GENERAL PATHOPHYSIOLOGY

Methodical recommendations for teachers regarding preparation for students' practical classes (majoring in "Medicine" and "Dentistry")

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
Харківський національний медичний університет

GENERAL PATHOPHYSIOLOGY

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ЗАГАЛЬНА ПАТОФІЗІОЛОГІЯ

Методичні рекомендації для викладачів щодо підготовки до практичних занять студентів (спеціальність «Медицина» та «Стоматологія»)

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Загальна патофізіологія : методичні рекомендації для викладачів щодо підготовки до практичних занять студентів (спеціальність «Медицина» та «Стоматологія») / упоряд. М. С. Мирошниченко, В. О. Бібіченко, М. О. Кучерявченко, О. О. Павлова та ін. Харків : ХНМУ, 2023. 108 с.

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Substantial module 1.
General nosology – general studies about illness, etiology and pathogenesis. Pathogenic action fators of environment. A role of internal factos in pathology

Topic № 1. The subject and the tasks of pathophysiology. The metods of pathophysiology

Number of hours: 2 academic hours.

Relevance of the topic:

Pathologic physiology – it is a branch of medical and biological sciences that studies the patterns of occurrence, development and outcome of pathological processes; features and nature of dynamic changes in physiological functions in various pathological conditions of the body.

The section of general pathophysiology includes such subsections as "general nosology" and "the doctrine of typical pathological processes".

The main method of studying of pathophysiology is an experiment, with reproduction of certain types of disease models, disorders of organs and systems in order to study the main patterns of the development of human diseases.

Purpose of the lesson:

General – to clarify the subject and tasks of pathophysiology. Pathophysiological research methods. The main stages of the development of pathophysiology. Determination of the essence of the pathophysiological experiment, its features and significance in medicine

Specifically:

Know:

1. The essence of acute and chronic experiments, to evaluate their positive and negative sides, the advantages of the experiment compared to the observation method.

Be able to:

1. To characterize the main stages of the pathophysiological experiment and the main criteria for the selection of animals in the experiment.

Practical experience:

1. Draw up a plan for conducting a pathophysiological experiment and choose a species of laboratory animal in accordance with its purpose.
2. To evaluate the relationship between the experiment and the method of clinical observation.

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1. Draw up a plan for conducting a pathophysiological experiment and choose a species of laboratory animal in accordance with its purpose.
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Technological map of students work on the topic
"The subject and the tasks of pathophysiology. The metods of pathophysiology"

No	Stage of lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
1	Determination of the initial level of knowledge	10	Control of theoretical training of students using a programmed method using constructive answers to cards questions	Tests, control, cards, questions	Study room
2	Analysis of theoretical material	35	Analysis of the theoretical material is carried out on the basis of control questions of the topic and "Krok-1" tasks	Control questions of the topic, "KROK-1 tasks"	
3	Conducting an experiment	30	Introduction and preparation for setting up the experiment Setting up the experiment	Mice, rats, rabbits, frogs, walls for fixing animals, tweezers, scissors, syringes and other surgical instruments, straps, pneumograph	
4	The final stage of determining the level of knowledge and skills. Summing up	15	Determination of the initial level of formation of knowledge and skills	Solving situational tasks	

Graphological structure of the topic "The subject and the tasks of pathophysiology. The metods of pathophysiology" is attached.

Material and methodical support from topics " The subject and the tasks of pathophysiology. The metods of pathophysiology".

1. Lectures;
2. Methodological developments for teachers;
3. Methodical instructions for students;
4. A set of test tasks to determine the basic level of knowledge;
5. A set of situational tasks to determine the final level of knowledge;
6. A set of KROK-1 tasks;
7. Tables and slides;
8. Mice, rats, rabbits, frogs;
9. Video films;
10. Syringes and other surgical instruments, straps, pneumograph, walls for fixing animals, tweezers, scissors.

Lesson content:

1) Goals and tasks of pathophysiology
2) Components of pathophysiology
3) Methods of pathophysiology
4) General nosology
5) Forms and periods (stages) of disease development

Setting up the experiment.
Discussion of results and formulation of conclusions

Acquaintance with the components of the experiment and the requirements for them.

1) Selection of research objects. Laboratory animals. Humane treatment of animals is a necessary condition of a scientific experiment.

2) Preparation of animals for the experiment. Methods of anesthetizing animals (general and local anesthesia). Methods of complete anesthetization of the animal (decerebration of the frog, anesthesia, curettage). Methods of partial restriction of animal movement (tying, machines for fixing animals). Accustoming animals to the laboratory environment.

3) Methods of taking blood from different animals (taking blood from surface vessels, from internal vessels in angiostomized animals). Injections under the skin, in the abdominal cavity, in the vein of a dog, rabbit, guinea pig, frog.

4) Methods of graphic registration of heart contractions, blood pressure, breathing. Bloodless methods of determining blood pressure.

5) Experimental surgical operations. Asepsis and antiseptics. Surgical instruments.

6) Peculiarities of experimental study of pathological processes at different levels of integration. Methods of molecular pathology.

7) Critical transfer of experimental data to the clinic.

Discussion of the results of the experiment:

In the introduction, it should be noted, that the experiment is the most important means of studying the laws of nature, which is of great importance for pathophysiology. The experiment makes it possible to reproduce many pathological processes under the simplest conditions. It makes it possible to dissect complex pathological phenomena into simpler ones. In the experiment, it is possible to study the general patterns and dynamics of the development of pathological processes. The significance of the experiment lies in the fact that it makes it possible to carry out such effects that are unacceptable on a person, to trace the dynamics of the pathological process in its entirety, to investigate its pathogenesis more deeply, and to carry out tests of new means.

Formulation of conclusions on the experiment:

1. The data obtained in the experiment cannot be mechanically transferred to a person:

- human physiological processes are strongly modulated by social factors;
- physiological processes in humans and different animal species may differ. However, "only after passing through the fire of experiment, medicine will become what it should be, that is, conscious, and therefore, always and fully expediently acting" (I. P. Pavlov).

2. An acute experiment, an experiment on isolated organs - a method of analytical research. The Pavlovian stage in the development of the experimental

method is characterized by the introduction of a chronic experiment as a method necessary "to obtain impeccable analytical data in many cases, and synthetically almost always" (I.P. Pavlov).

Terminology:

- Pathophysiology
- Disease
- Pathological process
- Pathological condition
- Pathological reaction
- Remission
- Relapse
- Complication
- Aggravation
- Preagony
- Agony
- Death

Tasks for independent work on the topic "The subject and the tasks of pathophysiology. The metods of pathophysiology".

It is necessary to draw up a plan for conducting a pathophysiological experiment and choose a species of laboratory animal in accordance with its purpose. To evaluate the relationship between the experiment and the method of clinical observation. Analysis of mistakes with an explanation of the correct answers.

List of questions and works to be studied:

1. Definition of the term "pathophysiology".
2. Subject, methods and tasks of pathophysiology.
3. The main features and tasks of the pathophysiological experiment.
4. Correlation of the clinical observation method with the pathophysiological experiment.
5. Is an experiment on a person possible?
6. The main stages of the pathophysiological experiment.
7. Name the famous founders of the scientific experiment method.
8. Specify the role of various scientists in the development of experimental pathology and medicine.

List of practical skills that must be mastered:

1. Methods of conducting a pathophysiological experiment;
2. Choose a type of laboratory animal according to its purpose;
3. Evaluate the correlation of the experiment with the method of clinical observation.

Situational tasks KROK-1 to determine the final level of knowledge

1. Patient D., 34 years old, complains of pain in the gums of the upper jaw, bleeding, slight loosening of the teeth. Diagnosed with periodontitis. What is a typical pathological process in this case?

A. Caries. *C. Inflammation.* *E. Redness.*
B. Bleeding. *D. Pain.*

2. A 10-year-old child suffered several attacks of rheumatism. During his clinical examination, it was established that there were inflammatory phenomena in the joints and there were signs of mitral valve insufficiency. Which of the pathological phenomena in this patient can be attributed to the concept of "disease"?

A. Rheumatism. *D. Inflammation of the joints.*
B. Mitral valve defect. *E. Insufficiency of the mitral valve.*
C. Arthritis.

3. A patient was admitted to the infectious department with complaints of pain in the right hypochondrium, general weakness, yellowness of the skin, discolored stool. Objectively: the sclera and skin are jaundiced, t – 39 °C, the liver is enlarged, the stool is acholic. A diagnosis of "hepatitis" was made. What stage of the disease does this correspond to?

A. The outcome of the disease. *D. Prodromal period.*
B. Incubation period. *E. The outbreak of the disease.*
C. Latent period.

4. Patient Zh., 5 years old, became acutely ill with an increase in body temperature to 38.2 °C, complained of pain when swallowing. In the oral cavity, a bright red rash, redness of the gums in the area of the front teeth of the upper jaw. What nosological concept characterizes the patient's condition?

A. Relapse of the disease. *D. Pathological reaction.*
B. Exacerbation of the disease. *E. Period of remission.*
C. The outbreak of the disease.

5. The patient was admitted to the hospital for the first time with a diagnosis of gastric ulcer. Currently, he complains of pain in the epigastric region, heartburn, nausea, tarry stool. How can such a patient's condition be characterized?

A. Complications. *C. Remission.* *E. Pathological condition.*
B. Relapse. *D. Pathological reaction.*

6. The patient consulted a doctor because of a furuncle (inflammation of a hair follicle) in the back area. The patient has no fever or signs of intoxication. This is most likely:

A. Disease. *C. Pathological reaction.* *E. –.*
B. Pathological condition. *D. Pathological process.*

7. A woman who had her teeth treated for caries agreed to a tooth extraction due to complications. Which of the pathological phenomena in women can be attributed to the concept of "pathological condition"?

A. Increase in temperature. *C. Swelling.* *E. Absence of a tooth.*
B. Redness. *D. Edema.*

8. During a dental examination, a 37-year-old patient was found to be missing 1 left upper premolar. According to the patient, the tooth was removed two years ago as a result of periodontal disease. What phenomenon is observed in the patient?

A. Pathological process. *C. Pathological condition.* *E. Complications.*
B. Pathological reaction. *D. Chronic process.*

9. In a patient with peptic ulcer, after the treatment, digestion normalized, pains disappeared, mood improved, but after a few weeks pains in the epigastrium, heartburn, acid belching appeared again. How should this course of the disease be characterized?

A. Prodromal period. *C. Latent period.* *E. Complications.*
B. Period of remission. *D. Relapse.*

10. A patient with pneumonia is prescribed complex treatment: etiotropic, pathogenetic, symptomatic. Etiotropic means of pharmacocorrection include drugs affecting:

A. The reason for the development of the disease.
B. The cause and conditions of disease development.
C. Conditions that will contribute to the development of the disease.
D. Causal relationships.
E. Function of the diseased organ.

Standards of correct answers to the task KROK-1

1	2	3	4	5	6	7	8	9	10
C	*A*	*E*	*C*	*A*	*D*	*E*	*C*	*D*	*A*

Recommendations for registration of work results

1. Written answer to test tasks (initial level of knowledge).
2. The results of the experiment are drawn up in the form of an experiment protocol with the determination of relevant conclusions.
3. Protocol for solving situational tasks with an explanation of the correct answers.

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Topic № 2. **Pathogenic effect of physical factors**

Number of hours: 2 academic hours.

Relevance of the topic: Various environmental factors can become pathogenic for living organisms. This is possible as the result of the absence of adaptation mechanisms in the organism to such effects, or in the case when the force of the influence of a common environmental factor exceeds the adaptive capabilities of the organism, or in the case of a change in the reactivity of the organism. Often an organism is exposed to the combined effects of various factors, which complicates the mechanisms and increases the severity of pathological changes. Knowledge of the possible consequences of the pathogenic impact of environmental factors, the mechanisms of their development makes it possible to define the ways of pathogenetic therapy, and in some cases, preventionof them. Distinguished such pathogenic factors as chemical (acids, alkalis, methanol, drugs); physical (electric current, ionizing radiation, ultrasound); biological (viruses, bacteria, helminths); thermal (high and low ambient temperatures); mechanical (impact, bruise, stretching) and other factors.

Purpose of the lesson:

General - to characterize the pathogenic effect of ionizing radiation on the body, to characterize local and general manifestations of radiation damage, the main mechanisms of their development in order to further develop the ability to rationally apply prevention and pathogenetic treatment of radiation sickness.

To characterize the essence of disorders that occur in the human body under the influence of high and low T°, to use knowledge of the mechanisms of these disorders in practice in the diagnosis and treatment of overheating and hypothermia.

Specifically:

Know:

1. Mechanisms of local and general reactions that occur during irradiation.
2. Identify the main manifestations of radiation damage, explain the mechanism of local and general action of ionizing radiation on the body.
3. To characterize the stages of overheating, the main phenomena of overheating and their mechanisms. Define the concept of heat stroke and solar stroke.
4. To characterize the stages of hypothermia, the main manifestations of hypothermia and their mechanisms. Define the concepts of natural and artificial hypothermia.
5. Describe the concept of defrosting. Describe the degrees of frostbite.

Be able to:

1. Interpret the concepts of "ionizing radiation", "free radicals", "lipid peroxidation", "radiolysis of water", "radiation disease".
2. Explain the mechanism of local and general reactions that occur during irradiation.

3. Identify the main manifestations of radiation damage, explain the mechanism of local and general action of ionizing radiation on the body.

4. Describe the stages of overheating, the main phenomena of overheating and their mechanisms, concepts of thermal and solar shock, burns.

5. Describe the stages of hypothermia, the main manifestations of hypothermia and their mechanisms, the concept of frostbite. Describe the degrees of frostbite.

Practical experience:

1. Describe ionizing radiation, its types and properties.
2. Interpret the processes of free radical oxidation in the norm.
3. Explain the mechanisms of heat exchange between the body and the external environment.
4. Explain the useful adaptive meaning of compensatory reactions that develop when the T° of the environment increases, when the T° of the environment decreases.

Technological map of students work on the topic "Pathogenic effect of physical factors"

No	Stage lesson	Academic time, min	Educational guide		Place holding class
			Educational tools	Equipment	
1	Determination of the initial level of knowledge	10	Control of theoretical training of students using a programmed method using constructive answers to card questions	Test control, card questions.	Study room
2	Analysis of theoretical material	35	Analysis of the theoretical material is carried out on the basis of control questions of the topic and "Krok-1" tasks	Control questions of the topic, tasks "Krok-1"	
3	Conducting an experiment	30	Introduction and preparation for setting up the experiment. Setting up the experiment	Mice, tripod, thermometer, kettle, glass rod, tubs with ice and water	
4	The final stage of determining the level of knowledge and skills. Summing up	15	Determination of the initial level of formation of knowledge and skills	Solving situational tasks	

The graphological structure of the topic "Pathogenic effect of physical factors" is attached.

Material and methodological support of the topic "Pathogenic effect of physical factors":

1. Lectures;
2. Methodical guidelines for teachers;
3. Methodical instructions for students;
4. A set of test tasks to determine the basic level of knowledge;
5. A set of situational tasks to determine the final level of knowledge;

6. A set of KROK-1 tasks;
7. A set of diagrams and tables (presentation);
8. Video films;
9. For the experiment (experimental animals – mice; tripod, thermometer, kettle, glass rod, tubs with ice and water).

Lesson content:

1) Ionizing radiation
2) Radiation disease
3) Overheating
4) Heat stroke
5) Sunstroke
6) Thermal burn
7) Hypothermia
8) Frostbite

Setting up the experiment.
Discussion the results and formulation the conclusions

Experiment No 1. The effect of elevated temperature.

1. Place the mouse in the bank.
2. To study the initial state of the animal: behavior, color of visible skin, number of respiratory movements per minute.
3. Place the jar with the mouse in a bath with water, temperature 38 ^{o}C.
4. In the future, increase the water temperature by 10 (up to 45 ^{o}C), and monitor changes in the animal's condition. When studying the condition of the animal, pay attention to the following: behavior, breathing, coat color, etc. after 5 minutes.
5. Describe the results according to the attached scheme.

After immersing the can with the mouse in water, a slight reddening of the visible integuments and some increased breathing is noted. In the future, the phenomena of hyperemia intensify, breathing becomes more frequent, anxiety appears, which is increasingly intensified. A state of excitement is observed, which is replaced by increasingly growing depression. Then the animal lies at the bottom of the can, severe shortness of breath, cyanosis, clonic convulsions, and death are noted.

Experiment No 2. Effect of low temperature.

1. Place the jar with the mouse in the ice bath.
2. Pay attention to the following: behavior, breathing, color of visible skin.
3. 5 minutes after immersing the jar with the mouse in ice, note a slight paleness of the visible integuments and a slightly accelerated breathing.
4. Describe the results according to the attached scheme.

In the future, pay attention to the appearance of hyperemia, a sharp increase in breathing, and the appearance of anxiety, which is increasing more and more. To observe a state of excitement, which will be replaced by an increasingly

growing depression. Record the position of the animal lying on the bottom of the jar, note severe shortness of breath, cyanosis, clonic convulsions, death.

Discussion of the results of the experiment

1. For hyperthermia - pay attention to the initial changes in the state of the body, which are an adaptive reaction aimed at maintaining a constant body temperature. These changes are manifested in shortness of breath, flushing and increased sweating. The mechanism is explained by a reflex reaction from exteroceptors on the surface of the body.

Initial changes constitute the first stage - compensation. In the future, these adaptive mechanisms turn out to be insufficient, the body temperature rises and overheating occurs. At the same time, the normal relationship between the physical and chemical regulation of the body is disturbed, the metabolism increases, which further contributes to the increase in body temperature. The nervous system is affected by the following effects: the flow of impulses from extero- and interoreceptors, high blood temperature, unoxidized metabolic products, loss of salts and water by the body. All this excites the nervous system. The normal regulation of functions is disturbed, which leads to an even sharper increase in breathing, impaired blood circulation, impaired water and other types of metabolism. This is the second stage of overheating - excitement. Then comes a state of depression. Breathing is uneven, sharp cyanosis. Seizures occur, which explain overexcitation in the central nervous system, which are replaced by paralysis of the centers. This is the third stage of overheating.

When discussing the mechanisms of the observed phenomena, emphasize the presence of not only quantitative, but also qualitative changes in the body.

2. For hypothermia –pay attention to the initial changes in the state of the body, which are an adaptive reaction aimed at maintaining a constant body temperature. These changes manifest in shortness of breath, pallor, and decreased sweating. The mechanism is explained by a reflex reaction from extrareceptors on the surface of the body.

The initial changes are the first stage of hypothermia – compensation. In the future, these adaptive mechanisms turn out to be insufficient, the body temperature decreases, hypothermia actually occurs. At the same time, the normal relationship between physical and chemical regulation of heat is disturbed. Increasing heat production and reducing heat output only by physical mechanisms becomes insufficient.

Metabolism increases, neurohumoral mechanisms of body protection against cold are activated. The nervous system is influenced by impulses from extra- and intrareceptors, transforms them and sends afferent impulses to muscles, adrenal cortex, hypothalamic-pituitary system. The normal regulation of functions is disturbed, which leads to an even sharper increase in breathing, impaired blood circulation, impaired energy and other types of metabolism.

The second, short-term stage of hypothermia comes – the stage of excitement, which is replaced by a longer stage of depression. Breathing is uneven, sharp cyanosis. Convulsions appear, which are explained by overexcitation of the central nervous system, which are replaced by paralysis of the center. When discussing the mechanisms of the observed phenomena, emphasize the presence of not only quantitative, but also qualitative changes in the body.

Formulation of conclusions based on the experiment

For hyperthermia:

1. The cause of the observed phenomena is an increase in the ambient temperature.

2. Conditions that contribute to overheating - humidity, physical exertion, lack of air movement, reduced reactivity of the body.

3. The initial increase in the temperature of the environment does not cause pronounced changes in the animal's condition. This is achieved due to an increase in heat transfer and a decrease in heat production. Further increase in ambient temperature – overstrain of compensatory mechanisms, body temperature rises. A stage of excitement is developing, which is replaced by depression.

For hypothermia:

1. The reason for the observed phenomena is the low temperature of the environment.

2. Conditions that contribute to hypothermia are high humidity.

3. The effect of low temperature is accompanied by the inclusion of compensatory reactions aimed at maintaining normal body temperature. It consists in changing thermoregulation in the direction of: – increasing heat production – limiting heat output. In the future, the compensatory mechanisms become insufficient and the body temperature decreases. At the same time, the function of the central nervous system is suppressed, which is manifested by a violation of the vasomotor center. This leads to paralysis of blood vessels and rapid loss of body heat.

Terminology:

- Ionizing radiation
- External radiation
- Internal radiation
- Pancytopenia
- Overheating
- Overcooling
- Heat stroke
- Sunstroke
- Thermal burn
- Overcooling
- Frostbite

Tasks for independent work

It is necessary to characterize ionizing radiation, its types and properties, to explain the useful adaptive meaning of compensatory reactions that develop when the T° of the environment increases and when the T° of the environment decreases. Be able to explain the mechanisms of occurrence. Analyze the errors with an explanation of the correct answers.

List of questions and works to be studied:

1. What types of ionizing radiation can have a pathogenic effect on the body?
2. What is the pathogenesis of general and local effects of ionizing radiation on the body?
3. What is the essence of the direct damaging effect of ionizing radiation on cells?
4. What is the essence of the indirect progressive effect of ionizing radiation on cells?
5. What determines the radiosensitivity of tissues to the action of ionizing radiation?
6. What is radiation sickness? Name the forms and stages of acute radiation sickness.
7. What syndromes are most characteristic of the period of the advanced clinical picture of ARD? What is their pathogenesis?
8. Name the most important long-term effects of ionizing radiation on the body.
9. What factors contribute to the development of radiation injuries and prevent them?
10. What protective and compensatory mechanisms in cells are aimed at preventing and eliminating radiation damage?
11. The concept of hyperthermia.
12. The cause and conditions of overheating.
13. Stages of overheating. The main phenomena of overheating and their mechanisms.
14. Heat and sunstroke.
15. Burn. Burn disease.
16. The concept of hypothermia. Reason and conditions of cooling.
17. Cooling stages. Compensatory reactions to the action of low T° of the environment and their mechanisms. The main phenomena of cooling and their mechanisms.
18. Natural and artificial hypothermia.
19. Frostbite.

