circulation and preventing the formation of autoantibodies.

Immunoglobulins of class G play an important role in the antimicrobial protection of the distal branches of the bronchial tree. The main biological and clinical significance

of IgG is opsonization and interaction with components of the complement system. Opsonization accelerates the process of phagocytosis of microbes when IgG interacts with Fc receptors on the surface of neutrophils, monocytes, macrophages, and natural killers.

The composition of the rhinobronchial secretion includes: lysozyme - breaks down mucopolysaccharides and mucopeptides of the cell wall of most bacteria, works as a mucolytic enzyme, causing a bactericidal effect, and effectively resists fungal invasion; lactoferrin is a protein capable of binding iron ions, making it unavailable for the metabolism of hall and zozolezh bacteria, thus it has a bacteriostatic effect and protects tissues from the harmful effects of hydroxyl radicals; fibronectin prevents adhesion of bacteria; interferons have antiviral activity.

The source of bronchial secretion is bronchial glands, goblet cells , epithelium of terminal bronchioles and alveoli (Fig. 1).

Rheological properties of rhinobronchial secretion. According to the concept of a two-layer secretion, mucus consists of an outer gel-like layer 2 microns thick (gel) and an underlying liquid layer (sol) 2-4 microns thick. Coordinated beating of the cilia (16-17 times per second) promotes the advancement and removal of the secret in the proximal direction.

Eyelashes have a very short relaxation period and transfer their kinetic energy to the outer gel layer. The daily volume of rhinobronchial secretion varies widely, averaging 0.1-0.75 ml/kg of body weight. Due to the normal activity of the mucociliary and transport systems, the bacteria in the secret move at the speed of 10 bronchial mucosa cells in 1 second, which reduces the contact time of the microorganism with the cell to 0.1 second and complicates its attachment to the mucous membrane epithelium. The speed of mucociliary transport in a healthy person ranges from 4 to 20 mm per minute. Normally, from 10 to 100 ml of secretion is transported per day, which, getting into the pharynx, is swallowed or coughed up. Part of the bronchial secretion enters the bronchi from the alveoli. These are mainly surfactant phospholipids synthesized in terminal bronchioles and alveoli.

Surfactant is a complex specialized histological structure. The pulmonary surfactant system consists of more than 80% phospholipids and approximately 10% of four specialized surface proteins: SP - A , SP - B , SP - C , SP - D . Surfactant protein A plays an important role in forming the response of the innate immune system, in surfactant metabolism, regulates its secretion, and protects against bacterial endotoxins, herpes simplex viruses, and influenza. SP - D also refers to the so-called collectins and leads bacteria to opsonization.

The surfactant lines the inner surface of the alveoli, reduces the surface tension in the lungs, stabilizes the alveoli, prevents their collapse at the end of the expiratory phase, promotes adequate gas exchange, which is maintained throughout the respiratory cycle. Violation of the surfactant system leads to the collapse of alveoli, violation of

non-ciliary transport, obstruction of small bronchi and bronchioles, increased viscosity and violation of secretion transport.

Respiratory distress syndrome of newborns (RDS), which occurs in the first hours of a child's life in connection with the development of pneumopathies (primary atelectasis of the lungs, g and alin -membrane disease, edematous-hemorrhagic syndrome), is more common in premature babies and is caused by the immaturity of the lung tissue , insufficient surfactant. The surfactant deficiency is higher, the shorter the gestation period of the newborn. Maternal diabetes, cesarean delivery, male sex, birth of the second of twins, and isoserological incompatibility of the blood of the mother and the fetus also lead to the development of RDS. Insufficient synthesis, changes in biochemical composition and properties, rapid surfactant inactivation lead to a decrease in lung distensibility, which, in combination with the compliance of the chest in premature newborns, leads to the development of hypoventilation and inadequate oxygenation.

RDS quite often occurs against the background of long-term artificial lung ventilation (VLT). As a result of mechanical ventilation, the amount of bronchial secretion and surfactant rapidly decreases, mucociliary clearance changes. Due to the formation of hypoventilation, indicators of the function of external breathing deteriorate, which leads to hypoxia, favorable conditions are created for the development of infectious processes. Inflammation, breathing pure oxygen, tobacco smoke, hypoxia, acidosis, narcosis negatively affect the synthesis and properties of surfactant.

Recent histological data indicate that the Eustachian tube is lined with a layer of phospholipids, similar in structure to pulmonary surfactant and has surface activity. A surfactant-like substance is secreted by the epithelium, released into the lumen of the auditory tube and ONP, can play an important role in aeration and adequate drainage of the cavity of the middle ear and sinuses.

Mechanisms of formation of pathologically changed secretion collectively determine the severity of violations of the drainage function of the bronchi. Often, their pathogenetic value is underestimated by the clinician, which narrows the scope of adequate measures aimed at correcting mucociliary clearance.

