

Syllabus of PATHOPHYSIOLOGY – dental medicine
Department of Pathophysiology, Faculty of Medicine in Pilsen, Charles University
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The student knows the facts in the field of general and special pathophysiology, can present and logically organize them, recognize and evaluate their importance, name examples of described phenomena. The student is oriented in the problem and can explain pathophysiological mechanisms of the diseases, explain how and why pathological processes happen and develop. The student can find and explain a context and relations between knowledge of various areas of pathophysiology, understand and use interdependence of individual organ systems in normal as well as pathological states. The student has knowledge of subjects which pathophysiology follows up on, i.e. anatomy, histology, embryology, biology chemistry and biochemistry, biophysics, physiology and microbiology. The student can use this knowledge to understand pathophysiology and can find and explain their relations.

General pathophysiology

Introduction to the subject

Definition of the content of the subject, sections of the subject, relations to other subjects of medical study, methods of pathophysiology as a science

History of pathophysiology

Definition of basic terms

Definition of the terms health and disease

Etiology, the main views on the etiology of diseases

Pathogenesis

General pathogenetic mechanisms, models of pathological states

Role of physiological regulatory mechanisms in the pathogenesis of diseases

Physiological and pathological parameters and phenomena, normal state versus pathology

Disease and its course

Disease, pathological state, nosological unit, symptom, syndrome

Stadia of a disease, forms of the course of a disease, results of a disease

Manifestations of diseases

Prognosis of diseases

Etiological factors

Classification of etiological factors

Etiological factors influenceable and uninfluenceable

Intrinsic etiological factors

- Definition, explanation of term inborn and hereditary disease, disorder
- Age, sex, circadian rhythmicity, congenital factors as etiological and risk factors of diseases
 - their basis, mechanisms of their role in disease development, examples of diseases
- Epigenetics – definition, mechanisms, sensitive periods, examples of diseases with epigenetic basis or participation
- Heredity
 - Basic terms
 - Types of mutations, types and mechanisms of mutation effects
 - Types of heredity, their features and principles, mechanisms of relation between alleles

- Examples of hereditary diseases
- Extrinsic etiological factors
- Physical factors
 - Mechanical influences – injuries, type of wounds, healing and its disturbances
 - Electrical current
 - Alternating, direct, mechanisms of effect, electrical current injuries, principles of safety
 - Thermal influences
 - General and local (including general response of the organism) impact of cold and heat (burns, frostbites, hypothermia, insolation, hyperthermia)
 - Environmental pressure and its changes
 - Adaptation on the high altitude, altitude disease, barotrauma, decompression illness, hyperbaric oxygenotherapy
 - Radiation – ionizing and non-ionizing
 - Classification of radiation, effect of different kinds of radiation on the organism and its mechanisms, radiation illness
 - Noise, infrasound, ultrasound
 - Kinetosis
 - Chemical factors
 - Toxins
 - Site of entrance, mechanisms of effects, toxicity quantification, elimination of toxins, manifestation of intoxications
 - Examples of important toxic substances and their influence (heavy metals, arsenic, cyanides, carbon monoxide, nitric and nitrous compounds, organophosphates, main plant and animal poisons)
 - Corrosive substances and their effect
 - Teratogenic, mutagenic a cancerogenic substances
 - Mechanisms and consequences of their influence, examples
 - Biological factors
 - Animals, plants, fungi
 - Infections
 - Classification (prions, viruses, bacteria, molds, protozoa, multicellular parasites – worms, mites, insects), characteristic of individual groups of infectious agents
 - Transfer mechanisms of infections and penetration of infectious agents into organism, mechanisms of pathological effect of microorganisms and multicellular parasites
 - Examples of infectious diseases
 - Coexistence of human organism with microorganisms, examples of positive influence of microorganisms on the human
 - Social factors
- Mutual influence and interaction of etiological factors

Developmental disorders

Stages of the ontogenetic development

Altricial and precocious types of development

Factors determining the individual's development and its disorder

Diseases and disorders linked to a certain age, changes in reactivity and resistance dependent on age