List of practical skills that must be mastered:

1. Interpret the processes of free radical oxidation in the norm;
2. To evaluate the results of the study of lipid peroxidation;
3. Explain the mechanisms of heat exchange between the body and the external environment;

4. Explain the useful adaptive meaning of compensatory reactions that develop when the temperature of the environment increases;

5. Explain the useful adaptive meaning of compensatory reactions that develop when the temperature of the environment decreases;

Situational tasks KROK -1 to determine the level of knowledge

1. When studying the comparative radiosensitivity of tissues, it was found that their sensitivity to the action of ionizing radiation is not the same. Indicate which of the listed tissues is the most radiosensitive?

A. Cartilaginous. *C. Bone.* *E. Nervous.*
B. Hematopoietic. *D. Muscular.*

2. During the accident on the nuclear submarine, the submariners were irradiated. The primary ionization of which molecules is most important in the development of radiation sickness?

A. Water. *C. Lipids.* *E. Enzymes.*
B. Structural proteins. *D. Nucleic acids.*

3. During the period of acute radiation sickness, the patient experienced leukopenia, thrombocytopenia, autoinfection, autointoxication, bleeding, and increased body temperature. What form of radiation sickness is this picture characteristic of?

A. Bone marrow. *C. Toxemic.* *E. Hemorrhagic.*
B. Intestinal. *D. Cerebral.*

4. The liquidator of the consequences of the accident at the nuclear power plant developed a hemorrhagic syndrome during the course of acute radiation sickness. What is most important in the pathogenesis of this syndrome?

A. Increasing the activity of the factors of the blood clotting system.
B. Decreased activity of blood coagulation factors.
C. Violation of the structure of the vessel wall.
D. Increase in the activity of fibrinolysis factors.
E. Thrombocytopenia.

5. In a rabbit after irradiation, the third period of the bone-marrow form of ARD is observed. Damage to which tissue is leading in the pathogenesis of disorders in this case?

A. Bone. *C. Nervous.* *E. Glandular epithelium.*
B. Hematopoietic. *D. Epithelium of gonads.*

6. A nuclear power plant worker was taken to the clinic after a single exposure with complaints of weakness, headache, increased T°, diarrhea. In the blood analysis – leukocytosis with lymphopenia. What is the most likely stage of radiation sickness?

A. The period of primary reactions. *D. Latent period.*
B. A period of imaginary well-being. *E. Prodromal period.*
C. The period of the developed clinical picture.

7. When working with radioactive substances, the employee received a total radiation dose of 4 Gy as a result of the accident. Complains of headache, nausea, dizziness. What changes in blood composition can be expected in a patient 10 hours after exposure?

A. Lymphocytosis. *C. Agranulocytosis.* *E. Neutropenia.*
B. Leukopenia. *D. Neutrophil leukocytosis.*

8. An employee of a "hot" workshop was taken to the hospital before the end of the working day, complaining of headache, dizziness, nausea, and general weakness. Objectively: consciousness is preserved, the skin is hyperemic, dry, hot to the touch. Heart rate – 130/min. Breathing is frequent, shallow. What violation of thermoregulation processes most likely occurred in a person in this situation?

A. A decrease in heat production without a change in heat output.
B. Enhancement of heat transfer and heat production.
C. Reduction of heat transfer.
D. Increasing heat production without changing heat output.
E. Increasing heat transfer and reducing heat production.

9. A patient with large burns of the skin of the body has signs of severe intoxication. For which stage of burn disease is this characteristic?

A. Burn infection. *C. Burn exhaustion.* *E. Terminal.*
B. Burn shock. *D. Burn toxemia.*

10. A 25-year-old man's body temperature rose to 39°C after a long stay in the sun with high air humidity. What pathological process is observed in this case?

A. Burn disease. *D. Non-infectious fever.*
B. Hyperthermia. *E. Hypothermia.*

Standarts of correct answers to the KROK-1 task

1	2	3	4	5	6	7	8	9	10
B	*A*	*A*	*E*	*B*	*A*	*D*	*C*	*D*	*B*

Recommendations for registration of work results

1. Written answer to test tasks (initial level of knowledge).
2. The results of the experiment are drawn up in the form of an experiment protocol with the determination of relevant conclusions.
3. Protocol for solving situational tasks with an explanation of the correct answers.

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Topic № 3. Pathology of reactivity. Barriers. Violation of phagocytosis

Number of hours: 2 academic hours.

Relevance of the topic: The reactivity of an organism is the property of an organism to respond to environmental influences by such changes in vital activity as metabolism, growth, reproduction, etc. Reactivity is inherent in every living organism. In the process of evolution, along with the complication of the organization of living beings, the forms and mechanisms of reactivity became more complex.

In practical medicine, the term "reactivity" was widely used for the purpose of a general, most often quantitative, assessment of the state of the patient's body. So, the state of increased reactivity was called hyperergy, and decreased – hypoergy.

The function of biological barriers of the organism was developed in the process of evolution as the result of the adaptation of the organism to environmental conditions. Biological barrers, presented by anatomical and physiological formations, belognging to the factors of non-specific protection of the body or its separate parts from the pathogenic effects of the environment and supporting the homeostasis. Permeability of biological barrers changing during pathological processes.

Purpose of the lesson:

General -to study the influence of environmental factors on the body's reactivity. To be able to characterize external and internal barriers under the influence of environmental factors. To study the essence of the processes of the phagocytic reaction, its mechanisms and place in the body's immune system, to evaluate its biological significance.

Specifically:

Know:

1. The influence of environmental factors on the body's reactivity.
2. To be able to characterize external and internal barriers under the influence of environmental factors.
3. To study the essence of the processes of the phagocytic reaction, its mechanisms and place in the body's immune system, to evaluate its biological significance.

Be able to:

1. Explain the general regularities of the functioning of the body, its individual organs and systems.
2. Explain the features of barrier devices.
3. To characterize phagocytosis as a biological phenomenon.
4. To characterize the main properties of tissue macrophages.

Practical experience:

To find out the general regularities of the functioning of the body, the peculiarities of barrier devices, the main properties of leukocytes, to

characterize phagocytosis as a biological phenomenon and the main properties of tissue macrophages.

Technological map of students work on the topic "The pathology of reactivity. Biological barriers. Violation of phagocytosis"

No	Stage lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
1	Determination of the initial level of knowledge	10	Control of theoretical training of students using a programmed method using constructive answers to ticket questions.	Test control, card questions.	Study room
2	Solving educational tasks on the following topics: 2.1 Analysis of theoretical material 2.2 Conducting the experiment	70	Analysis of the theoretical material is carried out on the basis of control questions of the topic and tasks "Step 1". Introduction and preparation for setting up the experiment Setting up the experiment	Control questions of the topic, task "Krok-1." Rabbit, pneumograph, kymograph, ammonia. frog, thin rubber probes, 10 % magnesium sulfate solution, syringes, tweezers. Mouse, syringes, scissors, 10 % trypan blue solution, ether	Study room
3	The final stage of determining the level of knowledge and skills. Summing up	10	Determination of the initial level of formation of knowledge and skills.	Solving situational tasks	Study room

The graphological structure of the topic "The pathology of reactivity. Biological barriers. Violation of phagocytosis" is attached.

Material and methodological support of the topic "The pathology of reactivity. Biological barriers. Violation of phagocytosis":

1. Lectures;
2. Methodological developments for teachers;
3. Methodical instructions for students;
4. A set of test tasks to determine the basic level of knowledge;
5. A set of situational tasks to determine the final level of knowledge;
6. A set of KROK-1 tasks;
7. A set of diagrams and tables (presentation);
8. Video films;
9. For the experiment (rabbit, pneumograph, kymograph, ammonia. frog, thin rubber probes, 10 % magnesium sulfate solution, syringes, tweezers, syringes, scissors, 10 % trypan blue solution).

Lesson content:

1) Reactivity
2) Resistance

3) Biological barriers
4) Phagocyte system
4) Disorders of phagocytosis
5) System of macrophages
5) Disorders of mononuclear system

Setting up the experiment.
Discussion the results and formulation the conclusions

Experiment No. 1: study of the barrier function of the mucous membranes of the respiratory tract.

1. Fix the rabbit. Put a pneumograph on the chest, connect it with a rubber tube to the capsule Moray and record the output breath.
2. Bring a cotton ball soaked in ammonia to the external respiratory tract of the animal, record changes in breathing. Repeat the effect on the respiratory tract with ammonia. Pay attention to the duration of the breath stop after each subsequent irritation. Draw a pneumogram.

Experiment No 2: study of the barrier properties of the skin.

1. In the experiment, take two frogs of the same mass, study the initial state.
2. Administrate 2–3 ml of 10 % magnesium sulfate solution, one into the spinal lymphatic bag, and the other into the stomach (using a syringe and probe).
3. Monitor the condition of the animals for 30 minutes. The first observation should be carried out 7–10 minutes after the injection of magnesium sulfate.
4. Pay attention to changes in reflex activity (rollover, corneal, pain reflexes) characteristic of magnesium sulfate intoxication.
5. Enter the results in the table.

Time	Frog No 1	Frog No 2
	2–3 ml of magnesium sulfate is injected into the dorsal lymphatic bag	2–3 ml of magnesium sulfate is injected into the stomach

Experiment No 3: study of the blood-brain barrier.

1. Inject to the mice under the skin of 0.5–1 ml of 10 % trypan blue solution.
2. After 40 minutes kill the animal with ether.
3. Open the chest, abdominal cavity, skull.
4. Compare the intensity of staining of internal organs and the brain.

Discussion of the results of the experiment

Experiment 1. Short-term respiratory arrest was observed during inhalation of ammonia vapors. During repeated inhalations of ammonia vapors, the breath holding time is shortened.

Experiment 2. After the introduction of 3.0 ml of magnesium sulfate solution into the spinal lymphatic bag, after 30 minutes there is a decrease in mobility, weakening of reflexes, and respiratory disorders. The condition of the second frog, to which magnesium sulfate was injected into the stomach, did not change.

Experiment 3. 30 minutes after the injection of 0.5–1.0 ml of 1 % solution of trypan blue under the skin of a rat, an intense blue staining of all organs is revealed during an autopsy, while the brain tissue is not stained.

Formulation of conclusions based on the experiment

1. Due to the presence of a large number of receptors of the nervous system in the mucous membrane, reflexes of a protective nature can occur here. In the case of sudden entry of irritating gases or vapors into the respiratory tract, there is a reflex delay of breathing, as a result of which the entry of the harmful agent into the body stops.

2. With regard to many substances, the mucous membrane of the stomach and intestines has limited permeability. Some substances are absorbed by the mucous membrane in small amounts, for example, magnesium sulfate. Therefore, in this experiment, no noticeable signs of poisoning were detected after the introduction of magnesium sulfate into the digestive tract of animals. The second animal, to which magnesium sulfate was injected under the skin, soon showed signs of poisoning, which increased all the time.

3. The function of the blood-brain barrier is performed by the endothelium of the brain capillaries, as well as the meninges, the ependyma of the ventricles, and the choroid plexus.

Terminology:

- Reactivity
- Resistance
- Biological barriers
- Phagocytes
- Phagocytosis

Tasks for independent work

It is necessary to find out the general regularities of the functioning of the organism, the peculiarities of barrier devices, the main properties of leukocytes, to characterize phagocytosis as a biological phenomenon. Be able to explain the mechanism of occurrence. Analyze the errors with an explanation of the correct answers.

List of questions and works to be studied:

1. Concept of reactivity.
2. Types and mechanisms of reactivity.
3. The importance of endogenous factors in the formation of pathological reactivity.
4. The influence of exogenous factors on the development of pathological reactivity. Mechanisms of changes in sensitivity to hypoxia under conditions of hypothermia. Value for the clinic.

5. The concept of barrier devices of the body. External and internal barriers.
6. Mechanisms providing the barrier role of the skin and mucous membranes.
7. Mechanisms providing the barrier role of blood, bone marrow, spleen, lymph nodes, liver, kidneys.
8. Histohematic barriers, the barrier role of cell membranes and cell organelles.
9. Significance of violation of the body's barrier functions in pathology.
10. The concept of phagocytosis.
11. Phagocytic theory of I.I. Mechnikova.
12. Classification of phagocytes, its principles.
13. Stages of phagocytosis, their mechanisms. Regulation of phagocytosis.
14. Pinocytosis and ultramicrophagocytosis.
15. Disorders of phagocytosis and their role in pathology.
16. Concept of the systemmononuclear phagocytes.
17. Principles of uniting cellular elements into the system of mononuclear phagocytes, its structure and functions.
18. Role mononuclear phagocytes in specific immunological reactions.

List of practical skills that must be mastered:

Characterize the general regularities of the functioning of the organism, the peculiarities of barrier devices, the main properties of leukocytes, phagocytosis as a biological phenomenon and the main properties of tissue macrophages.

Situational tasks KROR-1 to determine the final level of knowledge

1. Non-specific factors protecting the oral cavity from the penetration of pathogenic microorganisms play an important role in the general system of physiological resistance of the body. Which of the components in the oral cavity is the most important factor of non-specific protection?

A. β-lysine. *C. Complement.* *E. Properdin.*
B. Phagocytosis. *D. Lysozyme.*

2. The periodontist needs to evaluate the patient's factors of non-specific resistance of saliva and secretions of the mucous membranes of the oral cavity. What factor of non-specific resistance should be studied in the researched material in the first place?

A. Complement. *C. Lysozyme.* *E. Interferon.*
B. Secretory IgA. *D. Properdin.*

3. In patients with chronic granulomatosis, saprophytes cause serious diseases. What mechanisms cause the manifestations of this disease?

A. Gammaglobulin deficiency in the blood.
B. Violation of phagocytosis.
C. Absence of the thymus gland.
D. Deficiency of the T-lymphocyte system.
E. Disorders in the complement system.

4. In a practical session, students studied a stained blood smear of a mouse with bacteria phagocytosed by leukocytes. What organelle completes the digestion of these bacteria?

A. Ribosomes.
B. Golgi apparatus.
C. Lysosomes.
D. Granular endoplasmic reticulum.
E. Mitochondria.

5. When examining patients with periodontitis, the degree of periodontal tissue damage was noted to depend on the amount of lysozyme in saliva and gingival fluid. What is the indicator of the body's protection under investigation?

A. Non-specific resistance.
B. Autoreactivity.
C. Cellular immunity.
D. Tolerance.
E. Humoral immunity.

6. As a result of the viral process in the submaxillary salivary glands, significant sclerosis of their parenchyma occurred and the production of biologically active hormonal substances decreased. Because of this, regeneration of CO in the oral cavity was disturbed. The reason for this is insufficient content in saliva:

A. Mumps.
B. Thymocyte-transforming factor.
C. Lysozyme.
D. Growth factorepithelium.
E. Insulin-like factor.

7. In the experiment, a significant number of stem cells of the ChKM were destroyed in a certain way. Renewal of which cell populations in the composition of loose connective tissue will be inhibited?

A. Fibroblasts.
B. Pigment cells.
C. Macrophages.
D. Lipocytes.
E. Pericytes.

8. A 15-year-old girl has a history of frequent purulent diseases. In the blood – leukopenia, neutropenia, impaired formation of lysosomes, incomplete phagocytosis. What is the most likely diagnosis?

A. Chronic granulomatosis.
B. Complement deficiency.
C. Thymus hypoplasia.
D. Chediak-Higashi syndrome.
E. Alder's disease.

Standards of correct answers to the task KROK-1

1	2	3	4	5	6	7	8
D	*C*	*B*	*C*	*A*	*D*	*C*	*D*

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Topic № 4. Disturbances in the immunologic reactivity

Number of hours: 2 academic hours.

Relevance of the topic: The immune system plays an important role in the complex mechanism of human adaptation organism, ensuring the preservation of antigenic homeostasis, violation of which may be due to penetration into organism of foreign antigens or spontaneous mutation. The immune system usually protects the organism against foreign antigens, but sometimes its excessive activity can cause disease. Distinguished such disorders of immune system, such as immunodepressive and immunodeficient states, which significantly affect the development and course of diseases.

Purpose of the lesson:

General – to be able to characterize the regularities of immunodepressive and immunodeficient states.

Specific:

Know:

1. Immunodepressive and immunodeficient states, types of immunodeficient states.
2. To determine the cause, mechanism of development and manifestations of acquired immunodeficiency syndrome.

Be able to:

1. To characterize the structure of the immunocompetent system.
2. Explain the functions of individual cells of the immunocompetent system.
3. To analyze the mechanisms of immunological reactivity.
4. To analyze the mechanisms of high- and low-dose immunological tolerance.
5. To explain disorders leading to acquired insufficiency of the immune system – immunodepressive states.

Practical experience:

To justify the mechanisms of immunological reactivity, immunological tolerance, to explain the disorders leading to the acquired insufficiency of the immune system – immunodepressive states.

Technological map of students work on the topic "Disturbances in the immunologic reactivity"

No	Stage of lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
1	Determination of the initial level of knowledge	10	Control of theoretical training of students using a programmed method using constructive answers to card questions	Test control, card questions.	Study room

No	Stage of lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
2.	Solving educational tasks on the following topics: 2.1 Analysis of theoretical material	10 45	Analysis of the theoretical material is carried out on the basis of control questions of the topic and "Krok-1" tasks	Topic control questions, "Krok-1" tasks	Study room
3.	The final stage of determining the level of knowledge and skills. Summing up	25	Determination of the initial level of formation of knowledge and skills	Solving situational tasks.	Study room

The graphological structure of the topic "Disturbances in the immunologic reactivity" attached.

Material and methodological support of the topic "Disturbances in the immunologic reactivity":

1. Lectures;
2. Methodical instructions for teachers;
3. Methodical instructions for students;
4. Set of test tasks to determine the basic level of knowledge;
5. Set of situational tasks to determine the final level of knowledge;
6. Set of KROK-1 tasks;
7. Set of schemes and tables (presentation);
8. Set of forms with a clinical blood test;
9. Video films.

Lesson content:

1) Immune system overview
2) Immunocompetent cells
3) Interaction of cells during the immune response
4) Immunological reactivity
5) Immunopathological conditions
6) Primary immunodeficiency states
7) Secondary immunodeficiency states

Terminology:

- Cellular immune response
- Humoral immune response
- Immunopathological condition
- Primary immunodeficiency
- Secondary immunodeficiency
- Combined immunodeficiency

Tasks for independent work

It is necessary to substantiate the mechanisms of immunological reactivity. Explain the mechanisms that enable the body to produce antibodies against all antigens that are present in nature and created artificially. Analyze the errors with an explanation of the correct answers

List of questions and works to be studied:

1. The concept of immunity and immunological reactivity.
2. Physiological and pathological immunological reactivity.
3. Specific and non-specific, cellular and humoral mechanisms of immunological reactivity (immune reactions).
4. The concept of immunodeficiency and immunodepressive conditions.
5. Classification of immunodeficiency states. Features of individual species.
6. Immunodeficiencies associated with a violation of T-lymphocytes.
7. Immunodeficiencies associated with B-lymphocyte disorders.
8. Combined immunodeficiency states.
9. Etiology, pathogenesis of acquired immunodeficiency syndrome (AIDS).
10. Immunological tolerance.
11. Pathophysiological basis of transplantation of organs and tissues.

List of practical skills that must be mastered:

Mechanisms of immunological reactivity, to analyze the mechanisms of protection of the mucous membrane of the oral cavity, mechanisms of high- and low-dose immunological tolerance, to explain disorders leading to acquired insufficiency of the immune system - immunodepressive states.

Situational tasks KROK-1 to determine the final level of knowledge

1. In a patient with clinical signs of primary ID, a violation of the function of antigen presentation to immunocompetent cells was found. The defect in the structures of which cells is possible?

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

2. For the diagnosis of generalized herpetic infection, blood serum was examined in order to detect specific Ab of a certain class. Which type indicates the acute stage of a viral infection?

A. Ig M. *B. IgA.* *C. Ig E.* *D. Ig G.* *E. Ig D.*

3. In the second year of his life, the boy often began to suffer from respiratory diseases, stomatitis, pustular lesions of the skin. Even small injuries to the skin (gums) are complicated by long-term inflammation. It was established that the blood of the child is practically devoid of Ig of all classes. A decrease in the functional activity of which cell population underlies the described syndrome?

A. NK lymphocytes. *C. Neutrophils.* *E. T-lymphocytes.*
B. B-lymphocytes. *D. Macrophages.*

4. During the examination of a patient who has been taking glucocorticoids for a long time, lymphopenia was found. How can the functional state of the patient's immune system be characterized?

A. Secondary immunodeficiency. *D. Tolerance to autoantigens.*
B. Primary immunodeficiency. *E. Anaphylaxis.*
C. Congenital immunodeficiency.

5. When examining the state of the immune system of a patient with chronic fungal lesions of the skin, a violation of cellular immunity was revealed. The decrease of which indicators is the most characteristic in this case?

A. Immunoglobulins G. *C. T-lymphocytes.* *E. Plasma cells.*
B. Immunoglobulins E. *D. B-lymphocytes.*

6. A two-year-old child was diagnosed with hypoplasia of the thymus. Which indicator of the state of the immune system is most characteristic of this immunodeficiency?

A. Decrease in the number of B-lymphocytes.
B. Deficiency of T and B lymphocytes.
C. Decrease in the number of T-lymphocytes.
D. Absence of plasma cells.
E. Decrease in immunoglobulins M.

7. The patient has DiGeorgi syndrome, which is based on hypoplasia of the thymus gland. What form of immune pathology does this disease belong to?

A. Congenital B-lymphocyte deficiency.
B. Purchased B-lymphocyte deficiency.
C. Aquired deficiency of T-lymphocytes.
D. Congenital deficiency of T-lymphocytes.
E. Immunodepression in the T-lymphocyte system.

8. Mice with no hair cover (i.e., nude) did not have cellular reactions of the delayed type. For this pathology, the most probable are:

A. Absence of the thymus gland.
B. Absence of gammaglobulins in the blood.
C. Disorders of hematopoiesis.
D. Phagocytosis defect.
E. Deficiency of components of the complement system.

