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MEDICAL FACULTY N 2
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GENERAL NOSOLOGY

METHODICAL INSTRUCTIONS
for practical classes and self-study on Pathophysiology
for 3rd year students
of medical faculty №2, specialty 222 “Medicine”

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Methodological instruction to practical lesson № 1
Module 1. General pathology

Theme: OBJECT AND TASKS OF PATHOPHYSIOLOGY. METODS OF PATHOPHYSIOLOGY RESEARCHES. BASIC STAGES OF DEVELOPMENT OF PATHOPHYSIOLOGY.

Student should know:

- Basic concepts of etiology: causal factors, factors of risk, conditions of origin and development of illness

Student should be able to:

- Analyze the different variants of development of causative-consequence mutual relations in pathogenesis.
- Analyze pathological and adaptative-compensatory phenomena in pathogenesis, local and general, specific and nonspecific.
- Select the leading link of pathogenesis

LIST OF CONTROL QUESTIONS

1. Pathophysiology as a science. Clinical pathophysiology.
2. General study about illness, etiology and pathogenesis.
3. Determination of concept "etiology". A problem of causality in pathologies, modern state of its solving. Modern understanding of causal factors, factors of risk, condition of origin and development of illnesses.
4. Classification of etiologic factors. External and internal etiologic factors. Ecological, genetic, cumulative and ontogenetic conception of origin of human illnesses.
5. Determination of concept "pathogenesis". The pathological (destructive) and adaptative-compensatory (protective) phenomena in pathogenesis. Examples of damage at the different levels: molecular, cellular, tissue, organ, at the level of whole organism.
6. Protective adaptative reactions. Adaptation, compensation. Mechanisms of immediate and long duration adaptation. A role of nervous and humoral factors in their realization.

Pathological physiology is the science that studies general laws of occurrence, development and completion of a disease. Pathophysiology consists of two parts:

1) <u>General pathophysiology</u> – deals with:

- The concept of disease as a philosophical category (nosology);
- The concept of causes and conditions of disease origination (etiology);

- The concept of mechanisms of onset, development, and outcome of disease (pathogenesis);
- Typical pathological process (i.e., inflammation, neoplasia, fever, etc.)

2) Pathophysiology of organs and systems – furnishes information on the general laws of dysfunction of the various systems – blood, circulatory, respiratory, digestive, urinary, endocrine and nervous systems.

Nosology is a science about disease. The main definitions of nosology include health, norm, disease, pathological process, pathological reaction and pathological state.

Health (WHO) is a state of complete physical, mental and social wellbeing, but not only the absence of disease or physical defects. ***Health*** is a state of a body, in which there is correspondence of the structure and function, and ability of the regulatory systems to maintain constancy of the internal environment (homeostasis).

Norm means value of parameters and functions that occurs in population most often (e.g., normal blood pressure, body temperature).

Disease is a complex of qualitatively new reaction of the organism to the action of the pathogenic agent that arises as a result of disturbances in the organism's interaction with the environment and characterized by the disturbances in the regulation of functions and adaptation, reduced capacity for work and socially useful activity.

Periods of disease:

- Latent – from the beginning of the actin or entrance of pathogenic agent to the first clinical manifestations of the disease;
- Prodromal – lasts from appearance of the first signs of the disease to its complete manifestations;
- Period of marked manifestations – usually follows the prodromal period, it is the period of all principle morbid phenomena;
- Outcome – a) recovery; b) transition into a chronic form; c) death.

Pathological reaction is the inadequate in strength or focus, harmful or inappropriate reaction of the organism to the action as well as pathological factors.

Pathological process is the combination of local and general reactions that occur in the body in response to damaging action of the pathogenic factor.

Pathological state is characterized by weak development of the changes in the organism which have arisen as a result of the pathological process.

Typical pathological processes are developed according to the basic patterns, regardless of the localization, species of animals.

Etiology is the study of causes and conditions of the disease development. General and special etiology are distinguished. *General etiology* establishes the general regularities of the origin of *various disease or groups of diseases. Special etiology* studies the causes *of separate disease* (nosologic units).

The cause of a disease is the factor which determines the qualitative, specific features of disease. Other factors involved in the onset of a disease, excepting the

cause, are its conditions. It means, conditions are factors, which modulate the action of cause on the organism. They do not determine the specifity of disease.

Etiological factor is certain pathogenic factor. Classification of etiological factors:

- Exogenous and endogenous;
- Acquired and congenital;
- Physical (mechanical, thermal, electrical, radiation etc.), chemical (toxins, poisons, drug side effects, etc), biological (viruses, microbes, parasites).

Risk factors promote disease development. It may play role of cause, condition or link of pathogenesis.

Pathogenesis is the mechanism of development and consequence of the disease.

Concept of pathogenesis includes the following definitions: cause-and-effect relations, "the main link" and "vicious circle", local and general phenomena in pathogenesis.

Cause-and-effect relations: in course of disease, causes and consequences are constantly followed each other. The cause provokes the certain consequence. This consequence, having abnormal character for the organism, is the cause of other changes which in turn, are the cause of thr following pathogenic effects.

"The main link" of pathogenesis is the process which initiates the development of others. The elimination of "the main link" leads often to the elimination of whole process.

"Vicious circle": the cause (etiologic or pathogenic factor) provokes pathogenic reactions and then these reactions return to the first agent and intensify it.

Local and general phenomena in pathogenesis: pathologic processes are never strictly localized – disease can occur due to general disorders, but be marked only by affecting specific organs and disease can affect only some organs, but produce harmful changes in whole body.

Adaptation means adaptation of organism to conditions of existence with the help of adequate changes of function, metabolism and structure of its organs and systems.

Stage of compensation is such a disease stage, when compensatory reactions prevail, homeostasis and normal vital activity are maintained. Compensatory (defense) reactions are divided into *immediate* (urgent) and *delayed* (non-urgent, which provide long-term adaptation). Immediate protective reactions are a mobilization of physiological hyperfunction mechanisms. Long-term compensation may

be achieved by organ hypertrophy (myocardium pathology). ***Adaptation*** is such a state of compensation, when in spite of constant action of the etiological factor, the ability to work is supported completely. ***Stage of decompensation*** is such a disease stage, when (a) compensatory mechanisms are not adequate, (b) adaptation reserves are depleted, (c) homeostasis alters.

KROK 1_mcqs: *(A is correct answer)*

1 . A patient has undergone an amputation of lower extremity. Some time late painful nodules appeared in a stump. Amputatious neuromas were found out at the microscopic examination. To what pathological processes do those formations relate?

A. Regeneration
B. Dystrophy
C. Inflammation
D. Hyperemia
E. Metaplasia

2. A pneumonia patient has been administered acetylcysteine as a part of complex therapy.
What principle of therapy was taken into consideration when applying this drug?

A. Pathogenetic
B. Symptomatic
C. Etiotropic
D. Antimicrobial
E. Immunomodulatory

Tests for Self-Control

1. A patient has pulmonary tuberculosis and is infected. Koch's bacillus has
been revealed in the mucus. What is the role of Koch's bacillus in disease development? It plays the role of:
A. Condition.
B. Pathogenesis.
C. Main link of pathogenesis.
D. Etiological factor.
E. Genetic factor.

2. The main pharmaceutical agent for radiation disease treatment is the use of antioxidants against active forms of oxygen, which determine the main pathophysiological changes and clinical manifestations. What is the role of active forms of oxygen? They are:
A. Etiological factor.
B. Condition.
C. Main link of pathogenesis.
D. Compensatory reaction.
E. Manifestation.

3. A clinical examination of a 47-year-old man revealed dark-red gums of
the upper jaw, suppuration in the gingival pockets, loosening of the teeth.
Established diagnosis: parodontosis. What period of the disease is it?
A. Preillness.
B. Latent.
C. Period of pronounced manifestations.
D. Prodromal.
E. Outcome.

4. A stomatologist has found some carious teeth in a 32-year-old woman. What is
the proper nosological term to determine this state?
A. Pathological reaction.
B. Pathological process.
C. Remission.
D. Illness.
E. Compensatory reaction.

Recommended literature:

Basic

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4. Porth, Carol. Essentials of pathophysiology: concepts of altered health states /Carol Mattson Porth ; consultants, Kathryn J. Gaspard, Kim A. Noble. —3rd ed. 2011 Wolters Kluwer Health | Lippincott Williams & Wilkins. – 2011. – 1282 p.
5. Robbins Pathology basis of disease / Cotran R.S., Kumar V., Robbins S.L. - 2000.

Methodological instruction to practical lesson №2
Module 1. General pathology

Theme: PATHOGENIC INFLUENCE OF ENVIRONMENT ON THE ORGANISM

Student should know:

- The role of environmental factors in development diseases.
- General laws of mechanisms of pathogenic action of environmental factors on the organism.

Student should be able to:

- Explain mechanisms of pathogenic action of mail physical factors.

LIST OF CONTROL QUESTIONS

1. Pathogenic action of mechanical factors. Laws of development of mechanical trauma, syndrome of long duration squashing, prolonged compression syndrome, traumatic illness.
2. Pathogenic action of thermal factors. Protective, compensatory reactions and actually pathological changes at hyperthermia. Sunstroke. Burns, combustial illness.
3. Hypothermia. Protective, compensatory reactions and pathological changes. Mechanisms of long duration adaptation to cold. Artificial hypothermia, its use in medicine. Local action of low temperatures: frostbites.
4. Pathogenic action of radial energy. Types of ionizing radiation. Radiosensitivity of tissues. Mechanisms of direct and indirect radial damage of biological structures. Radiolysis of water. Radiotoxins. Signs of radiation effects on molecular, cellular, tissue, organ and system levels.
5. Pathogenesis of radiation illness, its basic forms and syndromes. The nearest and remote consequences of large and small doses of ionizing radiation. Its stochastic and not stochastic effects. Natural mechanisms of antiradiation defence. Pathophysiological bases of radioprotection.
6. Pathogenic effect of electric current. Factors that determine the nature of injuries.

Environmental diseases include those caused by exposure to harmful substances in the environment, in a sense that it encompasses all nutritional, infectious, chemical and physical in origin. Environmental diseases are surprisingly common. They can originate from occupational exposures, polluted ambient air, chemicals taken to the body through the lung or GIT for several reasons, or from noxious physical agents that come in contact to the body.

MECHANICAL TRAUMA

Etiology. Etiological factors of the mechanical trauma are solid (rigid) or shock wave, which affects locally and causes ruptures, contusions, fractures, or crushing of tissues. An important condition that determines severity of the mechanical injury is its localization and presence of concomitant injuries (blood loss, damage of the nerve trunks, etc.).

Pathogenesis. The pain is often the leading link of pathogenesis of local injury. In the place of injury the inflammation occurs. General disorders for their importance may prevail over local and are manifested by the traumatic or hypovolemic shock, the syndrome of prolonged crushing.

THERMAL TRAUMA

Etiology. The thermal trauma is caused by the action of environment with changed temperature settings on the body (comfort temperature for a person is 18 °C). This injury is manifested by a number of pathological conditions with different etiology and pathogenesis.

The thermal factors (cold, heat) in the case of excessive exposure may be the etiological factor of damaging and cause pathological processes such as cooling, overheating, heat stroke, frostbite, bum, and shock. Thus an important condition, which determines the thermal injury course, is the general or local nature of the effect of the etiological factor.

Pathogenesis of the thermal injury is due to the complex of pathological disorders and compensatory reactions, which are the strain of physical and chemical thermoregulation (heat loss and heat production). In pathogenesis there are two stages: the stage of compensation and the stage of decompensation. In the compensation stage the adaptive reactions prevail, and homeostasis is not disturbed (the body temperature is at the original level). The stage of decompensation occurs, if protective reactions are exhausted, homeostasis is disturbed, and the body temperature is changed (decreased or increased).

The overall effect of low temperature may cause a decrease in the body temperature and develop **hypothermia (cooling)**.

In the compensation stage the body temperature is at the original level. The defense of the body is to limit the heat transfer (‘physical regulation’) by reducing sweating (perspiration), reduced thermal conductivity and thermal radiation (due to vasoconstriction of the skin) and additional insulation (by wool in animals, and clothing in people). In the case of more intense cold effect in the tissues, on which it acts directly, there is a kind of vascular reaction (‘game of vessels’), when at the same time blanching of the skin and its redness are observed (the arterial hyperemia prevents frostbite).

In the case of insufficiency of ‘physical regulation’ the ‘chemical thermoregulation’ joins; it is aimed at increasing of heat production. So, there is the increased metabolism and breakdown of glycogen in the liver and muscles, the

increased level of glucose in the blood and oxygen consumption; the systems of transport of oxygen to the tissues are more intense. Metabolism is not only increased, but it's rebuilt. Additional thermal energy is formed by the uncoupling of oxidation and phosphorylation. In the body adapted to cold the capacity of the mitochondrial system increases and the activity of enzymes lb. of the tricarboxylic acid cycle (TAC) and breathing apparatus also increases. This restructuring of thermoregulation is controlled by the neurohumoral mechanisms.

In the case of the prolonged or intense exposure to cold, the thermoregulatory mechanisms are depleted, the body temperature decreases, and the second stage of hypothermia comes — **the stage of decompensation**. During this period, there is not only the decrease of the body temperature, but also the intensity of metabolic processes and oxygen consumption; the vital functions are inhibited. The respiratory and hemodynamic violations cause oxygen starvation (hypoxia), inhibition of the central nervous system, and decrease of immunological reactivity.

The local effect of low temperature causes ***the frostbite***, in the pathogenesis of which the leading role is played by violation of local circulation due to spasm and paresis of the peripheral vessels, platelet formation, and direct damaging effect of low temperature on the colloidal system of the cytoplasm. If the frostbite is accompanied by infection, the last one on the background of circulatory disorders and decrease of immunological reactivity is very severe (it's like the sepsis).

The overall effect of high temperature is observed in the production conditions or in hot climate (weather). If the balance between heat production in the body and return it to the environment is disturbed, the hyperthermia (overheating) develops.

The adaptation is to strengthen the heat transfer by the expansion of the skin vessels (increasing of the heat conduction and heat irradiation) and increased sweating (increased evaporation). It provides the phase of compensation. In the case of the significant increase in the air temperature, the heat irradiation becomes difficult, and when the air temperature is 33°C (which corresponds to the temperature of the exposed areas of the skin) the heat irradiation is blocked. The possibility of the vascular response is exhausted, and it becomes ineffective.

The sunstroke by its clinical picture resembles the heat stroke (the fever, excitement and depression of the nervous system, blood circulation and respiration), however, their etiology and pathogenesis are different. The etiological factor of the sunstroke is the sun rays, which affect the bareheaded person. In this case, unlike the heat stroke, the disease process does not stop, but begins with violation of the nervous activity (the hyperemia and swelling of the meninges develop) and the body temperature rises as a result.

The local effect of high temperature leads to the *burn (combustion)* and is manifested by the local destructive and reactive changes. For their severity there are four degrees of the bums:

- The skin redness (erythema), mild inflammatory reaction without compromising the integrity of the skin;
- The acute exudative inflammation of the skin, blistering with detachment of the epidermis;
- The partial skin necrosis and ulceration;
- The charring of the tissues, necrosis of the skin, and of the tissues located deeper.

But it would be wrong to consider the bum only as a local phenomenon. Very often the risk of common violations exceeds the value of local. It's spoken about the burn disease.

The clinical course of the burn disease includes the following stages: the burn shock, burn toxemia, burn infection, burn exhaustion, and convalescence (or death).

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BAROTRAUMA

Barotrauma is caused by the pathogenic effect of modified atmospheric pressure on an organism.

Etiology and Pathogenesis. The level of atmospheric pressure, as it's known, affects some physical properties of gases and liquids of the organism (volume of gases in the body cavities, their solubility in the blood, the boiling point of the liquid, etc.). The pathogenesis of barotrauma depends on atmospheric pressure changes (decreasing or increasing). There are the compensation stage and stage of decompensation.