Gametopathy, blastopathy, embryopathy, fetopathy, perinatal damage

Teratogenic factors and effects

Mechanisms of developmental disorders

Critical developmental periods

Normal and impaired CNS development and factors that affect it, brain growth spurt

Growth disorders

Nanism, gigantism

Causes and mechanisms of growth disorders

Hereditary growth disorders

Influence of nutrition and the environment

Growth disturbances of endocrine origin

Aging

Basic concepts (gerontology, geriatrics, demographic aging)

Causes and mechanisms of aging, theory of aging

Manifestations of aging

Social and health aspects of aging, age-related illness

Abnormal aging

Factor influencing the course of aging

Terminal states, death

Definition of death, clinical and biological death

Cell death and its mechanisms, tissue death, death of an individual, brain death

Signs of death, determining the death of an individual

Causes and mechanisms of death

Philosophical, ethical, psychological, social aspects of death

Dying and its stages

Persistent vegetative state, locked-in syndrome

Stress

The definition of stress, the concept of general adaptation syndrome and its history

Basic concepts - stress, stressor, eustress, distress

Stress phases

Stress response scheme, mechanisms, roles of individual components of the stress axes

Humoral and metabolic changes during the stress response

The importance of stress for the organism

Relation of stress to pathogenesis of disease

Stress diseases - definitions, mechanisms of origin, examples

Stress axes disturbances

The relationship between stress and shock

Pathophysiology of immunity

Immunity mechanisms and their classification

Classification of disorders and diseases of the immune system

Immunodeficiency

- Causes, pathogenesis, symptoms and consequences

- Examples of congenital and acquired immunodeficiencies

Allergy

- Causes of allergic diseases

- Types of allergic reaction, their mechanisms, manifestations, consequences

- Anaphylaxis, anaphylactic shock

- Examples of illnesses

- Allergies, cross-allergy

Autoimmune diseases

- causes, pathogenesis, symptoms and consequences, examples of diseases

Inflammation

- Definition of inflammation
- Components of inflammatory reaction, course of inflammation
- Localized and general inflammatory manifestations and mechanisms of their origin
- The importance of inflammation for the organism
- Inflammation acute and chronic
- Inflammation as a pathogenic agent
- Damping of inflammation
- Systemic inflammatory response - definition, course and symptoms, causes, mechanisms
- Sepsis, septicemia, bacteremia

Transplantation

- Definition, purpose and types of transplantation
- Transplantation immunology, host-versus-graft reaction, graft-versus-host reaction
- Transplant rejection

Pathophysiology of thermoregulation

Control and mechanisms of thermoregulation

Overheating and hypothermia of the organism, their causes, manifestations and consequences

Fever

- Definitions, types of fever and its course
- Causes and mechanisms of fever
- The importance of fever for the organism
- The risks and complications of fever

Malignant hyperthermia

Pathophysiology of tumors

Definition of tumors

Classification of tumors

Malignant and benign tumors, their features, biological and clinical malignancy of the tumor

Causes and mechanisms of tumor formation

- Tumorigenesis, carcinogenic factors, protooncogenes, oncogenes, tumor suppressor genes
- Chemical and physical carcinogens, infectious etiology of tumors, tumor inheritance, role of immunity, endocrine factors
- Immunology of tumors

Tumor metabolism

Local and systemic effect of the tumor on the organism

Expansive and invasive tumor growth

Tumor metastasis - ways and consequences

Paraneoplastic phenomena - definitions, mechanisms, examples

Acid-base balance and its disorders

Components and parameters of acid-base balance

Mechanisms of acid-base balance maintenance

Buffer systems

- Buffer definition, mechanisms of action, buffer capacity
- Examples of buffers, importance of bicarbonate buffer

The role of lungs in maintaining acid-base balance

The renal role in maintaining acid-base balance

Acidosis, acidemia, alkalosis, alkalinity

Types of acid-base balance disorders

- Respiratory disorders of acid-base balance
- Metabolic disorders of acid-base balance
- Combined acid-base balance disorders