9. When registering a child for school, a Mantoux test was performed to resolve the issue of the need for revaccination, which turned out to be negative. What does this test result indicate?

A. Absence of cellular immunity to tuberculosis.
B. Absence of Ab to tuberculosis bacteria.
C. Presence of cellular immunity to tuberculosis.
D. Lack of antitoxic immunity to tuberculosis.
E. The presence of At to tuberculosis bacteria.

10. The patient's blood test revealed signs of HIV infection. Damage to which immunocompetent cells is characteristic of AIDS?

A. T-helpers. *C. B-lymphocytes.* *E. Neutrophils.*
B. T-killers. *D. Macrophages.*

Standarts of correct answers to the KROK-1 task

1	2	3	4	5	6	7	8	9	10
C	*A*	*B*	*A*	*C*	*C*	*D*	*A*	*A*	*A*

Recommendations for registration of work results

1. Written answer to test tasks (initial level of knowledge).

2. The results of the experiment are drawn up in the form of an experiment protocol with the determination of relevant conclusions.

3. Protocol for solving situational tasks with an explanation of the correct answers.

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Topic № 5. Allergy

Number of hours:2 academic hours.

Relevance of the topic: The urgency of the problem of allergic diseases is extremely high, both in view of their high prevalence and due to the fact that they significantly reduce the quality of life. Nowadays, every third inhabitant of the planet suffers from one or another allergic reaction. Moreover, there is a trend towards their wider distribution. In the formation of allergic reactions one of the first places is taken by various environmental factors.

Allergic reactions are atypical reactions of the immune system, accompanied by damage to healthy tissues of one's own body. The mechanisms of protection against various damaging factors and infectious agents, and the mechanisms of allergic reactions in which one's own tissues suffer, are similar. Thus, the components of immunity (antibodies, lymphocytes, etc.), in addition to fighting infections, are also involved in the development of allergic reactions.

Purpose of the lesson:

General – to clarify the causes and mechanisms of allergic reactions in humans and animals.

Specific:

Know:

1. Classification, causes, stages of allergic reactions, mechanisms of their development.

2. Prevalence of allergens in everyday life, at work, in medicine, the need for their regulation.

Be able to:

To explain the dialectical relationship between immunity and allergy as two sides of the same process based on immunological reactivity.

Practical experience:

1. To substantiate the relationship between immunity and allergy, the relationship of allergy to reactivity

2. In the experiment, reproduce the degranulation of basophilic granulocytes (tissue basophils) as one of the mechanisms of allergic reactions.

Technological map of students work on the topic "Allergy"

No	Stage of lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
1	Determination of the initial level of knowledge	10	Control of theoretical training of students using a programmed method using constructive answers to card questions	Test control, card questions	Study room

No	Stage of lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
2	Solving educational tasks on the following topics: 2.1 Analysis of theoretical material. 2.2. Conducting an experiment	 45 25	 Analysis of the theoretical material is carried out on the basis of control questions of the topic and "Krok-1" tasks. Introduction and preparation for setting up the experiment. Setting up the experiment	Topic control questions, "Krok 1" tasks. Microscopes, histological drugs, rabbits	Study room
3	The final stage of determining the level of knowledge and skills. Summing up	10	Determination of the initial level of formation of knowledge and skills	Solving situational tasks	Study room

The graphological structure of the topic "Allergy" is attached.

Material and methodological support of the topic "Allergy":

1. Lectures;
2. Methodological developments for teachers;
3. Methodical instructions for students;
4. A set of test tasks to determine the basic level of knowledge;
5. A set of situational tasks to determine the final level of knowledge;
6. A set of KROK-1 tasks;
7. A set of diagrams and tables (presentation);
8. Video films;
9. For the experiment (experimental animals – rabbits; microscopes, histological preparations).

Lesson content:

1) Allergy overview
2) Allergens classification
3) Stages of allergic reactions
4) I type of hypersensitivity
5) II type of hypersensitivity
6) III type of hypersensitivity
7) IV type of hypersensitivity
8) V type of hypersensitivity

Setting up the experiment. Discussion of results and formulation of conclusions

Experiment No 1: study of mast cell degranulation during anaphylactic shock in rats.

1. The rats that were sensitized before lesson by three subcutaneous injections of normal horse serum with complete Freund's adjuvant (a mixture of killed tuberculosis mycobacteria, petroleum jelly and lanolin) (1:1). 0.5 ml of the mixture was injected under the skin. Injections were performed every other

day. Freund's adjuvant serves to increase the sensitivity of rats to horse serum, since rats have a natural refractoriness to foreign protein.

2. At the height of sensitization (12–17 days after the last injection of allergen with adjuvant), animals were intravenously injected with 1 ml of horse serum to reproduce anaphylactic shock.

3. Control animals at the height of sensitization were injected with an isotonic solution of sodium chloride.

4. After the death of the control animals, mesentery preparations were prepared: the pieces were fixed in 10 % formalin with the addition of 0.1 % acetic acid and stained with a 1 % solution of toluidine blue. Adipose tissue was removed, mesenteric tissue was passed through alcohols of increasing concentration, clarified with xylene and placed in polystyrene.

5. During the lesson, perform microscopy of preparations at a magnification of ×400 (ocular ×10, objective ×40).

6. Draw prepatrations.

7. Explanation of preparations:

Preparation No 1 **(***CONTROL***).** Mast cells are round or oval in shape, compact, well stained with toluidine blue in an intense blue color. Degranulated cells occur very rarely and make up no more than 2–4 %.

Preparation No 2 **(***experiment***).** Mast cells are enlarged, their edges are indistinct. Most cells show signs of degranulation to varying degrees. Degranulated cells often do not form a single whole and resemble a "bunch of grapes" because they consist of a collection of separate clearly visible granules. Individual cells, due to the dissolution of granules in the intercellular fluid, represent a blurred spot.

Experiment No 2: familiarization with the method of reproduction and local manifestations of the Artus phenomenon in rabbits.

1. In the experiment, take two rabbits, which were given 4 injections (5 ml every 5 days) of normal horse serum under the skin of the previously depilated middle third of the thigh for the purpose of sensitization. The fifth, separate, injection was given to one rabbit under the skin, to another – into a joint.

2. During the lesson, pay attention to the local external manifestations of the Artyus phenomenon (skin and joint): hyperemia, local temperature increase, swelling, dysfunction, etc.

Experiment No 3: Study of morphological manifestations of the Artyus phenomenon by histological method.

In class, during microscopic examination, pay attention to the phenomena of hemorrhagic vasculitis: leukocyte thrombi in microvessels, tissue infiltration by leukocytes, edema and hemorrhage.

Discussion of the results of experiments

The first injections of horse serum, carried out at certain times, increased the animal's sensitivity to the injected substance (sensitization). Later injections of the same serum caused the development of a violent inflammatory reaction at the site of its introduction (separate injection). A necessary condition for the

development of the Artus phenomenon is a high titer of precipitating antibodies in the blood. After a separate injection, a large amount of precipitate (antigen-antibody complex) is formed locally in the vessel walls, which leads to the development of hemorrhagic vasculitis with hemorrhagic-necrotic tissue damage. In the genesis of local allergic reactions, it is necessary to take into account the role of leukocytes and platelets, a significant role in the Artus phenomenon belongs to the blockage of blood vessels by leukocyte thrombi. Disturbances of exchange processes play a significant role in the mechanism of the Artyus phenomenon. research,

Leukocyte thrombi, tissue infiltration with leukocytes, and fibrinous necrosis of vessels can be seen in the micropreparation of the focus of the Artus phenomenon.

Degranulation of mast cells during an anaphylactic reaction is associated with the interaction of the antigen with antibodies of the Ig E class, which were fixed on the surface of mast cells. Rapid release of biologically active substances from mast cells is one of the most important mechanisms of anaphylaxis.

Formulation of conclusions based on the experiment

1. Rats sensitized with Freund's adjuvant developed anaphylactic shock, as evidenced by the degranulation of dangerous cells. The rapid release of biologically active substances (histamine, etc.) from dangerous cells led to generalized vasodilatation of peripheral vessels, a drop in blood pressure, which was clinically manifested by the development of anaphylaxis.

2. A sensitized rabbit with repeated administration of horse serum developed the Artus phenomenon in the form of local external manifestations (skin and joint): hyperemia, local increase in temperature, swelling, impaired function, etc. Artyus' phenomenon is a local manifestation of an immune complex allergic reaction (type III) and is caused by the formation of CIC A/g – A/b (Ig M, IgG).

3. The basis of the development of an immune complex allergic reaction (type III) is the formation of CIC with the development of hemorrhagic vasculitis – leukocyte thrombi in microvessels, tissue infiltration by leukocytes, edema and hemorrhage.

Terminology:

- Hypersensitivity
- Sensitization
- Allergen
- Antigen
- Antibody
- Desensitization
- Artyus phenomenon

Tasks for independent work

It is necessary to substantiate the relationship between immunity and allergy, the relationship of allergy to reactivity. Be able to explain the mechanism of occurrence. Analyze the errors with an explanation of the correct answers.

List of questions and works to be studied:

1. Concept of allergy.
2. Definition of allergens
3. Mechanisms of the immunological stage of allergic reactions:

a) the essence of the mechanisms of sensitization and manifestation in the case of allergies of the delayed and immediate type;

b) allergy as overstrain or dysfunction of the immune system.

4. Mechanisms of the biochemical stage of allergic reactions:

a) production and deactivation systems of biologically active substances (BAS);

b) features of the implementation of the biochemical stage.

5. Mechanisms of the pathophysiological stage of allergic reactions.
6. Classification of mechanisms of development of allergic reactions
7. Mechanisms of the main allergic reactions of the immediate type (anaphylactic shock, bronchial asthma, urticaria, apnoea phenomenon, hay fever, etc.) and delayed (tuberculin reaction, reactions to infectious antigens, contact dermatitis, immunological reactions against the transplant).
8. Mechanisms of autoallergic reactions, hetero- and paraallergy.
9. Mechanisms of desensitization and allergy prevention.
10. The relationship between allergy, immunity, immunological reactivity and inflammation.

List of practical skills that must be mastered:

Be able to simulate anaphylactic shock in an experiment, to explain the mechanisms of the main clinical manifestations of anaphylaxis.

Situational tasks KROK-1 to determine the final level of knowledge

1. In August, after working at the farm, the patient developed a condition characterized by a doctor as a state of increased and qualitatively altered reaction to the introduction of compounds of an antigenic or haptenic nature into the body. Which of the conditions best fits the characteristics described by the doctor?

A. Anaphylaxis. *C. Allergy.* *E. Immunological tolerance.*
B. Paraallergy. *D. Tachyphylaxis.*

2. Prior to tooth extraction, the patient underwent conductive anesthesia with novocaine, after the administration of which swelling and hyperemia appeared around the injection site, skin itching, general weakness, hypotension, motor excitement. What is the name of this complication?

A. Allergy. *C. Tachyphylaxis.* *E. Inflammation.*
B. Idiosyncrasy. *D. Drug dependence.*

3. To simulate anaphylactic shock, guinea pigs were subjected to passive sensitization. What should be introduced for the purpose of passive sensitization?

A. Specific immunoglobulins. *D. Tissue basophils.*
B. Horse serum. *E. B-lymphocytes.*
C. Sensitized T-lymphocytes.

4. The dentist administered a solution of novocaine to the patient for pain relief during the removal of a carious tooth. A few minutes later, the patient developed symptoms: a drop in blood pressure, an increase in BP, and convulsions. What type of allergic reactions can this condition be attributed to?

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

5. A 27-year-old woman complained of itching and burning in the eyes, lacrimation, sneezing, running from the nose. The symptoms appeared after a trip out of town in the summer. Diagnosed pollinosis. What type of allergic reaction developed?

A. Cytotoxic. *D. Anaphylactic.*
B. The reaction of the formation of immune complexes. *E. Stimulating.*
C. Delayed sensitivity.

6. Immediately after repeated administration of the antibiotic, the patient developed shortness of breath, a feeling of fear, a decrease in blood pressure. What type of allergic reactions underlie this condition?

A. Humoral cytotoxicity. *C. Cellular cytotoxicity.* *E. Stimulants.*
B. Immunocomplex. *D. Anaphylactic.*

7. At the end of spring, a man shows signs of rhinitis, redness of the conjunctiva of the eyes. An increased content of eosinophils was found in the blood. What type of allergic reaction?

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

8. During haymaking, one of the workers had a fever, chills, lacrimation, and a runny nose. The worker said that he sees this every year at this time. What is the type of allergic reaction according to Coombs and Gell?

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

9. A 37-year-old man was treated with a solution of novocaine during the treatment of acute pulpitis. A few minutes later, the patient developed anaphylactic shock. What Ig mainly interacts with in the body of Ag during this allergic reaction?

A. IgM. *B. IgA.* *C. IgE.* *D. IgD.* *E. IgG.*

10. A 44-year-old man with acute pneumonia was prescribed intramuscular penicillin. After the injection, the patient's condition deteriorated sharply: shortness of breath appeared, the patient was covered in cold sweat. Pulse 140/min., weak filling. Blood pressure 90/40 mm Hg. What complication is most likely to occur?

A. Anaphylactic shock. *D. Infectious-toxic shock.*
B. Thromboembolism of the pulmonary artery. *E. –.*
C. Cardiogenic shock.

11. A 40-year-old man was treated with a lidocaine solution for pulpitis. A few minutes later, the patient developed tachycardia, a sharp drop in blood pressure. What condition has the patient developed?

A. Anaphylactic shock. *D. Stress-adaptation syndrome.*
B. Crash syndrome. *E. Burn shock.*
C. Bronchial spasm.

12. the patient developed anaphylactic shock after administration of anti-tetanus serum. What cells secrete mediators in the classical version of anaphylaxis?

A. Tissue basophils. *C. T-lymphocytes.* *E. B-lymphocytes.*
B. Eosinophils. *D. Neutrophils.*

13. In the patient, after 30 min. after treatment at the dentist, red itchy spots appeared on the skin of the face and the mucous membrane of the mouth. Urticaria was diagnosed. Which of the BAS that causes vasodilation and itching is released in this type of allergic reaction?

A. Prostaglandin E2. *C. Interleukin-1.* *E. Histamine.*
B. Leukotriene B4. *D. Bradykinin.*

14. A 54-year-old woman turned to a doctor with complaints about intolerance to chicken eggs, which appeared recently. The antihistamine drugs prescribed by the doctor led to some improvement in the patient's condition. What At could contribute to the development of this reaction?

A. Ig A. *B. Ig D.* *C. Ig G.* *D. Ig M.* *E. Ig E.*

15. With the development of anaphylactic reactions, marked hyperemia is observed, pain. What mediator of anaphylaxis determines the development of the above-mentioned disorders?

A. Heparin. *D. Histamine .*
B. Chemotaxis factors. *E. Complement proteins.*
C. Platelet activation factor.

16. A few minutes after the administration of the drug, the patient's blood pressure dropped to 70/30 mm Hg. Art. Which of the chemical mediators of anaphylaxis causes vasodilation and shock?

A. Heparin. *D. Chemotaxis factor of eosinophils.*
B. Interleukins. *E. Neutrophil chemotaxis factor.*
C. Histamine.

Standards of correct answers to the task KROK-1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
C	*A*	*A*	*A*	*D*	*D*	*A*	*C*	*D*	*A*	*A*	*A*	*E*	*E*	*D*	*C*

Recommendations for registration of work results

1. Written answers to test tasks (initial level of knowledge).
2. The results of the experiment are drawn up in the form of an experiment protocol with the determination of relevant conclusions.
3. Protocol for solving situational tasks with an explanation of the correct answers.

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Substantial module 2.
Typical pathological processes

Topic № 6. Typical disorders of peripheral blood circulation and microcirculation

Number of hours: 2 academic hours.

Relevance of the topic: Local circulatory disorder is the blood circulation inside the organs, that is, in the vessels from small arteries to small veins. Its violations are widespread among the population of organs and systems. Peripheral circulation and microcirculation disorders include: affective and venous hyperemia, ischemia, stasis. As the causes of the occurring cases of blood circulation, thrombosis and embolism are most often distinguished. local circulatory disorders arising from the action of various pathogenic agents, and especially in violation of the neuro-humoral regulation of blood circulation in the vessels. These changes lead to the fact that the tissues are not sufficiently supplied with oxygen and nutrients, carbon dioxide and metabolites are poorly removed from them. All this can lead to changes in the structure of organs and tissues. The discovery of the pathogenesis of typical peripheral circulations and microcirculation allows free treatment and treatment of problems.

Purpose of the lesson:

General: study of changes in local blood circulation, which are characteristic of arterial and venous hyperemia, ischemia, embolism, their types, causes and mechanisms of development, as well as manifestations.

Specifically:

Know:

1. Definition of the term peripheral blood circulation and microcirculation.
2. Arterial hyperemia, its causes, types, pathogenesis. Manifestations, their mechanisms. Consequences.
3. Venous hyperemia, its causes, pathogenesis. Manifestations, their mechanisms. Consequences.
4. Ischemia. Causes, types, pathogenesis. Manifestations, their pathogenesis. Consequences.
5. Stasis. Its types, pathogenesis.
6. Thrombosis. Reasons. The process of thrombus formation, its mechanisms. Types of blood clots. Consequences of thrombosis.
7. Embolism. Reasons, types. Experimental models. Consequences.
8. Parenchymal bleeding. Causes, types, pathogenesis. Consequences.

Be able:

1. Experimentally simulate arterial hyperemia and microcirculatory phenomena in arterial hyperemia, venous hyperemia, ischemia and embolism.
2. Explain the mechanisms of arterial and venous hyperemia, ischemia, thrombosis and embolism, microcirculation and lymph circulation disorders.

3. Determine the main clinical manifestations of arterial hyperemia, venous hyperemia, ischemia, thrombosis, and embolism.

Practical experience:

1. Determination of signs of peripheral blood circulation and microcirculation disorders using case tasks:

• arterial hyperemia
• venous hyperemia
• ischemia
• thrombosis
• embolism (fat, air, gas, thromboembolism of the pulmonary artery).

Technological map of students' work on the topic "Typical disorders of peripheral blood circulation and microcirculation"

№	Stage lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
1	Determination of the initial level of knowledge	10	Written answer to test tasks	Test tasks	Study room
2	Analysis of theoretical material	35	Analysis of theoretical material based on control questions of the topic, situational tasks, tasks KROK-1	Topic control questions, KROK-1 tasks, situational tasks	
3	Practical part (conduct experiment)	30	Introduction and preparation for setting up the experiment. Setting up the experiment. Discussion of the results of the experiment and formulation of conclusions	Rabbit. Frog. Microscope, cork board, tweezers, syringes, isotonic solution NaCl	
4	Determination of the final level of knowledge and skills. Summary.	15	Determination of the initial level of formation of knowledge and skills	KROK-1 tasks, situational tasks	

The graphological structure of the topic "Typical disorders of peripheral blood circulation and microcirculation" is attached.

Material and methodological support of the topic "Typical disorders of peripheral blood circulation and microcirculation":

1. Lectures;
2. Methodical instructions for teachers;
3. Methodical instructions for students;
4. A set of test tasks to determine the basic level of knowledge;
5. A set of situational tasks to determine the final level of knowledge;
6. Set of tasks KROK-1;
7. A set of schemes and tables (presentation);

8. A set of illustrative cards with disorders of peripheral blood circulation and microcirculation;

9. Video films;

10. For the experiment (experimental animals – rabbits, frogs; cork with a side groove, cork board for fixing the animal, rubber tourniquet, pins, tweezers, syringes, scissors, microscope, 0.1 % hydrochloric acid solution, petroleum jelly emulsion).

Lesson content:

1) Arterial Hyperemia: definition, causes, pathogenesis, forms
2) Venous Hyperemia: definition, causes, pathogenesis, forms
3) Ischemia: definition, causes, pathogenesis, forms
4) Stasis: definition, causes, pathogenesis, forms
5) Hemorrhages: definition, causes, pathogenesis, forms
6) Thrombosis: definition, causes, pathogenesis, forms
7) Embolism: definition, causes, pathogenesis, forms

Setting up the experiment. Discussion of results and formation of conclusions

Modeling of arterial hyperemia: Viewing rabbit ear vessels in transmitted light. Subject the ear to mechanical irritation (rubbing with hands) and observe changes in the color of the ear, the number of visible blood vessels, their diameter, and the temperature of the ear. As a result of the mechanical impact on the ear, a change in the color of the ear (redness), an increase in the number of functioning blood vessels and a local increase in temperature were visually observed (increased arterial blood flow and increased heat transfer, the subsequent increase in temperature causes an increase in oxidative processes and contributes to an even greater increase in temperature).

Modeling of microcirculatory phenomena in arterial hyperemia: A decerebrated frog is fixed on a cork board with its back to the top so that the front edge of the lower jaw is at the edge of the board opening. Fix the lower jaw with two pins at the corners of the mouth. Stretch the tongue over the hole of the board. In order not to interfere with microscopy, the pins fixing the tongue should be inserted at an angle to the center. Under low magnification, familiarize yourself with the blood circulation in the vessels of the tongue and sketch what you see. Then apply a drop of 0.1 % hydrochloric acid solution to the surface of the tongue. Observe changes in the blood flow rate, the size of the vessel lumen, the number of functioning capillaries and sketch what you see. Microscopy observed dilation of blood vessels, pulsation of small arteries and capillaries (dilation of afferent arteries, acceleration of blood flow and pulse wave transmission along the expanded blood vessel), an increase in the number of functioning vessels.

Modeling venous hyperemia: Look at the vascular network of a rabbit ear. Place a plug with a side groove on the auricle so that the central artery of the ear is under the groove. Put a rubber tourniquet on the outer surface of the ear. After 15–20 minutes, compare both ears of the rabbit (vascular condition, color, thickness, transparency, temperature).

Visually, one ear of the rabbit is of a cyanotic color, a decrease in the temperature of the auricle, swelling of the tissue is felt to the touch. In the final stages of hyperemia, the development of a pendulum-like movement of blood and stasis.