Mechanisms of violation of mucociliary clearance. Inflammation is a trigger that leads to a violation of the MCC, deterioration of airway drainage and the occurrence of cough, the development of bronchial obstruction, a decrease in local protective mechanisms, it creates conditions for bacterial infection. At the same time, a vicious circle of interrelated and mutually determining factors of inflammation arises. Penetration of the pathogen into the respiratory tract, its fixation on the surface of the mucous membrane, replication and cytopathic effect on the tissues of the respiratory system lead to desquamation of the epithelium with a sharp filling of the vessels of the microcirculatory channel, increasing their permeability; swelling of the mucous and submucosal layers; the coordination and efficiency of the cilia change. At the same time as ciliary dyskinesia, there is a restructuring of the secretory apparatus -

partial replacement of ivy cells by mucus-forming goblet cells and hyperplasia of the bronchial glands, a change in production modes (mucus hypersecretion).

Diseases of the respiratory organs with impaired secretion are characterized by a decrease in the content of acidic hydrophilic sialomucins - a decrease in the water component and an increase in the content of neutral hydrophobic fucomucins i , which repel water. The secret becomes viscous and thick. Acidic mucins affect the state of the reticular structure of mucus and its ability to hydrate. An increase in mucus production is accompanied by a decrease in the antibacterial and antiviral activity of the secretion due to a decrease in the concentration of secretory IgA, interferon, lactoferrin, and lysozyme. The gel fraction begins to dominate over the ash. This, in turn, contributes to the increased adhesion of pathogenic microorganisms to the mucous membrane of the respiratory tract and creates favorable conditions for microbial colonization. Stagnation of viscous secretion leads to a violation of the ventilation and diffusion function of the lungs, which can be the main cause of respiratory failure. Sputum is a pathologically changed tracheobronchial secretion secreted by expectoration, to which in the nasal part of the pharynx and oral cavity saliva and the secretion of the mucous membrane of the nose and paranasal sinuses are usually mixed, native DNA, F-actin, fragments of rejected cells and bacteria are added. The main source of DNA is the nuclei of neutrophils, as they disintegrate in response to bacterial infection. Rheological studies of sputum showed that the substrate is a strongly structured thixotropic viscous liquid. The viscosity of mucus when the function of the ciliated epithelium is weakened leads to a slowdown in the movement of mucus along the tracheobronchial tree.

In addition, oxidative stress, disruption of surfactant biosynthesis increase the adhesiveness of the secretion to the mucous membrane, which contributes to impaired mucociliary clearance. Mucostasis contributes to the aggravation of chronic bronchopulmonary diseases and the preservation of slowed inflammation in the remission phase, even in the absence of signs of acute respiratory syndrome.

Plan
Theoretical questions:

1. The mucous membrane of the airways. Covering epithelium: its cellular composition, morphology and cell functions.
2. Cellular composition of submucous glands, morphology and functions of cells.
3. Mucociliary apparatus: composition, regulation, role in air conditioning.
4. Physico-chemical properties of rhinobronchial mucus, its functional significance in the processes of local protection of the mucous membrane of the respiratory organs from external influences.
5. Endocrinocytes of the airways: localization, types, role in the regulation of mucus secretion and regulation of the tone of the muscle plate of the mucous

membrane.

6. Mechanisms of nervous and hormonal regulation of the mucociliary apparatus and bronchial tone.

Questions for self-control:

1. What are the protective functions of the respiratory system?
2. What is the cellular composition of the epithelium of the mucous membrane of the airways and what are the structural and functional characteristics of these cells?
3. What is the mucociliary apparatus?
4. What is the function of the mucociliary apparatus?
5. What is the role of sensitive nerve fibers in the development of bronchospasm?
6. What is the role of parasympathetic cholinergic fibers in the regulation of smooth muscle tone and in the secretion of bronchial secretions?
7. What is the effect of sympathetic adrenergic fibers on bronchokinetics?
8. What is the non-adrenergic and non-cholinergic type of bronchial tone regulation? Give examples of mediators of this type of regulation and their effects on bronchial smooth muscle, gland secretion, vascular tone, their permeability, as well as on inflammatory effectors and immunocompetent cells.

Approximate tasks for working out the theoretical material :

The mucociliary system is a close contact between goblet and goblet cells of the ciliated epithelium and tubular-acinous bronchial glands of the submucous layer.

The surfactant lines the inner surface of the alveoli, reduces the surface tension in the lungs, stabilizes the alveoli, prevents their collapse at the end of the expiratory phase, promotes adequate gas exchange, which is maintained throughout the respiratory cycle.

Practical works (tasks) to be performed:

Explain the structure and functions of the main links of the mucociliary system.

To analyze the mechanism of influence of ligands of different chemical nature on the receptors of the covering and glandular epithelium.

To be able to interpret changes in the reactions of epithelial cells of the mucous membrane of the airways depending on the type of activated receptors.

To be able to analyze cellular interaction with soluble substances of mucous secretion in physiological conditions.

To explain the features of regulatory influences on the structural and functional state of the mucociliary apparatus and bronchial tone in the mechanisms of protection of the mucous membrane of the respiratory organs against pathogenic factors of various nature.

Conduct an analysis of scientific literature, demonstrate basic concepts of anatomy, physiology, and biochemistry of cellular reception, apply them in practice.

Be able to determine the structural components of the mucociliary apparatus and bronchial walls at the microscopic and submicroscopic levels.