Compensation and correction of individual types of acid-base balance disorders

Causes of acid-base balance disorders

Symptoms and consequences of acid-base balance disorders

Pathophysiology of body fluids

Compartments of body water

Osmolality of body water

Changes in volume and osmolality of body fluids

- Dehydration and hyperhydration hypoosmolar, isoosmolar, hyperosmolar - their causes, mechanisms, characteristics, consequences

Edema

- Definition
- Basic mechanisms (factors) leading to the formation of edema - hydrostatic pressure, oncotic pressure, vascular wall permeability, lymphatic drainage
- Situations and processes leading to the application of the basic mechanisms of the formation of edema
- Types of edema by cause (cardiac, renal, inflammatory, lymphatic, venostatic, hepatic, cytotoxic) - characteristics, examples of a particular diseases, mechanisms
- Special types of edema, fluid accumulation in body cavities - causes, mechanisms, examples

Special pathophysiology – pathophysiology of organ systems

Pathophysiology of the cardiovascular system

General mechanisms of blood circulation disturbances and their consequences

Inborn heart defects

- Classification, division and characteristics of inborn heart defects
- Cyanotic, non-cyanotic, late cyanotic defects
- Hemodynamic consequences, manifestation and complications, secondary changes and reaction of organism as their consequences

Acquired valvular defects

- Etiology and risk factors
- Valvular stenosis, insufficiency, characteristic of individual defects and their hemodynamic consequences

Disturbances of peripheral blood circulation

- Factors influencing tissue blood perfusion under physiological and pathological conditions
- Ischemia
 - Causes, mechanisms of origin, consequences and manifestations
 - Passive and active hyperemia - causes, mechanisms, consequences and manifestations

Atherosclerosis

- Pathological-anatomical description, stable and unstable atherosclerotic plaques
- Etiology and risk factors, prevention
- Pathogenesis of atherosclerosis
- Consequences, examples of diseases connected with atherosclerosis

Ischemic heart disease

- Causes, risk factors, pathogenesis, classification

- Myocardial infarction - pathogenesis, manifestation, acute and chronic complications
- Angina pectoris stable and unstable, Prinzmetal (variant) type
- Sudden death

Arrhythmias

- Classification, characteristics of individual types, causes and mechanisms of origin, hemodynamic consequences

Arterial hypertension

- Definition, normal and pathological values of blood pressure
- Essential hypertension - etiological and risk factors, prevention, manifestation and consequences
- Secondary hypertension - definition, causes, pathogenesis, examples of diseases

Cardiac insufficiency and failure

- Causes, pathogenesis
- Acute and chronic form
- Functional disturbances of right and left heart
- Systolic and diastolic dysfunction – causes, pathogenesis, consequences
- Volume and pressure overload

Pulmonary hypertension

- Causes, pathogenesis, manifestation and consequences, cor pulmonale

Thromboembolic disease - causes, risk factors, pathogenesis, consequences, prevention

Circulatory shock cardiogenic, hypovolemic, septic, anaphylactic

- Causes, characteristic, pathogenesis, course and consequences of individual types
- Compensation, decompensation, irreversible shock phase

Pathophysiology of the blood

Changes of blood volume and composition - causes, pathogenesis, manifestation and consequences

Pathophysiology of red blood cells (RBC)

- Anemias
 - Definition of anemia, laboratory indicators
 - Anemic syndrome
 - Classification of anemias
 - Normocytic, microcytic, macrocytic; normochromic, hypochromic
 - Anemias caused by the insufficient RBC production
 - Anemias caused by the increased loss of RBC
 - Anemia caused by the acute and chronic bleeding
 - Hemolytic anemias corpuscular and extracorporeal
 - Intoxications with change of hemoglobin properties
 - Blood groups, transfusion, incompatibility

Pathophysiology of leukocytes

- Classification and function of leukocytes
- Disturbances of leukocyte function, inborn and acquired immunodeficient states related to leukocytes
- Changes of leukocytes number (total and individual types) – causes, consequences
- Leukemias, lymphomas – classification, etiology, pathogenesis, manifestation, consequences

Bleeding acute and chronic, external and internal – causes, manifestation of blood composition, response of organism