Modeling of ischemia: Look at the vessels of the rabbit ear. Use tweezers to apply painful irritation. Observe changes in the color of the ear, blood vessel filling, and the number of visible vessels. Explain the mechanism and determine the type of ischemia. In the animal, the paleness of the ear, a decrease in the number of functioning capillaries, a decrease in the temperature of the rabbit's ear, and a decrease in tissue turgor were observed. In this case, an angiospastic type of ischemia was reproduced, caused by reflex spasm of blood vessels from painful irritation of their vasoconstrictor apparatus.

Modeling of embolism: fix the decerebrated frog on a cork board in the "lying" position. Take out the tongue, straighten it and fasten it over the hole. Open the chest and open access to the heart. Remove the pericardium. Look at the blood circulation in the vessels of the tongue under a microscope. Slowly inject 0.5–1.0 ml of emulsion into the ventricle of the heart using a syringe. Shake the emulsion well beforehand. Observe the movement of emboli in the lumen of vessels and changes in blood circulation. Draw the observed phenomena and explain their mechanisms. Vascular spasm developed in the animals, and sometimes instantaneous insufficiency of coronary blood circulation, also of a reflex nature.

Discussion of the results of the experiment

- As a result of mechanical and chemical influence, arterial hyperemia develops, as a result of which the arterio-venous pressure difference increases, the speed of blood flow in the capillaries increases, the intra-capillary pressure increases and the number of functioning capillaries increases. The volume of the microcirculatory channel with arterial hyperemia increases due to an increase in the number of functioning capillaries and veins. As a result of the increase in the number of functioning capillaries, the plane for transcapillary metabolism increases, the cross-section of the microcirculatory channel increases, which leads to a significant increase in the volumetric velocity of blood flow. An increase in the volume of the capillary bed leads to an increased blood supply to the organ. An increase in the pressure in the capillaries leads to an increase in the filtration of liquid into tissue gaps, as a result of which the amount of tissue fluid increases.

- Since the pressure in the veins before the obstruction exceeds the diastolic pressure in the afferent arteries, normal blood flow is observed only during heart systole, and (reverse) blood flow (pendulum-like current) occurs during diastole. Increased intravascular pressure stretches the vessels and causes them to expand. All functioning veins become wider, non-functioning venous vessels open. Capillaries also dilate, usually in venous compartments. The blood supply to the organ increases. Although the cross-sectional plane of the vascular bed of the organ increases, the linear velocity of blood flow falls much more and therefore the volumetric velocity of blood flow remains reduced. That is why microcirculation in the body and blood supply to tissues weakens.
- An increase in resistance in the afferent arteries causes a decrease in intravascular pressure and creates conditions for their narrowing. The pressure falls primarily in small arteries and arterioles to the periphery from the site of occlusion or blockage, and therefore the arterio-venous pressure difference during the microcirculatory channel decreases and causes a decrease in the linear and volumetric blood flow velocities in the capillaries. Weakening of microcirculation causes disruption of tissue nutrition: the delivery of oxygen (circulatory hypoxia) and energy materials decreases, metabolic products accumulate. As a result of the decrease in pressure in the capillaries, the filtration of liquid from the vessels into the tissue decreases and conditions are created for its increased resorption from the tissue into the capillaries. Therefore, the amount of tissue fluid in the intercellular spaces is significantly reduced and the outflow of lymph from the area of ischemia is weakened to the point of complete stoppage.
- Reflex vasospasm during embolism is due to increased pressure in the pulmonary arterioles, mechanical irritation of the vessels by emboli, a decrease in blood flow in the vessel below the embolus, the release of substances (serotonin, histamine) at the site of the blockage, which have the properties of causing contraction of non-striated muscle fibers of the vessels.

Forming conclusions based on the experiment

- Arterial hyperemia. As a result of mechanical impact or chemical irritation (0.1 % hydrochloric acid solution), arterial hyperemia develops. Mechanism: Caused by cholinergic mechanism (effect of acetylcholine). It is observed in organs and tissues that are innervated by parasympathetic nerve fibers.
- Venous hyperemia is caused by applying a tourniquet. Mechanism: the effect of an obstacle that arose on the path of blood flow, as well as a violation of the nervous mechanisms of its regulation.
- Ischemia during painful irritation. Mechanism: reflex spasm of blood vessels from irritation of their vasoconstrictor apparatus. An important role in the occurrence of ischemia is played by an increase in the sensitivity of the muscle elements of the vessel wall to norepinephrine and vasoactive peptides, due to the accumulation of Na+ ions in them.

- Embolism caused by emulsion injection. Mechanism: the general reactivity of the organism is of great importance. The direction of emboli is often determined by the activity of the nervous system. In this case, vascular receptors play a major role. Irritation of angioreceptors can affect the speed of blood flow and the process of blood circulation as a whole and thereby the transfer of an embolus.

Terminology:

- Arterial Hyperemia
- Venous Hyperemia
- Ischemia
- Stasis
- Hemorrhages
- Thrombosis
- Embolism

Tasks for independent work on the topic "Typical disorders of peripheral blood circulation and microcirculation"

The student is offered 2–3 cases with various variants of peripheral blood circulation and microcirculation disorders. It is necessary to determine the main signs and type of peripheral blood circulation and microcirculation disorders. Be able to explain the mechanisms of occurrence. Analysis of errors with an explanation of the correct answers.

List of questions and works to be studied:

1. Definition of peripheral blood circulation and microcirculation.
2. Arterial hyperemia, its causes, pathogenesis. Manifestations, their mechanisms. Consequences.
3. Venous hyperemia, its causes, pathogenesis. Manifestations, their mechanisms. Consequences.
4. Ischemia. Causes, types, pathogenesis. Show their mechanisms. Consequences.
5. Stasis. Its types, pathogenesis.
6. Thrombosis. Reasons. The process of thrombus formation, its mechanisms. Types of blood clots. Consequences of thrombosis.
7. Embolism. Reasons. Kinds Experimental models. Consequences.
8. Parenchymal bleeding. Causes, types, pathogenesis. Consequences.

A list of practical skills that must be mastered.

Determination of signs of peripheral blood circulation and microcirculation disorders using case studies:

- Arterial hyperemia
- Venous hyperemia
- Ischemia
- Thrombosis
- Embolism

Situational tasks KROK-1 to determine the final level of knowledge

1. During the game of volleyball, the athlete landed on the outer edge of the foot after a jump. There was acute pain in the ankle joint. Then swelling appeared, the skin reddened, became warmer to the touch. What type of peripheral circulatory disorder developed in this case?

A. Ischemia. *C. Stasis.* *E. Thrombosis.*
B. Arterial hyperemia. *D. Venous hyperemia.*

2. Edema began to form in a patient with a hand injury. At what stage of local blood circulation disorder does this occur?

A. Arterial hyperemia. *C. Venous hyperemia.* *E. Prestasis.*
B. Stasis. *D. Spasm of arterioles.*

3. In an experiment, K. Bernard, irritating the chorda tympani (branches of the n. facialis), observed increased secretion of the submandibular salivary gland and the development of arterial hyperemia. What is the mechanism of development of this hyperemia?

A. Neurotonic. *B. Neuroparalytic.* *C. Metabolic.* *D. Reactive.* *E. Working.*

4. When simulating inflammation on the mesentery of frogs, expansion of arterial vessels, acceleration of blood flow, and axial blood flow were observed under a microscope. What type of arterial hyperemia occurred in this case?

A. Postischemic. *B. Metabolic.* *C. Vacant.* *D. Reactive.* *E. Working.*

5. In a patient with a fracture of the ankle joint, after removing the plaster cast, there is swelling of the foot, cyanosis, a local decrease in temperature, and an increase in the volume of the organ. What type of blood circulation disorder is observed in this case?

A. Working hyperemia. *D. Reactive hyperemia.*
B. Metabolic arterial hyperemia. *E. Ischemia.*
C. Venous hyperemia.

6. A plaster cast was applied to a patient with a closed fracture of the humerus. The next day, swelling, bluishness and cooling of the hand of the injured hand appeared. What disorder of peripheral blood circulation do these signs indicate?

A. Arterial hyperemia. *C. Venous hyperemia.* *E. Embolism .*
B. Ischemia. *D. Thrombosis.*

7. A patient with periodontitis has swelling of the gums. They have a dark red color. What local blood circulation disorder prevails in the patient's gums?

A. Arterial hyperemia. *C. Thrombosis.* *E. Embolism.*
B. Ischemia. *D. Venous hyperemia.*

8. After caries treatment, the patient developed hyperemia, swelling, and pain in the gum area around the diseased tooth. What violation of local blood circulation occurred in this case?

A. Thrombosis. *B. Ischemia.* *C. Stasis.* *D. Prestasis.* *E. Venous hyperemia.*

9. In a patient with varicose veins, when examining the lower extremities, the following is noted: cyanosis, pastiness, a decrease in skin temperature, isolated petechiae. What hemodynamic disorder does the patient have?

A. Venous hyperemia. *D. Thromboembolism.*
B. Compression ischemia. *E. Arterial hyperemia.*
C. Obstructive ischemia.

10. A 25-year-old patient complains of the appearance and intensification of pain in the leg muscles while walking, due to which he was forced to stop often. Objectively: the skin on the legs is pale, the hair cover is absent, the nails on the toes have trophic changes. There is no pulsation of the arteries of the feet. The likely reason for these changes will be:

A. Ischemia. *C. Arterial hyperemia.* *E. Embolism.*
B. Venous hyperemia. *D. –.*

11. In a 48-year-old man, a violation of peripheral blood circulation with a limitation of arterial blood flow was detected, while there is pallor of this area, a decrease in local temperature. This violation is called:

A. Venous hyperemia. *C. Reperfusion syndrome.* *E. Sludge.*
B. Stasis. *D. Ischemia.*

12. After a mechanical injury, a tourniquet was put on the patient's arm to stop the bleeding. Below the harness, the hand turned pale, a feeling of numbness appeared. This condition is a consequence of:

A. Venous stasis. *D. Compression ischemia.*
B. Obstructive ischemia. *E. Thrombosis.*
C. Angiospastic ischemia.

13. The pilot had an emergency depressurization of the cabin at an altitude of 14,000 m. What type of embolism did he develop?

A. Gaseous. *C. Thromboembolism.* *E. Fatty .*
B. Embolism by a foreign body. *D. Aer.*

14. After the forced rapid ascent of the diver from the depths to the surface, he developed signs of caisson disease – pain in the joints, itching of the skin, flickering in the eyes, clouding of consciousness. What type of embolism were they caused by?

A. By air. *B. Fatty.* *C. Fabric.* *D. Thromboembolism.* *E. Gas.*

15. A 54-year-old woman was taken to the trauma department after a car accident. The traumatologist diagnosed multiple fractures of the lower limbs. What type of embolism is most likely to develop in this case?

A. Textile. *B. Thromboembolism.* *C. Air.* *D. Fatty.* *E. Gaseous.*

Standards of correct answers to the KROK-1 task

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B	*A*	*A*	*B*	*C*	*C*	*D*	*E*	*A*	*A*	*D*	*D*	*A*	*E*	*D*

Recommendations for registration of work results

1. Written answer to test tasks (initial level of knowledge).
2. The results of the experiment are drawn up in the form of an experiment protocol with the determination of relevant conclusions.

3. Independent work of students. Protocol for solving a case with typical disorders of peripheral blood circulation.

4. Protocol for solving situational tasks with an explanation of the correct answers.

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Main

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Topic № 7. Inflammation

Number of hours: 2 academic hours.

Relevance of the topic: Inflammation is an actual problem of medicine in modern society. Also, inflammation is the most common typical pathological process underlying the development of diseases in our body. Inflammation (from the Latin word inflammatio – ignition) is the reaction of organism to its local injury characterized by phenomena of alteration, disturbances of the local circulation and microcirculation (with exudation and leukocyte emigration) and proliferation. There is no area of medicine that is not related to the prevention, diagnosis and treatment of the inflammatory process. Therefore, the study of the etiology, the general mechanisms of the onset, development and outcome of inflammation is necessary for the doctor for the timely and correct diagnosis of inflammatory diseases, for rational pathogenetic therapy at any stage of the development of the inflammatory process.

Purpose of the lesson:

General: to be able to characterize inflammation as a typical pathological process, to study changes in the body, the main causes and mechanisms of inflammation, principles of therapy.

Specifically:

Know:

1. Definition of the term "inflammation". The main signs of inflammation.
2. Etiology of inflammation. General pathogenesis of inflammation.
3. Mediators of inflammation.
4. The sequence of vascular phenomena of the focus of inflammation.
5. Classification of inflammation.
6. Definition of the terms exudation and exudate.
7. The concept of emigration of leukocytes. Mechanisms of emigration.
8. General manifestations of inflammation.
9. Relationship between local and general changes during inflammation.

Be able:

1. Simulate Kongheim's experiment to determine vascular reactions during inflammation.

2. To determine microscopically the cellular composition of the exudate in the temporal dynamics of the inflammatory process.

Practical experience:

1. Determination of signs and mechanisms of metabolic disorders during inflammation using case studies.

2. Determination of general (fever, leukocytosis, increased ESR, dysproteinemia, abnormal enzyme activity, changes in the content or activity of components of the coagulation, anticoagulation, and fibrinolytic systems, allergy of the body) and local (rubor, calor, dolor, tumor, functio leasa) tasks using case studies) signs of inflammation.

3. Determination of the type of inflammation depending on the cellular composition of the exudate (serous, hemorrhagic, fibrinous, diphtheritic, purulent and mixed).

Technological map of students' work on the topic "Inflammation"

№	Stage lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
1	Determination of the initial level of knowledge	10	Written answer to test tasks	Test tasks	Study room
2	Analysis of theoretical material	35	Analysis of theoretical material based on control questions of the topic, situational tasks, tasks KROK-1	Topic control questions, KROK-1 tasks, situational tasks	
3	Practical part (conduct experiment)	30	Introduction and preparation for setting up the experiment. Setting up the experiment. Discussion of the results of the experiment and formulation of conclusions	Frog. Syringes, slide and ground glasses, Petri dishes, microscopes, ether	
4	Determination of the final level of knowledge and skills. Summary	15	Determination of the initial level of formation of knowledge and skills	KROK-1 tasks, situational tasks	

The graphological structure of the topic " Inflammation" is attached.

Material and methodological support of the topic " Inflammation":

1. Lectures;
2. Methodical instructions for teachers;
3. Methodical instructions for students;
4. A set of test tasks to determine the basic level of knowledge;
5. A set of situational tasks to determine the final level of knowledge;
6. A set of krok-1 tasks;
7. A set of schemes and tables (presentation);
8. A set of cases for determining manifestations of inflammation;
9. Video films;
10. For the experiment (experimental animals – a frog, a mouse; syringes, glass and ground glasses, petri dishes, a microscope, ether, thiopental anesthesia, suspension of staphylococcal cultures, romanovsky dye).

Lesson content:

1) Definition of Inflammation
2) The cardinal signs of an inflammatory process
3) Etiology of inflammation
4) General pathogenesis of inflammation
5) Alteration
6) Mediators of inflammation

7) Circulatory disturbances
8) Exudation
9) Emigration
10) Proliferation
11) General manifestations of inflammation
12) Forms of inflammation
13) Course of inflammation
14) Outcomes of inflammation

Setting up the experiment. Discussion of results and formation of conclusions.

Simulation of the "Kongheim experiment": Fix the frog on the cortical plate in a prone position so that the lower third of its abdomen is at the edge of the side opening of the plate. Cut the skin on the lateral surface of the abdomen. Open the abdominal cavity (the length of the incision is 0.5–0.7 cm). With tweezers, carefully remove the loop of the small intestine, straighten the mesentery above the opening of the plate and fix the loop of the small intestine to the plate with pins. Observe under a microscope (at low and medium magnification) the development of the main vascular phenomena during inflammation. Draw the vascular changes observed under the microscope and record their sequence. In animals with inflammation, the following vascular phenomena were observed under a microscope: short-term ischemia, arterial hyperemia, venous hyperemia, prestasis and stasis.

Modeling the cellular composition of exudate in the dynamics of inflammation:

Smears-imprints with the cellular composition of the exudate are prepared in advance: 1 ml of staphylococcal culture suspension (2 billion microbial bodies) is injected into the peritoneum of ants. Animals are removed from the experiment after 40 minutes (after 3 and 24 hours) with the help of thiopental anesthesia. The abdominal cavity is opened and smears-prints are prepared, touching the wall of the intestine with a glass slide. Smears are air-dried, fixed for 5 minutes and stained with Romanovsky dye for 15 minutes. To examine under a microscope with immersion the pre-prepared preparations of 40-minute, 3- and 24-hour exudates. To determine changes in the cellular composition of the exudate in the dynamics of inflammation. Pay attention to the phenomena of phagocytosis by leukocytes. Draw drugs. Initially, granulocytes predominate among exudate leukocytes in the focus, mainly neutrophils, and monocytes-macrophages predominate later.

Discussion of the results of the experiment

- It is known that vascular reactions develop simultaneously with the influence of an inflammatory agent, since the initial ones are reflex. First of all, short-term ischemia develops, which is caused by spasm of arterioles. It is a consequence of reflex excitation of vasoconstrictors from direct exposure to an inflammatory agent. Short-lived, from a few seconds to a few minutes.

- Arterial hyperemia, which in turn is caused by the expansion of arterioles, the mechanism of which is associated with axon-reflex excitation of vasodilators or with direct vasodilator effects of inflammatory mediators (neuropeptides, AX, etc.). Observed for about half an hour.
- Venous hyperemia, which is based on several groups of factors: 1) violation of the rheological properties of blood; 2) changes in the vascular wall; 3) tissue changes.
- Pre-static state, characterized by a pendulum-like movement of blood, when due to increasing stagnation of blood, loss of vascular tone and sharp expansion of capillaries and venules, it moves from arteries to veins during systole, and in the opposite direction during diastole.
- Then stasis develops, the mechanisms of which are associated with a violation of the rheological properties of blood, which in turn is associated with changes in the structure of blood flow in microvessels, enhanced intravascular aggregation of erythrocytes due to changes in the physicochemical properties of their membranes, the protein composition of blood, and slowing of blood flow.
- Since the slowing down of blood flow in certain branches of the microcirculatory channel and the marginal state of leukocytes can develop quite quickly, and it takes 2–12 minutes for an emigrating neutrophil to pass through the vascular wall, the appearance of a significant number of granulocytes in the focus of inflammation can be observed up to 10 minutes after its onset. The rate of accumulation of neutrophils in the focus of inflammation is highest in the first two hours, then decreases. Granulocytes predominate in the focus of inflammation up to 24 hours, and in the period from 24 to 48 hours they are replaced by monocytes, the number of which reaches a maximum on the 2nd-3rd day. Emigration of monocytes begins simultaneously with the release of neutrophils, but at first its speed and mass are much lower. In addition, neutrophils, which are short-lived, undergo apoptosis and disappear en masse between 24 and 48 hours, while monocytes survive longer, especially when transformed into macrophages.

Forming conclusions based on the experiment

Vascular reactions observed in Kongheim's experiment occur at the same time as exposure to the phlogogenic agent and have a staged course: short-term ischemia, arterial hyperemia, venous hyperemia, and prestasis and stasis.

When studying the cellular composition of the exudate in the dynamics of the course of the inflammatory process, an increase in the number of leukocytes, in particular neutrophils in the focus of inflammation, and subsequently an increase in monocytes-macrophages was primarily revealed.

Terminology:

- Inflammation
- Alteration
- Exudation
- Emigration
- Proliferation

Tasks for independent work on the topic "Inflammation"

The student is offered 2–3 case studies with metabolic disorders during inflammation. It is necessary to determine the signs and type of inflammation depending on the predominant component. Be able to explain the mechanisms of occurrence. Analysis of errors with an explanation of the correct answers.

List of questions and works to be studied:

1. Definition of the term "inflammation". The main signs of inflammation.
2. Etiology of inflammation. General pathogenesis of inflammation.
3. Mediators of inflammation.
4. The sequence of vascular phenomena of the focus of inflammation.
5. Classification of inflammation.
6. Concept of exudation, exudate.
7. The concept of emigration of leukocytes. Mechanisms of emigration.
8. General manifestations of inflammation.
9. Relationship between local and general changes during inflammation.

List of practical skills that must be mastered:

Determination of signs of the inflammatory process using case tasks:

- Redness;
- Swelling;
- Pain;
- Increase in local temperature;
- Violation of function.

Determination of the type of exudate by cellular composition: fibrinous; serous; hemorrhagic; purulent; putrid and mixed exudate.

Situational tasks KROK-1 to determine the final level of knowledge

1. After tearing the meniscus, the athlete developed inflammation of the knee joint. Which of the pathogenetic factors is the main link in the pathogenesis of inflammation?

A. Arterial hyperemia. *C. Damage.* *E. Venous hyperemia.*
B. Pain. *D. Edema.*

2. Microscopy of the frog mesentery preparation revealed that in some capillaries a pendulum-like movement of blood is noted, while formed elements (in particular, leukocytes) move from the axial layer to the parietal layer, and some even release pseudopodia into the capillary wall. What stage of the vascular reaction during inflammation corresponds to the described phenomenon?

A. Stasis. *D. Arterial hyperemia.*
B. Short-term vasospasm. *E. Venous hyperemia.*
C. Prestasis.

3. When simulating inflammation of the lower limb in animals, the body temperature increased, the content of antibodies and leukocytes in the blood

increased. What substances caused the development of these general reactions of the body during inflammation?

A. Interleukins . *C. Mineralocorticoids.* *E. Somatomedins.*
B. Glucocorticoids. *D. Leukotrienes.*

4. A patient with an acute inflammatory process complains of headache, pain in muscles and joints, drowsiness, fever. Leukocytosis, an increase in the content of proteins, including immunoglobulins, was found in the blood. Which of the mediators of inflammation causes these changes to the greatest extent?

A. Interleukin-1. *C. Bradykinin.* *E. Thromboxane A2.*
B. Histamine. *D. Complement.*

5. During the examination of the skin, the doctor found a purulent process in the patient in the form of rounded reddish elevations, surrounded by a zone of hyperemia. What mediators of inflammation caused the phenomenon of vascular hyperemia?