Solve situational problems related to the structural organization and neurohumoral regulation of the mucociliary apparatus and bronchial tone.

Test tasks for self-control:

81. In the histological preparation of the airways, the covering epithelium contains ciliated and goblet cells that form the mucociliary complex. Specify the function of this complex.

A Air purification from dust particles.
B Secretion of hormones C Warming of the air.
D Air humidification.
E Respiratory.

82. A patient with acute rhinitis showed hyperemia and increased production of mucus in the nasal cavity. The activity of which cells of the epithelium of the mucous membrane is increased?

And Goblet-shaped
In Viichasti
With Microvilli
D Basal
E Endocrine

83. After prolonged inflammation of the mucous membrane of the nasal cavity, changes in the epithelium are observed in the patient. What epithelium has undergone changes?

A Single-layer multi-row
In One-layer flat
C Multilayer flat
D Multilayer cubic
E Multilayer cylindrical

84. On the preparation of one of the departments of the respiratory system, a tubular organ was found, in which a low epithelium, a well-developed muscular membrane, glands and cartilage are absent. Name this body.

A Small bronchi
In Trachea
S. Gortan
D Large bronchi
E Middle bronchi

85. Hyperemia and dryness of the mucous membrane of the nasal cavity were found in a patient with acute rhinitis. What epithelial cells are responsible for mucus secretion?

And goblet-like
In Viichast
C Microvillous
D Basal
E Endocrine

86. A patient with bronchial asthma has an attack of difficulty breathing. In which part of the bronchial tree spasm of muscle cells is noted, which causes the named phenomenon?

And Bronchi of small caliber
In Terminal bronchioles
C Bronchi of medium caliber
D Large-caliber bronchi
E Respiratory bronchioles

7. What cells are not included in the epithelium of the mucous membrane of the trachea?
+1. secretory cells Clara
2. basal
3. ciliated
4. cup-shaped
5. endocrine

8. What cells of the bronchial epithelium perform the function of chemoreceptors?
1. goblet-shaped
2. basal
3. ciliated
+4. cells with a border
5. Secretaries

9. What cells are part of the aerogematic barrier?
1. large epitheliocytes of alveoli
+2. respiratory epitheliocytes
3. secretory cells Clara
4. cells with a border
5. macrophages

10. The epithelium of respiratory bronchioles is:
1. single-layer flat
+2. single-layer cubic
3. multi-layer flat
4. single-layer prismatic
5. multi-row cylindrical

87. Individual tasks for students of higher education on the topic:

88. Physico-chemical properties of rhinobronchial mucus, its functional significance in the processes of local protection of the mucous membrane of the respiratory organs from external influences.

89. Endocrinocytes of the airways: localization, types, role in the regulation of mucus secretion and regulation of the tone of the muscle plate of the mucous membrane.

90. Mechanisms of nervous and hormonal regulation of the mucociliary apparatus and bronchial tone.

91. List of recommended literature (main, additional, electronic information

resources) :

Main :

_____ _____

Continuation of add. 5

Additional:

_____

GUIDELINES
TO THE INDEPENDENT WORK OF STUDENTS OF HIGHER EDUCATION FROM THE ACADEMIC DISCIPLINE

Faculty, second year medical course
Educational discipline of histology, cytology and embryology

With approved:
Meeting of the Department of Histology, Cytology and Embryology
Odessa National Medical University

Protocol No. ___ of "___" _____ 20__

Head of the department
Ph.D., associate professor _____ Tiron O.I.

Developers:

Topic: Congenital malformations of the organs of the urinary system.

Purpose: Defects in the development of the urinary system are quite common, which leads to disability and increased mortality, both in childhood and in adulthood.

Studying the stages of embryogenesis of organs of the urinary system allows you to connect the development process of a specific organ with its structure, and also helps to understand the causes and mechanisms of birth defects of these organs.

Basic concepts:

Anomalies of the development of the urinary system.

The close relationship between the development of the urinary and reproductive systems determines the formation of complex defects, so they are often called defects of the genitourinary system.

Anomalies of the ureter and kidneys.

Agenesis of the kidney is usually the result of a violation of the formation of the kidney embryo. Other possible reasons may be a violation of the formation of the embryo contact with the metanephric blastema, the absence of a blastema, or the regression of the ureter embryo (Fig. 3.2.21). Congenital defects of the genitourinary system, such as renal agenesis, are often combined with defects of the external ear. Bilateral renal agenesis is usually accompanied by decreased amniotic fluid volume (oligohydramnios), a characteristic face with a flattened nose (due to fetal compression) and pulmonary hypoplasia (due to lung compression) (Potter syndrome). In severe cases, non-separation of the rudiments of the lower limbs (simmelia) is observed. With bilateral agenesis of the kidneys, only prenatal existence is possible. Kidney hypoplasia is a decrease in the size of the kidney compared to the norm.

Renal dysplasia is a pathological histological differentiation that leads to the fact that the distal end of the ureter ends in an abnormal area (ectopia). Duplication of the ureter develops from a doubled bud of the ureter or from an additional ureteric growth of the mesonephric duct. In most such cases, both ureters intersect, and the one that leaves the upper pelvis flows into the bladder below. An accessory kidney develops when the double ureteric primordia divide and reach the metanephric mesenchyme.