Hemorrhagic diathesis

- Definition, classification; inborn and acquired

- Hemorrhagic diathesis related to platelets (thrombocytopenia, thrombocytopathies), coagulopathies (including pharmacological influence of hemostasis), vasculopathies - causes, pathogenesis, manifestations, particular diseases and their characteristics
Thrombotic states

Pathophysiology of breathing

Breathing description, process of breath gases exchange between the external environment and the tissue cells, external and internal breathing

Basic processes in the lungs (ventilation, diffusion, perfusion) and the factors that affect them
Definitions of basic concepts (hypoxia, hypoxemia, asphyxia, hypercapnia, hypocapnia, dyspnea, orthopnea)

Hypoxic, transport, circulatory and histotoxic hypoxia

- Characteristics of individual types, causes, mechanisms of origin

Central and peripheral cyanosis - definition, mechanism of origin

Respiratory insufficiency partial and global

Obstructive and restrictive disorders of lung ventilation - characteristics, examples of diseases

Disorders of lung diffusion and perfusion

Disorders of breathing regulation

Acute respiratory distress syndrome

Pathophysiology of the excretory system

Determination of renal function (examination of dilution and concentration function, determination of renal blood flow and glomerular filtration, clearance of prominent substances)

Anuria, oliguria, polyuria - definitions of terms, causes and mechanisms of origin

Pathophysiology of acute renal failure

- Prerenal, renal and postrenal causes

- Oliguric and polyuric form of renal failure and their consequences for the organism

Pathophysiology of chronic renal failure

- Causes, pathogenesis, mechanisms of compensation for decreased functional kidney capacity, mechanisms of renal failure progression

- Uremic syndrome - pathogenesis, manifestations

Pathophysiology of the endocrine system

Principles of function of the endocrine system, principles of endocrine regulations

General causes of diseases of endocrine glands, mechanisms of endocrine disorders

Classification of diseases of the endocrine glands

- Hypofunction, hyperfunction, eufunction

- Primary and secondary disorders

Pathophysiology of endocrine function of the hypothalamus

Pathophysiology of the neurohypophysis

- Vasopressin (ADH)

- Central and peripheral diabetes insipidus

- Syndrome of inappropriate secretion of ADH

Disorders of the hypothalamus-pituitary-peripheral gland axis

- Primary, secondary and tertiary disorders

- Hypothalamic statins and liberins and disorders of their production

- Adenohypophyseal hyper- and hypofunction syndromes – causes, pathogenesis, manifestations

Pathophysiology of the thyroid gland – thyroid hormones

- Regulation of thyroid gland function, effects of thyroid hormones, the importance of iodine
- Hyperthyroidism – causes, pathogenesis, manifestations and consequences
- Hypothyroidism - inborn (acquired in childhood) and acquired in adulthood
 - Causes, manifestation, cretinism, endemic cretinism, myxedema
- Inflammations of the thyroid gland – Graves-Basedow disease, Hashimoto's thyroiditis
- Eufunction, hyperfunction and hypofunction goiter – causes, mechanisms of origin, manifestations

Pathophysiology of the adrenal cortex

- Regulation of the adrenal cortex and its disorders
- Hypercorticalisms
 - Cushing's syndrome - causes, pathogenesis, manifestations and consequences
 - Conn's syndrome - causes, pathogenesis, manifestations and consequences
 - Secondary hyperaldosteronism
 - Overproduction of the sex hormones in the adrenal cortex - causes, manifestations and consequences
- Hypofunction of the adrenal cortex
 - Selective insufficiency of the glucocorticoids – causes, manifestations and consequences
 - Hypoaldosteronism - causes, manifestations and consequences
 - Addison's disease – causes, pathogenesis, manifestations and consequences, Addisonian crisis

Pathophysiology of the adrenal medulla and sympatoadrenal system

Pathophysiology of the parathyroid glands

- Primary and secondary hyper- a hypoparathyroidism, pseudohyperparathyroidism
 - Causes, pathogenesis, manifestations and consequences

Pathophysiology of metabolism and internal environment

Homeostasis, its mechanisms and fundamental principles of homeostasis disturbances

Pathophysiology of energetic metabolism, basal metabolism and its changes, excessive and insufficient energetic intake, obesity, weight loss

Pathophysiology of carbohydrate metabolism

- Disorders of carbohydrate digestion and absorption - causes, pathogenesis, manifestations and consequences
- Importance of carbohydrates from nutrition point of view
- Disorders of metabolism of particular carbohydrates (galactosemia, fructosuria, lactose intolerance etc.)