The effect of low atmospheric pressure people feel at height (in the mountains, on the nonhermetic aircraft, etc.). The pathological changes occurring in such condition are caused by two factors: low partial pressure of oxygen ($p0_2$) in the inspired air, which leads to the **hypoxic hypoxia** and decreased atmospheric pressure, accompanied by the complex symptoms, the syndrome of decompression. The gases contained in body cavities are expanded and the person feels the pain in the ears and frontal sinuses, joints, and abdomen (high altitude flatulence). The nosebleed is possible as a result of dilation and rupture of the small blood vessels. In liquid medium the solubility of gases decreases and they are in the form of bubbles enter the tissues and blood (gas embolism).

The effect of high atmospheric pressure people feel, when they are immersed in water to a considerable depth during diving and caisson works. As a result, the pain occurs in the ears because of pressure on the eardrums; with a sharp and quick dip the injury of the pulmonary alveoli is possible. However, a greater role is played by the fact that in the hyperbaric condition people should breathe the air or gas mixtures under high pressure, resulting in additional quantity of gas dissolved in the blood and tissues (saturation).

To prevent the toxic effects of oxygen during respiration in conditions of high pressure the underwater devices are filled with mixtures of low oxygen

content, and nitrogen is replaced by helium. For example, when diving to a depth of 100m, the oxygen content in the gas mixture should be not more than 2 %.

While a person returning from depth to the normal atmospheric pressure (decompression) t**he pre-breathing (desaturation)** occurs — an excessive quantity of dissolved gas is released through the blood and lungs.

RADIATION INJURY

The radiation injury is caused by the pathogenic effect of ionizing radiation on an organism; it has the property to penetrate into organs and tissues ionizing atoms and molecules.

Etiology. Etiological factor of the radiation injury is the ionizing radiation, which by its nature is divided into the electromagnetic wave (x-ray and y-rays) and corpuscular (a- and p-particles, neutron radiation, etc.). Their common feature is the ability to penetrate into the environment, to be absorbed by it, and to ionize atoms and molecules.

The character and extent of the radiation damage depend on the type of the ionizing radiation, doses, and conditions of the radiation exposure.

The ability to penetrate the body depends on the presence or absence of the charge of the ionizing radiation. Thus, the greatest permeability have neutrons, x-rays and y-rays, they have no charge; and the smallest a- and p-rays; these are the rays, which have a charge and are inhibited during interaction with the charged protein molecules.

An important **condition** that significantly modifies the type and extent of the radiation damage is the pathway to exposure of the ionizing radiation (distant, contact, inhaled, or oral). There is the **external radiation**, when its source is located outside the body, and **internal (incorporated) radiation**, which takes place, when radioactive substances got into the body.

The primary physical-chemical processes are the initial link of pathogenesis. They consist of radiochemical transformation of atoms and molecules, their ionization and excitation, because the kinetic energy of the ionizing radiation exceeds the energy of the intramolecular relations. The chemical transformation of substances under the action of ionizing radiation with the formation of active intermediate products is called radiolysis.

The biochemical disorders mean the damaging of biological macromolecules as a result of the direct effect of energy of the ionizing radiation, and because of the attacks of their active oxygen radicals. In such condition also radicals are produced; these radicals have free electrons, and that's why they are very reactive.

Disorder of the Biological Processes in the Cells. Any cellular structure can be the target for radiation energy and also the target for active oxidizers, radio toxins, and activated enzymes.

With the help of microscopes they detect signs of radiation lesions of the nucleus (swelling, pyknosis, lysis) and chromosome mutations (breaks, deletion,

fragmentation), which, together with gene mutations, cause disorders of **the hereditary properties of the cell**, inhibition of synthesis of DNA and proteins. Damage of the nucleus is caused not only by the direct action of ionizing radiation on DNA molecules and chromosome structure, but also by violations of other organelles that occur like a vicious circle.

Disorder of the Biological Processes at the Tissue Level. In spite of the fact that radio sensitivity of the nucleus is not higher than that in other organoids, its damage is more evidently manifested in the vital activity of cells. The highest radio sensitivity is in the tissue with high rate of cell division. First of all these are the hematopoietic and lymphoid tissues, in which the process of cell division is constant. Next to them there is the epithelial tissue (especially the glandular epithelium of the digestive and sex glands), then the covering epithelium of the mucous membranes and skin, and vascular endothelium. The fibrous, cartilaginous, osseous, muscular and nervous tissues are less radiosensitive.

Disorders of the Biological Processes in the Whole Organism and Main Pathophysiological Syndromes:

Hematologic Syndrome - It is characterized by changes in the structure of the hematopoietic tissue, progressive atrophy of the bone marrow, lymphatic glands, and spleen and is accompanied by changes in the peripheral blood.

Vascular Syndrome - The blood vessels (especially smaller) are seriously damaged in radiation. The mechanisms of such damage are as follows:

• The direct effect of radiation on the vascular endothelium;
• The endothelial damage by oxidizers (water radiolysis products) and radio toxins;
• Violation of the vessel trophicity as a result of deficiency of platelets;
• Loss of endothelial ability to produce polysaccharide-protein complexes for constructing basal membranes;
• Destructive changes of the perivascular tissue that gives mechanical support of vessels
• Release of BAS, which are lysosomal proteolytic enzymes, kinins, hyaluronidase, that increases the damage of the vascular wall;
• The tone and resistance of the vessels, as well as the permeability and exchange of substances between blood and tissues, are disturbed.

Hemorrhage Syndrome - The hemorrhage syndrome is the typical manifestation of radiation damage in the form of minor and major hemorrhages into the skin, mucous membranes, and internal organs, bleeding from the nose, intestines, and urethra. In pathogenesis of this syndrome the thrombocytopenia, damage of the vascular walls and activation of fibrinolysis are important.

The Immunodepresive Syndrome - It is manifested by decrease in the activity of phagocytosis and inhibition of the antibody productions, so infectious inflammatory process is the earhest and severest complication of radiation.

Gastrointestinal Syndrome - The gastrointestinal syndrome is a complex of symptoms of the digestive tract, which leads to disruption of digestion and development of intoxication.

Neurocerebral Syndrome - The neurocerebral syndrome confirms the high sensitivity of the nervous system to the ionizing radiation.

Endocrine Violation Syndrome - It develops as a result of the direct and indirect damage of the endocrine gland epithelium.

ELECTROTRAUMA

Etiology. Damage of the body by electric current depends on its physical parameters: force (amperage), voltage, character of effect, frequency of the alternating current, and resistance of the medium. Another important factor is that the electric properties of the tissue resistance in the organism are heterogeneous: the fluids are good conductors, and the epidermis has a high resistance. Also an important condition that determines the damaging effects of electric current is the pathway of its going through the body.

Pathogenesis. The body's response to the electric current is based on the primary changes in the tissues, through which the current passed, resulting in the transformation of electric energy into other forms of energy — thermal, mechanical, and electrochemical. In a biological medium electric current polarizes atoms and molecules, changes the spatial orientation of the charged particles and enhances their motion: the electrical energy is converted into heat that increases with the resilience of the environment. Violation of the integrity of tissues (ruptures and even bone fractures) is manifestation of the mechanical effect of the current.

For people the most dangerous is the passage of electric current through the heart muscle, which is the most sensitive to its effects in a state of refractoriness. Electrolysis in the cardiac syncytium may shorten the refractor phase and change the heart rhythm. The ventricular heart fibrillation developing under such condition is fatal and does not pass spontaneously (in some animals it is reversed). Disturbances of the heart rhythm (the tachycardia, bradycardia, extrasystole, and blockade) can occur in cases, when the electric current through the heart doesn't pass, and is the result of reflex disorders of the coronary circulation or increased tone of the vagus nerve.

The sudden respiratory impairment or arrest may be caused by the electrotrauma due to the central mechanisms (paralysis of the respiratory center, respiratory arrest after the passage of the current through the transbulbular loop) and peripheral mechanisms (reflex dysfunction of the respiratory center due to the irritation of sensitive nerves and intero-receptors). The spasm of the vertebral vessels (that carry blood to the respiratory center), or laryngospasm, or tetanic contraction of the respiratory muscles also significantly make breathing (acute electric asphyxia) more difficult.

KROK 1_mcqs: *(A is correct answer)*

1.A 5-year-old child who often fells ill with respiratory diseases has eczematous appearances after consumption of some food products, tendency to prolonged course of inflammatory processes. What kind of diathesis can be suspected in this case?

A. Exudative-catharral
B. Hemmorhagic
C. Arthritism
D. Lymphohypoplastic
E. Asthenic

2.Objective examination of a patient revealed: slender figure, big skull, highly developed frontal region of face, short extremities. What constitutional type is it characteristic for?

A. Respiratory
B. Muscular
C. Digestive
D. Cerebral
E. Mixed

3.Examination of a patient revealed a strong, balanced, inert type of higher nervous activity according to Pavlov. What temperament type does the patient have (according to Hippocrates classification)?

A. Phlegmatic
B. Sanguine
C. Choleric
D. Melancholic
E. -

4.The patient has come to the hospital from the smelting workshop in the condition of hyperthermia. What is the direct cause of loss of consciousness at the heatstroke?

A. Decreased brain blood supply
B. Arterial pressure drop
C. Increased water loss through sweating
D. Decrease of heart output
E. Dilatation of peripheral vessels

5.The preventive radioprotector was given to a worker of a nuclear power station. What mechanism from the below mentioned is considered to be the main mechanism of radioprotection?

A. Inhibition of free radicals formation
B. Prevention of tissue's hypoxia
C. Activation of oxidation reactions
D. Increasing of tissue blood supply
E. Increasing of respiration

6.A damage of the atomic power plant reactor resulted in the run out of radioelements. People in the superstandard radiation zone were radiated with approximately 250-300 r. and were immediately hospitalized. What changes in the blood count would be typical?

A. Lymphopenia
B. Leukopenia
C. Anemia
D. Thrombopenia
E. Neutropenia

7.Having helped to eliminate consequences of a failure at a nuclear power plant, a worker got an irradiation doze of 500 roentgen. He complains of headache, nausea, dizziness. What changes in leukocytes quantity can be expected 10 hours after irradiation?

A. Neutrophilic leukocytosis
B. Lymphocytosis
C. Leukopenia

D. Agranulocytosis
E. Leukemia

8.A teenager was irradiated with high radiation dose that resulted in serious damages of lymphoid system, lysis of many lymphocytes. Restoration of normal hemogram is possible due to the functioning of the following gland:
A. Thymus
B. Thyroid
C. Liver
D. Pancreas
E. Adrenal

9.A patient who had been working hard under conditions of elevated temperature of the environment, has now a changed quantity of blood plasma proteins. What phenomenon is the case?
A. Relative hyperproteinemia
B. Absolute hyperproteinemia
C. Absolute hypoproteinemia
D. Disproteinemia
E. Paraproteinemia

10.Continuous taking of some drugs foregoing the pregnancy increase the risk of giving birth to a child with genetic defects. What is this effect called?
A. Mutagenic effect
B. Embryotoxic effect
C. Teratogenic effect
D. Fetotoxical effect
E. Blastomogenic effect

11.A woman who was infected with toxoplasmosis during the pregnancy has a child with multiple congenital defects.Thisis a result of:
A. Teratogenesis
B. Cancerogenesis
C. Biological mutogenesis
D. Chemical mutogenesis
E. Recombination

12.A human body cools in water much faster that in the air. What way of heat emission in water is much more efficient?
A. Heat conduction
B. Convection
C. Heat radiation
D. Sweat evaporation
E. -

13.A patient with massive burns developed acute renal insufficiency characterized by a significant and rapid deceleration of glomerular filtration. What is the mechanism of its development?
A. Reduction of renal blood flow
B. Renal artery embolism
C. Rise of pressure of tubular fluid
D. Reduction of functioning nephron number
E. Damage of glomerular filter

14.Following exposure to radiation a lot of mutant cells appeared in a patient. Some time later most of them were detected and destroyed by the following cells of the immune system
A. T-lymphocytes-killers
B. T-lymphocytes-supressors
C. B-lymphocyte
D. Plasmoblasts
E. Stem cells

15.A disaster fighter at a nuclear power plant developed hemorrhagic syndrome on the background of acute radiation disease. What is the most important factor of syndrome pathogenesis?
A. Thrombocytopenia
B. Vascular wall damage
C. Increased activity of fibrinolysis factors
D. Increased activity of anticoagulative system factors

E. Decreased activity of coagulative factors

16.A patient with extensive burns of torso skin exhibits signs of severe intoxication. What stage of the burn disease is this typical for?

A. Burn toxemia
B. Burn shock
C. Burn infection
D. Burn emaciation
E. Terminal

17.At the end of the working day a worker of a hot work shop has been delivered to a hospital. The patient complains of a headache, dizziness, nausea, general weakness. Objectively: the patient is conscious, his skin is hyperemic, dry, hot to the touch. Heart rate is of 130/min. Respiration is rapid, superficial. What disorder of thermoregulation is most likely to have occurred in this patient?

A. Reduced heat transfer
B. Increased heat transfer and reduced heat production
C. Increased heat transfer and heat production
D. Increased heat production with no changes to the heat transfer
E. Reduced heat production with no changes to the heat transfer

18.An experiment proved that UV irradiated skin cells of patients with xeroderma pigmentosum restore the native structure of DNA slower than the cells of healthy people due to the defect in repair enzyme. What enzyme takes part in this process?

A. Endonuclease
B. RNA ligase
C. Primase
D. DNA polymerase
E. DNA gyrase

19.A patient with acne has been prescribed doxycycline hydrochloride.What recommendations should be given to the patient, while he is taking this drug?

A. Avoid long stay in the sun
B. Take with large quantity of liquid, preferably milk
C. Take before meal
D. The course of treatment should not exceed 1 day
E. Do not take with vitamins

20.A child is pale, pastose, muscular tissue is bad developed, lymph nodes are enlarged. He often suffers from angina and pharyngitis, blood has signs of lymphocytosis. The child is also predisposed to autoallergic diseases. What type of diathesis can be presumed in this case?

A. Lymphohypoplastic
B. Exudative
C. Gouty
D. Asthenic
E. Hemorrhagic

21.A 25 year old man has spent a long time in the sun under high air humidity. As a result of it his body temperature rose up to 39^{o}C. What pathological process is it?

A. Hyperthermia
B. Infectious fever
C. Hypothermia
D. Noninfectious fever
E. Burn disease

22.Autopsy of a man, who served on a nuclear submarine, revealed the following pathologies: bone marrow atrophy (panmyelophthisis), anemia, leukopenia, thrombocytopenia, lymphocytes disintegration in the lymph nodes, spleen, gastrointestinal lymphatic system, and hemorrhages

into the adrenal glands. What disease had developed in this case?

A. Acute radiation sickness
B. Decompression sickness
C. Acute leukemia
D. Acute anemia
E. Vibration disease

23.A man has been working for a long time in oil processing. What type of carcinogens does he encounter at his workplace?
A. Polycyclic aromatic hydrocarbons
B. Amino-azo compounds
C. Nitrosamines
D. Biological carcinogens
E. Amines

Tests and a Task for Self-Control

1. A man, who worked in a thick uniform in summer, manifested body temperature rise, dyspnea, tachycardia, dizziness, cramps. Then he lost consciousness. What is the cause of this serious state?
A. Decreased heat production.
B. Intensified heat production.
C. Intensified heat emission.
D. Decreased heat emission.
E. Heat emission equals heat production.

2. Low temperature stimulates activity of the thermoregulation mechanisms. What mechanism most efficiently limits heat emission?
A. Bradypnea.
B. Dermal vessel contraction (angiospasm).
C. Bradycardia.
D. Vasodilatation of the skin.
E. Increased sweating.

3. During liquidation of Chornobyl catastrophe consequences, a worker received a radiation dose of 5 Gr. He complains of headache, nausea, dizziness. What kind of changes of the leukocyte formula will take place in 10 h?
A. Eosinophilia.
B. Lymphocytosis.
C. Leukopenia.
D. Agranulocytosis.
E. Neutrophilia.