Ectopia of the kidney is an anomaly associated with a violation of lifting, for example, the kidney of the pelvis. Below, the kidney "rotates" and is accompanied by a large number of vessels. With crossed renal ectopy, it is believed that one of the kidneys "wanders" in the direction of the opposite side, and its ureter crosses the medial plane. Often, ectopic and normal kidneys are combined, that is, they can develop from a common blastema. Although there are many theories of the formation of the defect, none of them has been fully confirmed.

Horseshoe kidney - a kidney that is thought to develop when the kidneys fuse at 5 weeks, when they are close together in the pelvic cavity, or even earlier when nephrogenic cells migrate through the primary streak Abnormalities of "rotation" affect the ball of the ureter, which can be located ventrally, ventromedially, laterally or dorsally. A ventrally rotated kidney reflects the absence of so-called rotation, while dorsally and laterally located ones indicate hyperrotation and reverse rotation.

Persistence of the fruit lobe - external manifestations of the kidney lobes. Defects are due to the following reasons: 1) different terminology; 2) coexistence of liver changes; 3) the variability of the manifestation of the defect in the infant type is autosomal recessive, and the adult type is autosomal dominant. The frequency of anomalies is from 1:3500 to 1:5000. Most of them are probably hereditary and develop at the end of the fruiting period. The theory of a violation of the connection

of nephrons with collecting tubules from the ureteral bud and subsequent cystic enlargement of blind nephrons is no longer considered, since the anomaly develops after the differentiation of metanephros.

Meckel-Gruber syndrome is a fatal autosomal recessive disease characterized by polycystic kidney disease, proliferation of the bile ducts of the liver, brain herniation, and often, polydactyly. It is assumed that the cause of the defect is a defect in the organization of the stroma. Primary damage obviously occurs at the very beginning of the embryonic period, although many manifestations of the syndrome can be secondary.

Nephroblastoma (Wilms tumor) is one of the two most common neoplasms in children. (The other is retinoblastoma.) It is made up of mixed cell types and tissues, including striated muscle tissue, although all arise from the renal blastema, meaning they are only mesodermal in origin. The defect can be combined with aniridia (bilateral absence of the iris). 3.2.23. A child with polycystic kidney disease. Significantly enlarged kidneys of a newborn with small, small cysts.

Abnormalities of the urinary bladder and urethra

Cloacal defects usually lead to the formation of rectovesical or rectourethral fistulas.

Abnormalities of the urachus *develop with regression disorders. The middle* part can remain open, and sometimes even its end cannot be reversed (bladder diverticulum; umbilical sinus). Rarely, the urachus remains open throughout its length.

Ectopy of the ureter opening - its location outside the triangle, for example, in the prostatic urethra or in the female urethra. The majority of cases are the result of a violation of the entry of the urethral and mesonephric ducts. into the bladder.

Ureterocele is a cystic expansion of the lower end of the ureter. It probably develops as a result of a violation of the canalization of the ureteral-bladder connection.

Urethral valves are located near the neck of the bladder and can cause obstruction. The origin of the defect has not yet been established.

Hypospadias are characterized by localization of the urethral opening on the underside of the penis, on the scrotum or on the perineum. Their frequency is from 1:150 to 1:2000. In some cases, the occurrence of defects is associated with chromosomal abnormalities. In severe cases, the defect is usually accompanied by disturbances in the development of the reproductive system. Normally, the opening of the female urethra is hypospadias, but it can be located even deeper. Hypospadias develop when the formation of urethral folds is disturbed or their distal closure is disturbed.

Epispadias - defects characterized by localization of the opening of the urethra on the back of the penis or on the bifurcated clitoris, are rare. In severe cases, the pubic bones are not connected, there is a violation of the continuity of the urinary tract. According to one of the theories, epispadias develops with a caudal displacement of the lateral primordium of the genital tubercle. It is also assumed that the lack of medial fusion of the mesenchyme of the infraumbilical part of the abdominal wall near the genital tubercle can cause a rupture of the phallic part of the urogenital sinus dorsally. Cavernous bodies can approach each other only below this slit.

Bladder ectopy is usually accompanied by epispadias, separation of the pubic bones and eversion of the mucous membrane of the back wall of the bladder. It is most common in male newborns. According to one of the theories, the main cause of

ectopy may be the formation of a paired primordia of the genital tubercle more caudally, which leads to epispadias, and the cephalic stretching of the defect - to the absence of medial fusion of the mesenchyme of the subumbilical part of the abdominal wall. Other investigators believe that an overdeveloped cloacal membrane may delay or impede the movement and fusion of the mesenchyme.