A. Interleukin-1. *C. Platelet activation factor.* *E. Lysosomal enzymes.*
B. Histamine. *D. Thromboxane.*

6. The woman was bitten by a dog in the area of the right calf muscle. During examination: edema, swelling of tissues, hyperemia of the skin is observed in the area of the bite. Which of the listed mechanisms is involved in the development of arterial hyperemia during inflammation?

A. Compression of venules by swollen tissue.
B. Release of histamine.
C. Decreased elasticity of the vascular wall.
D. Swelling of the endothelium.
E. Increase in blood viscosity.

7. According to Schade's physicochemical theory, the following occurs in the inflammation zone: hyperosmia, hyperonkyia, acidosis. The development of hyperosmia, to some extent, is associated with an increase in the concentration of K+ in the area of inflammation. State the causes of hyperkalemia in inflammatory exudate.

A. Intensive destruction of damaged cells.
B. Increased permeability of the vascular wall.
C. Activation of proliferative processes.
D. Suppression of glycogenolysis in the area of inflammation.
E. An excess of Ca++ ions.

8. A 60-year-old man fell ill with croupous pneumonia as a result of prolonged stay in wet clothes at a low ambient temperature. What is the cause of this form of lung inflammation?

A. Age. *D. Pneumococcus.*
B. . Decreased reactivity of the body *E. Effect of low humidity on the body.*
C. Effect of low temperature on the body.

9. The patient's caries was complicated by pulpitis, which was accompanied by unbearable pain. What phenomenon in inflammation of the pulp is the main cause of pain?

A. Primary alteration. *C. Exudation.* *E. Proliferation.*
B. Ischemia. *D. Emigration of leukocytes.*

10. A 30-year-old man complains of shortness of breath, heaviness in the right half of the chest, general weakness. Body temperature is 38.9 °C. Objectively: the right half of the chest lags behind the left. Exudate was obtained during pleural puncture. What is the leading factor of exudation in the patient?

A. Increased permeability of the vessel wall.
B. Increase in blood pressure.
C. Hypoproteinemia.
D. Aggregation of erythrocytes.
E. Reduction of resorption of pleural fluid.

11. When modeling inflammation on the mesentery of a frog, the marginal standing of leukocytes and their emigration through the vascular wall is observed. Which of the listed factors determines this process?

A. Influence of chemotactic substances.
B. An increase in oncotic pressure in the focus of inflammation.
C. Reduction of oncotic pressure in blood vessels.
D. Increase in hydrostatic pressure in blood vessels.
E. Reduction of hydrostatic pressure in blood vessels.

12. A microscopic examination of a punctate from a focus of inflammation in a patient with a skin abscess revealed a large number of different blood cells. Which of the cells listed below are the first to arrive from blood vessels in tissues during inflammation?

A. Monocytes. *C. Neutrophils.* *E. Lymphocytes.*
B. Basophils. *D. Eosinophils.*

13. A 34-year-old woman developed sharp pain, redness, and swelling on her right index finger after careless handling of an iron. After a few minutes, a bubble filled with a clear straw-yellow liquid appeared. The changes will be described as a manifestation of which pathological process?

A. Traumatic edema. *D. Proliferative inflammation.*
B. Exudative inflammation. *E. Vacuolar dystrophy.*
C. Alterative inflammation.

14. A 38-year-old man was admitted to the therapeutic department with a diagnosis of "right-sided exudative pleurisy." The fluid obtained from the pleural cavity of the chest is transparent, has a relative density of 1.020, contains 55 g/l of protein, an albumin-globulin ratio of 1.6, the total number of cells in 1 μl is 2.8, and the pH is 6.5. What type of exudate does the patient have?

A. Fibrinous. *C. Purulent.* *E. Hemorrhagic.*
B. Serous. *D. Rotten.*

15. A 17-year-old boy became acutely ill, his body temperature rose to 38.5 °C, he developed a cough, runny nose, lacrimation, and discharge from the nose. What inflammation developed in the young man?

A. Catarrhal. *C. Fibrinous.* *E. Hemorrhagic.*
B. Serous. *D. Purulent.*

16. A 5-year-old child developed an acute respiratory disease, which was accompanied by coughing and discharge of a significant amount of mucus from the nose. What is the type of inflammation in a sick child?

A. Catarrhal. *C. Hemorrhagic.* *E. Rotten.*
B. Fibrinous. *D. Purulent.*

17. The patient's knee joint swelled a day after the injury. During its puncture, 30 ml of pink liquid with a specific density of 1.020 was obtained. Its total protein content is 3 %, albumins – 0.3 %, globulins – 2 %, fibrinogen – 0.7 %. Leukocytes – 1–3, erythrocytes – 15–20, sometimes up to 50 in the field of vision. What is the nature of the exudate obtained during the puncture of the patient's knee joint?

A. Serous. *C. Putrid.* *E. Fibrinous.*
B. Purulent. *D. Hemorrhagic.*

18. A foul-smelling liquid containing biogenic amines and gases was found in the pleural cavity of a patient with pleurisy. What kind of inflammation in this case?

A. Alterative. *B. Catarrhal.* *C. Purulent.* *D. Fibrinous.* *E. Rotten.*

19. With gout, the patient often observes an increase and deformation of the joints due to the development of the inflammatory process. What type of inflammation underlies these changes?

A. Alterative. *B. Exudative.* *C. Fibrinous.* *D. Mixed.* *E. Proliferative.*

20. The patient has a purulent wound in the maxillofacial area. Which of the listed cells play the main role in the regeneration phase of the wound process?

A. Neutrophils. *C. Eosinophils.* *E. Lymphocytes.*
B. Monocytes. *D. Fibroblasts.*

21. When studying inflammation, animals were injected with a lethal dose of tetanus toxin into the cavity of an abscess induced by turpentine. But the animal did not die. Indicate the most likely reason for this research result.

A. Formation of a barrier around inflammation.
B. Activation of antibody synthesis during inflammation.
C. Stimulation of leukopoiesis during inflammation.
D. Increased vascularization of the site of inflammation.
E. Activation of the detoxification function of phagocytes.

22. With various inflammatory processes in a person, the number of leukocytes in the blood increases. This regularity is a manifestation of:

A. Adaptations. *C. Reparations.* *E. Degenerations.*
B. Regeneration. *D. Transplants.*

Standards of correct answers to the KROK-1 task

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
C	*C*	*A*	*A*	*B*	*B*	*A*	*D*	*C*	*A*	*A*
12	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
C	*B*	*B*	*A*	*A*	*D*	*E*	*E*	*D*	*A*	*A*

Recommendations for registration of work results

1. Written answer to test tasks (initial level of knowledge).

2. The results of the experiment are drawn up in the form of an experiment protocol with the determination of relevant conclusions.

3. Independent work of students. Protocol for solving cases of tasks with the identification of signs of inflammation.

4. Protocol for solving situational tasks with an explanation of the correct answers.

LITERATURE

Main

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Topic № 8. Fever

Number of hours: 2 academic hours.

Relevance of the topic: The urgency of the problem of fever is determined by the widespread and incessant an increase in indicators such as septic diseases, and, as a result, high mortality, formation of resistance of microflora to antibiotics, decrease for various reasons the level of biological resistance of the population. Under the so-called "syndrome of prolonged fever of unknown origin" can mask a wide range of both infectious and non-communicable diseases. Today it is considered possible be used as a preliminary diagnosis if the fever lasts for at least 5–7 days, and the routine laboratory and instrumental studies did not allow establish a diagnosis. Thus, knowledge of the basics of fever (study of the main causes, mechanisms of development and course of fever) is relevant among medical students and physicians.

Purpose of the lesson:

General: to be able to characterize fever as a typical pathological process, to study functional changes in the body, the main mechanisms of their development, and the principles of fever therapy.

Specifically:

Know:

1. Interpretation of the concepts "fever", "hyperthermia", "pyrogenic substances".
2. Classify fever, pyrogenic substances.
3. Identify the main manifestations of a febrile reaction, explain the mechanism of their occurrence in the dynamics of the development of the process.
4. Explain the difference in the pathogenesis of fever and hyperthermia.
5. To determine which phenomena in the body during fever are actually pathological, and which are protective and adaptive in nature, in order to justify the symptomatic and pathogenetic therapy of fever.

Be able:

1. Simulate fever in animals by injecting pyrogenal and justify your conclusions.
2. Explain the general mechanisms of fever, metabolic disorders during fever.
3. Identify and differentiate the main signs of different variants of fever according to the nature of temperature curves (fever of constant, weakening, intermittent, reversed, hectic, perverse, atypical, wave-like, short-term type).

Practical experience:

Determination of the nature of fever on the temperature curve:

- Permanent type;
- Weakening;
- Intermediate;
- Reverse;
- Hectic;
- Perverted;
- Atypical;
- Wave-like;
- Short-term type.

Technological map of students' work on the topic "Fever"

№	Stage lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
1	Determination of the initial level of knowledge	10	Written answer to test tasks	Test tasks	Study room
2	Analysis of theoretical material	35	Analysis of theoretical material based on control questions of the topic, situational tasks, tasks KROK-1	Topic control questions, KROK-1 tasks, situational tasks	
3	Practical part (conduct experiment)	30	Introduction and preparation for setting up the experiment. Setting up the experiment. Discussion of the results of the experiment and formulation of conclusions	Rabbit; electric thermometers or medical thermometers, syringes, pyrogenal solution containing 2 units. in 1 ml (1 unit is the minimum pyrogenic dose), petroleum jelly	
4	Determination of the final level of knowledge and skills. Summary.	15	Determination of the initial level of formation of knowledge and skills	KROK-1 tasks, situational tasks	

The graphological structure of the topic "Fever" is attached.

Material and methodological support of the topic "Fever":

1. Lectures;
2. Methodical instructions for teachers;
3. Methodical instructions for students;
4. A set of test tasks to determine the basic level of knowledge;
5. A set of situational tasks to determine the final level of knowledge;
6. A set of step-1 tasks;
7. A set of schemes and tables (presentation);
8. A set of cards (temperature sheets) with different variants of temperature curves;
9. Video films;
10. For the experiment (experimental animals – rabbit; electric thermometers or medical thermometers, syringes, pyrogenal solution containing 2 units in 1 ml (1 unit is the minimum pyrogen dose), petroleum jelly).

Lesson content:

1) Definition of fever
2) Etiology of fever
3) Pathogenesis of fever
4) Types of temperature curves
5) Involvement of the nervous, endocrine and immune systems in the development of fever
6) Metabolic changes during fever
7) Changes in the functions of internal organs during fever
8) Protective value and pathological manifestations of fever

9) Pathophysiological principles of antipyretic therapy
10) The use of fever
11) The main differences between fever and hyperthermia

Setting up the experiment. Discussion of results and formulation of conclusions

Simulation of fever in animals by the introduction of a pyrogenic substance – pyrogenal. (Pyrogenal is a high-molecular lipopolysaccharide obtained from the culture of gram-negative microorganisms): Measure the body temperature, determine the rate of respiration and heart rate in a rabbit. Body temperature should be measured in the rectum (if an electrothermometer is available – on the skin). Lubricate the tip of the thermometer with petroleum jelly in advance. After measuring the initial indicators, inject 1 ml of pyrogenal solution subcutaneously into the rear third of the thigh of the rabbit. Measure the body temperature, determine the frequency of breathing and heart rate every 20 minutes.

Discussion of the results of the experiment

• In this case, the increase in temperature is due to the fact that under the influence of pyrogen, the "set point" in the preoptic area of the hypothalamus adjusts to a higher temperature level than normal and perceives the normal body temperature as very low. As a result of such a change in perception, the "set point" directs impulses to the centers of the vegetative system, which regulate the processes of heat generation and heat transfer. Under the influence of these pulses, heat generation increases, and heat transfer decreases. Subsequently, a new balance between heat production and heat output is achieved at a higher level.

• The heart rhythm increases as a result of the stimulation of the sympathetic nervous system and the direct effect of heated blood on the sinus node. An increase in temperature by 1 °C was observed in the animal, which was accompanied by an acceleration of the rhythm by 8 beats. In parallel with increased heart rate and increased body temperature, increased breathing rate was observed, which is associated with increased functioning of the respiratory center, as well as increased blood temperature and acidosis, which in turn is caused by the accumulation of underoxidized metabolic products.

• Formulation of conclusions based on the experiment

• In an experimental animal, when pyrogenal was administered, an increase in temperature and an increase in pulse and breathing were observed, which is due to changes in the "set point" of the hypothalamus, and the resulting changes in thermoregulation (increased heat production and decreased heat output).

Terminology:

- fever
- hyperthermia
- hypothermia
- pyrotherapy

Tasks for independent work on the topic "Fever"

The student is offered 2–3 cards (temperature sheets) with different variants of temperature curves. It is necessary to determine the main features and type of temperature curve. Be able to explain the mechanism of occurrence. Analysis of errors with an explanation of the correct answers.

List of questions and works to be studied:

1. Definition of the term "fever".
2. Etiology of fever. Exogenous and endogenous pyrogens.
3. Mechanisms of disturbance of thermoregulation and increase in body temperature during fever.
4. Stages of fever. The relationship between heat production and heat output at different stages of fever.
5. Types of temperature curves.
6. Changes in metabolism and body functions during fever.
7. Harmful and protective and adaptive value of fever.

List of practical skills that must be mastered:

Definition on temperature sheets of the type of temperature curve:

- Permanent type;
- Weakening;
- Intermediate;
- Reverse;
- Hectic;
- Perverted;
- Atypical;
- Wave-like;
- Short-term type.

Situational tasks KROK-1 to determine the final level of knowledge

1. In an experiment on a rabbit, the introduction of pyrogenal led to an increase in the animal's body temperature. Which of the listed substances plays the role of a secondary pyrogen, which takes part in the mechanism of febrile reaction?

A. Interleukin-1. *C. Histamine.* *E. Immunoglobulin.*
B. Pyromen. *D. Bradykinin.*

2. A patient with pneumonia has a fever. What directly causes a change in the temperature set point in the neurons of the hypothalamus of this patient?

A. Prostaglandins E1, E2. *D. Interleukin-2.*
B. Endotoxin. *E. Platelet growth factor.*
C. Exotoxin.

3. A 25-year-old man complains of general weakness, chills, sore throat. Objectively: redness in the area of the tonsils. Body temperature is 38.6 °C. Which of the listed cells are the main source of endogenous pyrogens that cause fever in the patient?

A. Neutrophils. *C. B-lymphocytes.* *E. Mast cells.*
B. Eosinophils. *D. Basophils.*

4. A patient with fever has pale skin, "goosebumps", chills, tachycardia. What stage of fever does this condition correspond to?

A. Stages of temperature rise. *D. –.*
B. Stages of standing temperature. *E. –.*
C. Stages of falling temperature.

5. After the introduction of a pyrogen, a person experiences pallor of the skin, chills, "goosebumps", when gas exchange is determined - an increase in oxygen consumption. For which stage of fever are these changes most characteristic.

A. Standing temperature at an elevated level.
B. Reduction of temperature by crisis.
C. Lowering the temperature by lysis.
D. –.
E. Increase in temperature.

6. During the examination of a patient with a temperature, the following objective data were found: the skin is hyperemic, moist to the touch, polyuria, polydipsia are observed, the body temperature is 37.2 ˚C. What stage of fever does this condition correspond to?

A. Temperature rise. *D. –.*
B. Standing temperature. *E. Decrease in temperature.*
C. –.

7. In a patient with acute bronchitis, which lasted for a week, an increase in body temperature to 38.5 °C is determined by a decrease in temperature to 37 °C. Which of the listed mechanisms is leading in the 3rd stage of fever?

A. Strengthening of heat production.
B. Development of chills.
C. Increased diuresis.
D. Expansion of peripheral vessels.
E. Increased breathing rate.

8. A patient with a long-term fever had a temperature in the range of 36.4–36.9 °C in the morning, and it rose to 37.0–38.0 °C in the evening. What type of fever is observed in the patient according to the degree of temperature rise?

A. Moderate. *B. Hyperpyretic.* *C. High.* *D. Subfebrile.* *E. –.*

9. The flu epidemic this year was characterized by the fact that the body temperature of most patients fluctuated between 36.9–37.9 °C. This type of fever is called:

A. High. *C. Subfebrile.* *E. Moderate.*
B. Hyperpyretic. *D. Apyretic.*

10. In a patient with a long-term fever, the morning body temperature was in the range of 36.4–36.9 °C. In the evening, it rose to 37.0–38.0 °C, on some days to 38.8 °C. The patient has a fever for more than 2 months. What type of fever does the patient have?

A. Attenuating. B. Exhausting. C. Permanent. D. Wavy. E. Hectic.

11. In the afternoon, the patient's temperature suddenly rose to 39.5 °C and returned to normal in 6 hours. On the second day, the attack was repeated and the temperature reached 41.5 °C, the period of apyrexia came after 8 hours. What type of temperature curve?

A. Intermittent. *C. Septic.* *E. Permanent.*
B. Attenuating. *D. Exhausting.*

12. In the afternoon, the patient's temperature instantly rose to 39 °C and after 6 hours it returned to normal. On the second day, the attack was repeated: during the paroxysm, T° reached 41 °C, the period of apyrexia came after 8 hours. What is this type of temperature curve called?

A. Intermittent. B. Reverse. C. Hectic. D. Septic. E. Permanent.

13. Patient N. has fever attacks every other day. During an attack, the temperature rises sharply and remains at a high level for up to 2 hours, and then decreases to the initial level. This type of fever is characteristic of:

A. Typhoid fever. *C. Sepsis.* *E. Typhus fever.*
B. Malaria. *D. Brucellosis.*

14. A patient with osteomyelitis of the upper jaw has an increase in body temperature during the day to 40 °C, which sharply decreases to 35.6 °C. What type of temperature curve is this typical for?

A. Constant [sontinua]. *D. Revolving [recurrens].*
B. Hectic [hectica]. *E. Atypical [atypica].*
C. Intermittent [intermittens].

15. The patient developed a fever, which is accompanied by a shift of the set point of the thermoregulatory center to a higher level, with successive alternation of the following stages: incrementi, fastigii, decrementi. In what disease can similar changes be observed?

A. Acromegaly. *D. Myocardial hypertrophy.*
B. Diabetes. *E. Acute pneumonia.*
C. Renal diabetes.

16. A patient with hypertrophy of the thyroid gland has an elevated body temperature. What disturbances in energy exchange are the main causes of temperature rise in this case?

A. Increased breakdown of glycogen.

B. Enhancement of lipolysis.

C. Activation of enzymes in the Krebs cycle.

D. Activation of respiratory chain enzymes.

E. Separation of oxidation and oxidative phosphorylation.

Standards of correct answers to the KROK-1 task

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
A	*A*	*A*	*A*	*E*	*E*	*D*	*D*
9	**10**	**11**	**12**	**13**	**14**	**15**	**16**
C	*C*	*A*	*A*	*B*	*B*	*E*	*E*

Recommendations for registration of work results

1. Written answer to test tasks (initial level of knowledge).

2. The results of the experiment are drawn up in the form of an experiment protocol with the determination of relevant conclusions.

3. Independent work of students. Protocol for the analysis of temperature sheets with different variants of temperature curves.

4. Protocol for solving situational tasks with an explanation of the correct answers.

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Topic № 9. Tumors

Number of hours: 2 academic hours.

Relevance of the topic: Tumor growth is one of the leading causes of death in the world, which will take the lives of many people. Tumor (blastomatous, neoplastic) growth - is a special kind of abnormal tissue growth that arises from the transformation of normal tissue in the tumor and is characterized by atypical structure and function, by the relative autonomy (lack of proper regulation of the growth), the infinite growth and progressive development. The most common types of tumors are cancers of the breast, lung, colon and rectum, and prostate. Approximately one third of tumor deaths are caused by tobacco use, high body mass index, alcohol use, low fruit and vegetable intake, and physical inactivity. Approximately 30 % of cancers in low-income and lower middle-income countries are due to cancer-causing infections such as human papillomavirus and hepatitis. Many types of cancer are curable with early diagnosis and treatment. Therefore, knowledge of the etiopathogenetic bases of tumor growth is necessary.

Purpose of the lesson:

General: to get acquainted with the methods of experimental reproduction of tumors, with the peculiarities of tumor growth by demonstrating various strains of experimental tumors that grow, as well as tumors that are induced by exposure to chemical carcinogens.

Specifically:

Know:

1. Definition of the term "tumorous growth".
2. Characteristics of the conditions necessary for successful tumor resection.
3. Types of transplantation.
4. Performing a reexamination of the experimental tumor.
5. Carcinogenic environmental factors.
6. Etiology and pathogenesis of tumor growth.
7. Relationship between the tumor and the body.

Be able:

1. Experimentally model tumors and justify their conclusions.
2. Explain the general mechanisms of the occurrence and development of tumors, the relationship between the body and the tumor.
3. To determine the main signs of various variants of atypism (morphological, functional, biochemical, physicochemical anaplasia). Explain the mechanisms of their occurrence. To determine the main mechanisms and ways of metastasis of tumors.

Practical experience:

Determination of the signs of the tumor process using case studies:

- Mechanisms of disruption of cell division;
- Origin of mutations;

- Processes of tissue growth regulation;
- Types of tissue growth;
- Biochemical processes, the violation of which occurs during tumor growth;
- Factors that are important in the etiology of tumor growth.

Technological map of students' work on the topic "Tumors"

№	Stage lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
1	Determination of the initial level of knowledge	10	Written answer to test tasks	Test tasks	Study room
2	Analysis of theoretical material	35	Analysis of theoretical material based on control questions of the topic, situational tasks, tasks KROK-1	Topic control questions, KROK-1 tasks, situational tasks	
3	Practical part (conduct experiment)	30	Introduction and preparation for setting up the experiment. Setting up the experiment. Discussion of the results of the experiment and formulation of conclusions	Museum preparations of tumors, smears prepared from ascitic fluid of mice, microscopes, immersion oil	
4	Determination of the final level of knowledge and skills. Summary	15	Determination of the initial level of formation of knowledge and skills	KROK-1 tasks, situational tasks	

The graphological structure of the topic "Tumors" is attached.