4. A man was admitted to the hospital in 3 days after exposure to an ionizing radiation dose of 3 Gr. What physiological system is damaged most of all in such a case?
A. Digestive.
B. Cardiovascular.
C. Nervous.
D. Blood.
E. Endocrine.

5. As a result of an accident at a nuclear power station a worker received a dose of ionizing radiation of 4 Gr. What changes in the blood of the victim are observed on the first day?
A. Thrombocytopenia.
B. Leukopenia.
C. Anemia.
D. Lymphopenia.
E. Neutropenia.

6. After diving at a depth of 60 m, a diver developed such symptoms of CNS dysfunction: excitement, euphoria, attention deficit, making professional mistakes. Which substance caused this toxic influence on the neurons?
A. Lactic acid.
B. Oxygen.
C. Carbon dioxide.

D. Ammonia.
E. Nitrogen.
7. While climbing a mountain for several days at an altitude of 3,500 m a mountainclimber had tachypnea, tachycardia, headache and dizziness. What are these symptoms caused by?
A. Decrease of barometric air pressure.
B. Decrease of the fractional pressure of oxygen in the air.
C. Hypoventilation.
D. Gas embolism.
E. Decrease of atmospheric temperature.
8. As a result of rapid ascent a diver developed convulsions and unconsciousness.
What is the basic pathogenic mechanism of such symptoms?
A. Hypercapnia.
B. Hypoxia.
C. Toxic effect of oxygen.
D. Toxic effect of nitrogen.
E. Gas embolism.
9. A diver worked at a depth of 40 m for a long time. During decompression he developed caisson disease. What kind of embolism is its underlying cause?
A. Histic.
B. Air.
C. Fatty.
D. Thromboembolism.
E. Gas.
10. An electrician casually touched a bared electricity cable with both hands and died. What was the cause of death?
A. Sinus bradycardia.
B. Sinus tachycardia.
C. Fibrillation of the heart.
D. Complete heart blockade.
E. Cardiac tamponade.

Recommended literature:

Basic:

1. Simeonova N.K. Pathophysiology/ N.Simeonova.// Kyiv, Ukraine. – 2010. – 21-40pp.
2. Krishtal N.V. Pathophysiology: textbook/ N.Krishtal et al.// Kyiv: AUS Medicine Publishing, 2017. - 41-56pp.
3. Lecture Notes For Health Science Students. General Pathology// Mesele Bezabeh, Abiye Tesfaye, Bahiru Ergicho, Mengistu Erke, Seyoum Mengistu, Alemayehu Bedane, Abiyot Desta/ Jimma University, Gondar University Haramaya University, Dedub University. – 2004. – 231-250pp.

Additional:

4. Porth, Carol. Essentials of pathophysiology: concepts of altered health states /Carol Mattson Porth ; consultants, Kathryn J. Gaspard, Kim A. Noble. — 3rd ed. 2011 Wolters Kluwer Health | Lippincott Williams & Wilkins. – 2011. – 1282 p.
5. Robbins Pathology basis of disease / Cotran R.S., Kumar V., Robbins S.L. - 2000.

Methodological instruction to practical lesson № 3
Module 1. General pathology

Theme: A ROLE OF HEREDITY, CONSTITUTION, AGING IN PATHOLOGY

Student should know:

- The role of anomalies of constitution
- Fetal development and heredity
- Role of aging changes and disorders of reactivity in development of diseases.

Student should be able to:

- Characterize the etiologic factors of origin and development of the inherited illnesses and disorders of fetal development.

LIST OF CONTROL QUESTIONS

1. Heredity as a reason and condition of development of illnesses.
2. Geno- and phenocopies. Classification of the inherited illnesses.
3. Mutations. Principles of their classification. Types of mutations. Reasons of mutations. Mutagenic factors of physical, chemical and biological origin.
4. Monogenenetic inherited illnesses. Characteristic of monogenetic illnesses according to the type of inheritance of pathological gene.
5. Polygenic (multifactor) illnesses. The inherited predisposition to illnesses.
6. Chromosomal illnesses. Mechanisms of origin of genomic and chromosomal mutations. Polyploidy, aneuploidy, deletion, duplication, translocation, inversion. Syndromes, caused by the change of amount of chromosomes.
7. Aging. Factors which determine specific, individual and middle life-span. Progerias.

Genetically determined diseases -are diseases caused by genetic factors.

Hereditary diseases are diseases caused by the violation of the genetic apparatus and passed in generations. A close concept is the **congenital diseases**, which include diseases that occur immediately after birth.

Phenocopies are diseases associated with exposure to environmental factors, but the clinical picture of which is identical to such well-known hereditary diseases.

Mutation is a jumping stable change of the genetic apparatus (not connected with cell division or usual chromosomal recombination) and a material basis of genetically determined diseases.

Etiological factors, which cause mutations, are termed ***mutagens.*** They are divided into physical, chemical and biological as well as exogenous and endogenous.

Among ***physical mutagens*** ionizing radiation is the strongest. It damages the genetic apparatus directly or by radiolysis products. Mutation may be caused by ionizing radiation in such a minimal dose, which does not cause radiation disease. The most potent ***chemical mutagens*** are the analogs of purine and pyrimidine bases. The chemical compounds of carbon (polycyclic aromatic hydrocarbons) and nitrogen (nitrosamines) refer to mutagens.

Biological mutagens are DNA- and RNA-containing viruses. They sometimes behave as mutagens in patients with measles, chickenpox, mumps, infectious mononucleosis. Rubella infection in pregnant women is associated with congenital infantile malformations. The products of the vital activity of some fungi (e.g. aflatoxin) also belong to mutagens. Oncoviruses are the strongest biological mutagens.

Exogenous mutagens can induce ***endogenous mutagens*** (active forms of oxygen, free radicals, radio toxins, etc.).

Types of mutations:

Mutations are divided into ***useful*** and ***harmful, spontaneous*** and ***induced. Somatic*** mutations (in somatic cells) disappear from the population after the host's death and are not transmitted from generation to generation. ***Germ*** mutations (in germ cells) affect heredity of descendants.

Depending on the degree of destruction, mutations are divided into gene and chromosomal ones.

Gene mutation is a change of the structure of only one gene, namely, the specific order of purine and pyrimidine bases in the DNA molecule (the so-called *point mutation).* It results in a change of the order of amino acids in the protein molecule.

Chromosomal mutation is a more vast destruction of the hereditary apparatus and is characterized by changes of the chromosome structure (break, deletion, inversion, translocation and fragmentation) or quantity (increased or decreased). The quantitative changes of chromosomes result from nondisjunction of homologous chromosomes during gametogenesis or at the early stage of zygote splitting.

Depending on the degree of genetic defect (a gene is smaller than a chromosome, so, the consequences of gene and chromosomal mutations are different) diseases are divided into ***molecular genetic*** and ***chromosomal***. The former in their turn are divided into ***monogenic*** and ***polygenic***. Monogenic diseases are subdivided into ***dominant, recessive and sex-associated***.

A *gene mutation* carrier usually preserves the reproductive function. Therefore, molecular genetic diseases may be transferred in generations. Etiological factors are physical, chemical, and biological mutagens, which are

capable to change the genetic apparatus of germ cells. The initial pathogenetic link of hereditary diseases is a germ mutation in one of the parents. If the mutant cell is impregnated, such events take place — inheritance of the mutant gene by the child, disease development, its transmission to the following generations.

Chromosomal disease is such a disease, which develops as a result of chromosomal mutations in the germ cell of one of the parents. Thus, chromosomal diseases relate to genetically determined disorders, and not to inherited ones. Chromosomal anomalies are not accumulated in population.

Etiological factors are mutagens of physical, chemical and biological origin.

The peculiarities of chromosomal disease etiology are the following:

•An etiological factor affects parents, but disease develops in a descendant.
•De novo a chromosomal mutation in a germ cell takes place in a healthy adult person, and if this cell is not impregnated, mutation has no consequences.
•Family predisposition to chromosome nondisjunction has been revealed.
•The disorders of gametogenesis and chromosome nondisjunction are more frequent in elderly people, but their germ cells are impregnated less frequently.

The initial pathogenetic link is chromosomal mutation in the sex cell of one parent.

Hereditary predisposition is a genetically determined state of increased probability of a certain disease development under certain environmental conditions.

Disorders of fetal development

The prenatal period of life is primarily the period of implementation of the genetic program of development. Its course is under conditions of special security, however, in this period the influence of pathogenic factors on the body may develop. Their harmful effects may occur at any stage of early ontogenesis, but especially in the so-called critical periods. The critical period is a period of time in the development of the body, when after the next stage the further ways of forming a whole embryo or its rudiments are identified, so, their transition to a new stage of morphogenesis. This period is characterized by high metabolic activity in certain beginnings, and their sensitivity to the action of damage factors.

There are two main critical periods: during the first period there is the transition of the embryo from the cleavage stage to differentiation into three germ layers; it ends with implantation (end of the 1st and the whole 2nd week); the second is the period of laying organs, including the placenta; it's the period of placentation and great organogenesis (the 3rd—8th week).

Classification. All disorders of the fetal development are classified by the temporary signs, that is, depending on what period of development they happened. Before the fertilization during gametogenesis the **gametopathias** may occur, and then they affect the formation of the embryo. Among further violations of the fetal development the major ones are the blastopathia, embryopathia, and fetopathia.

The blastopathia is formed in the first 15 days of the embryo development (blasto-cystes), when after fertilization the embryo enters the uterus through the fallopian tube: it is located in it about 3 days and at the beginning of the 2nd week it's implanted. During this period, the crushing of the embryo, i.e. the formation of the embryoblast, tro-phoblast and differentiation into three germ layers are taken place.

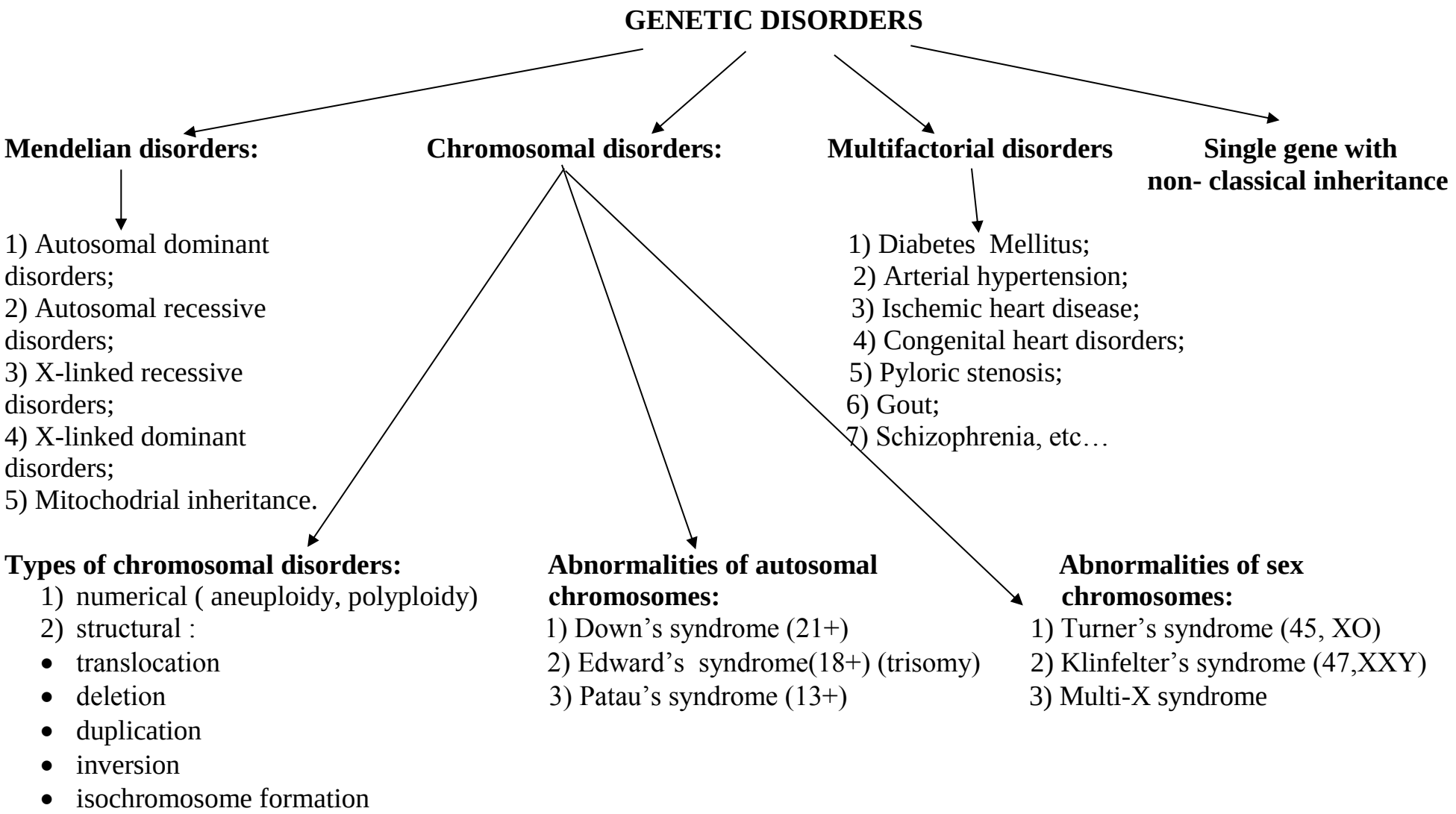

Fig.1. Classification of genetic disorders

The embryopathia includes disorders that occur after differentiation of the embryoblast up to the completion of the laying of the organs (from the 16th day to the 12th week).

The fetopathia means the disorders of fetal development; it includes the pathology of the early fetogenesis, when the fine structures are formed and the viability of the fetus is achieved (from the 12th week to the 7th month), and also the disorders of the late fetogenesis, when there is the formation of functions of the fetus and at the same time the aging of the placenta (from the 7th month to labour).

Etiology:

- The Inferiority of Gametes
- Pathogenic Environmental Factors.
- Disease of Pregnant.

Ageing is a progressive deterioration of various functions after an organism attains reproductive maturity.

- Aging is theoretically distinct from disease. The maximal life span is limited by the aging process itself rather than by the ravages of disease.
- Aging is thought to be the result of accumulated DNA damage, decreased proliferative capacity of steam cells, and accumulated metabolic damage.
- Age-related changes in body systems can generally be described as a decrease in functional reserve and a reduced ability to adapt to environmental demands.

Children both of her husbands are healthy.

KROK 1_mcqs:

1.An individual is characterized by rounded face, broad forehead, a Mongolian type of eyelid fold, flattened nasal bridge, permanently open mouth, projecting lower lip, protruding tongue, short neck, flat hands, and stubby fingers. What diagnosis can be put to the patient?

A. Down's syndrome
B. Klinefelter's syndrome
C. Alkaptonuria
D. Supermales
E. Turner's syndrome

2.A healthy woman has three sons affected by color blindness who were born after her two marriages. What is the most possible pattern of inheritance of this disease?

A. X-linked recessive
B. Y-linked
C. Autosomal recessive
D. Autosomal dominant
E. X-linked dominant

3.A couple came for medical genetic counseling. The man has hemophilia, the woman is healthy and there were no cases of hemophilia in her family. What is the risk of having a sick child in this family?

A. 0

B. 100%
C. 75%
D. 50%
E. 25%

4.A woman who was sick with rubella during the pregnancy gave birth to a deaf child with hare lip and cleft palate. This congenital defect is an example of:

A. Phenocopy
B. Edward's syndrome
C. Genocopy
D. Patau's syndrome
E. Down's syndrome

5.Part of the DNA chain turned about180 degrees due to gamma radiation. What type of mutation took place in the DNA chain?

A. Inversion
B. Deletion
C. Doubling
D. Translocation
E. Replication

6.The study of the genealogy of a family with hypertrichosis (helix excessive pilosis) has demonstrated that this symptom is manifested in all generations only in men and is inherited by son from his father. What is the type of hypertrichosis inheritance?