Plan

92. Theoretical questions:

93. Development of the prostate gland, sources, terms and mechanism of development

94. Development of the primary kidney, sources, terms and mechanism of development

95. Development of the final kidney, sources, terms and mechanism of development. Formation of nephrons.

96. Malformations of the kidneys.

Development of the urinary tract, transformation in the area of the cloaca

Questions for self-control:

1. What organs are part of the urinary system?
2. What is the general structure of the organs of the urinary system?
3. What are the main components of a nephron?
4. What stages are distinguished in the process of kidney development?
5. How is the prostate gland formed (age of the embryo, sources of development)?
6. Does the prostate function in the human embryo?
7. What are the sources of primary kidney development?
8. What structures are characteristic of the primary kidney?
9. At what age does the embryo's primary kidney function?
10. What is the embryonic germ of the epithelial components of the final kidney?
11. From which embryonic germ do the epithelial structures of the urinary tract develop?

Approximate tasks for working out the theoretical material :

Renal dysplasia is a pathological histological differentiation that leads to the fact that the distal end of the ureter ends in an abnormal area (ectopia).

Epispadias - defects characterized by localization of the opening of the urethra on the back of the penis or on the bifurcated clitoris, are rare.

Ectopy of the ureter opening - its location outside the triangle, for example, in the prostatic urethra or in the female urethra.

Ureterocele is a cystic expansion of the lower end of the ureter.

Persistence of the fruit lobe - external manifestations of the kidney lobes.

Agenesis of the kidney is usually the result of a violation of the formation of the kidney embryo.

97. Practical works (tasks) to be performed:

98. Schematically draw the main stages of kidney development.

99. Schematically draw the formation of nephrons.

100. Schematically sketch the transformation in the area of the cloaca and the formation of the urinary bladder.

101. Test tasks for self-control:

1. From what embryonic source does the prostate develop?

A. Dorsal mesoderm
B. Segmental legs of the main part of the intermediate mesoderm
C. Segmental legs of the body part of the intermediate mesoderm
D. Metanephrogenic tissue
E. Metanephrogenic diverticulum

2. From which embryonic source does the primary kidney develop?

A. Dorsal mesoderm
B. Segmental legs of the main part of the intermediate mesoderm
C. Segmental legs of the body part of the intermediate mesoderm
D. Metanephrogenic tissue
E. Metanephrogenic diverticulum

3. From what embryonic source does the final kidney develop?

A. Dorsal mesoderm
B. Segmental legs of the main department
C. Segmental legs of the trunk
B. Metanephrogenic tissue and metanephrogenic diverticulum
E. Ventral mesoderm

4. Which part of the germ layer is metanephrogenic tissue?

A. Dorsal mesoderm
B. Intermediate mesoderm
C. Ventral mesoderm
D. Ectoderms
E. Endoderms

5. What is the name of the embryonic rudiment from which collecting renal tubules are formed?

A. Metanephrogenic diverticulum
B. Wolff channel
C. Prorenal duct
D. _ Metanephrogenic tissue
E. Blastema

1. What is the source of nephron development?

A. Ectoderm
B. Endoderm

C. Dorsal mesoderm
D. Intermediate mesoderm
E. Ventral mesoderm

7. What tissue forms the visceral leaf of the capsule of the glomerulus of the renal corpuscle:
1. Juxtaglomerular cells
2. Endotheliocytes
3. Mesangiocytes
+ 4. Single-layer flat epithelium
5. Podocytes
A stain

8. What tissue is formed by the parietal sheet of the capsule of the glomerulus of the renal corpuscle:
1. Multilayered flat epithelium of the epidermal type
2. Single-layer flat epithelium of the angiodermal type
3. Loose fibrous connective tissue
4. Single-layer flat epithelium of the celonephrodermal type
+5. A single-layer cubic epithelium of the celonephrodermal type

9. What is the function of the renal corpuscle:
1. Synthesis and secretion of prostaglandins
9. Obligatory reabsorption of glucose, proteins, active transport of sodium, passive transport of chlorine and water
3. Passive reabsorption of water, secretion of hydrochloric acid
4. Optional reabsorption of electrolytes and water
+ 5. Blood filtration

10. Functions of mesangial cells:
1. Osmoreception
+2. Supportive, regulatory, phagocytic, matrix synthesis
3. Synthesis and secretion of renin
4. Participation in the formation of a filtration barrier
5. Obligatory reabsorption of glucose, proteins, active transport of sodium, passive transport of chlorine and water

102. Individual tasks for students of higher education on the topic:
103. Malformations of the kidneys.
Development of the urinary tract, transformation in the area of the cloaca

104. List of recommended literature (main, additional, electronic information resources) :

Main :

Continuation of add. 5

Additional:

GUIDELINES
TO THE INDEPENDENT WORK OF STUDENTS OF HIGHER EDUCATION FROM THE ACADEMIC DISCIPLINE

Faculty, second year medical course
Educational discipline of histology, cytology and embryology

With approved:
Meeting of the Department of Histology, Cytology and Embryology
Odessa National Medical University

Protocol No. ___ of "___" _____ 20__

Head of the department
Ph.D., associate professor _____ Tiron O.I.

Developers:

Topic: Congenital malformations of the male reproductive system. Possible causes and means of prevention.

Purpose: An important study of the development of the male reproductive system is for hygienists who study the effect of adverse environmental factors on spermatogenesis in order to regulate these substances in the air of the working area, in the soil and water. Knowledge of the age-related features of the formation of the

male reproductive system is also necessary for pediatric and medical doctors.