Disorder of glycaemia regulation

- Mechanisms of glycaemia regulation and their disorders
- Causes, manifestations and consequences of hyperglycemia
- Causes, manifestations and consequences of hypoglycemia

Diabetes mellitus

- Definition, classification, characteristics of each type
- Pathophysiology of diabetes mellitus type 1
- Pathophysiology of diabetes mellitus type 2
- MODY, gestational diabetes, steroid diabetes, secondary diabetes, renal diabetes and other types of diabetes mellitus
- Acute and chronic complications of diabetes mellitus
- Diabetic hyperosmolar and ketoacidotic coma – occurrence, pathogenesis, manifestations

Pathophysiology of calcium metabolism

- Distribution and forms of calcium in an organism, role of pH

- Regulation of calcium metabolism and its disorder, role of parathormone, calcitonin and D vitamin
- Syndrome of hypercalcemia and hypocalcemia – causes, mechanisms of origin, manifestations and consequences
- Tetany – characteristics, causes and mechanisms of its origin

Pathophysiology of protein and amino acids metabolism

- Protein digestion disorders
- Importance of essential amino acids
- Nitrogen balance and its disorders, metabolism of nitrogenous substances and its disorders
- Hereditary disorders of amino acid metabolism

Pathophysiology of lipid metabolism

- Disorders of digestion and absorption of lipids – their causes, pathogenesis, manifestations and consequences, context with fat soluble vitamins and essential fatty acids
- Disorders of metabolism of apolipoproteins and cholesterol, dyslipidemias and their causes and consequences

Pathophysiology of nutrition

Eating disorders, malnutrition, anorexia, bulimia

Pathophysiology of starvation

Obesity - causes, types including obesity of endocrine origin, health risks

Rational diet - composition, importance of individual components, consequences of lack and excess of individual components, including essential substances

Carbohydrates, fats and proteins as food components - their digestion and absorption disorders

Vitamins

- Fat soluble vitamins and water-soluble vitamins
- Enumeration of individual vitamins, their importance for the organism, sources of vitamins
- Hypovitaminoses and hypervitaminoses - causes, consequences, manifestations and mechanisms of their development

Minerals, trace elements (sodium, potassium, calcium, magnesium, phosphorus, chlorine, iron, zinc, copper, selenium)

- List of important substances and their importance for the organism
- Sources of minerals and trace elements
- Causes and mechanisms of their lack and excess
- The manifestations and consequences of their lack and excess

Pathophysiology of the gastrointestinal tract

Pathophysiology of the oral cavity

- Saliva secretion disorders, Sjögren's syndrome

Pathophysiology of the stomach

- Disorders of stomach secretion and motility
- Pathophysiology of gastroduodenal ulcer disease and its complications
- Gastritis
- Nausea and vomiting

Pathophysiology of the small and large intestine

- Disorders of bowel secretion and motility
- Pathophysiology of the ileus - types, causes, pathogenesis and consequences
- Disorders of digestion and absorption of substances in the intestines
- Dyspepsia
- Constipation - definition, etiology, pathogenesis, consequences, prevention

- Diarrhea - definition, etiology, pathogenesis, consequences
- Pathophysiology of exocrine pancreas
- Acute and chronic pancreatitis - etiology, pathogenesis, course and consequences
- Pancreatic secretion disorders - etiology, pathogenesis, consequences of decreased secretion

Pathophysiology of the liver

- Hepatic function indicators
- Causes and mechanisms of hepatic disorders
- Symptoms and consequences of hepatic dysfunction, acute and chronic hepatic insufficiency
- Cirrhosis of the liver - etiology, pathogenesis, symptoms and consequences
- Portal hypertension - causes, pathogenesis, symptoms and consequences
- Ascites - causes, pathogenesis, symptoms and consequences
- Hyperbilirubinemia and prehepatic, hepatic and posthepatic icterus
- Causes, pathogenesis, consequences, differential diagnosis and its explanation