A. Y-linked chromosome
B. Autosome-recessive
C. Autosome-dominant
D. X-linked recessive chromosome
E. X-linked dominant chromosome

7.Albinos can't stand sun impact - they don't acquire sun-tan but get sunburns. Disturbed metabolism of what amino acid underlies this phenomenon?

A. Phenilalanine
B. Methionine
C. Tryptophan
D. Glutamic acid
E. Histidine

8.A genetics specialist analyzed the genealogy of a family and found that both males and females may have the illness, not across all the generations, and that healthy parents may have ill children. What is the type of illness inheritance?

A. Autosomal recessive
B. Autosomal dominant
C. X-linked dominant
D. X-linked recessive
E. Y-linked

9.Analysis of amniotic fluid that was obtained as a result of amniocentesis(puncture of amniotic sac) revealed cells the nuclei of which contain sex chromatin(Barr's body).What can it be evidence of?

A. Development of female fetus
B. Development of male fetus
C. Genetic disorders of fetus development
D. Trisomy
E. Polyploidy

10.In course of prophylactic medical examination a 7-year-old boy was diagnosed to have daltonism. Parents are healthy, color vision is normal. But grandfather from the mother's side has the same disorder. What is the type of inheriting of this anomaly?

A. Recessive, sex-linked
B. Dominant, sex-linked
C. Incomplete domination
D. Autosomal-recessive
E. Autosomal-dominant

11.In some regions of South Africa there is a spread sickle-shaped cell anemia, in which erythrocytes have shape of a sickle as a result of substitution of glutamin byvaline in

the hemoglobin molecule. What is the cause of this disease?

A. Gene mutation
B. Disturbance of mechanisms of genetic information realization
C. Crossingover
D. Genomic mutations
E. Transduction

12.A 32 y.o. man is tall, he has gynecomastia, adult woman pattern of hair distribution, high voice, mental deficiency ,sterility. Provisional diagnosis is Klinefelter's syndrome. In order to specify diagnosis it is necessary to analyze:

A. Caryotype
B. Leukogram
C. Spermatogenesis
D. Blood group
E. Genealogy

13. Autopsy of a newborn boy revealed polydactylia, microcephalia, cheiloschisisand uranoschisis as well as hypertrophy of parenchimatous organs. These defects correspond with the description of Patau's syndrome. What is the most probable cause of this pathology?

A. Trisomy of the 13th chromosome
B. Trisomy of the 18th chromosome
C. Trisomy of the 21st chromosome
D. Nondisjunction of sex chromosomes
E. Partial monosomy

14.Examination of a 12 year old boy with developmental lag revealed achondroplasia: disproportional constitution with evident shortening of upper and lower limbs as a result of growth disorder of epiphyseal cartilages of long tubal bones. This disease is:

A. Inherited, dominant
B. Inherited, recessive
C. Inherited, sex-linked
D. Congenital
E. Acquired

15.Hartnup disease is caused by point mutation of only one gene which results in disturbance of tryptophane absorption in the bowels and its resorption in the renal tubules. It is the reason for disorder of both digestive and urination systems. What genetic phenomenon is observed in this case?

A. Pleiotropy
B. Complementary interaction
C. Polymery
D. Codominance
E. Semidominance

16. As a result of prophylactic medical examination a 7 year old boy was diagnosed with Lesch-Nyhan syndrome (only boys fall ill with it). The boy's parents are healthy but his grandfather by his mother's side suffers from the same disease. What type of disease inheritance is it?

A. Recessive, sex-linked
B. Dominant, sex-linked
C. Autosomal recessive
D. Autosomal dominant
E. Semidominance

17. A man suffering from a hereditary disease married a healthy woman. They got 5 children, three girls and two boys. All the girls inherited their father's disease. What is the type of the disease inheritance?

A. Dominant, X-linked
B. Recessive, X-linked
C. Y-linked

D. Autosomal dominant
E. Autosomal recessive

18. A married couple came to the genetic counseling. The husband suffers from the insulin- dependant diabetes, the wife is healthy. What is the probability that this couple will have an insulin-dependant child?
A. Higher than throughout the population
B. The same as throughout the population
C. Lower than throughout the population
D. 50%
E. 100%

19. A married couple consulted a specialist at the genetic consultation about probability of having children with hemophilia. Both spouses are healthy, but the wife's father has hemophilia. In this family hemophilia may be passed to:
A. Half of sons
B. All the children
C. Both sons and daughters
D. Half of daughters
E. Daughters only

20. Medical examination at the military registration and enlistment office revealed that a 15- year-old boy was high, with eunuchoid body proportions, gynecomastia, female pattern of pubic hair distribution. The boy had also fat deposits on the thighs, no facial hair, high voice, subnormal intelligence quotient. Which karyotype corresponds with this disease?
A. 47, XXY
B. 47, XXX
C. 46, XX
D. 45, XO
E. 46, XY

21. Examination of a patient with frequent hemorrhages from the internal organs and mucous membranes revealed proline and lysine within the collagen fibers. Disorder of their hydroxylation is caused by lack of the following vitamin:
A. C
B. K
C. A
D. B1
E. E

22. Blood of a 12 year old boy presents low concentration of uric acid and accumulation of xanthine and hypoxanthine. This child has genetic defect of the following enzyme:
A. Xanthine oxidase
B. Arginase
C. Urease
D. Ornithine carbamoyl-transferase
E. Glycerylkinase

23. A family of students who came from Africa got a child with anemia signs. The child died soon. Examination revealed that the child's erythrocytes have abnormal semilunar shape. Specify genotypes of the child's parents:
A. Aa x Aa
B. Aa x aa
C. AA x AA
D. aa x aa
E. Aa x AA

24. Blood group of a 30 year old man was specified before an operation. His blood is Rh- positive. Reaction of erythrocyte agglutination was absent with standard sera of 0αβ (I), Aβ (II), Bα (III) groups. The

blood under examination is of the following group:

A. 0alpha_beta (I)
B. A beta (II)
C. B alpha (III)
D. AB (IV)
E. -

25. Cytogenetic examination of a patient with reproductive dysfunction revealed normal karyotype 46 XY in some cells, but most cells have karyotype of Klinefelter's syndrome - 47 XXY. Such cell heterogeneity is called:

A. Mosaicism
B. Inversion
C. Transposition
D. Duplication
E. Monomorphism

26. One of the parents is suspected of having phenylketonuria recessive gene. What is the risk of giving birth to a child with inborn phenylketonuria?

A. 0%
B. 25%
C. 50%
D. 75%
E. 100%

27. A 28-year-old female patient consulted a gynecologist about sterility. Examination revealed underdeveloped ovaries and uterus, irregular menstrual cycle. Analysis of the sex chromatin revealed 2 Barr's bodies in most somatic cells. What chromosome disease is most likely?

A. Triple X syndrome
B. Edwards' syndrome
C. Patau's syndrome
D. Klinefelter's syndrome
E. Turner's syndrome

28. Sex chromosomes of a woman didn't separate and move to the opposite poles of a cell during gametogenesis (meiosis). The ovum was impregnated with a normal spermatozoon. Which chromosomal disease can be found in her child?

A. Turner's syndrome
B. Down's syndrome
C. Patau's syndrome
D. Edwards' syndrome
E. Cat cry syndrome

29. Examination of an 18-year-old girl revealed the following features: hypoplasia of the ovaries, broad shoulders, narrow pelvis, shortening of the lower extremities, "sphinx neck". Mental development is normal. The girl was diagnosed with Turner's syndrome. What kind of chromosome abnormality is it?

A. Monosomy X
B. Trisomy X
C. Trisomy 13
D. Trisomy 18
E. Nullisomy X

30. Hypertrichosis is the Y-linked character. The father has hypertrichosis, and the mother is healthy. In this family, the probability of having a child with hypertrichosis is:

A. 0,5
B. 0,25
C. 0,125
D. 0,625
E. 1

31. A patient with a dislocated shoulder had been admitted to a hospital. With the purpose of skeletal muscle relaxation he was given an injection of relaxant dithylinum acting normally 5-7 minutes. However, the effect of dithylinum in

this patient lasted up to 8 hours. What is the most likely cause of the prolonged effect of dithylinum in this patient?

A. Genetic deficiency of blood cholinesterase
B. Reduced activity of microsomal liver enzymes
C. Reduced drug excretion
D. Material accumulation of the drug
E. Potentiation by another drug

32. A 35-year-old male patient has been referred by an andrologist for the genetic counselling for the deviations of physical and mental development. Objectively: the patient is tall, has asthenic constitution, gynecomastia, mental retardation. Microscopy of the oral mucosa cells revealed sex chromatin (single Barr body) in 30% of cells. What is the most likely diagnosis?

A. Klinefelter syndrome
B. Di-George syndrome
C. Down syndrome
D. Recklinghausen's disease
E. Cushing pituitary basophilism

33. It is known that individuals with genetically caused deficiency of glucose6-phosphate dehydrogenase may develop RBC hemolysis in response to the administration of some antimalarial drugs. Manifestation of adverse reactions to drugs is called:

A. Idiosyncrasy
B. Allergy
C. Sensibilization
D. Tachyphylaxis
E. Tolerance

34. Healthy parents with unremarkable family history have the child with multiple developmental defects. Cytogenetic analysis revealed the trisomy 13 in the somatic cells (Patau syndrome). What phenomenon has caused the defects?

A. Abnormal gametogenesis
B. Somatic mutation
C. Recessive mutation
D. Dominant mutation
E. Chromosomal mutation

35. A 25-year-old patient consulted a doctor about dysmenorrhea and infertility. Examination revealed that the patient was 145 cm high and had underdeveloped secondary sex characteristics, alar folds on the neck. Cytological study didn't reveal any Barr bodies in the somatic cells. What diagnosis was made?

A. Turner's syndrome
B. Klinefelter syndrome
C. Morris syndrome
D. Trisomy X syndrome
E. –

36. A mother had taken synthetic hormones during pregnancy. Her daughter was born with hirsutism formally resembling of adrenal syndrome. Such manifestation of variability is called:

A. Phenocopy
B. Mutation
C. Recombination
D. Heterosis
E. Replication

37. Analysis of the family history of children with Van der Woude syndrome revealed that in their families one of the parents had the typical for this syndrome defects (cleft lip and palate, lip pits regardless of gender). What is the type of inheritance of this syndrome?

A. Autosomal dominant

B. X-linked recessive
C. X-linked dominant
D. Autosomal recessive
E. Multifactorial

38. A boy referred to a genetics clinic was found to have 1 drumstick in blood neutrophils.
The boy is likely to have the following syndrome:
A. Klinefelter's
B. Down's
C. Turner's
D. Edwards'
E. Trisomy X

39. Amniocentesis revealed two sex chromatin bodies (Barr bodies) in each cell of the sample. What disease is this character typical for?
A. Trisomy X
B. Klinefelter syndrome
C. Turner's syndrome
D. Down's syndrome
E. Patau syndrome

40. A patient intending to undergo a gender reassignment surgery has been admitted to a specialised clinic. In the course of examination both male and female gonades have been revealed, with male structure of external genitals. What kind of genital maldevelopment has the patient?
A. True hermaphroditism
B. Male pseudohermaphroditism
C. Female pseudohermaphroditism
D. Accessory ovary
E. Ectopia of testis

41. An 18-year-old male has been diagnosed with Marfan syndrome. Examination revealed a developmental disorder of connective tissue and eye lens structure, abnormalities of the cardiovascular system, arachnodactylia. What genetic phenomenon has caused the development of this disease?
A. Pleiotropy
B. Complementarity
C. Codominance
D. Multiple allelism
E. Incomplete dominance

42. A female patient saught medical genetic consultation. Physical examination revealed pterygium colli deformity (webbed neck), broad chest, underdeveloped breasts. Study of buccal epithelium cells revealed no X-chromatin in the nuclei. This indicates that the patient has the following syndrome:
A. Turner's
B. Klinefelter's
C. Patau's
D. Down's
E. Edwards'

43. An 8-week-pregnant woman with acute respiratory disease and temperature rise up to 39, 0oC has called in a doctor. The doctor insisted on her avoiding taking paracetamol, because in this period of pregnancy there is a risk of its:
A. Teratogenicity
B. Embryotoxicity
C. Fetotoxicity
D. Hepatotoxicity
E. Allergenicity

44. A female suffered rubella during pregnancy. The child was born with developmental abnormalities, namely cleft lip and palate. The child's genotype is normal. These malformations are a manifestation of:
A. Modification variability
B. Polyploidy
C. Combinative variability
D. Chromosomal mutation
E. Aneuploidy

45. A 2-year-old boy is diagnosed with Down syndrome. What chromosomal changes may be the cause of this disease?

A. Trisomy 21
B. Trisomy 13
C. Trisomy X
D. Trisomy 18
E. Monosomy X

46. An underage patient has signs of achondroplasia (dwarfism). It is known that this is a monogenic disease and the gene that is responsible for the development of such abnormalities is a dominant one. The development of that child's brother is normal. Specify the genotype of the healthy child:

A. aa
B. AA
C. Aa
D. AaBb
E. AABB

47. A child with a normal karyotype is diagnosed with cleft lip and hard palate, defects of the cardiovascular system, microcephaly. The child's mother suffered rubella during pregnancy. This pathology in the child may be an example of:

A. Genocopy
B. Trisomy
C. Phenocopy
D. Monosomy
E. –

48. A healthy woman has three sons affected by color blindness who were born after her two marriages. Children both of her husbands are healthy. What is the most possible pattern of inheritance of this disease?

A. X-linked recessive
B. Y-linked
C. Autosomal recessive
D. Autosomal dominant
E. X-linked dominant

49. A couple came for medical genetic counseling. The man has hemophilia, the woman is healthy and there were no cases of hemophilia in her family. What is the risk of having a sick child in this family?

A. 0
B. 100%
C. 75%
D. 50%
E. 25%

50. During a prophylactic medical examination a 7-year-old boy was diagnosed with daltonism. His parents are healthy and have normal colour vision, but his grandfather on his mother's side has the same abnormality. What is the type of the abnormality inheritance?

A. Recessive, sex-linked
B. Dominant, sex-linked
C. Semidominance
D. Autosomal recessive
E. Autosomal dominant

51. Daltonism was diagnosed in a 7-year-old boy while prophylactic medical examination. Parents are healthy, color vision is normal. Grandfather from the mother's side has the same disorder. What is the type of inheriting of this anomaly?

A. Recessive, connected with sex
B. Dominant, connected with sex
C. Incomplete domination
D. Autosomal-recessive
E. Autosomal-dominant

52. A couple had a child with Down's disease. Mother is 42 years old. This disease is most probably caused by the following impairment of prenatal development:

A. Gametopathy
B. Blastopathy
C. Embryopathy
D. Non-specific fetopathy
E. Specific fetopathy

53. Examination of a 12 year old boy with developmental lag revealed achondroplasia: disproportional constitution with evident shortening of upper and lower limbs as a result of growth disorder of epiphyseal cartilages of long tubal bones. This disease is:
A. Inherited, dominant
B. Inherited, recessive
C. Inherited, sex-linked
D. Congenital
E. Acquired

54. Parents of a 5-year-old boy report him to have frequent colds that develop into pneumonias, presence of purulent rashes on the skin. Laboratory tests have revealed the following: absence of immunoglobulins of any type, and naked cells are absent from the lymph nodes punctate. What kind of immune disorder is it?
A. X-linked hypogammaglobulinemia (Bruton type agammaglobulinemia)
B. Autosomal recessive agammaglobulinaemia (Swiss type)
C. Hypoplastic anemia
D. Agranulocytosis
E. Louis-Barr syndrome.