Material and methodological support of the topic "Tumors":

1. Lectures;
2. Methodical instructions for teachers;
3. Methodical instructions for students;
4. A set of test tasks to determine the basic level of knowledge;
5. A set of situational tasks to determine the final level of knowledge;
6. A set of KROK-1 tasks;
7. A set of schemes and tables (presentation);
8. Set of ECG with heart rhythm disturbance;
9. Video films;
10. For experiment (museum tumor preparations: 1) rat sarcoma M-1, 2) Brown-pierce carcinoma, 3) Ehrlich adenocarcinoma, 4) tumor induced by 20-methylcholarnthrene in mice and rats, 5) tumors of viral origin - milk factor; smears prepared from ascitic fluid of mice, microscopes, immersion oil).

Lesson content:

1) Atypicality of tumors
2) Autonomy of the tumor
3) Infinity tumor growth
4) Tumor progression

5) Benign and malignant tumors. Biological characteristics of tumor growth.
6) Metastasis, its mechanisms
7) The etiology of tumor
8) Mechanisms of of tumora
9) Effect of tumor on the body.
10) The mechanisms of natural antitumor defense, immune and non-immune mechanisms of resistance
11) Pathophysiological basis for prevention and treatment of tumors

Setting up the experiment. Discussion of results andformulation of conclusions

Acquaintance with various strains of experimental tumors: Describe museum preparations of tumors (1. M-1 rat sarcoma; 2. Brown-Pierce carcinoma; 3. Ehrlich adenocarcinoma – ascites and subcutaneous forms; 4. Tumor induced by 20-methylcholanthrene in mice and rats; 5. Tumors of viral origin – milk factor), indicate the type of animal, the name of the tumor strain, localization, size, appearance, consistency.

Microscopic examination of the ascitic form of Ehrlich's adenocarcinoma: Microscopy preparations. Pay attention to the atypicality of cell division, the presence of dwarf and giant cells. Draw drugs.

Discussion of the results of the experiment

Ehrlich ascites carcinoma in mice. The source tumor is spontaneous breast cancer. The strain has existed since 1905. Life expectancy of an animal with a tumor is 7–16 days. Ascites is formed when the tumor is transplanted intraperitoneally. For this, 0.2 ml of ascites fluid, which contains many tumor cells, is injected into the abdominal cavity. When this liquid is injected subcutaneously, a tumor is formed.

Sarcoma M-1 in rats. The original tumor is a sarcoma, which was obtained from a rat using the carcinogenic substance 3,4-benzpyrene in the Shabad laboratory (1943). The histological type of the tumor is polymorphocellular sarcoma.

Brown-Pierce carcinoma in rabbits. The original tumor is a spontaneous tumor in a rabbit injected with syphilitic material into the scrotum (1916). Histological type – epithelial multicellular brain-like structureless tumor.

The tumor is characterized by intensive growth and tendency to central necrosis. It metastasizes very quickly. The primary tumor sometimes resolves, but the animal dies from metastases in the internal organs.

When studying preparations of the ascitic form of Ehrlich adenocarcinoma in rats, giant and dwarf cells were found, as well as changes in the shape of cellular elements and the presence of hyperchromatosis phenomena, an increase in centrosomes and the Golgi apparatus, a discrepancy between the mass of the cytoplasm and the mass of an enlarged and chromatin-rich nucleus, a large nucleolus, and a decrease in the number mitochondria and changes in their structure, the presence of signs of atypical mitosis.

Forming conclusions based on the experiment

Under the influence of various carcinogens, malignant tumors develop in experimental animals (rats, rabbits, and mice), which are characterized by the presence of signs inherent in this type of tumors, i.e. unlimited cell division, unlimited growth, infiltrative growth, pronounced destruction of tumor tissues and surrounding normal tissues, the formation of metastases, and expressiveness of biological atypism.

Terminology:

- blastomatosis
- anaplasia
- atypia
- metastasis
- relapse

Tasks for independent work on the topic "Tumors"

The student is offered 2–3 case assignments with signs of tumor growth. It is necessary to determine the signs of tumor growth and the type of tumor. Be able to explain the mechanism of occurrence. Analysis of errors with an explanation of the correct answers.

List of questions and works to be studied:

1. Definition of the term "tumorous growth"
2. Methods of experimental reproduction of tumors. Strains of experimental tumors.
3. Morphological, biochemical and physicochemical features of tumor tissue.
4. Etiology of tumors. Mechanism of carcinogenesis. The role of the organism in carcinogenesis.
5. The relationship between the tumor and the body.
6. Precancerous conditions.
7. The role of domestic scientists in the development of experimental oncology.

List of practical skills that must be mastered:

Determination of the signs of the tumor process using case studies:

- Mechanisms of disruption of cell division;
- Origin of mutations;
- Processes of tissue growth regulation;
- Types of tissue growth;
- Biochemical processes, the violation of which occurs during tumor growth;
- Factors that are important in the etiology of tumor growth.

Situational tasks KROK-1 to determine the final level of knowledge

1. A 67-year-old woman suffers from stomach cancer with metastases in the liver. What feature of tumor cells determines their ability to metastasize?

A. Biochemical atypism. *C. Autonomy.* *E. Infiltrative growth.*
B. Rapid growth. *D. Antigenic anaplasia.*

2. The patient was diagnosed with a malignant neoplasm of the tongue. What are the features of this tumor that allow it to be classified as malignant?

A. Expansive nature of growth. *D. An increase in the number of mitotic cells.*
B. Anaplasia. *E. Infiltrative nature of growth.*
C. Positive Pasteur effect.

3. The absence of Hayflick's limit in tumor cells was discovered during the study of cell division in tissue culture. What experimental method of studying tumors was used?

A. Transplantation. *D. Induction by chemical carcinogens.*
B. Induction by radiation. *E. Induction by viruses.*
C. Explantation.

4. During the operation, the patient was diagnosed with a stomach tumor in the primary focus of malignancy (within the mucous membrane). Metastases in the lymph nodes and distant metastases are absent. What is the stage of tumor pathogenesis in this case?

A. Initiations. *C. Promotions.* *E. Immune suppression of the tumor.*
B. Transformations. *D. –.*

5. In a patient with leukemia, the number of blast cells in the blood increased sharply, leukemic infiltrates appeared in the liver. These changes are caused by the transition from the monoclonal stage of the disease to the polyclonal one. What stage of carcinogenesis do these changes correspond to?

A. Progressions. *C. Transformations.* *E. Latentnoi.*
B. Initiations. *D. Promotions.*

6. A patient with chronic myeloid leukemia developed signs of ulcerative-necrotic stomatitis. A mucosal biopsy revealed leukemic cells. What part of tumor pathogenesis is the lesion of the oral cavity associated with?

A. Tumor progression. *D. Promotion.*
B. Mutational mechanism of transformation. *E. Initiation.*
C. Epigenomic mechanism of transformation.

7. During the operation, the patient was diagnosed with a stomach tumor with the growth of mucous, submucous and serous membranes. Metastases were detected in the perigastric lymph nodes, there were no distant metastases. Stage 3 (T3, N1, M0) of tumor development was determined. What is the stage of tumor pathogenesis in this case?

A. Tumor progression.
B. Promotions.
C. Transformation of a proto-oncogene into an oncogene.
D. Formation of oncoproteins.
E. Transformations.

8. It has been established that with the development of a hepatoma in it, the synthesis of bile acids often stops. What type of anaplasia does this indicate?

A. Functional. *C. Morphological.* *E. Physico-chemical.*
B. Energetic. *D. Biochemical.*

9. It has been established that during the development of a lung tumor, the synthesis of glucocorticoids can occur in it. What variant of tumor atypia occurs in this case?

A. Energetic. *C. Morphological.* *E. Physico-chemical.*
B. Functional. *D. Biochemical.*

10. An epidemiological study of the spread of tumors revealed a high coagulation of the development of lung tumors with tobacco smoking. The occurrence of this type of pathology is most likely associated with the action of which chemical carcinogen?

A. Orthoaminoazotoluene. *C. Methylcholanthrene.* *E. Diethylnitrosamine.*
B. Aflatoxin. *D. 3,4-benzpyrene.*

11. A 58-year-old man suffers from bladder cancer. In the course of his work, he had contact with carcinogenic substances. Which of the following carcinogens is most likely to act in this case?

A. 20-methylcholanthrene. *D. Dimethylaminoazobenzene.*
B. β-naphthylamine. *E. Orthoaminoazotoluene.*
C. Benzpyrene.

12. A medical examination of the employees of the workshop for the production of aniline dyes is conducted. The presence of a tumor of which localization can be considered as an occupational disease due to contact with beta-naphthylamine?

A. Esophagus. *C. Kidney.* *E. Legeniv.*
B. Liver. *D. Urinary bladder.*

13. The clinical examination of the patient made it possible to establish a preliminary diagnosis: liver cancer. The presence of which protein in blood serum will confirm the diagnosis?

A. Properdin. *C. Alpha-fetoprotein.* *E. Gamma globulins.*
B. Paraproteins. *D. C-reactive protein.*

14. In a patient with a malignant tumor of the lungs, over time, a neoplasm of another location was found. What process will this phenomenon be a consequence of?

A. Expansive growth. *C. Metastasis.* *E. Metaplasia.*
B. Infiltrative growth. *D. Anaplasia.*

15. The patient complained of aching pain in the upper palate, difficulty swallowing. Recently, general weakness, weight loss appeared. During the examination, cancer of the oral mucosa with metastases in the lymph nodes was diagnosed. What is the mechanism of development of cachexia in this patient?

A. Disorders of gastric secretion.
B. Disorders of the trophic function of the nervous system.
C. Dysfunction of the endocrine system.
D. Enhancement of gluconeogenesis.
E. Reduction of plastic and energy reserves.

16. The woman was diagnosed with erosion of the cervix, which is a precancerous pathology. What protective mechanism can prevent the development of a tumor?

A. Increase in natural killers (NK cells).

B. High-dose immunological tolerance.

C. Increased activity of lysosomal enzymes.

D. Simplification of the antigenic composition of tissues.

E. Low-dose immunological tolerance.

Standards of correct answers to the KROK-1 task

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
E	*E*	*C*	*C*	*A*	*A*	*A*	*A*	*B*	*D*	*B*	*D*	*C*	*C*	*E*	*A*

Recommendations for registration of work results

1. Written answer to test tasks (initial level of knowledge).

2. The results of the experiment are drawn up in the form of an experiment protocol with the determination of relevant conclusions.

3. Independent work of students. Protocol for the analysis of cases of tasks with signs of tumor growth.

4. Protocol for solving situational tasks with an explanation of the correct answers.

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Topic № 10. Hypoxia

Number of hours: 2 academic hours.

Relevance of the topic: Currently, hypoxia is considered as one of the leading medical and social problems of modern society. This is determined by the fact that hypoxia is the cause of morbidity and death of the population not only in Ukraine, but also in all developed countries of the world. First of all, it should be noted that the factor of hypoxia and its role in the development of pathology of organs and systems is directly and extremely closely associated with the problem of energy supply and energy deficiency of cellular structures, both of the brain and of all internal organs. Physicians of a therapeutic profile often underestimate the role of central neurometabolic changes, which are the basis for the subsequent development of a number of urgent conditions (stroke, myocardial infarction, acute inflammatory diseases, coma, etc.). In this regard, it is advisable to dwell briefly on the etiopathogenetic aspects of the development of hypoxia.

Purpose of the lesson:

General: to be able to characterize hypoxia as a typical pathological process, to assess functional disorders in the body, to explain the main mechanisms of damage and compensation during oxygen starvation in order to develop the ability to apply symptomatic and pathogenetic treatment of this pathology at departments of a clinical profile.

Specifically:

Know:

1. Definition of the term "hypoxia", "hypoxemia", to be able to classify oxygen starvation by etiology and pathogenesis.
2. The main manifestations of hypoxia and determine which reactions are intrinsically pathological and which are protective-adaptive in nature, explain the mechanisms of their occurrence in order to justify the symptomatic and pathogenetic therapy of hypoxic conditions.

Be able:

1. Experimentally simulate oxygen starvation and justify your conclusions.
2. To explain the general mechanisms of oxygen starvation, pathogenetic and protective-adaptive reactions of the body during hypoxia.
3. Determine the main indicators of pulmonary ventilation depending on changes in the gas composition of the blood.
4. Evaluate the results of the respiratory rate study and the results of spectrometric analysis of blood for methemoglobin content.

Practical experience:

1. Determining the gas composition and pH of blood and establishing the type of hypoxia:

- hypoxic hypoxia;
- respiratory hypoxia;

- hemic hypoxia;
- circulatory hypoxia;
- tissue hypoxia;
- substrate hypoxia;
- overloading hypoxia;
- mixed hypoxia.

Technological map of students' work on the topic "Hypoxia"

№	Stage lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
1	Determination of the initial level of knowledge	10	Written answer to test tasks	Test tasks	Study room
2.	Analysis of theoretical material	35	Analysis of theoretical material based on control questions of the topic, situational tasks, tasks KROK-1	Topic control questions, KROK-1 tasks, situational tasks	
3	Practical part (conduct experiment)	30	Introduction and preparation for setting up the experiment. Setting up the experiment. Discussion of the results of the experiment and formulation of conclusions	White mice; glass jars with a capacity of 200 ml, crystallizer for mixing water with ice, thermometer, tripods, ice, water, plasticine	
4	Determination of the final level of knowledge and skills. Summary	15	Determination of the initial level of formation of knowledge and skills	KROK-1 tasks, situational tasks	

The graphological structure of the topic "Hypoxia" is attached.

Material and methodological support of the topic "Hypoxia":

1. Lectures;
2. Methodical instructions for teachers;
3. Methodical instructions for students;
4. A set of test tasks to determine the basic level of knowledge;
5. A set of situational tasks to determine the final level of knowledge;
6. A set of KROK-1 tasks;
7. A set of schemes and tables (presentation);
8. A set of case studies and analyzes of gas composition and blood ph;
9. Video films;
10. For the experiment (experimental animals - white mice; glass jars with a capacity of 200 ml, a crystallizer for a mixture of water and ice, a thermometer, tripods, ice, water, plasticine).

Lesson content:

1) Pathophysiology of internal respiration. Hypoxia.
2) Classification of hypoxia
3) Disturbances in Metabolism and Functions in Hypoxia
4) Adaptive Reactions in Hypoxia

Setting up the experiment. Discussion of results and formulation of conclusions

Modeling the effect of hypothermia on the body's sensitivity to oxygen starvation: Take two mice and place them in separate jars (air access is free). Put jar #1 in a mixture of water and ice (temperature 3–4 °C), and jar #2 leave at room temperature. After 15 minutes, study the initial state of both animals: behavior, reaction to sound, skin color, breathing rate. Then seal both cans at the same time. Observations lead to the death of animals. Record the results in the table every 2–3 minutes.

Discussion of the results of the experiment

- Under the influence of these factors, an increase in cardiac output due to tachycardia and an increase in systolic volume and an increase in blood pressure were observed in rats. Also increased frequency and deepening of breathing. Hyperventilation of the alveoli leads to the development of hypocapnia, which increases the affinity of hemoglobin for oxygen and accelerates the oxygenation of the blood flowing to the lungs. An increase in the mass of circulating blood due to the emptying of blood depots and accelerated washing out of erythrocytes from the bone marrow; thanks to this, the oxygen capacity of the blood increases.
- Adaptive reactions at the level of cells that experience oxygen starvation of tissues and are expressed in an increase in the affinity of oxidation and phosphorylation processes and in the activation of glycolysis, due to which the energy needs of cells can be satisfied for some time.
- When glycolysis increases, lactic acid accumulates in the tissues, acidosis develops, which accelerates the dissociation of oxyhemoglobin in the capillaries.
- In case of insufficient oxygen entering the cells, the process of anaerobic glycolysis is enhanced. Under the influence of hypoxia, the permeability of brain capillaries increases, which leads to its swelling. Already 3–4 minutes after the cessation of oxygen delivery to the myocardium, the heart loses its ability to create the arterial pressure necessary to maintain blood flow in the brain, as a result of which irreversible changes occur in it, which can cause the death of the body.

Formulation of conclusions based on the experiment

Under the influence of hypoxia, both adaptive and pathogenic reactions develop, which lead to irreversible organ damage, the basis of which is a metabolic disorder, which in turn is associated with a reduced or complete cessation of the formation of macroergic phosphorus compounds, which limits the ability of cells to perform normal functions and maintain a state of internal homeostasis.

Terminology:

- Hypoxia
- Hypoxic hypoxia
- Respiratory hypoxia
- Hematic hypoxia

- Circulatory hypoxia
- Histotoxic hypoxia

Tasks for independent work on the topic "Hypoxia"

The student is offered 2–3 cases and analyzes with indicators of gas composition and blood pH. It is necessary to determine the type of hypoxia. Be able to explain the mechanism of occurrence. Analysis of errors with an explanation of the correct answers

List of questions and works to be studied:

1. Definition of the terms "hypoxemia", "hypoxia".
2. Classification of oxygen starvation by etiology and pathogenesis.
3. The essence and mechanisms of the development of functional disorders in the body during oxygen starvation.
4. The main pathogenetic mechanisms of the development of each form of oxygen starvation.
5. Compensatory mechanisms that prevent the development of oxygen starvation.

List of practical skills that must be mastered:

Determining the gas composition and pH of the blood and establishing the type of hypoxia:

- hypoxic hypoxia;
- respiratory hypoxia;
- hemic hypoxia;
- circulatory hypoxia;
- tissue hypoxia;
- substrate hypoxia;
- overloading hypoxia;
- mixed hypoxia.

Situational tasks KROK-1 to determine the final level of knowledge

1. When climbing to a height in a pressure chamber, the rat developed frequent breathing, tachycardia, and a decrease in pO2 tension in the blood. What form of hypoxia occurs in this case?

A. Hypoxic. B. Chemical. C. Circulatory. D. Textile. E. Respiratory.

2. A research doctor as part of a mountaineering expedition climbed to a height of 5,000 m. On the 3rd day of his stay, he developed symptoms of mountain sickness: shortness of breath, headache, loss of appetite, general weakness, cyanosis. What type of hypoxia occurs in this case?

A. Circulatory. B. Hypoxic. C. Stagnant. D. Chemical. E. Fabric.

3. Mountaineers, who were climbing to the top, developed a headache, loss of consciousness, and shortness of breath. What type of hypoxia occurred in climbers?

A. Chemical. B. Hypoxic. C. Circulatory. D. Fabric. E. Mixed.

4. To simulate a stomach ulcer, the animal was injected with atophane, which causes its sclerosing, into the gastric artery. What mechanism of damage to the mucous membrane of the stomach will be the leading one in this experiment?

A. Hypoxic. *C. Mechanical.* *E. Neurohumoral.*
B. Neurodystrophic. *D. Disregulatory.*

5. A 36-year-old man complains of cough with phlegm, shortness of breath, headache, and general weakness. He fell ill after severe hypothermia. During the examination: the skin is pale, the body temperature is 38 °C. Pulse – 91/min, blood pressure – 125/60 mm Hg. In the blood analysis – neutrophilic leukocytosis. The diagnosis was established: focal pneumonia. What type of hypoxia does the patient have?

A. Chemical. *C. Respiratory.* *E. Circulatory ischemic.*
B. Textile. *D. Circulatory congestion.*

6. In a patient during an attack of bronchial asthma, the presence of hypercapnia was detected when determining pCO2 in the blood, and hypoxemia when determining PO2. What type of hypoxia is observed in this case?

A. Chemical. *B. Circulatory.* *C. Respiratory.* *D. Textile.* *E. Histotoxic.*

7. A 40-year-old man complains of general weakness, headache, cough with phlegm, shortness of breath. After a clinical examination and examination, a diagnosis was made: focal pneumonia. What type of hypoxia does the patient have?

A. Respiratory. *B. Circulatory.* *C. Chemical.* *D. Textile.* *E. Hypoxic.*

8. A 65-year-old man suffers from chronic left-sided heart failure. Objectively: cyanosis, shortness of breath, cough with sputum, periodic attacks of suffocation. What type of hypoxia initially occurred in the patient?

A. Circulatory congestion. *C. Fabric.* *E. Chemical.*
B. Circulatory ischemic. *D. Respiratory.*

9. The patient is in the hospital with a diagnosis of chronic heart failure. Objectively: the skin and mucous membranes have a cyanotic shade, tachycardia, tachypnea. What type of hypoxia does the patient have?

A. Anemic. *B. Toxic.* *C. Hypoxic.* *D. Fabric.* *E. Circulatory.*

10. A man, approximately 50 years old, was carried out in an unconscious state from a closed room filled with smoke from a fire. What type of hypoxia occurred in the victim?

A. Respiratory. *B. Hypoxic.* *C. Fabric.* *D. Circulatory.* *E. Chemical.*

11. A 23-year-old patient complains of severe weakness, drowsiness, darkening of the eyes, dizziness, and a change in taste. Menorrhagia in the anamnesis. Blood analysis: Er – 2.8×10^{12}/l, Hb – 70 g/l, CP – 0.75. Which hypoxia most likely led to the development of the identified symptoms in the patient?

A. Chemical. *B. Circulatory.* *C. Fabric.* *D. Respiratory.* *E. Mixed.*

12. A man complained of feeling unwell to the district doctor. In the blood test, erythrocytes are 3×1012/l, hemoglobin is 70 g/l, the color indicator is 0.7. What type of hypoxia does the patient have?

A. Krovyan. *C. Cardiovascular.* *E. Fabric.*
B. Respiratory. *D. Hypoxic.*

13. Hypoxia was detected in a patient who is being treated for anemia. It belongs to the following type:
A. Respiratory. *C. Fabric.* *E. Mixed.*
B. Circulatory. *D. Chemical.*

14. A utility service worker went down into the sewage well without protective equipment and after some time lost consciousness. Emergency doctors diagnosed hydrogen sulfide poisoning. What type of hypoxia has developed?
A. Overloading. *C. Fabric.* *E. Respiratory.*
B. Chemical. *D. Circulatory.*

15. A 55-year-old patient has been taking barbiturates for a long time, which is a favorable factor for the development of blood hypoxia. A sign of which pathological form of hemoglobin can lead to the development of blood hypoxia in this case?
A. Sulfhemoglobin. *C. Methemoglobin.* *E. S-hemoglobin.*
B. Carboxyhemoglobin. *D. F-hemoglobin.*

16. After an accident at a chemical plant, the environment was polluted with nitro compounds. Some of the people living in this area have experienced sudden weakness, headache, shortness of breath, and dizziness. What is the mechanism of development of this form of hypoxia?
A. Increase in methemoglobin formation.
B. Decrease in the function of flavin enzymes.
C. Formation of carboxyhemoglobin.
D. Inactivation of cytochrome oxidase.
E. Suppression of dehydrogenases.