Basic concepts:

It is known that the development of the male reproductive system takes place in two stages: the indifferent stage and the dimorphic stage. In the indifferent stage of development, the rudiments of the male reproductive system are represented by Wolffian bodies (primary kidney), Wolffian ducts and indifferent gonads.

The development of gonads begins at the 4th week of embryonic development in the form of thickening of the coelomic epithelium from the medioventral surface of the Wolff body (primary kidney), resulting in the appearance of indifferent gonads - genital folds. The coelomic epithelium grows in the direction of the primary kidney. The mesenchyme of the primary kidney divides the entire epithelial layer into separate cords, which were named sexual Valentin-Pflüger cords. In their composition, two types of cells are distinguished: large light cells - actually sex cells (gonocytes) and small cells - cells of the follicular epithelium. The first germ cells - gonocytes appear in the wall of the yolk sac, which is explained by the presence of nutrients. In the future, gonocytes migrate in the direction of the gonads either along the vessels or along the mesenchyme. Later, spermatogonia are formed from gonocytes, and Leydig cells are formed from the follicular epithelium.

In the dimorphic stage, indifferent sexes turn into testes (testes). Genital Valentin-Pflügerian tracts form tortuous seminiferous tubules, which connect with the tubules of the Wolff body (primary kidney) with the help of thin tubules formed from the mesenchyme - Hoffmann tubules. In the future, the Hofmannian ducts turn into direct ducts and testicular meshwork. Ten to twelve tubules of the Wolffian body form seminiferous tubules. The upper part of the Wolffian duct turns into the nadyaechka duct. The lower part of the Wolff duct forms the vas deferens and ejaculatory ducts.

Male external genitalia begin to form in the indifferent stage. Mesenchyme grows near the urogenital plate and a genital tubercle is formed. On the lower surface, it is divided into left and right genital folds. Thickenings are formed around the genital tubercle - genital ridges. Next, the genital tubercle lengthens and turns into a genital organ, the genital rollers into a scrotum. The genital ridges grow and form a genital groove, from which the distal part of the urethra is formed later. Prostate is formed from protrusions of the urethral wall under the influence of fetal testosterone.

The study of the embryonic development of the male reproductive system provides an opportunity to better understand the peculiarities of its structure, functioning and regulation of its activity.

In addition, knowledge of the patterns of embryonic development of the genitals is also important from a practical point of view, since the testicles, being formed in the area of the primary kidney, move into the scrotum under the influence of a number of factors. Violation of this process leads to the development of cryptorchidism (non-descension of both testicles) or monorchism (non-descension of one testicle).

Plan

105. Theoretical questions:

1. Embryonic rudiments from which the male reproductive system develops;
1. Stages of differentiation of the male reproductive system;
2. Features of the course of the indifferent stage of the formation of the male reproductive system;

3. Factors that determine formation in the dimorphic stage of organs of the male reproductive system;
4. The formation of tortuous seminiferous tubules of the testis from Valentin-Pflugerian cords;
5. Formation of straight tubules and ovarian mesh from Hoffmann's tubules;
6. The role of the Wolff body in the formation of the seminiferous tubules of the testis;
7. Formation of the seminiferous and seminal ducts from the Wolffian duct;
8. Formation of additional organs of the male reproductive system;
9. Anomalies of the development of the male reproductive system.

When studying this topic, it is necessary to use the materials of the lecture "Male reproductive system".

Questions for self-control:

1. From what embryonic rudiments does the male reproductive system develop?
2. What are the two stages of differentiation of the male reproductive system?
3. What organs of the male reproductive system are formed in the indifferent stage?
4. What factors determine the formation of organs in the dimorphic stage of the male reproductive system?
5. What structures of the testicle are formed from Valen and n-I Ifflugerian cords?
6. How are the straight tubules and testicular meshwork formed?
7. From which germinal structures are the seminiferous tubules of the testis formed?
8. What are the seven efferent pathways formed from the Wolff duct?
9. How is the prostate gland formed?
10. What abnormalities in the development of the male reproductive system can occur when the testicle is disturbed?

Approximate tasks for working out the theoretical material :

106. Practical works (tasks) to be performed:

1. Identify at the microscopic level the structure of the testicle.

To identify the structural components of the seminiferous convoluted tubule at the microscopic and ultramicroscopic levels.

1. Identification of cells at the micro- and sub-microscopic levels at different stages of spermatogenesis.
2. Determine the structural components of the hematotesticular barrier at the submicroscopic level.

107. Test tasks for self-control:

1. The development of the reproductive system begins after the appearance of

signs of functioning of the urinary organs. Structures of the urinary system are used to develop the reproductive system. What structures of the urinary system are used for the development of the indifferent gonad?

A. Nephrostomes
B. Metanephrogenic diverticulum
C. Elements of pronephros
D. Elements of metanephros
E. Mesenchyme of the primary kidney

2. In the dimorphic stage of the development of the reproductive system of the embryo, the indifferent gonad turns into a testicle, if it develops according to the male type. What is the source of the development of the straight tubules of the testis during the development of the gonad according to the male type?