Pathophysiology of the nervous system

- Specifics of the nervous system from pathophysiology point of view, components and functions of the nervous system, general principles of disorders of the nervous system,
- Methods of examination of the nervous system and its functions and their pathophysiological context
- Basic concepts of neuropathophysiology, general characteristics of disorders of the nervous system, excitatory (irritation) and extinction (inhibition) disorders of the afferent and efferent systems
- Neural plasticity and compensation
- Excitotoxicity
- Causes of disorders and illnesses of the nervous system, functional, organic and metabolic affections of the nervous system
- Developmental disorders of the nervous system, factors determining appropriate and inappropriate development of the nervous system structure and function
- Genetically determined diseases of the nervous system
- Metabolic and endocrine disorders affecting the nervous system
- Secondary brain injuries (intracranial hypertension, depolarization, biochemical cascade)
- Cerebrovascular disorders – ischemia, hemorrhage, intracranial venous thrombosis – their causes, risk factors, pathogenesis, consequences
- Vascular disorders of the spinal cord
- Vascular disorders of the peripheral nerves
- Mechanical injuries of the nervous system
- Craniocerebral injuries, spinal cord injuries, injuries of the peripheral nerves
- Tumors of the nervous system
- Immune-mediated diseases of the nervous system, inflammation of the nervous system, neuroinfections
- Neurodegenerative diseases – general characteristics, causes and mechanisms of neurodegeneration, classification, examples of diseases (Alzheimer disease, Parkinson disease, amyotrophic lateral sclerosis etc.)
- Demyelinating and dysmyelinating - disorders etiology, pathogenesis, pathophysiology of multiple sclerosis
- Pathophysiology of the cerebrospinal fluid
- Hydrocephalus – definition, classification, causes, pathogenesis, manifestations and consequences
- Loss of the cerebrospinal fluid – causes, manifestations

Disorders of the synaptic and non-synaptic transmission, receptors, neurotransmitters and channels

Disorders of peripheral nerves

- Causes and mechanisms of peripheral nerve damage
- Mononeuropathy, polyneuropathy, neuritis
- Manifestations of damage of peripheral motor, sensitive, vegetative and mixed nerves, specific manifestations of damage of cranial nerves
- Process of degeneration of an injured nerve fiber and its manifestations
- Regeneration in the peripheral nervous system

Pathophysiology of the spinal cord

- Causes and mechanisms of spinal cord damage and illnesses
- Spinal shock - definition, manifestations, dynamics of functional changes
- Manifestations of damages of particular spinal cord structures in sensitive, motor and vegetative functions
- Manifestations of transversal spinal cord lesion
 - General symptoms below and on the lesion level
 - Specific manifestations according to damage of particular spinal segments
- Brown-Sequard spinal hemisyndrome
- Spinal ataxia

Pathophysiology of the brain stem

- Causes and mechanisms of brain stem damage and disease
- Disorders of the respiratory center
- Disorders of the cardiovascular center
- Disorders of brain stem reflexes
- Alternating brain stem syndromes, bulbar and pseudobulbar paralysis
- Pathophysiology of the reticular formation
 - Manifestations of functional disturbance of ascending and descending reticular formation, system, decerebrate and decorticate rigidity, „cerveau isolé“ and „encéphale isolé“ syndromes, apallic syndrome

Pathophysiology of the cerebellum

- Causes and mechanisms of cerebellar damages
- Extinction cerebellar syndrome

Pathophysiology of the hypothalamus – causes and manifestations of hypothalamic damages

Pathophysiology of the thalamus – causes, manifestations and pathogenesis of their damages

Pathophysiology of the basal ganglia

- Causes and mechanisms of affection of the basal ganglia and changes of their function
- Hypotonic-hyperkinetic syndromes
- Hypertonic-hypokinetic (parkinsonian) syndrome

Pathophysiology of the brain cortex – mechanisms, causes and manifestations of individual areas of the brain cortex