55. Sex chromosomes of a woman didn't separate and move to the opposite poles of a cell during gametogenesis (meiosis). The ovum was impregnated with a normal spermatozoon.Which chromosomal disease can be found in her child?
A. Turner's syndrome
B. Down's syndrome
C. Patau's syndrome
D. Edwards' syndrome
E. Cat cry syndrome

56. An 18-year-old woman has body disproportion, wing-like folds on the skin of her neck, underdeveloped ovaries, nuclei of her buccal epithelium cells have no Barr bodies. Dermatoglyphics method revealed that her adt angle is 66*o*. What provisional diagnosis can be made in this case?
A. Turner's syndrome
B. Cri du chat (cat cry) syndrome
C. Kleinfelter's syndrome
D. Patau's syndrome
E. Edwards' syndrome

57. Parentsofasick5-year-old girl visited a genetic consultation. Karyotype investigation revealed 46 chromosomes. One chromosome of the 15^{th} pair was abnormally long, having a part of the chromosome belonging to the 21^{st} pair attached to it. What mutation occurred in this girl?
A. Translocation
B. Deletion
C. Inversion
D. Deficiency
E. Duplication

58. Sex chromatin was detected during examination of a man's buccal epithelium. It is characteristic of the following chromosome disease:
A. Klinefelter's syndrome
B. Down's disease
C. Turner's syndrome
D. Triple X syndrome
E. Hypophosphatemicrickets

59. According to phenotypic diagnosis a female patient has been provisionally diagnosed with X-chromosome polysomia. This diagnosis can be confirmed by cytogenetic method. What karyotype will confirm the diagnosis?

A. 47(XXX)
B. 48(XXXY)
C. 48(XXYY)
D. 47(XXY)
E. 46(XX)

60. A family of healthy students, who have arrived from Africa, gave birth to a child with signs of anemia. The child has died shortly after. Examination has revealed that the child's erythrocytes are abnormally crescent-shaped. The disease is characrerized by autosomalrecessive inheritance. Determine the genotype of the child's parents:

A. AaxAa
B. Aaxaa
C. AA xAA
D. aa x aa
E. Aa xAA

61. Exposure to colchicine resulted in metaphase plate of a human containing 23 chromosomes more than it is normal. Name this mutation:

A. Polyploidy
B. Aneuploidy
C. Polyteny
D. Inversion
E. Translocation

62. A 45-year-old woman gave birth to a boy with cleft maxilla (cleft lip and palate). On additional examination there are significant disturbances of the boy's nervous, cardiovascular, and visual systems. Karyotype investigation allowed diagnosing the patient with trisomy

13. What syndrome is present in the boy?

A. Patau
B. Down
C. Kleinfelter
D. Turner
E. DiGeorge

63. Clinical presentations of a woman allowed provisionally diagnosing her with X polysomy. Cytogenetic method is applied to clarify the diagnosis. The diagnosis will be confirmed if the patient's karyotype is:

A. 47, XXX
B. 48, XXXY
C. 48, XXYY
D. 47, XXY
E. 46, XX

64. A 13-year-old boy presents with eczematous rashes on his shins and torso. Anamnesis states cases of otitis, pneumonia, and furuncles in the patient. Blood test: platelets - 70 · 109/l, low activity of T helper and T suppressor cells, low IgM, with normal IgA and IgG. What immunodeficient disease does this boy have?

A. Wiskott-Aldrich syndrome
B. Louis-Bar syndrome (Ataxiatelangiectasia)
C. Severe combined immunodeficiency (Swiss type)
D. DiGeorge syndrome
E. Chediak-Higashi syndrome

65.A 10-year-old child had cut his leg with a glass shard, when playing, and was delivered to the outpatient department to receive antitetanus serum. To prevent development of anaphylactic shock the serum was introduced by Bezredka method. This

method of organism hyposensitization is based on the following mechanism:

A. Binding of mast cell-fixed IgE
B. Blocking of mast cell mediators synthesis
C. Stimulation of immune tolerance to antigen
D. Stimulation of antigen-specific IgG2
E. Stabilization of mast cell membranes

66.A woman with the III (B), Rh (-) blood group gave birth to a child with the II (A) blood group. The child is diagnosed with hemolytic disease of newborn caused by rhesus incompatibility. What blood group and Rh are likely in the father?

A. II (A), Rh (+)
B. I (0), Rh (+)
C. III (B), Rh (+)
D. I (0), Rh (-)
E. II (A), Rh (-)

67. A 45-year-old woman gave birth to a boy with cleft maxilla (cleft lip and palate). On additional examination there are significant disturbances of the boy's nervous, cardiovascular, and visual systems. Karyotype investigation allowed diagnosing the patient with trisomy 13. What syndrome is present in the boy?

A. Patau
B. Down
C. Kleinfelter
D. Turner
E. DiGeorge

68. Determining a patient's blood group with monoclonal test-reagents revealed positive agglutination reaction to anti-A and anti-B reagents, and negative reaction to anti-D. What blood group does this patient have?

A. IV (AB) Rh (-)
B. II (A) Rh (+)
C. III (B) Rh (-)
D. IV (AB) Rh (+)
E. I (0) Rh (+)

69. A 40-year-old pregnant woman underwent amniocentesis. Examination determined the fetal karyotype to be 47, XY+21. What fetal pathology was detected?

A. Down syndrome
B. Klinefelter syndrome
C. Turner syndrome
D. Phenylketonuria
E. Patau syndrome

70. A 20-year-old young man with tall stature, asthenic body type, signs of hypogonadism and gynecomastia, and low sperm count (azoospermia) has karyotype 47, XXY. What hereditary syndrome can be characterized by this chromosomal anomaly?

A. Klinefelter syndrome
B. Wiskott-Aldrich syndrome
C. Turner syndrome
D.Louis-Bar syndrome (ataxiatelangiectasia)
E. Down syndrome

71. Representatives of a certain human population can be characterized by elongated body, height variability, decreased volume of muscle mass, increased length of limbs, decreased size and volume of rib cage, increased perspiration, decreased indices of base metabolism and fat synthesis. What type of adaptive evolution is it?

A. Tropical
B. Arctic
C. Moderate
D. Intermediate
E. Mountain

72. Genealogical analysis of a child with myotonic dystrophy determined that this disease is present in every generation, equally presented by the relatives of both genders, the risk of inheriting this disease is equal no matter which parent is affected. If one of the parents is heterozygous for this disease and the other parent is healthy, the risk of them giving birth to a sick child is 50%. What type of disease inheritance is it?
A. Autosomal dominant
B. Autosomal recessive
C. X-linked dominant
D. X-linked recessive
E. Y-linked

73. During pregnancy a woman has been taking an antiepileptic drug - sodium valproate. It resulted in her child developing a vertebral column malformation - spina bifida. Name the described effect of the drug:
A. Teratogenic effect
B. Immunosuppressive effect
C. Acquired tolerance
D. Dependence
E. Sensitizing effect

Tasks for Self-Control

(give correct answers and find mistakes in the statements)

1) Characterize the significance of mutation.
    1. Mutation is an etiological factor of inherited diseases.
    2. Mutation is the main link of inherited diseases pathogenesis.
    3. A virus may be a mutagene.
    4. Mutation may result in the synthesis of an anomalous protein form.
    5. Mutation may result in biochemical processes disorder.
    6. Mutation is always harmful.
    7. All germ cell mutations are transmitted to the next generation.
    8. Mutations in the somatic cells may be transmitted to the next generation.
    9. Gene mutation underlies Down's syndrome.
2) Characterize the consequences of mutations.
    1. Mutation always leads to errors in metabolism.
    2. There is no defense mechanism against gene disorders.
    3. There are enzymal systems for the repair of damaged DNA molecules.
    4. The reproductive function of a gene mutation carrier may be preserved.

5. All congenital diseases are genetically determined.
6. Mutation may result in a deficiency of an important protein.
7. Mutations are always harmful.
8. Most mutations have no harmful consequences for the organism.
9. Mutations declare themselves right after birth of a child.
10. Consequences of gene mutations do not depend on the age of the patient.

3) Name the mechanisms, which prevent harmful effects of mutations.

1. The enzymatic systems of damaged DNA reparation are present in cells.
2. The immune system neutralizes free radicals.
3. Antioxidant systems neutralize the active forms of oxygen.
4. Recessive genes are more strictly controlled by natural selection.
5. Polygenetic diseases are controlled by the environment.
6. The homozygous condition of the recessive pathological gene prevents
   pathology manifestation.
7. T-killers destroy cell mutants by lymphokines.

4) Explain manifestations of mutations.

1. Clinical manifestations of mutations depend on the type of inheritance if
   a disease is monogenetic.
2. Mutation of the genes, which control the DNA repair enzymes, leads to
   an increased sensitivity to radiation.
3. Enzymopathy is a genetically determined disorder of enzyme amount or
   activity.
4. Clinical manifestations of mutations never depend on the patient's sex.
5. Coagulopathy is a genetically determined coagulation factor deficiency.
6. The intensity of the clinical manifestation of a genetic disease is called penetrance.
7. The probability of the phenotypical manifestation of a mutant gene is called expressiveness.

5) Explain possible disease mechanism if a hereditary predisposition to this disease is suspected.

1. It is determined only by genetic factors.
2. Exogenous factors have no influence on the disease development.
3. It is not possible to change manifestations of this disease by environment changes.
4. A certain etiological factor may cause different diseases depending on hereditary
   predisposition.

Hereditary predisposition may be based on:

5. Dominant type of inheritance.
6. Enzymopathy.
7. Polygenetic type of inheritance.

6) A woman with signs of mental retardation gave birth to a child (girl). A genetic pathology and its possible transmission is supposed. What concepts must guide a physician? How must the child be examined?

Such diseases are sex-linked:

1. Down's syndrome.
2. Enzymopathy.

If the karyotype is examined, such characteristics are typical of certain syndromes:

3. A patient with Klinefelter's syndrome is a girl.
4. A patient with Turner's syndrome is a boy.
5. The amount of chromosomes in a patient with Down's syndrome is 45.
6. The amount of chromosomes in a patient with Turner's syndrome is 45.
7. Down's syndrome — XO.
8. Turner's syndrome — XXX.
9. Sex chromatin (Barr's body) is absent in patients with Turner's syndrome.
10. A patient with multi-X syndrome has no sex chromatin (Barr's body).

Recommended literature:

Basic

1. Simeonova N.K. Pathophysiology/ N.Simeonova.// Kyiv, Ukraine. – 2010. – 44-61pp.
2. Krishtal N.V. Pathophysiology: textbook/ N.Krishtal et al.// Kyiv: AUS Medicine Publishing, 2017. – 57-85pp.
3. Lecture Notes For Health Science Students. General Pathology// Mesele Bezabeh, Abiye Tesfaye, Bahiru Ergicho, Mengistu Erke, Seyoum Mengistu, Alemayehu Bedane, Abiyot Desta/ Jimma University, Gondar University Haramaya University, Dedub University. – 2004. – 98-136pp.

Additional

4. Porth, Carol. Essentials of pathophysiology: concepts of altered health states /Carol Mattson Porth ; consultants, Kathryn J. Gaspard, Kim A. Noble. — 3rd ed. 2011 Wolters
5. Kluwer Health | Lippincott Williams & Wilkins. – 2011. – 1282 p.
6. Robbins Pathology basis of disease / Cotran R.S., Kumar V., Robbins S.L. - 2000.

Methodological instruction to practical lesson №4
Module 1. General pathology

Theme: THE PATHOPHYSIOLOGY OF REACTIVITY. IMMUNOLOGICAL REACTIVITY DISORDERS. IMMUNODEFICIENCY. ALLERGY

Student should know:

- Basic concepts of immunology.
- Mechanisms of resistance, its role in protection from diseases
- Mechanisms of immunodeficiency development and pathogenic principles of their cure.

Student should be able to:

- Explain mechanisms of immune response.
- Perform analysis of pathogenesis of immunodeficiencies.
- Explain pathogenesis and manifestation of the immediate and delayed allergy development and to ground pathogenic principles of its prophylaxis.

LIST OF CONTROL QUESTIONS

1. Infectious process, general laws of development. Classification of pathogens. Protective barriers from infection, conditions of their overcoming. Distribution and dissemination of pathogens in an organism. Sepsis. The role of pathogen properties and reactivity in the development of infectious diseases.
2. Reactivity as condition of development of illnesses. Signs of reactivity on molecular, cellular, tissue, organ, systemic levels and at the level of organism on the whole. Types of reactivity. Dependence of reactivity from a gender, age, heredity, state of the immune, nervous and endocrine systems. Influence of factors of environment on reactivity of organism.
3. A concept about resistance. Passive and active resistance. Connection of resistance with reactivity. Mechanisms of nonspecific resistance. Biobarriers, their classification, role in resistance of organism.
4. Disorder of phagocytosis: reasons, mechanisms, consequences. Humoral factors of nonspecific resistance of organism to the pathogens. The complement system and its disorders.
5. Mechanisms of immune response. Humoral and cell-type mechanisms of immunological tolerance, its types. General patterns of immune system disorders, hyper-, hypo- and dysfunction of the immune system. Experimental modeling of immune pathology.
6. Immune deficiency, definition, classification (WHO). Causes, mechanisms of development, types of primary immunodeficiencies. The role of physical, chemical and biological factors in the development of secondary

immunodeficiency (immunosuppressive) states. The pathogenesis of clinical manifestations of immune deficiency. The etiology and pathogenesis of acquired immunodeficiency syndrome (AIDS).

7. Pathophysiological basis of transplantation of organs and tissues. The reaction of transplant rejection, its causes and mechanisms. The reaction of "graft versus host".
8. Immunological relationships in the system "mother-fetus".
9. Basic principles of immunostimulation and immunosuppression.
10. Definition and general characteristics of allergies. Exogenous and endogenous allergens. Formation of allergic reactions depending on the condition of the body.
11. Principles of classification of allergic reactions. General characteristics of allergic reactions of immediate and delayed types.
12. Stages of pathogenesis of allergic reactions.
13. Anaphylactic reactions: experimental models, the main clinical forms. Immunological mechanisms of anaphylactic reactions, tissue basophils role in their development. Active and passive anaphylaxis, anaphylactic shock pathogenesis.
14. Cytotoxic reactions. The role of complement activation products and the development of cytotoxic reactions.
15. Immunocomplex reactions: the main clinical forms. Factors that determine the pathogenicity of immune complexes. Immunocomplex damage: local and general symptoms.
16. The cell mediated hypersensitivity reaction (delayed type hypersensitivity reaction). The role of lymphokines.
17. Allergic reactions of stimulatory and inhibitory type, clinical forms.
18. Pseudoalergic reaction.
19. Autoimmune reactions and diseases. The causes and mechanisms of development.

Reactivity is the ability of an organism to change its activity in response to influence of various external and internal factors.

Different species of animals change their vital activity under endogenous influence differently; different groups of people react to the same influence in different ways, and every individual has his own peculiar ways of reacting.

The types of reactivity:

1. Species (biological).
2. Group.
3. Individual: (physiological, pathological, non-specific, specific).

Species (biological) reactivity is the reactivity typical of particular species of animals. Species reactivity is aimed at preserving the species in general, and has an adaptive character. We can cite animals' seasonal behavior as an example of the species' reactivity (hibernation, migration of birds and fish, etc.), specific features

of pathologic processes in different species (inflammation, fever, allergy, the response of an acute stage, etc.)

Group reactivity is the reactivity of separate groups of people (or animals) sharing a common sign which determines the reaction specifics of all the representatives of this group to external exposure. Group reactivity is property of a specific group of animals or humans to react by change of vital activity to response of environmental factors. This reactivity is aimed at preserving certain group of people or animals due to protective and adaptive responses. The group was formed in the process of evolution, and during the life of animals or humans of a certain group. Such signs are: age, sex, constitution type, race, blood group, higher nervous activity type, group of people with the same illness, etc.

Individual reactivity is the property of the individual to react by change of vital activity to response of adequate or extreme stimuli of the environment. Individual reactivity is aimed to preserve or restore of homeostasis and to maintain the health and save the life of the individual.