A. Metanephrogenic diverticulum
B. Endoderm
C. Epithelium of an indifferent gonad
D. Mesenchyme of an indifferent gonad
E. Metanephrogenic tissue

3. In the dimorphic stage of the development of the reproductive system, the indifferent gonad begins to develop according to the female or male type. From what is the connective tissue of the gland formed in the case of the development of an embryo according to the male type?

A. Mesenchyme of the primary kidney
B. Intermediate mesoderm
C. Dorsal mesoderm
D. Endoderm
E. Ectoderm

4. In the dimorphic stage of the development of the reproductive system, the testicle and epididymis are formed, if the embryo develops according to the male type. What is the source of the development of the epididymal duct during the development of the gonad according to the male type?

A. Endoderm
B. Mesenchyme of an indifferent gonad
C. Muller's duct
D. _ Epithelium of an indifferent gonad
E. Wolf's channel

5. On the histological preparation of the testicles, you can see tortuous seminiferous tubules, the epithelium of which develops during embryogenesis from:

A. Sexual attraction
B. Metanephrogenic diverticulum
S. Wolf's Strait
D. _ Mesenchyme of an indifferent gonad
E. Metanephrogenic tissue

6. On the histological preparation of the testis and epididymis, 10-12 seminiferous tubules can be seen, the epithelium of which develops during embryogenesis from:

A. Wolf Channel
B. Wolf's body

C. From Valentyn-Pflugerivsky strings
D. From Hoffmann's tubules
E. From metanephrogenic tissue

7. The epithelium of the epididymal duct contains the following types of cells:
1. Basal and covering
2. Microvillous with stereocilia and basal
3. Basal, ciliated, goblet-shaped
4. Microvillous and goblet-like
5. Basal, spiky and flat

108. Individual tasks for students of higher education on the topic:

1. Cryptorchidism, reasons for its occurrence.
2. Prostate tumors: benign hypertrophy, adenocarcinoma. The causes of ecchymosis, means of prevention.
3. Abnormalities of sexual differentiation

109. List of recommended literature (main, additional, electronic information resources) :

Main :

_____ _____

Continuation of add. 5

Additional:

_____

GUIDELINES
TO THE INDEPENDENT WORK OF STUDENTS OF HIGHER EDUCATION FROM THE ACADEMIC DISCIPLINE

Faculty, second year medical course
Educational discipline of histology, cytology and embryology

With approved:
Meeting of the Department of Histology, Cytology and Embryology
Odessa National Medical University

Protocol No. ___ of "___" _____ 20__

Head of the department
Ph.D., associate professor _____ Tiron O.I.

Developers:

Topic: Congenital cleft lip and palate. Anomalies of teeth development. Causes of occurrence.

Purpose: _____

Basic concepts: _____ _____ _____

Plan

110. Theoretical questions:

_____ _____
_____ _____
_____ _____
_____ _____

Continuation of add. 5

Note. Depending on the complexity and specificity of the educational topic, the availability of modern educational and scientific literature, this section can be presented with different levels of detail (the right to choose the form of displaying the content remains with the department):

The second option: the content of the topic can be presented in the form of theses, which reflect the main information blocks of the topic, its main provisions, concepts, criteria, signs, relationships, interdependence, etc.;

Option II: justified in those cases when students of higher education have the opportunity to use modern literature on the topic and there is no need to explain it in detail in the methodical development, in this case it will be methodologically justified to display the content of the topic in the form of its structural and logical scheme;

Option III: in the absence of a sufficient amount of modern literature on the topic, this section in methodological development can be provided in the form of the text of the topic in an expanded and detailed version;

Option IV: in the presence of relevant literature that details the content of the topic, a specific reference to certain literary sources is quite sufficient.

Questions for self-control:

_____
_____
_____
_____
_____

Approximate tasks for working out the theoretical material :

— Compile a dictionary of basic concepts on the topic.

— Fill out an orientation card for independent training of a higher education seeker using literature on the topic (need to include the orientation card in methodical development is decided by the department staff).

Continuation of add. 5

Main tasks	Instructions	Answers
Learn:		
1. Etiology	Name the main etiological	

	factors...	
2. Clinic	Make a classification of clinical manifestations...	
3. Diagnostics	Give a list of the main diagnostic methods...	
4. Differential diagnosis	Fill in the table of differential diagnosis of the disease...	
5. Treatment	Draw up a typical treatment scheme...	

111. Practical works (tasks) to be performed:

_____

_____

112. Test tasks for self-control:

_____

_____

Note. It is suggested to use test tasks (for those seeking higher education who have to take part in the licensing test exams this year , it is more appropriate to use tests of the "Step" type) and tests compiled by the departments for rector's control.

Continuation of add. 5

113. Individual tasks for students of higher education on the topic:

_____

_____

114. List of recommended literature (main, additional, electronic information resources) :

Main :

_____ _____

Continuation of add. 5

Additional:

_____

GUIDELINES
TO THE INDEPENDENT WORK OF STUDENTS OF HIGHER EDUCATION FROM THE ACADEMIC DISCIPLINE

Faculty, second year medical course
Educational discipline of histology, cytology and embryology

With approved:
Meeting of the Department of Histology, Cytology and Embryology
Odessa National Medical University

Protocol No. ___ of "___" _____ 20__

Head of the department
Ph.D., associate professor _____ Tiron O.I.