Pathophysiology of vegetative nervous system

- Control of vegetative functions and its disorders, vegetative imbalance
- Functional characteristics and anatomical arrangement of sympathetic and parasympathetic nervous system, general manifestations of their disorders, specific manifestations of damages of particular structural components of the vegetative system
- Pharmacologically induced disorders of vegetative system function

Pathophysiology of the motor system

- Paralysis
 - Definition, types of paralysis – central (spastic) and peripheral (flaccid) palsy, pathophysiological background for of the classification, paresis, plegia

- Causes of central and peripheral paralysis
- Characteristics of central and peripheral paralysis and their manifestations
- Distribution of central and peripheral paralysis on the body and its relation to localization of the lesion in the motor system
- Ataxias
 - Definition, cerebellar, spinal and vestibular ataxia
 - Causes, mechanisms and character of particular types of ataxias, differential diagnosis
- Extrapyrarnidal disorders, hyperkinetic and hypokinetic symptoms, muscle tone disorders, tremor, central and peripheral convulsions – classification, etiology, pathogenesis, consequences

Pathophysiology of neuromuscular transmission

- Functional and structural characteristics of the neuromuscular plate in relation to mechanism of its function disturbances
- Mechanisms of neuromuscular transmission disorders, examples of particular types of disorders
- Pathophysiology of the myasthenia gravis
- Pharmacological and toxic influence on neuromuscular transmission
- Pathophysiology of calcium modulation of neuromuscular excitability

Pathophysiology of behavior and affectivity

Pathophysiology of learning and memory

- Fundamental terminology
- Causes and mechanisms of learning and memory disorders
- Dementias, mental retardations

Disorders of phatic functions – aphasias, aprosodia, agraphia, alexia, dyslexia

Disorders of gnostic functions - agnosias

Disorders of practice functions – apraxias

Qualitative and quantitative disorders of consciousness, coma – characteristics, classification, causes and pathogenesis

Pathophysiology of sleep and biological rhythms

Pathophysiology of the epilepsy

- Definition of epilepsy as an illness, definition of an epileptic seizure
- Causes and pathogenesis of the epilepsy and mechanisms of epileptic seizure development, epileptogenesis
- Classification of epileptic seizures, characteristics of their particular types

Intracranial hypertension

- Definition, origin of the phenomenon
- Causes and mechanisms of intracranial hypertension
- Consequences of the intracranial hypertension, its impact on brain perfusion and metabolism of the brain tissue, brain conuses and their consequences, compensatory mechanisms and decompensation of intracranial hypertension

Brain edema pathophysiology

- Types, causes and mechanisms of the brain edema origin and development
- Symptoms and consequences of the brain edema

Pathophysiology of the sensory systems

Pathophysiology of somatosensory system

- Modalities of the somatosensory system, their receptors and pathways
- Basic terms naming abnormal perceptions or disorders of perception
- Causes, pathogenesis and manifestations of disorders of somesthesia origination on individual levels of the somatosensory system

- Complex and dissociated disorder of perception (tabic and syringomyelic dissociation of sensation)

Pain

- Definition of pain and related basic terms
- Aspects and importance of the pain for the organism and in medicine
- Processes of nociception
 - Transduction
 - Nociceptors – characteristics and classification
 - Nociceptive stimuli
 - Mechanisms of transduction (TRPV1, H⁺-activated channels, purinergic receptors, mechanically activated ion channels)
 - Transmission – nociceptive pathways and their disorders
 - Pain modulation
 - Peripheral and central sensitization
 - Historical importance of the gate control theory
 - Stress analgesia - opioid and non-opioid
- Pain types
 - According to its duration
 - According to its cause
 - According to its localization, explaining of the referred pain phenomenon
- Disorders of pain perception
- Neuropathic (neurogenic) pain – central and peripheral
 - Definition and characteristics
 - Causes and mechanisms of origin of the neuropathic pain
- Painful syndromes and states (anesthesia dolorosa, phantom pain, thalamic pain, radicular pain) – characteristics, causes and mechanisms
- Pain treatment (pharmacologic, surgical, neuromodulation, psychological) and its pathophysiological aspects
- Headache - primary (functional – migraine, cluster headache, tension cephalaea) and secondary (organic)

Practical knowledge and skills

The student can present an overview of the problem and describe relevant facts in the field. He can apply the knowledge practically, relate it theoretical knowledge, understand the context and correctly perform practical skills.