Physiological reactivity means a change of the bodily vital activities, definite forms of reaction to the influence of external agents that don't disturb its homeostasis; it is the reactivity of a healthy person (or an animal) to non-pathogenic stimulants (e. g. adaptation to moderate physical strain, processes of thermoregulation, secretion of hormones and peptic enzymes, natural emigration of leucocytes, etc.).

Individual pathological reactivity is the property of the individual to react by change of vital activity to response of extreme stimuli of the environment. This reactivity is aimed to restore of homeostasis and save the life of the individual. Pathologic reactivity manifests itself when an organism is exposed to pathogenic factors causing lesions of the body and disturbing its homeostasis.

Specific reactivity is related to certain factor. Specific reactivity is the ability of an organism to respond to the influence of an antigen by producing antibodies or with a complex of cell reactions, that are specific to this antigen, i.e. it is the reactivity of the immune system (immune reactivity). Its types are as follows: active specific immunity, allergy, autoimmune diseases, immunodeficiency and immunosuppressive conditions, immunoproliferative diseases.

Immunological tolerance is a condition of a specific immunological non-reactivity to a particular antigen caused by the previous contact with this antigen. Immune reactivity to other antigens is preserved. Immunological tolerance is an active process when the contact with an antigen (tolerogen) causes specific elimination or inactivation of the antigen- reactive clones of lymphocytes (e.g. by means of antibody complexes) or formation of suppressor-cells inhibiting immunocompetent lymphocytes. The types of immunological tolerance are as follows: congenital or natural, acquired (immunological paralysis or high doses, small doses, drug-induced). Runt disease (homologous disease) is conditioned by the immunological reaction of a transplant to a host. It is usually observed in case of transplanting allogenic immunocompetent lymphocytes of a donor to an adult

recipient whose immune system is considerably impaired as a result of earlier roentgen- or chemotherapy.

Non-specific reactivity is related to many factors. All changes in the body occurring in response to the influence of external agents and not associated with the immune reaction, are the signs of nonspecific reactivity. For example, the changes in the body in response to the hypovolemic or traumatic shock, hypoxia, acceleration or overstrain are the signs of nonspecific reactivity. In infectious, allergic, autoimmune diseases the mechanisms of both specific (production of antibodies) and nonspecific reactivity (inflammation, fever, hyper-cytosis, changes of function of damaged organs and systems, etc.) are involved. Both the whole organism and its separate systems, organs, cells may have reactivity. When an environmental agent affects the whole organism, its main regulatory systems – nervous and endocrine – get involved in response to it, when metabolism, blood circulation and respiration change, we can witness the reactivity of the whole organism. If a patient with an ischemic heart disease develops a stenocardial attack as a result of physical exertion, in this case we mainly deal with cardiac reactivity with affected coronary vessels.

Biological barriers are an important mechanism of resistance and relate to passive ones.

There are two types of biological barriers — external and internal. ***External*** barriers include the skin, mucosa of the respiratory, digestive and urogenital tracts, which contain bactericidal factors (leukocytes, lysozyme and secretory IgA antibodies) on the surface.

Internal barriers prevent penetration of foreign and poisonous materials from the blood into organs and tissues. Internal barriers perform regulative, trophic and defense functions. They regulate the process of necessary substances getting from the blood into organs, support the optimal composition of organ medium, maintain cellular homeostasis and protect organs from infection. The main structural elements of internal barriers are the blood capillaries — endothelium, basal membrane
and perivascular connective tissue.

Each tissue has its own medium and barrier. The common term for such barriers is ***histohematic.***

Each histohematic barrier has its selective permeability. In some organs it is strengthened by additional structures and receives a new name. These are the so-called ***specialized*** barriers. It is a particular group of barriers, which defend organs with weak local immunity mechanisms (antibody formation and phagocytosis).

Specialized barriers are ***hematoencephalic, hematoophthalmic, hematolabyrinthic, hematotesticular, hematothyroid,*** and ***placenta.***

Phagocytosis is an important but nonspecific reactivity mechanism. ***Phagocytosis*** is a process of capture and intracellular destruction of foreign particles (microbes, distorted tissues) by special cells of the connective tissue, which arecalled phagocytes.

Phagocytes are leukocytes: neutrophils (microphages), monocytes (macrophages) and the tissue type of macrophages (star cells in the liver, alveolar, pleural and peritoneal macrophages). Phagocytes are circulating in the blood while phagocytosis proceeds in the tissues. Consequently, leukocytes must emigrate from vessels into tissue through the capillary walls.

Phagocytosis proceeds in four stages.

1. Chemotaxis (approaching) of a phagocyte to an object after its recognition. On their surface phagocytes have receptors to chemotactic substances (microbial products belong to them).

2. Adhesion (attachment) of phagocytes to objects. Adhesion is provided by polysaccharides, which are located on the leukocyte surface. Electrostatic interaction between the negative leukocyte charge and the positive charge of the inflammatory focus contributes to adhesion.

3. Capture of foreign particles by phagocytes (endocytosis) and phagosome formation.

4. Intracellular digestion of phagosome content by lysosomal proteolytic enzymes.

Phagocytosis disorders are divided into acquired and genetically determined. Mechanisms are the following:

• Decrease of the quantity of phagocytes (leukopenia) is the most frequent reason for suppressed phagocytosis. Hemopoiesis in the bone marrow is depressed in radiation disease, intoxication, autoimmune injury, avitaminosis or leukopoietin deficiency.

• Excessive glucocorticoid secretion suppresses phagocytosis. The same effect is produced by the influence of glycolytic poisons (they diminish energy formation in leukocytes), inhibitors of DNA synthesis and other factors, which disorder cell division.

• Genetically determined disorders may result from enzymopathy (deficiency of myeloperoxidase and NADPH oxidase, lysosomal proteolytic enzymes and glycolytic enzymes), lack of lysosomes in phagocytes or deficiency of receptors on their surface.

• Acquired and genetically determined pathology of BAS formation, lack of opsonizing, complement and other factors, which are functionally connected with phagocytosis.

• Phagocytosis suppression under stress, thyroid hypofunction, sex gland insufficiency (during climax). Leukemia is accompanied by reduced enzyme activity in leukocytes.

BAS regulate microcirculation,vessel tone and permeability, blood coagulation, activate phagocytosis and immunity mechanisms, stimulate leukocyte formation and liberation from the bone marrow, have an enzymatic effect and destroy membranes of microbes and foreign cells. They cause fever and have growth factor characteristics.

BAS (cellular origin) are formed by means of some mechanisms: a) release (secretion) from the granules of neutrophils, eosinophils, basophiles and mast cells;

b) synthesis (as lymphokines in T-lymphocytes, interleukin-1 in monocytes); c) formation from membrane phospholipids; d) appearance after cell damage (proteolytic enzymes are released from destructed tissues as cathepsins and hyaluronidase; histamine and heparin are released from destructed thrombocytes and mast cells).

BAS (plasma origin) consists of a complement system and proteolytic enzymes, which are found in the blood plasma in the inactive form.

Criteria of individual reactivity in disease (criteria of pathological individual reactivity):

1. Quantitative (rate of occurrence of the reaction, the amplitude, the duration of the reaction).

2. Qualitative (protective potential of the organism, its passive and active resistance).

Quantitatively is distinguished forms of reactivity:

- normergy;
- hyperergy;
- hypoergy;
- disergy.

Normal reactivity – normergy, increased – hyperergy (hyper – more, ergon – act), decreased – hypoergy, perverted – disergy. The lack of reaction to any influence is called anergy. If a disease (pneumonia, tuberculosis, dysentery, etc) takes an intensive, rapid course, with clearly marked symptoms, high fever, sharp acceleration of erythrosedimention rate, high leucocytosis, etc., the course of this disease is considered to be hyperergical. On the contrary, if the symptoms of a disease are poorly marked and the course of the disease is inactive without manifestations of the acute phase, they speak about the hypoergical course of the disease. A perverse (atypical) reaction of the 4 patient to a drug, vasodilation and excessive sweating at low temperatures in patients with disorders of the vegetative nervous system are the examples of disergy. Anergy is a condition when the body doesn't respond to the presence of pathogenic microorganisms in it (carriers), or when the central nervous system is either deeply depressed or inhibited (coma, shock, anesthesia, inhibitory stage of parabiosis). The condition of immunological tolerance to an antigenic stimulus can be also classified as anergy. Reactivity should be estimated in relation to a particular intervention. Quite often high reactivity to one agent is coupled with low reactivity to another (for example, reactivity to hypoxia and acceleration, overheating and over-cooling, to physical overstrain and starvation, reactivity to different infective agents, etc.). During prenatal development an embryo doesn't respond to enteric fever and jail fever infection but responds to diphtheria, staphylococcus and streptococcus. A newborn has low reactivity to hypoxia but high reactivity to overheating. Sometimes when two or several agents affect the body, it can respond only to one of them ignoring the others.

Qualitative characteristics of reactivity:

1. Resistance – basic qualitative indicator.
2. Irritability - a general property of all living things, defines the most basic reaction.
3. Lability (functional mobility) - the rate of elementary reactions.
4. Excitability - ability of the nervous, muscular, glandular tissues to respond to stimulation by occurrence of the excitement.
5. Sensitivity - The ability of the whole organism to determine the location, strength and quality of the stimulus.

Resistance is the body insusceptibility to pathogenic effects.
Forms of resistance:
1. Primary resistance: -active; -passive;
2. Secondary resistance;
3. Passive resistance;
4. Active resistance;
5. Specific resistance;
6. Non-specific resistance;
7. Local resistance;
8. General resistance;

The resistance of the body to pathogenic effects manifests itself in different forms: for example, skin and mucous membranes are the structures preventing the penetration of microorganisms and many poisonous agents into the body. They perform the so-called barrier function. Subcutaneous fat tissue has poor thermal conductivity, while bones and other tissues of the locomotor apparatus are characterized by high resistance to deformation under the influence of mechanical agents. These examples testify to the resistance of tissues and the whole body depending on their inherited structure and properties. This is the so-called primary resistance.

Primary resistance is hereditary. It is based on the morphofunctional specifics of the body owing to which an organism is resistant to the action of extreme factors (unicellular organisms and worms are resistant to radiation, cold-blooded animals – to hypothermia, etc.). Due to hereditary immunity people are not subjected to many infections typical of animals, and in the period of epidemics of smallpox and plague some people who were directly in contact with sick people didn't catch the infection. Hereditary resistance (immunity in particular) may be absolute and relative.

Secondary resistance is acquired (for example, immunity develops after some infectious diseases, after the administration of vaccines and sera). Resistance to non-infectious interventions can be acquired through exercising resitance to physical exertion, to acceleration and overstrain, hypoxia, low and high temperatures, etc.

Passive resistance of the body is provided by its barrier systems (skin, mucous membranes, hematoencephalic barrier, etc.), the present bactericidal agents (hydrochloric acid in the stomach, lysozyme in the saliva) and hereditary immunity.

Active resistance is provided by the activation of its protective-adapting and compensatory mechanisms, such as production of leukocytes, phagocytosis, production of antibodies, neutralizition and excretion of toxins, secretion of stress hormones, changes of blood circulation and breathing, fever, synthesis of acute phase proteins by the liver, increase of leuco- and erythropoiesis, etc.

Factors of individual reactivity of organism:

1. Heredity.
2. Age.
3. Sex.
4. Life story.
5. Constitution type of the body.

Mechanisms of immune response depend on the type of antigens, their dose, channel of entry, whether antigens circulate in the blood or persist inside cells. These conditions determine the type of immune response (by humoral antibodies or cellular mechanisms).

Humoral Mechanisms:

• Humoral mechanisms develop if an antigen is a microorganism or its toxins, which circulate in the blood.
• Antibodies also circulate in the blood and organism liquids (humoral antibodies).
• Humoral mechanisms are connected with the function of B-lymphocytes.
• B-lymphocytes react to an antigen and transform (in the spleen and lymph nodes) into plasmacytes, which in a couple of days (3—5) produce immunoglobulins (A, D, G, M, E). The latter enter the blood and liquid medium and spread throughout the organism (IgE can fix to some cells including mast cells).
• After humoral antibody production, an immune complex (antigen+antibody) is formed. It is the initial stage of antigen destruction. Immune complexes activate the complement, phagocytes, BAS, which accelerate antigen destruction involving the whole organism into immune response and increasing body temperature.
• T-helpers and T-suppressors regulate these processes. Cells of immunological memory remember this situation. *Active natural immunity* forms (the organism is immunized).
• If the same antigen (microbe) enters again, the organism, which is immunized, elaborates antibodies very quickly because immunological memory cells are quickly transformed into plasmacytes and antibody formation begins.

Cellular Mechanisms:

Cellular mechanisms of immunity are activated if the humoral ones are not sufficient. The type of antigen also matters. Cellular mechanisms have the

following
characteristics.

- Antigens do not circulate in the blood.
- Humoral antibodies (immunoglobulins) are not formed.
- Cellular mechanisms develop:
    1. for elimination of body's own mutant cells;
    2. in case of intracellular localization of a foreign antigen (virus, mycobacterium
       of tuberculosis, Treponema pallidum in lues, brucella, histoplasma, etc.);
    3. as a response to incomplete antigen.
- Macrophages represent antigens to T-effectors, which transform into T-killers.
- T-killers react with antigens directly. Lymphocytes infiltrate the locus with antigens. T-killers destruct the cells by cytolysis with the aid of lymphokines and
  perforin.
- Phagocytosis and BAS are involved in immune reactions.
- T-helpers and T-suppressors take part in the process as well.

Immunity is divided into natural and artificial (formed for the purpose of prophylaxis and treatment). In their turn, each type is subdivided into active and passive.

Natural active immunity appears after an infectious disease.

Natural passive immunity forms by antibody transmission from a mother to her baby with the mother's milk and through the placenta.

Artificial active immunity (***active immunization)*** is formed by injection of vaccines containing weak or dead microorganisms.

Artificial passive immunity ***(passive immunization)*** is formed by injection of an immune serum, which contains specific antibodies against a certain infection.

Immunological tolerance is the absence of immune reaction to some antigens with preserved reactivity to other antigens.

Immunodepression is an acquired decrease of immunological reactivity.

Immunodeficiency is a genetically determined decrease of immunological reactivity (immunopathy).

Allergy is a disorder of immunological reactivity in the form of increased and qualitatively changed immune response, which damages the organism by immune mechanisms.

All allergic reactions have common pathogenetic mechanisms and proceed in three stages.

1. **Immunological** stage (sensibilization formation) starts at the moment of the first entry of an allergen into the organism. It embraces

formation of antibodies or sensitized lymphocytes and is finished by formation of immune complexes after a repeated entry of the allergen.

2. **Pathochemical** stage consists of BAS formation.
3. **Pathophysiological** stage appears as morphological and functional disturbances, which underlie clinical manifestations.

According to Gell and Comb's classification, hypersensitivity reactions can be divided into four types (type I, II, III, and IV) depending on the mechanism of immune recognition involved and on the inflammatory mediator system recruited. Types – I II, and III reactions are dependent on the interaction of specific antibodies with the given antigen, whereas, in type IV reactions recognition is achieved by antigen receptors on T-cells.

1) Type I hypersensitivity (anaphylactic or immediate type) reaction
Type I hypersensitivity reaction may be defined as a rapidly developing Immunologic reaction occurring, within minutes after the combination of an antigen with antibody bound to mast cells or basophilic in individuals previously sensitized o the antigen. The reactions depend on the site of antigen exposure for example in skin – hive, upper respiratory tract – Hay fever, bronchial asthma and systemic reaction – anaphylactic syndrome.

2) Type II hypersensitivity reaction
Type II hypersensitivity is mediated by antibodies directed towards antigens present on the surface of exogenous antigens. Three different antibody-dependent mechanisms are involved in this type of reaction

(i) Complement-dependent reaction
(ii) Antibody dependent cell - mediated cytotoxicity /ADCC/
(iii) Antibody-mediated cellular dysfunction

3) Type III hypersensetivity / immune complex-mediated
Type III hypersensitivity reaction is induced by antigen-antibody complex that produces tissue damage as a result of their capacity to activate the complement system. The antibodies involved in this reaction are IgG, IgM or IgA.