17. The patient developed hemic hypoxia as a result of poisoning with Bertolet salt. The formation of which substance plays a role in the pathogenesis of this hypoxia?
A. Nitrous oxide. *C. Carbhemoglobin.* *E. Methemoglobin.*
B. Sulfhemoglobin. *D. Carboxyhemoglobin.*

18. The emergency doctor diagnosed the victim with signs of carbon monoxide poisoning. What connection caused this?
A. Carbhemoglobin. *C. Deoxyhemoglobin.* *E. Carboxyhemoglobin.*
B. Methemoglobin. *D. Oxyhemoglobin.*

19. After repairing the car in the garage, the driver was hospitalized with symptoms of exhaust gas poisoning. The concentration of which hemoglobin in the blood will be increased?
A. Methemoglobin. *D. Glycolized hemoglobin.*
B. Carbhemoglobin. *E. Carboxyhemoglobin.*
C. Oxyhemoglobin.

20. The man lost consciousness in the garage, where he had been repairing the car for a long time with the engine running. A pathological compound of hemoglobin was found in his blood. Which one exactly?

A. Carboxyhemoglobin. C. Oxyhemoglobin. E. Carbhemoglobin.
B. Methemoglobin. D. Deoxyhemoglobin.

21. Patient V. 38 years old, brought to the reception department with signs of hypoxia, which developed after carbon monoxide poisoning. Moderate condition, tachycardia, shortness of breath, blood pressure 160/100. What is the mechanism of the toxic effect of carbon monoxide on the body?

A. Formation of carboxyhemoglobin.
B. Formation of methemoglobin.
C. Violation of dissociation of oxyhemoglobin.
D. Formation of carbhemoglobin.
E. Blockade of calcium channels of erythrocytes.

22. A man was brought to the hospital in an unconscious state after carbon monoxide poisoning. Hypoxia in him is due to the appearance in the blood of:

A. Methemoglobin. C. Oxyhemoglobin. E. Deoxyhemoglobin.
B. Carbhemoglobin. D. Carboxyhemoglobin.

23. The patient was admitted to the intensive care unit with severe hypothermia. What type of hypoxia does this patient have?

A. Hypoxic (hypobaric). C. Hypoxic (hyperbaric). E. Respiratory.
B. Chemical. D. Fabric.

24. Urethane poisoning was caused in an experimental animal. What type of hypoxia occurred?

A. Chemical. B. Textile. C. Circulatory. D. Respiratory. E. Hypoxic.

Standards of correct answers to the KROK-1 task

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
A	*B*	*B*	*A*	*C*	*C*	*A*	*A*	*E*	*E*	*A*	*A*
13	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
D	*B*	*C*	*A*	*E*	*E*	*E*	*A*	*A*	*D*	*D*	*B*

Recommendations for registration of work results

1. Written answer to test tasks (initial level of knowledge).
2. The results of the experiment are drawn up in the form of an experiment protocol with the determination of relevant conclusions.
3. Independent work of students. Protocol of analysis of case studies and studies of gas composition and pH of blood.
4. Protocol for solving situational tasks with an explanation of the correct answers.

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Topic № 11. Violation of carbohydrate metabolism

Number of hours: 2 academic hours.

Relevance of the topic: Violations of carbohydrate metabolism (hyperglycemia and hypoglycemia) are a number of diseases. The steady increase in the prevalence of diabetes mellitus (DM) determines the relevance of early diagnosis of carbohydrate metabolism disorders. The general structure of carbohydrate metabolism disorders is represented by type 1 diabetes, the share of which is 10–12 %, type 2 diabetes – 85–90 %, other specific types of diabetes – less than 1 %. The prevalence of gestational diabetes among pregnant women in different countries varies from 1 to 14 %, averaging 7 %. In addition to diagnosing DM, it is important to identify conditions that precede type 2DM (fasting hyperglycemia, impaired glucose tolerance, euglycemic insulin resistance), the timely correction of which can delay the development of DM and its complications. Thus, the pathology of carbohydrate metabolism is an urgent problem in medicine requiring study.

Purpose of the lesson:

General: to be able to conduct a pathophysiological analysis of situations related to disorders of carbohydrate metabolism, to characterize the etiology and pathogenesis of diabetes mellitus, to know experimental models of diabetes mellitus.

Specifically:

Know:

1. The main typical forms of violation of carbohydrate metabolism. Their reasons.
2. Hypoglycemia syndrome: types, causes, mechanisms, pathogenesis of hypoglycemic coma.
3. Hyperglycemia syndrome: types, causes and mechanism of development.
4. Diabetes mellitus: definition, classification.
5. Etiology, pathogenesis of type 1 diabetes mellitus, pathogenesis of absolute insulin deficiency.
6. Etiology, pathogenesis of type 2 diabetes mellitus, variants of relative insulin deficiency in type 2 diabetes mellitus (secretory disorders of β-cells, resistance of target tissues to insulin).
7. Laboratory diagnosis of diabetes.
8. Complications of diabetes mellitus, pathogenesis. Diabetic coma: ketoacidotic, hyperosmolar, hypoglycemic. Causes, pathogenesis. Manifestations
9. Significance in clinical practice of various forms of carbohydrate metabolism disorders.
9. Hereditary disorders of carbohydrate metabolism.

Be able:

1. To characterize the main causes of disorders of carbohydrate metabolism.
2. Characterize the syndromes of hypoglycemia and hyperglycemia, explain the causes, pathogenesis.

3. To explain the mechanism of development of clinical manifestations of the main syndromes of hypoglycemia and hyperglycemia.

4. Explain the causes and mechanisms of metabolic disorders in diabetes (hydrocarbon, lipid, protein, water-salt, acid-base).

5. Explain the mechanism of development of the main clinical signs of diabetes.

6. Explain the mechanism of development of diabetes complications (early, late).

Practical experience:

Evaluate the results of laboratory studies of impaired carbohydrate metabolism (blood plasma glucose, glycosylated hemoglobin -HbA1c, serum C-peptide, blood insulin level, glucose tolerance test, determination of glucose and acetor in urine).

Technological map of students' work on the topic "Violation of carbohydrate metabolism"

№	Stage lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
1	Determination of the nitial level of knowledgei	10	Written answer to test tasks	Test tasks	Study room
2	Analysis of theoretical material	35	Analysis of theoretical material based on control questions of the topic, situational tasks, tasks KROK-1	Topic control questions, KROK-1 tasks, situational tasks	
3	Practical part (conduct experiment)	30	Introduction and preparation for setting up the experiment. Setting up the experiment. Discussion of the results of the experiment and formulation of conclusions	Experimental animals - rabbits; centrifuge, FEK, test tubes, water bath, syringe, alloxan, orthotoluide-new reagent	
4	Determination of the final level of knowledge and skills. Summary	15	Determination of the initial level of formation of knowledge and skills	KROK-1 tasks, situational tasks	

The graphological structure of the topic "Violation of carbohydrate metabolism" is attached.

Material and methodological support of the topic "Violation of carbohydrate metabolism":

1. Lectures;
2. Methodological developments for teachers;
3. Methodical instructions for students;
4. A set of test tasks to determine the basic level of knowledge;
5. A set of situational problems to determine the final level of knowledge;
6. A set of krok-1 tasks;
7. A set of laboratory tests of blood and urine for diabetes.
8. A set of diagrams and tables (presentation);
9. Video films;
10. For the experiment (experimental animals – rabbit; centrifuge, fec, test tubes, water bath, syringe, alloxan, orthotoluidine reagent).

Lesson content:

1) Mechanism of the disturbances in carbohydrate metabolism (Disturbances in carbohydrate absorption, Disturbances in intermediate carbohydrate metabolism, Disturbances in the regulation of carbohydrate metabolism).
2) Hyperglycemias and Glucosurias
3) Diabetes mellitus (Etiology, Pathogenesis)
4) Hypoglycemia

Setting up the experiment. Discussion of results and formulation of conclusions

To determine the blood sugar content in experimental diabetes in rabbits.

1. In the experiment, take two rabbits, one of which was previously injected with alloxan at the rate of 160–170 mg per 1 kg of body weight to obtain alloxan diabetes.

2. During the lesson, take blood from control and diabetic rabbits and determine the sugar content in it by the orthotoluidine method. The principle of the method: glucose, when heated with orthotoluidine in acetic acid solution, forms a blue-green compound, the color intensity of which is directly proportional to the concentration of glucose.

3. The results of the experiment are drawn up in the form of a protocol (the blood sugar content of a rabbit with alloxan diabetes is significantly higher than that of a control).

During the discussion, pay attention to the role of exogenous factors that disrupt the formation of insulin (alloxan, etc.), which leads to the development of insulin-dependent diabetes mellitus type I. Physiological hyperglycemia is observed with emotional stress, consumption of a large amount of carbohydrates with food; pathological hyperglycemia – in diseases of the endocrine system, diabetes, tumors of the adrenal cortex and pituitary gland, hyperfunction of the thyroid gland, severe disorders of liver function, organic lesions of the central nervous system.

In humans, this type occurs due to the interaction of genetic and immune mechanisms. In the pathogenesis of type II diabetes (non-insulin-dependent) insulin resistance and pancreatic dysfunction are important

Forming conclusions based on the experiment

The introduction of alloxan into the rabbit's body causes the development of alloxan diabetes, which is evidenced by an increase in blood sugar (hyperglycemia) compared to the blood sugar in a control (intact) rabbit.

Terminology:

- polyuria
- polydipsia
- polyphagia
- glycosuria
- hyperglycemia
- hypoglycemia

Tasks for independent work on the topic "Violation of carbohydrate metabolism"

Students are offered to evaluate glycosylated hemoglobin and glycemic profile (glucose tolerance test). It is necessary to define syndromes of impaired carbohydrate metabolism (impaired glucose tolerance, diabetes mellitus) and explain the mechanism of occurrence. Analysis of errors with an explanation of the correct answers.

List of questions and works to be studied:

1. Violation of absorption of carbohydrates.
2. Concept of glycogenesis, glycogenolysis, gluconeogenesis. their violation.
3. Hyperglycemia, its types. Glucosuria, its mechanisms. Experimental hyperglycemia and glucosuria.
4. Insulin deficiency (pancreatic and extrapancreatic).
5. Concepts in diabetes. Etiology and pathogenesis of diabetes.
6. Forms of diabetes mellitus. Violations of various types of metabolism in diabetes.
7. Experimental models of diabetes.
8. Pathogenesis of diabetic coma.
9. Hypoglycemia, its types. Hypoglycemic coma.

List of practical skills that must be mastered:

1. To characterize the main causes of disorders of carbohydrate metabolism.
2. Characterize the syndromes of hypoglycemia and hyperglycemia, explain the causes, pathogenesis.
3. Explain the mechanism of development of clinical manifestations of the main syndromes of hypoglycemia and hyperglycemia.
4. Explain the causes and mechanisms of metabolic disorders in diabetes (hydrocarbon, lipid, protein, water-salt, acid-base).
5. Explain the mechanism of development of the main clinical signs of diabetes.
6. Explain the mechanism of development of diabetes complications (early, late).
7. Evaluate the results of laboratory studies of carbohydrate metabolism disorders (blood plasma glucose, glycosylated blood hemoglobin – HbA1c, serum C-peptide, blood insulin level, glucose tolerance test, determination of glucose and acetor in urine).

KROK-1 situational tasks to determine the final level of knowledge

1. Patient L., 46 years old, complains of dry mouth, thirst, frequent urination, general weakness. A biochemical blood test revealed hyperglycemia and hyperketonemia. In the urine – glucose, ketone bodies. Diffuse changes in the myocardium on the ECG. The patient reliably has:

A. Diabetes.
B. Alimentary hyperglycemia.
C. Acute pancreatitis.
D. Diabetes insipidus.
E. Ischemic heart disease.

2. A 25-year-old boy complains of dry mouth, thirst, weight loss, despite a high appetite. During examination: height 170 cm, weight – 50 kg, blood glucose level – 10.5 mmol/l, glucosuria. For which of the following conditions are these symptoms most characteristic?

A. Renal diabetes.
B. Diabetes.
C. Alimentary glycosuria.
D. Steroid diabetes.
E. Diabetes insipidus.

3. Patient A., 18 years old, started to lose body weight after having rubella, she notes a constant sensation of dry mouth, thirst, increased appetite, frequent urination. Objectively: the daily amount of urine is 6 l, blood glucose is 17.8 mmol/l, glucose and acetone are found in the urine. What is the most likely pathogenetic mechanism that caused an increase in the patient's glucose level?

A. Increased destruction of insulin.
B. Increase in gluconeogenesis.
C. Decreased insulin production.
D. Damage to insulin receptors of cells.
E. Increased production of glucocorticoids.

4. An experimental animal (rat) was induced with experimental diabetes by intravenous administration of alloxan. What is the mechanism of action of this substance?

A. Activation of insulinase.
B. Binding of zinc.
C. Formation of antibodies to insulin.
D. Damage to beta cells of pancreatic islets.
E. Activation of counterinsular hormone production.

5. The patient was brought to the clinic in an unconscious state, with the smell of acetone coming from his mouth. Blood sugar – 25 mmol/l, ketone bodies – 0.57 mmol/l. Such a condition can develop with a deficiency of which hormone?

A. Somatotropic hormone.
B. Thyroxine.
C. Glucocorticoids.
D. Aldosterone.
E. Insulin.

6. A 9-year-old girl was hospitalized in the department with a diagnosis of type I diabetes. Laboratory examination revealed a high level of ketone bodies. What is the main mechanism of disease development?

A. Insulin deficiency.
B. Insulin excess.
C. Glucagon excess.
D. Excess of somatostatin.
E. Violation of complexation of insulin with receptors.

7. Hyperglycemia of 19 mmol/l was detected in a patient with diabetes, which is clinically manifested by glucosuria, polyuria, and polydipsia. Which of the presented mechanisms is responsible for the development of glucosuria?

A. Non-enzymatic glycosylation of proteins.
B. Threshold glucose reabsorption.
C. Polyuria.
D. Polydipsia.
E. Dehydration of tissues.

8. Glucosuria and hyperglycemia were found in the patient during the examination. Complaints of dry mouth, itchy skin, frequent urination, thirst. The diagnosis was made: diabetes mellitus. What causes polyuria in this patient?

A. By increasing the filtration pressure.
B. By reducing the oncotic pressure of plasma.
C. An increase in the osmotic pressure of urine.
D. A decrease in cardiac output.
E. An increase in plasma oncotic pressure.

9. A 45-year-old woman has no symptoms of diabetes, but an elevated blood glucose level (7.2 mmol/l) is determined on an empty stomach. What is the next test to be performed?

A. Determination of glucose in urine.
B. Determination of residual nitrogen in the blood.
C. Determination of blood glucose.
D. Determination of glucose tolerance.
E. Determination of glycosylated hemoglobin.

10. A girl with diabetes is waiting for a donor kidney. What complication of diabetes is the cause of chronic renal failure?

A. Retinopathy. *C. Atherosclerosis.* *E. Microangiopathy.*
B. Macroangiopathy. *D. Neuropathy.*

11. A woman complains of deteriorating eyesight. The examination revealed obesity, fasting hyperglycemia. What complication of diabetes can cause vision loss or blindness?

A. Microangiopathy. *C. Atherosclerosis.* *E. Glomerulopathy.*
B. Macroangiopathy. *D. Neuropathy.*

12. An unconscious woman was brought to the intensive care unit by ambulance. During the clinical examination, the blood glucose level was 1.98 mmol/l, Hb – 82 g/l, erythrocytes – 2.1×10^{12} g/l, ESR – 18 mm/h, leukocytes – 4.3×10^{9} g/l . The patient probably has:

A. Diabetes. *C. Galactosemia.* *E. Renal diabetes.*
B. Hypoglycemia. *D. Lack of somatotropic hormone.*

13. A patient with diabetes was admitted to the hospital in an unconscious state. Kussmaul breathing, blood pressure 80/50 mm Hg, with the smell of acetone from the mouth. Accumulation of what substances in the body can explain the occurrence of these disorders?

A. Lactic acid. *C. Ketone bodies.* *E. Complex carbohydrates.*
B. Modified lipoproteins. *D. Carbonic acid.*

14. A 53-year-old man was taken to a hospital in an unconscious state. Objectively: dry skin, frequent shallow breathing, no smell of acetone, pulse 126 bpm, blood pressure 70/40 mm Hg. Art., the blood glucose content is 48 mmol/l, the urine reaction to acetone is negative. For which of the listed conditions are the most characteristic symptoms in the patient?

A. Toxic coma. *C. Lactacidemic coma.* *E. Collapse.*
B. Hyperketonemic coma. *D. Hyperosmolar coma.*

15. The patient was found to have a violation of glucose reabsorption in the proximal part of the tubules with the development of glucosuria, while hypoglycemia occurs in the blood plasma. What is the name of this violation?

A. Diabetes.
B. Renal glycosuria.
C. Phosphate renal diabetes.
D. Extrarenal glycosuria.
E. Renal glycosuria. Galactosemia.

16. During the examination of a patient with type 1 diabetes mellitus, a violation of protein metabolism was revealed, which is manifested by amino-acidemia in a laboratory blood test, and clinically by a slowdown in wound healing and a decrease in the synthesis of antibodies. Which of the listed mechanisms causes the development of aminoacidemia?

A. Increase in proteolysis.
B. Hyperproteinemia.
C. A decrease in the concentration of amino acids in the blood.
D. Increase in oncotic pressure in blood plasma.
E. Increase in low-density lipoproteins.

17. A patient who complains of polyuria has sugar in his urine. The content of sugar in the blood plasma is normal. What is the mechanism of glucosuria in the patient?

A. Violation of glucose filtration in the glomerular part of the nephron.
B. Violation of glucose reabsorption in nephron tubules.
C. Hyperproduction of glucocorticoids by the adrenal glands.
D. Insufficient production of insulin by the pancreas.
E. Insulin resistance of cell receptors.

18. In a 15-year-old patient, the fasting glucose concentration is 4.8 mmol/l, an hour after the sugar load is 9.0 mmol/l, after 2 hours it is 7.0 mol/l, and after 3 hours it is 4.8 mmol/l. These indicators are characteristic of such a disease:

A. Itsenko-Cushing diseases.
B. –.
C. Hidden diabetes.
D. Type II diabetes.
E. Type I diabetes.

19. The patient was brought to the clinic in a comatose state. There is a history of type II diabetes for 5 years. Objectively: breathing is loud, deep, in exhaled air the smell of acetone is felt. The content of glucose in the blood is 15.2 mmol/l, ketone bodies – 100 μmol/l. What complications of diabetes are characterized by such clinical manifestations?

A. Hyperglycemic coma.
B. Hyperosmolar coma.
C. Hepatic coma.
D. Ketoacidotic coma.
E. Hypoglycemic coma.

20. The patient was diagnosed with diabetes mellitus accompanied by hyperglycemia. The concentration of which blood plasma protein will allow retrospectively (4–8 weeks before the examination) to assess the level of glycemia?

A. C-reactive protein.
B. Albumins.
C. Ceruloplasmin.
D. Fibrinogen.
E. Glycosylated hemoglobin.

Standards of correct answers to the task KROK-1

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A	*B*	*C*	*D*	*E*	*A*	*B*	*C*	*D*	*E*
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
A	*B*	*C*	*D*	*E*	*A*	*B*	*C*	*D*	*E*

Recommendations for registration of work results

1. Written answer to test tasks (basic level of knowledge).

2. The results of the experiment are formed in the form of an experiment protocol with the determination of relevant conclusions.

3. Protocol for solving situational tasks with an explanation of the correct answers. (final level of knowledge).

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Substantial module 3. Pathophysiology of the methabolism

Topic № 12. Disorders in water-electrolyte metabolism

Number of hours: 2 academic hours.

Relevance of the topic: Water-electrolyte imbalance is an abnormal concentration of electrolytes in the body, which play a vital role in maintaining homeostasis in it. Electrolytes are playing role in regulation of cardiac and neurological function, fluid balance, acid-base balance, and more. An electrolyte imbalance can develop as the result of inadequate intake or excretion of electrolytes. The most common and serious electrolyte imbalances are associated with abnormal levels of sodium, potassium, or calcium.

Disorders of the water balance are leading to dangerous disorders of homeostasis, affecting the functions of all systems of living organism and can be cause of of such complication as death. Water imbalance divides into two forms of water metabolism disorders: dehydration and fluid retention (hyper-hydration). Accumulation of extracellular fluid is known as swelling. The study of swelling revealing the basic mechanisms of its development, and showing the pathogenic mechanisms of edema development in vital organs.

Purpose of the lesson:

General – be able to characterize a violation of water exchange as a typical metabolic disorders, swelling like a typical pathological process, to classify and explain the basic pathogenetic mechanisms of edema.

Specifically:

Know:

1. Classify forms of violation of water metabolism (dehydration, hyperhydration).
2. Formulate a definition of "swelling".
3. Give etiologic and pathogenetic classification of edema. Analyze the pathogenetic mechanisms that underlie the different types of edema.
4. Modeled pulmonary edema by intraperitoneal injection of adrenaline, select physiological indicators to assess the degree of its development, and analyze the mechanism.
5. Determine the amount of pulmonary factor. Show by neural mechanisms anesthesia's role in the pathogenesis of pulmonary edema.
6. To substantiate on the basis of the data obtained pathogenetic therapy in edema of various etiologies.

Be able to:

1. Determine the concept of "water balance", its size, and components.
2. The mechanism of regulation of the water balance, to explain the role of hydrostatic, osmotic, and oncotic pressure in the mechanisms of transcapillary water exchange.
3. To show the role of neuroendocrine regulation in maintaining water balance.