Statistics

- Definition and scope of the subject, basic terms
- Statistical sets
- Statistical variables
- Presentation of data
- Statistical surveys
- Hypothesis testing

Laboratory animals and principles of laboratory work

Importance for biomedical research

The most important and most commonly used types of laboratory animals

- Enumeration, characteristics, examples of use

Genetics of laboratory animals

- Strains genetically defined, partially defined, undefined

Gnotobiology of laboratory animals

- Categories, ways of breeding

Principles of working with laboratory animals

Alternative methods

Electrocardiography

Principles of ECG examination, leads, electrodes, Einthoven triangle

Physiological ECG curve

ECG record description - action, frequency, rhythm, electric axis declination, description of individual parts of the curve

Diagnosis – Disturbances of impulse origin (sinus arrest, nodal rhythm, idioventricular rhythm, extrasystoles, respiratory arrhythmia, nonrespiratory sinus arrhythmia, sinus tachycardia, supraventricular tachycardia, ventricular tachycardia, atrial fibrillation and flutter, ventricular fibrillation and flutter, stimulated rhythm, pulsus alternans) , disturbances of impulse transmission (sinoatrial blocks, atrioventricular blocks, Tawara bundle branch block, fascicular block, block in arborisation, preexcitation), angina pectoris, myocardial infarction (type, stage, localization). P pulmonale, P mitrale, pulmonary embolism, ventricular overload and hypertrophy, pericarditis, changes in ion levels

Explanation of the basics of ECG changes in individual diagnoses

Electroencephalography

Methods of electrophysiological examination of the brain, ways and principles

Basic EEG rhythms - frequency, occurrence, relationship between frequency and amplitude

Evoked potentials

Using electricity in medicine

Active and passive electrical properties of tissues

Ohm's law

Electrocardiography, electroencephalography, electromyography

Examination of the presence of muscle mass, fat and its distribution and water in the body

Injection technique

Basic principles of injection technique

Types of injections for systemic and local application of substances - characteristics, use, principles

Calculation of the applied dose

Anesthesia

Definition

Local anesthesia

- Definition

- Local anesthetics - pharmacology, examples of substances, mechanism of effect

- Methods of application of local anesthesia

- Factors influencing the effectiveness of local anesthesia

- Complications of local anesthesia

General anesthesia

- Methods of administration and their characteristics

- Examples of general anesthetics and their characteristics

- Pharmacokinetics of general anesthetics

- Stages of general anesthesia - definition, characteristics
- Complex management of general anesthesia
- Premedication, premedication, analgesia, vegetative stabilization, myorelaxation
- Myorelaxation
- Types of myorelaxants, their characteristics, complications and risks of administration

Surgical instruments and sewing materials

Naming of basic surgical instruments

Use of surgical instruments

Types of surgical needles and threads, their use

Types of surgical sewing materials (absorbable, non-absorbable, monofilament, braided)

- Uses, features, advantages and disadvantages, examples, fiber strength

Asepsis, antisepsis

Definition of concepts, methods, preparation of the surgical field

Basic surgical procedures

Threading the surgical needle

Surgical knot with hand, tool

Surgical stitches

- Single simple stitch, serial stitch, single and serial mattress stitch, single and serial Donati stitch, tobacco stitch

Extraction of stitches

Examination of hemorrhagic diatheses

Rumpel-Leede test - principle, execution, calculation of mean arterial pressure

Quick's test

aPTT

Measurement of blood pressure

Measurement of systolic and diastolic blood pressure by mercury and digital tonometer

Principles of blood pressure measurement, base of blood pressure measurement

Normal resting values of systolic and diastolic blood pressure

Examination of pulmonary ventilation

Definition and description of pulmonary ventilation

Spirometry and its principles

Basic measured parameters - definitions, normal values

Obstructive and restrictive disorders of lung ventilation - definitions, examples, spirometric findings