Developers:

Topic: Congenital malformations of the cardiovascular system. Possible causes and means of prevention.

Purpose: _____

Basic concepts: _____ _____ _____

Plan

115. Theoretical questions:

_____ _____
_____ _____
_____ _____
_____ _____

Continuation of add. 5

Note. Depending on the complexity and specificity of the educational topic, the availability of modern educational and scientific literature, this section can be presented with different levels of detail (the right to choose the form of displaying the content remains with the department):

The second option: the content of the topic can be presented in the form of theses, which reflect the main information blocks of the topic, its main provisions, concepts, criteria, signs, relationships, interdependence, etc.;

Option II: justified in those cases when students of higher education have the opportunity to use modern literature on the topic and there is no need to explain it in detail in the methodical development, in this case it will be methodologically justified to display the content of the topic in the form of its structural and logical scheme;

Option III: in the absence of a sufficient amount of modern literature on the topic, this section in methodological development can be provided in the form of the text of the topic in an expanded and detailed version;

Option IV: in the presence of relevant literature that details the content of the topic, a specific reference to certain literary sources is quite sufficient.

Questions for self-control:

_____
_____
_____
_____
_____

Approximate tasks for working out the theoretical material :

— Compile a dictionary of basic concepts on the topic.

— Fill out an orientation card for independent training of a higher education seeker using literature on the topic (need to include the orientation card in methodical development is decided by the department staff).

Continuation of add. 5

Main tasks	Instructions	Answers
Learn:		
1. Etiology	Name the main etiological	

	factors...	
2. Clinic	Make a classification of clinical manifestations...	
3. Diagnostics	Give a list of the main diagnostic methods...	
4. Differential diagnosis	Fill in the table of differential diagnosis of the disease...	
5. Treatment	Draw up a typical treatment scheme...	

116. Practical works (tasks) to be performed:

_____

_____

117. Test tasks for self-control:

_____

_____

Note. It is suggested to use test tasks (for those seeking higher education who have to take part in the licensing test exams this year , it is more appropriate to use tests of the "Step" type) and tests compiled by the departments for rector's control.

Continuation of add. 5

118. Individual tasks for students of higher education on the topic:

_____

_____

119. List of recommended literature (main, additional, electronic information resources) :

Main :

_____ _____

Continuation of add. 5

Additional:

_____

GUIDELINES
TO THE INDEPENDENT WORK OF STUDENTS OF HIGHER EDUCATION
FROM THE ACADEMIC DISCIPLINE

Faculty, second year medical course
Educational discipline of histology, cytology and embryology

With approved:
Meeting of the Department of Histology, Cytology and Embryology
Odessa National Medical University

Protocol No. ___ of "___" _____ 20__

Head of the department
Ph.D., associate professor _____ Tiron O.I.

Developers:

Topic: Prenatal diagnosis of congenital malformations.

Purpose: _____

Basic concepts: _____ _____ _____

Plan

120. Theoretical questions:

_____ _____
_____ _____
_____ _____
_____ _____

Continuation of add. 5

Note. Depending on the complexity and specificity of the educational topic, the availability of modern educational and scientific literature, this section can be presented with different levels of detail (the right to choose the form of displaying the content remains with the department):

The second option: the content of the topic can be presented in the form of theses, which reflect the main information blocks of the topic, its main provisions, concepts, criteria, signs, relationships, interdependence, etc.;

Option II: justified in those cases when students of higher education have the opportunity to use modern literature on the topic and there is no need to explain it in detail in the methodical development, in this case it will be methodologically justified to display the content of the topic in the form of its structural and logical scheme;

Option III: in the absence of a sufficient amount of modern literature on the topic, this section in methodological development can be provided in the form of the text of the topic in an expanded and detailed version;

Option IV: in the presence of relevant literature that details the content of the topic, a specific reference to certain literary sources is quite sufficient.

Questions for self-control:

_____
_____
_____
_____
_____

Approximate tasks for working out the theoretical material :

— Compile a dictionary of basic concepts on the topic.

— Fill out an orientation card for independent training of a higher education seeker using literature on the topic (need to include the orientation card in methodical development is decided by the department staff).

Continuation of add. 5

Main tasks	Instructions	Answers
Learn:		
1. Etiology	Name the main etiological factors...	

2. Clinic	Make a classification of clinical manifestations...	
3. Diagnostics	Give a list of the main diagnostic methods...	
4. Differential diagnosis	Fill in the table of differential diagnosis of the disease...	
5. Treatment	Draw up a typical treatment scheme...	

121. Practical works (tasks) to be performed:

_____

_____

122. Test tasks for self-control:

_____

_____

Note. It is suggested to use test tasks (for those seeking higher education who have to take part in the licensing test exams this year , it is more appropriate to use tests of the "Step" type) and tests compiled by the departments for rector's control.

Continuation of add. 5

123. Individual tasks for students of higher education on the topic:

_____

_____

124. List of recommended literature (main, additional, electronic information resources) :

Main :

_____ _____

Continuation of add. 5

Additional:

_____