Practical experience:

1. Modeled pulmonary edema by intraperitoneal injection of adrenaline, select physiological indicators to assess the degree of its development, and analyze the mechanism.

2. Determine the amount of pulmonary factor. Show by neural mechanisms anesthesia's role in the pathogenesis of pulmonary edema.

Technological map of students work on the topic "Disorders in water-electrolyte metabolism"

№	Stage lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
1	Determination of the initial level of knowledge	10	Written answer to test tasks	Test tasks	Study room
2	Analysis of theoretical material	35	Analysis of theoretical material based on control questions of the topic, situational tasks, tasks of KROK-1	Topic control questions, KROK-1 tasks, situational tasks	
3	Practical part (conduct experiment)	30	Introduction and preparation for setting up the experiment. Setting up the experiment. Discussion of the results of the experiment and formulation of conclusions	White mice, injections, scissors, pincers, hemostatic clamp, weigh balance, 0.1 % solution of adrenaline, 10 % solution of urethane	
4	Determination of the final level of knowledge and skills. Summarizing the results	15	Determination of the final level of knowledge and skills. Summarizing the results	KROK-1 tasks, situational tasks	

The graphological structure of the topic "Disorders in water-electrolyte metabolism" is attached.

Material and methodological support of the topic "Disorders in water-electrolyte metabolism":

1. Lectures;
2. Methodical instructions for teachers;
3. Methodical instructions for students;
4. Set of test tasks to determine the basic level of knowledge;
5. Set of situational tasks to determine the final level of knowledge;
6. Set of KROK-1 tasks;
7. Set of schemes and tables (presentation);
8. Set of forms with a blood test
9. Video films;
10. For the experiment (experimental animals – white mice, injections, scissors, pincers, hemostatic clamp, weigh balance, 0.1 % solution of adrenaline, 10 % solution of urethane.).

Lesson content:

1) Isotonic hypohydria
2) Hypoosmic hypohydria
3) Hyperosmic hypohydria
4) Isotonic hyperhydria
5) Hypoosmic hyperhydria
6) Hyperosmic hyperhydria
7) Edema and dropsy

Setting up the experiment.
Discussion of results and formulation of conclusions

- **Experimental edema of lungs and the study of the influence of CNS in its development.**

Weigh the animal. Observe the condition of the animal, depth and rate of respiration, colour of skin. Inject intraperitoneally into one of the mice 0.3 ml solution of urethane. Within 15 minutes watch for the development of narcosis. Simultaneously inject intraperitoneally into mouse # 1 (in a state of narcosis) and mouse # 2 (control mouse) 0.3 ml 1 % solution of adrenaline. Compare the state of both animals. Watch for changes in behavior, respiration, skin colour, foaming in the mouth. After the death of one mouse, watch the second in a period of ten minutes. Cut open the animals, take the lungs out, describe the external appearance, weigh and calculate the lung coefficient.

Method of calculating lung's coefficient: Cut the skin of the neck along linea mediana, find the trachea and place a hemostatic clamp on it. Cut open the thoracic cavity, take out the lungs and the heart. Separate the heart and large vessels from the lungs, take off the clamp from the trachea and remove the trachea. Weigh the lungs and calculate the relative percentage of the weight of the lungs to the body weight.

Table

Mouse № 1					Mouse № 2			
Without of narcosis					With narcosis			
Time	Behavior	Sound react	Colour skin	Respiratory rate	Behavior	Sound react	Colour skin	Respiratory rate
	Injection of 0,5 ml 0,1 % solution of adrenalin							

Discussion of the results of the experiment

Point to the main edema development mechanisms: hydrodynamic, physico-chemical factors and permeability of the capillary wall. Emphasize on the importance of nervous and humoral factors in the regulation of water exchange. Describe in detail the changes that occur in the body during injection of large

doses of adrenaline.adrenaline pulmonary edema develops in conditions of pronounced hypertension in a large circle of blood circulation, with the accumulation of blood in the area of the small circle and increased blood pressure in the vessels of the small circle circulation. An important link in the mechanism of adrenaline edema are pulmonary vascular receptors, the fibers from which go to part of the vagus nerve, the efferent link is represented sympathetic neurons in the thoracic region. Vagotomy, removal sympathetic nodes on the neck, the introduction of urethane either prevents adrenaline edema, or weakens its course.

Formulation of conclusions based on the experiment

The animal (without anesthesia) develops changes characteristic for pulmonary edema - shortness of breath, cyanosis, foaming from mouth, etc. In an animal in a state of urethane anesthesia, the same changes develop more slowly and they are weaker expressed. Without anesthesia, the animal dies earlier. Pulmonary the coefficient is greater in an animal without anesthesia.

Terminology:

- Hyperhydria
- Hypohydria
- Edema
- Ascitis
- Anasarca

Tasks for independent work on the topic "Disorders in water-electrolyte metabolism"

The student is offered to investigate the results of a clinical blood analysis of a patient with a disorder of water-electrolyte metabolism. It is necessary to determine the signs and type of violation. Be able to explain the mechanism of occurrence. Analysis of errors with an explanation of the correct answers

List of questions and works to be studied:

1. Positive and negative water balance. Hyperhydria and hypohydria. Their types.
2. What is oedema. Etiology and pathogenesis.
3. The role of neuro-humoral mechanisms in the pathogenesis of oedemas.
4. Types of oedemas. The specific role of pathogenic factors in the mechanism of different types of oedemas.
5. The mechanism of adrenaline oedema of the lungs.
6. Anasarca. Types.

List of practical skills that must be mastered:

1. Modeled pulmonary edema by intraperitoneal injection of adrenaline, select physiological indicators to assess the degree of its development, and analyze the mechanism.

2. Determine the amount of pulmonary factor. Show by neural mechanisms anesthesia's role in the pathogenesis of pulmonary edema.

Situational tasks KROK-1 to determine the final level of knowledge

1. A 45-year-old woman complains of strong general weakness, dyspnea, palpitation, feet edema, increased size of abdomen. On examination: serious condition, respiration rate 32 per min, cyanosis of face, lips, edema of feet, limbs, ascites, edema of anterior abdominal wall. Pulse 124 per min, BP 150/90 mm Hg. Liver is increased. Total serum protein – 70 g/L. What is the driving member of edema pathogenesis in the patient?

A. Increase of permeability of vessel wall.
B. Increase of hydrostatic pressure in capillaries.
C. Increase of oncotic pressure of interstitial fluid.
D. Hypoproteinaemia.
E. Disorder of lymphatic drainage.

2. On examination in patient the expressed swelling was found out in the field of the left forearm. It developed after a bee sting. Name leading pathogenetic mechanism of the edema?

A. A. Hydrodynamic. *C. Osmotic.* *E. Membranogenous.*
B. Colloid. *D. Lymphogenous.*

3. The liquid was received from the patient with heart decompensation at a puncture of a belly cavity, density ratio – 1012 albumine – 10 g/l, globuline – 2 g/l transparent citreous color, fibrinogen is not present, single red blood cells, 1–3 leukocytes in sight. Name leading pathogenetic mechanism of the edema?

A. Hydrodynamic. *C. Lymphogenous.* *E. Osmotic.*
B. Membranogenous. *D. Colloid.*

4. Gastric resection was done to a 35-years-old patient after ulcerous genesis stenosis of pylorus. In 3 days after operation patient complains of intolerable thirst. Objectively: dryness of tongue and mucous membrane of mouth, BP 110/70 mm Hg; hemoglobin, hematocrit and total serum protein are normal. What alteration in water metabolis is likely to take place in this case?

A. Extracellular hyperhydration. *D. Intracellular dehydration.*
B. Intracellular hyperhydration. *E. Total dehydration.*
C. Extracellular dehydration.

5. 40-years-old patient complains of total weakness, breathlessness, palpitation, feet swellings, increasing of belly. Objectively: resperation rate 32 per min, cyanotic face, ascitis, liver is increased, pulse 124 per min, BP 170/90 mm Hg. Total serum protein 70 g/L. What is the leading pathogenesis factor in the patient?

A. Increasing of oncotic pressure if transcellular fluid.
B. Increasing of permeability of vessel wall.
C. Increasing of hydrostatic blood pressure in capillars.
D. Disorder of lymphatic drainage.
E. Lipoproteinemia.

6. In a patient, who used plant food for a long time, swellings have appeared. What is the direct cause of this condition?

A. Hypoaminoacidemia. *D. Hypoglycemia.*
B. Hypoproteinemia. *E. Anemia.*
C. Decreasing of blood amount of microelements.

7. Dehydration appears in patients with diabetes incipidus and in patient with forced perspiration or stomach secretion. In both cases debit of water excesses debit of electrolytes. Changes of what of the following rates will have the same directions in those pathologies?

A. Urine osmolality. *D. Blood osmolarity.*
B. Circulatory volume. *E. Concentration of sodium in blood.*
C. Concentration of sodium in urine.

8. Patient has severe nephropathia with massive edematous syndrome complicated with chronic bronchiectasis dicease. The following characteristics have been found by taking measurements: heavy proteinuria, cylindruria, heavy serum protein decrease, hyperlipemia, hypokaliemia and other. What is the initial and significal event in swelling pathogenesis in this patient?

A. Blood oncotic pressure decrease. *D. Limphatic flow block.*
B. Blood hydrodynamic pressure increase. *E. Microvessels permeability increase.*
C. Extracellular fluid pressure increase.

9. Lung edema appeared in a patient with hypertensive crisis. What is the main factor in the pathogenesis of this condition&

A.Blood pressure increase.
B. Pulmonary vessels permeability increase.
C. Pulmonary vessels hydrodynamic pressure increase.
D. Pulmonary vessels resistance increase.
E. Blood oncotic pressure decrease.

10. What process is not important in the pathogenesis of swelling?

A. Tissue oncotic pressure increase. *D. Blood osmotic pressure decrease.*
B. Blood oncotic pressure increase. *E. Capillar hydrostatic pressure increase.*
C. Tissue osmotic pressure increase.

11. Thirst appeared in 'hot shop' worker as a result of forced perspiration. Worker quenched thirst with water without salt. What kind of water-salt alteration could be in this case?

A. Isoosmolar hypohydration. *D. Hypoosmolar hypohydria.*
B. Hyperosmolar hyperhydration. *E. Hypoosmolar hyperhydria.*
C. Hyperosmolar hypohydration.

12. Clinical signs of lung edema appeared in a patient with left-heart failure. What pathogenic mechanism is the initial in this case?

A. Colloid-osmotic. *C. Lymphagenic.* *E. Congestive.*
B. Hydrodynamic. *D. Membranogenous.*

13. A 72-years-old patient 8 years has essential hypertension. Last 3 weeks he has such sighs of enterocolitis as intensive and frequent diarrhea. Swellings on the face and limbs appeared. What is the cause of swellings?

A. Dehydration.
B. Na reabsorbtion decrease.
C. Arterial hypertension.
D. Hypoproteinemia.
E. Venous pressure increase.

14. Swellings are marked in a patient as a result of kidney disease. There is significance amount of protein in urine analysis. What mechanism could explain swellings appearing in this patient?

A. Lymphatic oncotic pressure decrease.
B. Kidney filtration pressure decrease.
C. Blood oncotic pressure decrease.
D. Interstitial oncotic pressure decrease.
E. Blood osmotic pressure increase.

Standards of correct answers to the task KROK-1

1	2	3	4	5	6	7	8	9	10	11	12	13	14
B	*E*	*A*	*D*	*C*	*B*	*D*	*A*	*C*	*B*	*D*	*B*	*D*	*C*

Recommendations for registration of work results

1. Written answer to test tasks (initial level of knowledge).
2. The results of the experiment are drawn up in the form of an experiment protocol with the determination of relevant conclusions.
3. Protocol for the study of the results of the patient's blood analysis.
4. Protocol for solving situational tasks with an explanation of the correct answers.

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Topic № 13. Violation of acid-base balance

Number of hours: 2 academic hours.

Relevance of the topic: Among the many homeostasis indicators, acid-base balance is one of the most important. At the same time, due to the lack of pronounced clinical symptoms earnestly testifying about its shift towards acidosis or alkalosis, such disorders are often diagnosed only in advanced cases, often critical cases. Given the above, knowledge of the features of acid-base balance disorders, and understanding of its possible changes in various diseases will allow the future doctor to determine the correct diagnosis and select a treatment regimen that will provide for pharmacological correction of the blood pH shift. This topic is necessary for future clinical practice doctors and should be included in the process studying of the subject.

Purpose of the lesson:

General. To be able to characterize acid-base balance disorders as typical changes of metabolism, to classify and to define the main pathogenetic mechanisms of the main types of disorders.

Specifically:

Know:

1. Formulate the concept of "acid-base balance", "acidosis" and "alkalosis".
2. Classify its forms.
3. Analyze the pathogenetic mechanisms forming different types of acid-base disorders.
4. Estimate acid-base indexes in different types of alkalosis and acidosis.
5. Substantiate using given data pathogenetic therapy of different types of acid-base disorders.

Be able to:

1. Define the "acid-base state" concept, indexes, determining it
2. Show mechanisms of regulation (disorders compensation) of acid-base balance.
3. Evaluate indicators of acid-base balance, to explain the mechanism of violation and justification of the clinical conclusion.

Technological map of students' work on the topic "Violation of acid-base balance".

№	Stage lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
1	Determination of the basic level of knowledge	10	Written answer to test tasks	Test tasks	Learning room
2	Analysis of theoretical material	65	Analysis of theoretical material based on control questions of the topic, situational tasks, tasks of KROK-1	Topic control questions, KROK-1 tasks, situational tasks	

№	Stage lesson	Academic time, min	Educational guide		Place holding a class
			Educational tools	Equipment	
3	Determination of the final level of knowledge and skills. Summarizing the results	15	Determination of the final level of knowledge and skills. Summarizing the results	KROK-1 tasks, situational tasks	

The graphological structure of the topic "Violation of acid-base balance" is attached.

Material and methodical support of the topic "Violation of acid-base balance".

1. Lectures;
2. Methodical instructions for teachers;
3. Methodical instructions for students;
4. Set of test tasks to determine the basic level of knowledge;
5. Set of situational tasks to determine the final level of knowledge;
6. Set of KROK-1 tasks;
7. Set of schemes and tables (presentation);
8. Set of forms with a clinical blood test;
9. Video films;

Lesson content:

1. Acid-base balance
2. Acidosis
3. Alkalosis
4. Buffer system
5. Indicators of evaluation of ABB.
6. Urgent compensation ABB shift.
7. Long-term compensation ABB shift.

Terminology:

- Acidosis
- Alkalosis
- Hypoxemia
- Hypercapnia
- Hypoventilation
- Acidogenesis
- Ammoniogenesis

Tasks for independent work on the topic «Violation of acid-base balance»

The student is offered 2–3 results of research on indicators of ABB. It is necessary to determine the disorder (acidosis, alkalosis, the degree of compensation and decompensation, etc. Be able to explain the mechanism of occurrence. Analysis of errors with an explanation of the correct answers.

List of questions and works to be studied:

1. Concepts of "acid-base state", "acidosis", "alkalosis".
2. Mechanisms of ABB regulation. The main indicators of ABB assessment.
3. Classification of violations of the ABB. Types of violations of the ABB.
4. Acidosis: definition, types, causes, pathogenetic mechanisms of development.
5. Compensatory mechanisms of acidosis. Clinical manifestations.
6. ABB indicators in various types of acidosis.
7. Alkalosis: definition, types, causes, pathogenetic mechanisms of development.
8. Compensatory mechanisms of alkalosis. Clinical manifestations.
9. ABB indicators in different types of alkalosis.
10. Pathogenetic therapy of various variants of ABB violation.

List of practical skills that must be mastered:

1 Determine the concepts of "acid-base state", "acidosis", "alkalosis".

2. Describe the pathogenetic mechanisms of development and compensation of ABB violation.

3. Identify the ABB indicators in various types of alkalosis and acidosis.

4. Identify on the basis of the received data, the pathogenetic therapy of various variants of ABB violation.

Situational tasks KROK-1 to determine the final level of knowledge

1. A patient suffering from a respiratory failure has the blood pH level of 7.35. Hypercapnia was diagnosed on the basis of his $PaCO_2$ rate measurements. An increase in his urine pH was found when measured. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

2. A patient has the following results of laboratory examinations: pH = 7.32, $PaCO_2$ = 38 mmHg, SB = 19 mEq/L, BB = 36.0 mEq/L, BE = 6 mEq/L, blood lactic acid = 26 mg%, daily urine TA – 45 mEq/L. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

3. A patient with food toxicoinfection accompanied by profuse diarrhea suffers a severe condition attended with impairment of consciousness and Kussmaul's breathing. The blood test showed the pH level of 7.3. A substantial drop of base fund (i.e. a base deficit) in blood is observed. The urine is in a strong acid condition; containing excessive phosphates and ammonium salts. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

4. A patient with pylorostenosis suffers from a frequent vomiting with caused him to feel worse. He appeared to feel apathetic and weak, with the muscles' tone increased and cramps sometimes to occur. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

5. A patient suffering from the mountain disease which develops has the compensatory hyperventilation in his lungs. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

6. Hypercapnia was found in patient's blood when tested for CO_2 content which caused a bronchial asthma attack. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

7. A solution of glucose containing sodium bicarbonate is being infused intravenously to a patient. The following characteristics have been found by taking measurements: pH =7.43, $PaC0_2$ = 61,0 mm Hg, SB = 31.5 mEq/L, BB = 59.0 mEq/L, and BE = +8.5 mEq/L. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

8. The following lab test data were obtained: pH = 7.28, $PaC0_2$ = 35 mm Hg, SB = 16.5 mEq/L, BB = 35 mEq/L, BE – 9.0 mEq/L, daily urine TA = 8.0 mEq/L/day, urine H^+ = 17 mEq/L. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

9. The following lab test data were obtained: pH = 7.35, $PaC0_2$ = 52 mm Hg, SB = 26.5 mEq/L, BB = 45 mEq/L, BE = +3.0 mEq/L. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

10. The following changes in a patient's blood composition occurred as a cause of severe blood loss: pH = 7.19, $PaC0_2$ = 25 mm Hg, SB = 11.0 mEq/L, BB = 26 mEq/L, BE = -17.0 mEq/L. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

11. A patient suffers from a prolonged loss of intestinal juice caused by bowel fistula. The following changes in blood composition are observed: pH = 7.25, $PaC0_2$ = 36 mmHg, SB = 14.0 mEq/L, BB = 24.0 mEq/L, BE = -8.0 mEq/L. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

12. The following blood composition changes were observed in a patient with concussion of the brain ("brain-shaking") accompanied by frequent vomiting attacks and dyspnea: pH = 7.56, $PaCO_2$ = 30 mmHg, SB = 27.0 mEq/L, BB = 50 mEq/L, BE = +3.0 mEq/L. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

13. A patient suffers from hyponatremia and polyuria caused by nephrosis, (he keeps taking the Diacarb medication). The following data of his blood lab tests were obtained: pH = 7.30, $PaC0_2$ = 36 mmHg, SB = 17.0 mEq/L, BB = 42 mEq/L, BE = -8.0 mEq/L. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

14. The following data have been obtained during the blood lab tests: pH = 7.36, $PaCO_2$ = 36 mmHg, SB = 19.5 mEq/L, BB = 39 mEq/L, BE = -5.0 mEq/L. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

15. A patient suffers from severe vomiting and tetany attacks. The following data have been obtained during the blood lab tests: pH = 7.50, $PaCO_2$ = 36 mmHg, SB = 28.0 mEq/L, BB = 57 mEq/L, BE = +5.6 mEq/L. Which of the following types of acid-base balance disorders is likely to take place in this case?

A. Metabolic alkalosis. *C. Excretory alkalosis.* *E. Respiratory alkalosis.*
B. Metabolic acidosis. *D. Respiratory acidosis.*

16. A 19-vear-old young man has been examined in a nephrological hospital. Increased potassium content was detected in secondary urine of the patient. Such changes have been most likely caused by the increased secretion of the following hormone:

A. Glucagon. *B. Aldosterone.* *C. Testosterone.* *D. Adrenalin.* *E. Oxytocin.*

17. 30 minutes after drinking mango juice a child suddenly developed a local swelli-ng in the area of the soft palate, which impeded swallowing and, eventually, res ration. 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. Inflammatory. *C. Cardiac.* *E. Allergic.*
B. Hepatic. *D. Alimentary.*

18. Due to recurring vomiting a patient has lost significant amount of gastric juice, which led to development of acid-base dysbalance. What type of acid-base dysbalance has developed?

A. Metabolic acidosis. *D. Nongaseous acidosis.*
B. Nongaseous alkalosis. *E. Gaseous alkalosis.*
C. Gaseous acidosis.

19. Ketoacidosis that develops due to accumulation of ketone bodies in blood serum is a primary complication of diabetes mellitus. What acid-base disbalance develops during this condition?

A. Respiratory alkalosis. *D. Metabolic acidosis.*
B. Metabolic alkalosis. *E. –.*
C. Respiratory acidosis.

20. A patient suffers from disrupted patency of the airways at the level of small and medium-sized bronchial tubes. What changes of acid-base balance can occur in the patient?

A. Respiratory acidosis.
B. Metabolic alkalosis.
C. Respiratory alkalosis.
D. Acid-base balance remains unchanged.
E. Metabolic acidosis.

Standards of correct answers to the task КROK-1

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
D	*B*	*B*	*A*	*E*	*D*	*C*	*B*	*C*	*B*
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
B	*C*	*B*	*D*	*A*	*B*	*E*	*B*	*D*	*A*

Recommendations for registration of work results

1. Written answer to test tasks (basic level of knowledge).
2. The results of the experiment are drawn up in the form of an experiment protocol with the determination of relevant conclusions.
3. Protocol for the analysis of ABB indicators.
4. Protocol for solving situational tasks with an explanation of the correct answers.

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Content

Навчальне видання

ЗАГАЛЬНА ПАТОФІЗІОЛОГІЯ

Методичні рекомендації для викладачів щодо підготовки до практичних занять студентів (спеціальність «Медицина» та «Стоматологія»)

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