4) Type IV hypersensitivity (Cell-mediated) reaction
The cell-mediated type of hypersensitivity is initiated by specifically sensitized Tlymphocytes. It includes the classic delayed type hypersensitivity reactions initiated by CD4+Tcell and direct cell cytotoxicity mediated by CD8+Tcell. Typical variety of intracellular microbial agents including M. tuberculosis and so many viruses, fungi, as well as contact dermatitis and graft rejection are examples of type IV reactions.

KROK 1_mcqs

1.A patient with clinical signs of immunodeficiency has unchanged number and functional activity of T and B lymphocytes. Dysfunction's

defect of antigen-presentation to the immunocompetent cells was found during investigation on the molecule level. Defect of what cells is the most probable here?

A. Macrophages, monocytes
B. T-lymphocytes, B-lymphocytes
C. NK-cells
D. Fibroblasts, T-lymphocytes, B-lymphocytes
E. 0-lymphocytes

2. Live vaccine is injected into the human body. Increasing activity of what cells of connective tissue can be expected?

A. Plasmocytes and lymphocytes
B. Macrophages and fibroblasts
C. Pigmentocytes and pericytes
D. Adipocytes and adventitious cells
E. Fibroblasts and labrocytes

3. Blood analysis of a patient showed signs of HIV infection (human immunodeficiency virus). Which cells does HIV-virus primarily affect?

A. Cells that contain receptor T4 (T-helpers)
B. Cells that contain receptor IgM (B-lymphocytes)
C. Specialized nervous cells (neurons)
D. Mast cells
E. Proliferating cells (stem hematoplastic cells)

4. While enrolling a child to school Mantu's test was made to define whether revaccination was needed. The test result is negative. What does this test result mean?

A. Absence of cell immunity to the tuberculosis
B. Presence of cell immunity to the tuberculosis
C. Absence of antibodies for tubercle bacillus
D. Absence of antitoxic immunity to the tuberculosis
E. Presence of antibodies for tubercle bacillus

5. At the laboratory experiment the leukocyte culture was mixed with staphylococci. Neutrophile leukocytes engulfed and digested bacterial cells. This processes is termed:

A. Phagocytosis
B. Pinocytosis
C. Diffusion
D. Facilitated diffusion
E. Osmosis

6. The process of heart transplantation determined the viability of myocardial cells. The determination of what myocardium parameter is the most important?

A. Rest potential of cardiomyocytes
B. Heart temperature
C. Concentration of oxygen in heart vessels
D. Concentration of calcium-ions in myofibrils
E. Concentration of Ca-ions in heart vessels

7. Donor skin transplantation was performed to a patient with extensive burns. On the 8-th day the graft became swollen and changed color;

on the 11-thday graft rejection started. What cells take part in this process?

A. T-lymphocytes
B. Erythrocytes
C. Basophils
D. Eosinophils
E. B-lymphocytes

8. A patient with infectious mononucleosis had been taking glucocorticoids for two weeks. He was brought into remission, but he fell ill with acute attack of chronic tonsillitis. What action of glucocorticoids caused this complication?

A. Immunosuppressive
B. Anti-inflammatory
C. Antishock
D. Antiallergic
E. Antitoxic

9. A patient with clinical presentations of immunodeficiency went through immunological examinations. They revealed significant loss of cells that form rosettes with erythrocytes of a ram. What conclusion can be made according to the analysis data?

A. Decrease of T-lymphocytes rate
B. Decrease of B-lymphocytes rate
C. Decrease of natural killer cell rate
D. Decrease of complement system rate
E. Insufficiency of effector cells of humoral immunity

10. A woman with III (*B*), *Rh*− blood group born a child with II (*A*) blood group. The child is diagnosed with hemolytic disease of newborn as a result of rhesus incompatibility. What blood group is the child's father likely to have?

A. II (*A*), *Rh*+
B. *I* (0), *Rh*+
C. *III* (*B*), *Rh*+
D. *I* (0), *Rh*−
E. *II* (*A*), *Rh*−

11. A 6 month old baby ill with bronchitis was taken for an X-ray of chest. Apart of changes associated with bronchi the X-ray film showed a shadow of thymus gland. What might have caused such changes?

A. The above-mentioned condition is abnormal variant for this age
B. It's the effect of bronchitis
C. It is caused by abnormal position
D. It is caused by thymus inflammation
E. It is caused by neoplastic process

12.A pregnant woman had her blood group identified. Reaction of erythrocyte agglutination with standard serums of 0$\alpha\beta$(I), Bα (III) groups didn't proceed with standard serum of Aβ (II) group. The blood group under examination is:

A. Aβ (II)
B. 0$\alpha\beta$ (I)
C. Bα (III)
D. AB (IV)
E. -

13.A child was born with cleft palate. Examination revealed aorta defects and reduced number of T-

lymphocytes in blood. What immunodeficient syndrome is it?

A. Di George
B. Wiskott-Aldrich
C. Chediak-Higashi
D. Louis-Bar
E. Swiss-type

14. A pregnant woman was registered in an antenatal clinic and under went complex examination for a number of infections. Blood serum contained *IgM* to the rubella virus. What is this result indicative of?

A. Of primary infection
B. Of a chronic process
C. The woman is healthy
D. Of exacerbation of a chronic disease
E. Of recurring infection with rubella virus

15.A boy has I (*I*0*I*0) blood group and his sister has IV(*IAIB*) blood group. What blood groups do their parents have?

A. II (*I_I*0) and III (*I_I*0)
B. II (*I_I_*) and III (*I_I*0)
C. I (*I*0*I*0) and IV (*IAIB*)
D. III (*I_I*0) and IV (*IAIB*)
E. I (*I*0*I*0) and III (*I_I*0)

16. For the purpose of myocardium infarction treatment a patient was injected with embryonal stem cells derived from this very patient by means of therapeutic cloning . What transplantation type is it?

A. Autotransplantation
B. Allotransplantation
C. Xenotransplantation
D. Isotransplantation
E. Heterotransplantation

17.Quite often the cause of secondary immunodeficiency is an infection involvement, when the causative agents propagate directly in the cells of immune system and destroy it. The following diseases are characterized by:

A. Infectious mononucleosis, AIDS
B. Dysentery, cholera
C. Tuberculosis, mycobacteriosis
D. Poliomyelitis, type A hepatitis
E. Q-febris, epidemic typhus

18. 10-year-old child had the Mantoux tuberculin test administered. 48 hours later a papule up to 8 mm in diameter appeared on the site of the injection. What type of hypersensitivity reaction developed after the tuberculin injection?

A. Type IV hypersensitivity reaction
B. Type II hypersensitivity reaction
C. Atopic reaction
D. Arthus phenomenon
E. Seroreaction

19. Examination of a patient revealed autoimmune hemolytic anemia (cytotoxic type). What substances act as antigens in the II-type allergic reactions?

A. Modified receptors of cell membranes
B. Serum proteins
C. Hormones
D. Antibiotics
E. Inflammation modulators

20.Examination of a child who frequently suffers from infectious diseases revealed that IgG concentration in blood serum was 10 times less than normal, IgA and IgM concentration was also significantly reduced. Analysis showed also lack of B-lymphocytes and plasmocytes. What disease are these symptoms typical for?

A. Bruton's disease
B. Swiss-type agammaglobulinemia
C. Dysimmunoglobulinemia
D. Louis-Bar syndrome
E. Di George syndrome

21. A female patient underwent liver transplantation. 1,5 month after it her condition became worse because of reaction of transplant rejection. What factor of immune system plays the leading part in this reaction?

A. T-killers
B. Interleukin-1
C. Natural killers
D. B-lymphocytes
E. T-helpers

22. A patient in a transplantation centre underwent heart transplantation. The organ was taken from a donor who died in a road accident. Foreign heart can be rejected as a result of development of transplantation immunity. It is usually prevented by means of:

A. Immunosuppressors
B. Chemotherapy
C. Ultrasound
D. Enzymes
E. X-ray therapy

23. Examination of a pregnant woman having Rh-negative blood revealed high level of antierythrocytic antibodies. For its reduction she was implanted with her husband's Rh-positive skin graft. The graft was rejected in two weeks. Its microscopic examination revealed circulatory disturbance, edema and cellular infiltration with lymphocytes, neutrophils and macrophages predominance. What is the most likely pathology?

A. Graft immunity
B. Immediate hypersensitivity
C. Delayed-type hypersensitivity
D. Granulomatous inflammation
E. Interstitial inflammation

24. After an immunoassay a child was diagnosed with immunodeficiency of humoral immunity. What is the reason for the primary immunodeficiency development in the child?

A. Hereditary abnormality of immune system
B. Embryonal development abnormalities
C. Pathometabolism in mother's organism
D. Immune responsiveness and resistance disorders
E. --

25. A child with suspected tuberculosis was given Mantoux test. After 24 hours the site of the allergen injection got swollen, hyperemic and painful. What are the main

components that determine such response of the body?

A. Mononuclear cells, T-lymphocytes and lymphokines
B. Granulocytes, T-lymphocytes and IgG
C. Plasma cells, T-lymphocytes and lymphokines
D. B-lymphocytes, IgM
E. Macrophages, B-lymphocytes and Monocytes

26. A girl receives antibiotics of the penicillin group for acute bronchitis. On the third day of treatment she developed allergic dermatitis. Which drug should be administered?

A. Loratadine
B. Cromolyn sodium
C. Beclomethasone
D. Ephedrine hydrochloride
E. Levamisole

27. A child entering the school for the first time was given Mantoux test in order to determine if there was a need for revaccination. The reaction was negative. What is the meaning of this test result?

A. No cell-mediated immunity to tuberculosis
B. Availability of cell-mediated immunity to tuberculosis
C. No antibodies to the tuberculosis bacteria
D. No anti-toxic immunity to tuberculosis
E. Presence of antibodies to the tuberculosis bacteria

28. A male patient has been diagnosed with acute post-streptococcal glomerulonephritis. It is most likely that the lesion of the basement membrane of renal corpuscles was caused by the following allergic reaction:

A. Immune complex
B. Anaphylactic
C. Cytotoxic
D. Delayed
E. Stimulating

29. A child cut his leg with a piece of glass while playing and was brought to the clinic for the injection of tetanus toxoid. In order to prevent the development of anaphylactic shock the serum was administered by Bezredka method. What mechanism underlies this method of desensitization of the body?

A. Binding of IgE fixed to the mast cells
B. Blocking the mediator synthesis in the mast cells
C. Stimulation of immune tolerance to the antigen
D. Stimulation of the synthesis of antigenspecific IgG
E. Binding of IgE receptors to the mast cells

30. What condition may develop 15-30 minutes after re-administration of the antigen as a result of the increased level of antibodies, mainly IgE, that are adsorbed on the surface of target cells, namely tissue basophils (mast cells) and blood basophils?

A. Anaphylaxis
B. Antibody-dependent cytotoxicity

C. Delayed-type hypersensitivity
D. Immune complex hyperresponsiveness
E. Serum sickness

31. 10 days after having quinsy caused by beta-hemolytic streptococcus a 6year-old child exhibited symptoms of glomerulonephritis. What mechanism of glomerular lesion is most likely in this case?

A. Immunocomplex
B. Cellular cytotoxicity
C. Anaphylaxis
D. Atopy
E. Antibody-dependent cell-mediated cytolysis

32. A 22-year-old woman ate some seafood. 5 hours later the trunk and the distal parts of limbs got covered with small itchy papules which were partially fused together. After one day, the rash disappeared spontaneously. Specify the hypersensitivity mechanism underlying these changes:

A. Atopy (local anaphylaxis)
B. Systemic anaphylaxis
C. Cellular cytotoxicity
D. Immune complex hypersensitivity
E. Antibody-dependent cell-mediated Cytolysis

33. On allergological examination a patient has been diagnosed with pollinosis. Specific desensitization can be performed by:

A. Intermittent administration of allergen
B. Antihistamines
C. Glucocorticoids
D. Administration of saline
E. –

34. A 3-year-old child had eaten some strawberries. Soon he developed a rash and itching.

What was found in the child's leukogram?

A. Eosinophilia
B. Hypolymphemia
C. Neutrophilic leukocytosis
D. Monocytosis
E. Lymphocytosis

35. The development of both immune and allergic reactions is based upon the same mechanisms of the immune system response to an antigen. What is the main difference between the immune and allergic reactions?

A. Development of tissue lesion
B. Amount of released antigen
C. Antigen structure
D. Routes by which antigens are delivered into the body
E. Hereditary predisposition

36. During local anesthetization the patient has gone into anaphylactic shock. What drug must be administered to the patient?

A. Epinephrine hydrochloride
B. Diazepam
C. Atropine sulfate
D. Propranolol
E. Nitroglycerin

37. During blood transfusion a patient has developed intravascular erythrocyte hemolysis.

What kind of hypersensitivity does the patient have?

A. II type (antibody-dependent)
B. I type (anaphylactic)
C. III type (immune complex)
D. IV type (cellular cytotoxicity)
E. IV type (granulomatosis)

38. In the course of puncture biopsy of transplanted kidney the following has been revealed: diffuse infiltration of stroma by lymphocytes and plasmocytes and necrotic arteritis. What pathological process has developed in the transplant?

A. Immune rejection
B. Ischemic kidney failure
C. Glomerulonephritis
D. Tubular necrosis
E. Pyelonephritis

39. A 30-year-old patient has dyspnea fits, mostly at night. He has been diagnosed with bronchial asthma. What type of allergic reaction according to the Gell-Coombs classification is most likely in this case?

A. Anaphylactic
B. Cytotoxic
C. Stimulating
D. Immune complex
E. Delayed-type hypersensitivity

40. A 30-year-old patient has undergone keratoplasty in the transplantation center, cornea has been taken fron a donor, who died in a road accident. What kind of transplantation was performed?

A. Allotransplantation
B. Autotransplantation
C. Xenotransplantation
D. Explantation
E. Heterotransplantation

41. In our country, routine preventive vaccinations against poliomyelitis ivolve using live vaccine that is administered orally. What immunoglobulins are responsible for the development of local post-vaccination immunity in this case?

A. Secretory IgA
B. IgM
C. IgG
D. Serum IgA
E. IgE

42. Parents of 5-year-old child report him o have frequent colds that develop into pneumonias, presence of purulent rashes on the skin. Laboratory tests have revealed the following: absence of immunoglobulins of any type, and naked cells are absent from the lymph nodes punctate. What kind of immune disorder is it?

A. X-linked hypogammaglobulinemia (Bruton type agammaglobulinemia)
B. Autosomal recessive agammaglobulinaemia (Swiss type)
C. Hypoplastic anemia
D. Agranulocytosis
E. Louis-Barr syndrome

43. A patient has been diagnosed with ARVI (Acute Respiratory Viral Infection). Blood serum contains

immunoglobulin M. What is the stage of infection in this case?

A. Acute
B. Prodromal
C. Incubation
D. Reconvalescence
E. Carriage

44. A 12-year-old boy often suffers from virus and bacterial infections and eczematous skin lesions. Enlargement of T-lymphocytes and IgM with normal IgA and IgG was revealed on examination. What type of immune system pathology is presented in the patient?

A. Composite immunedefficiency
B. Hypoplasia of thymus
C. Bruton's hypogammaglobulinemia
D. Turner's syndrome
E. Hereditary immundeficiency of the complement system

45. A 27 y.o. patient put eye drops that contain penicillin. After a few minutes she felt itching and burning of her body, there appeared lip and eye-lid edemata; arterial pressure began to drop. What immunoglobulins took part in the development of this allergic reaction?

A. lgE and lgG
B. IgM and IgG
C. IgA and IgM
D. IgM and IgD
E. IgG and IgD

46. A patient was stung by a bee. Examination revealed that his left hand was hot, pink, edematic, there was a big red blister on the site of sting. What is the leading mechanism of edema development?

A. Increased vessel permeability
B. Reduced vessel filling
C. Injury of vessels caused by the sting
D. Drop of oncotic pressure in tissue
E. Drop of osmotic pressure in tissue

47. A child was born with cleft palate. Examination revealed aorta defects and reduced number of T-lymphocytes in blood. What immunodeficient syndrome is it?

A. Di-George
B. Wiskott-Aldrich
C. Chediak-Higashi
D. Louis-Bar
E. Swiss-type

48. Examination of a child who frequently suffers from infectious diseases revealed that IgG concentration in blood serum was 10 times less than normal, IgA and IgM concentration was also significantly reduced. Analysis showed also lack of B-lymphocytes and plasmocytes. What disease are these symptoms typical for?

A. Bruton's disease
B. Swiss-type agammaglobulinemia
C. Dysimmunoglobulinemia
D. Louis-Bar syndrome
E. Di George syndrome

49. A patient with skin mycosis has disorder of cellular immunity. The most typical characteristic of it is reduction of the following index:

A. T-lymphocytes
B. Immunoglobulin G
C. Immunoglobulin E
D. B-lymphocytes
E. Plasmocytes

50. A patient visited a dentist with complaints of redness and edema of his mouth mucous membrane in a month after dental prosthesis. The patient was diagnosed with allergic stomatitis. What type of allergic reaction by Gell and Cumbs underlies this disease?

A. Delayed type hypersensitivity
B. Cytotoxic
C. Immunocomplex
D. Anaphylactic
E. Stimulating

51. Tuberculin was introduced intracutaneously to the child for tuberculin test. Marked hyperemia, tissue infiltration developed on the place of injection in 24 hours. What mechanism caused these modifications?

A. Cell cytotoxity
B. Reagin type cytotoxity
C. Antibody cytotoxity
D. Granuloma formation
E. Immunocomplex cytotoxity

52. A patient had been ill with bronchial asthma for many years and died from asthmatic fit. Histologic lung examination revealed: lumen of bronchioles and small bronches contain a lot of mucus with some eosinophils, there is sclerosis of alveolar septums, dilatation of alveole lumen. What mechanism of development of hypersensibility reaction took place?

A. Reagin reaction
B. Cytotoxic reaction
C. Immunocomplex reaction
D. Cytolysis determined by lymphocytes
E. Granulomatosis

53. A 38-year-old patient died during intractable attack of bronchial asthma. Histologic examination revealed mucus accumulation in bronchial lumen, a lot of fat cells (labrocytes) in the wall of bronches, many of them are in the state of degranulation, there are also a lot of eosinophils. What pathogenesis of bronchial changes is it?

A. Atopy
B. Cytotoxic, cytolytic action of antibodies
C. Immunocomplex mechanism
D. Cellular cytolysis
E. Granulomatosis

54. A woman has been applying anew cosmetic preparation for a week that resulted in eye- lid inflammation accompanied by hyperemia, infiltration and painfulness. What type of allergic reaction was developed?

A. IV
B. I
C. II
D. III
E. V

55. An experimental animal was first sensibilized whereupon an antigen dose was introduced subcutaneously.

This injection resulted in the development of a fibrinous inflammation with alteration of vessel walls, basal substance and fibrous structures of connective tissue inform of mucoid and fibrinoid swelling and necrosis. What immunological reaction took place?

A. Immediate hypersensitivity
B. Delayed-type hypersensitivity
C. Reaction of transplantation immunity
D. Normergic reaction
E. Granulomatosis

56. 48 hours after tuberculin test (Mantoux test) a child had a papule 10mm in diameter on the spot of tuberculin injection. What hypersensitivity mechanism underlies these changes?

A. Cellular cytotoxicity
B. Anaphylaxy
C. Antibody-dependent cytotoxicity
D. Immunocomplex cytotoxicity
E. Granulomatosis

57. A 30 year old woman has applieda lipstick with a fluorescent substance for a long time. Then she got a limited erythema and slight peeling on her lip border, later there appeared transversal striae and cracks. Special methods of microscopic examination of the affected are a helped to reveal sensibilized lymphocyte sand macrophages in the connective tissue; cytolysis. What type of immunological hypersensitivity was developed?

A. IV type (cellular cytotoxicity)
B. I type (reaginic)
C. II type (antibody cytotoxicity)
D. III type (immune complex cytotoxicity)
E. Granulomatosis

58. After the prior sensibilization an experimental animal was given a subcutaneous injection of an antigen. The place of injection exhibited a fibrinous inflammation with alteration of the vessel walls, basal substance and fibrous structures of the connective tissue in form of mucoid and fibrinoid swelling and necrosis. What immunological reaction is it?

A. Immediate hypersensitivity
B. Reaction of transplantation immunity
C. Granulomatosis
D. Normergic reaction
E. Delayed-type hypersensitivity

59. 48 hours after tuberculin test (Mantoux test) a child had a papule 10 mm in diameter on the spot of tuberculin injection. What hypersensitivity mechanism underlies these changes?

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B. Anaphylaxy
C. Antibody-dependent cytotoxicity
D. Immunocomplex cytotoxicity
E. Granulomatosis

60. A patient was stung by a bee. Examination revealed that his left

hand was hot, pink, edematic, there was a big red blister on the site of sting. What is the leading mechanism of edema development?

A. Increased vessel permeability
B. Reduced vessel filling
C. Injury of vessels caused by the sting
D. Drop of oncotic pressure in tissue
E. Drop of osmotic pressure in tissue

61. After transfusion of 200 ml of blood a patient presented with body temperature rise up to 37, 9oC. Which of the following substances is the most likely cause of temperature rise?

A. Interleukin-1
B. Interleukin-2
C. Tumor necrosis factor
D. Interleukin-3
E. Interleukin-4

62. A 10-year-old child had the Mantoux tuberculin test administered. 48 hours later a papule up to 8 mm in diameter appeared on the site of the injection. What type of hypersensitivity reaction developed after the tuberculin injection?

A. Type IV hypersensitivity reaction
B. Arthus phenomenon
C. Seroreaction
D. Atopic reaction
E. Type II hypersensitivity reaction

63. During surgical manipulations a patient has been given novocaine injection for anesthesia. 10 minutes later the patient developed paleness, dyspnea, hypotension. What type of allergic reaction is it?

A. Anaphylactic immune reaction
B. Cellulotoxic immune reaction
C. Aggregate immune reaction
D. Stimulating immune reaction
E. Cell-mediated immune reaction

64. A man with a long-term history of bronchial asthma died from asphyxia. Histological examination of his lungs revealed that the lumens of bronchioles and minor bronchi contained a lot of mucus with some eosinophils. There was also sclerosis of interalveolar septa, dilatation of alveole lumens. What mechanism accounts for the development of hypersensitivity reaction?

A. Reagine reaction
B. Cytotoxic reaction
C. Immune complex reaction
D. Lymphocyte-mediated cytolysis
E. Granulomatosis

65. To prevent the transplant rejection after organ transplantation it is required to administer hormonotherapy for the purpose of immunosuppression. What hormones are used for this purpose?

A. Glucocorticoids
B. Mineralocorticoids
C. Sexual hormones
D. Catecholamines
E. Thyroid

66. Tuberculin was injected intraperitoneally to the animal sensibilized with tuberculin. Venous hyperemia and peritonial edema were

detected on the laparotomy in hours. Increased amount of lymphocytes and monocytes were in the smear-print from the peritonium. What pathological process is in the animal?

A. Allergic inflammation
B. Serous inflammation
C. Suppurative inflammation
D. Fibrinous inflammation
E. Aseptic inflammation

67. A 12-year-old child has developed nephritic syndrome (proteinuria, hematuria, cylindruria) 2 weeks after the case of tonsillitis, which is a sign of affected glomerular basement membrane in the kidneys. What mechanism is the most likely to cause the basement membrane damage?

A. Immune complex
B. Granulomatous
C. Antibody-mediated
D. Reaginic
E. Cytotoxic

68. Several minutes after a dentist administered novocaine for local anaesthesia of a patient's tooth, the following symptoms sharply developed in the patient: fatigue, skin itching. Objectively the following can be observed: skin hyperemia, tachycardia, BP dropped down to 70/40 mm Hg. What kind of allergic reaction is this pathology?

A. Anaphylactic
B. Cytotoxic
C. Stimulating
D. Cell-mediated immune reaction
E. Immune complex

69. During blood transfusion a patient has developed intravascular erythrocyte hemolysis. What kind of hypersensitivity does the patient have?

A. II type (antibody-dependent)
B. I type (anaphylactic)
C. III type (immune complex)
D. IV type (cellular cytotoxicity)
E. IV type (granulomatosis)

70. Lymphocytes and other cells of our body synthesize universal antiviral agents as a response to viral invasion. Name these protein factors:

A. Interferon
B. Interleukin - 2
C. Cytokines
D. Interleukin - 4
E. Tumor necrosis factor

71. What condition may develop15-30minutes after re-administration of an antigen as a result of the increased level of antibodies, mainly IgE, that are adsorbed on the surface of target cells, namely tissue basophils(mast cells)and blood basophils?

A. Anaphylaxis
B. Antibody-dependent cytotoxicity
C. Delayed-type hypersensitivity
D. Immune-complex hyperresponsiveness
E. Serum sickness

72. 30 minutes after drinking mango juice a child suddenly developed a local swelling in the area of the soft palate, which impeded swallowing and, eventually, respiration. Mucosa of the swollen area was hyperemic and painless. Blood test revealed moderate eosinophilia. Body temperature was normal. Anamnesis states that the elder sister of the child

has been suffering from bronchial asthma attacks. What kind of edema has developed in the child?

A. Allergic
B. Inflammatory
C. Cardiac
D. Alimentary
E. Hepatic

73. After sensitization a test animal received subcutaneously a dose of antigen. At the site of injection a fibrinous inflammation developed with alteration of vessel walls, basal substance, and fibrous structures of connective tissue. The inflammation took form of mucoid and fibrinoid degeneration, fibrinoid necrosis. What immune response occurred in the test animal?

A. Immediate hypersensitivity
B. Delayed hypersensitivity
C. Transplantation immune reaction
D. Normergic reaction
E. Granulomatosis

74. On examination the patient was determined to have strong, balanced, inert type of higher nervous activity according to Pavlov's classification. What temperament according to Hippocrates is it?

A. Phlegmatic
B. Sanguine
C. Choleric
D. Melancholic
E. –

75.A 10-year-old child had cut his leg with a glass shard, when playing, and was delivered to the outpatient department to receive antitetanus serum. To prevent development of anaphylactic shock the serum was introduced by Bezredka method. This method of organism hyposensitization is based on the following mechanism:
A. Binding of mast cell-fixed IgE
B. Blocking of mast cell mediators synthesis C. Stimulation of immune tolerance to antigen
D. Stimulation of antigen-specific IgG2
E. Stabilization of mast cell membranes

76.After sensitization a test animal received subcutaneously a dose of antigen. At the site of injection a fibrinous inflammation developed with alteration of vessel walls, basal substance, and fibrous structures of connective tissue. The inflammation took form of mucoid and fibrinoid degeneration, fibrinoid necrosis. What immune response occurred in the test animal?
A. Immediate hypersensitivity
B. Delayed hypersensitivity
C. Transplantation immune reaction
D. Normergic reaction
E. Granulomatosis

77.A 5-year-old child is diagnosed with Bruton syndrome (X-linked agammaglobulinemia) that manifests itself in severe clinical course of bacterial infections and absence of B lymphocytes and plasma cells. What changes of immunoglobulin content can be observed in blood serum of the child with immunodeficiency?
A. Decreased IgA, IgM
B. Increased IgA, IgM
C. Decreased IgD, IgE
D. Increased IgD, IgE
E. No changes

78.A pregnant woman was detected to have IgM to rubella virus. An obstetriciangynecologist recommended therapeutic abortion due to the high risk of teratogenic affection of the fetus. Detection of IgM was of great importance as it is these specific immunoglobulins that:
A. Indicate recent infection
B. Penetrate placental barrier
C. Have the largest molecular weight
D. Are associated with anaphylactic reactions E. Are the main factor of antiviral protection

79.A patient with clinical signs of a primary immunodeficiency has functionally disturbed mechanism of antigen-presentation to the immunocompetent cells. What cells are likely to have structural defects?
A. Macrophages, monocytes
B. T-lymphocyte
C. B-lymphocyte
D. Fibroblasts
E. O-lymphocytes

80. Antileukocytic antibodies are detected in the blood of a patient with leukopenia. What type of Coombs-Gell hypersensitivity reaction developed in this case?
A. Cytotoxic
B. Stimulating
C. Anaphylactic
D. Delayed-type hypersensitivity
E. Immune complex-mediated

Tasks for Self-Control

(give correct answers and find mistakes in the statements)

1) Give the characteristics of BAS effect control mechanisms:
    1. A special role in BAS activity regulation belongs to eosinophilic granulocytes.
    2. Eosinophilic granulocytes contain arylsulfatase.
    3. Eosinophilic granulocytes contain histaminase.
    4. Neutrophils contain arylsulfatase.
    5. T-suppressors stimulate immune reactions
    6. cAMP accelerates mast cell degranulation.
    7. Cortisole protects target cells from BAS effect.
    8. BAS secretion and inactivation depend on genetics.

2) Pharmacologists propose different drugs for the treatment of inflammatory and allergic diseases. This therapy is based on BAS inactivation. What knowledge about BAS should guide pharmacologists?

Blood kallikrein-kinin system activation is accompanied by formation of such BAS:

1. histamine,
2. serotonin,
3. prostaglandins,
4. bradykinin,
5. eicosanoids,
6. heparin,
7. leukotrienes.

The following BAS are of cellular origin:

8. complement,
9. proteolytic enzymes from neutrophil lysosomes.

Such BAS are released from tissue basophiles:

10. histamin,
11. heparin,
12. serotonin,
13. kinins,
14. kallidin.
15.

3) Pharmacologists devise medical drugs for the treatment of immunological system disorders. What scientific knowledge should guide them?

Lymphokines have the following properties:

1. They are released from T-lymphocytes after contacting an antigen.
2. They regulate the function of all lymphocyte populations.
3. They do not influence granulocytes.

Antibodies are characterized by the following features:

4. They get into the organism from the outside.

5. They are formed from albumins.
6. Antibodies are immunoglobulins.
7. They provide the humoral mechanism of immunity.
8. They freely circulate in the blood and organism liquids.

Immunoglobulins have the following types and properties:

9. IgE can be absorbed by tissue basophiles.
10. There are 3 classes of immunoglobulins.
11. They inhibit complement activity.
12. Immunoglobulins can pass through the placenta and form active natural immunity in the newborn.
13. IgE can pass through the placenta.

4) Give the characteristics of the lsl stage of the immediate type of allergy.

1. It is a pathochemical stage.
2. It is a stage of BAS formation.
3. Sensibilization of the organism is formed during this stage.
4. One antibody molecule is formed on one molecule of the antigen.
5. This stage begins after the second dose of the antigen.
6. It is finished after immune complex (antigen+antibody) formation.
7. Sensibilization of the organism may be active only.
8. Sensibilization consists in distribution of humoral antibodies in the organism
1. and their fixation on tissue basophils and other somatic cells.
9. The period of antibody formation is 3—5 days.
10. The period of sensitization formation is 1—2 weeks.

5) Allergic diseases are widespread among people and their number is constantly increasing. A physician must know that there is allergic predisposition, which is determined genetically.

1. Allergic predisposition is inherited as a dominate type.
2. Allergic predisposition is inherited as a polygenetic type.

The mechanisms of allergic predisposition may be the following:

3. T-immunodeficiency.
4. Increased permeability of the mucous membranes for foreign proteins.
5. Surplus of T-suppressors.
6. T-suppressors deficit.
7. Predisposition to IgE production.
8. Deficiency of BAS inhibitors production.
9. Adrenal cortex hyperfunction and surplus of glucocorticoids production.

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