

Syllabus of PATHOPHYSIOLOGY – general 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 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 interrelationships 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 the 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

Stages of a disease, forms of the course of a disease, outcomes of a disease

Manifestations of diseases

Prognosis of diseases

Etiological factors

Classification of etiological factors

Etiological factors influenceable and uninfluenceable

Intrinsic etiological factors

- Constitution, reactivity and their basis

- Epigenetics

- Heredity – basic terms, types of heredity, its basis and principles, examples of hereditary diseases

Extrinsic etiological factors

- Physical factors

- Mechanical influences – injuries, type of wounds, healing and its disturbance

- Electric current

- Alternating, direct, mechanisms of effect, electric current injuries, principles of safety

- Thermic influences
 - General and local (including general response of the organism) impact of cold and heat (burns, frostbites, hypothermia, insolation, hyperthermia)
 - Pressure of the environment (e.g. atmosphere) and its changes
 - Adaptation on the higher 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
 - Ways of entrance, mechanisms of effect, toxicity quantification, elimination of toxins, manifestation of intoxication
 - 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 and 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 the 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 influences and interactions of etiological factors

Developmental disorders

Stages of the ontogenetic development

Altricial and precocious types of the development

Factors determining the individual's development and its disorders

Diseases and disorders linked to a certain age, changes of the 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 the 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, euthanasia, disthanasia
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
- Allergization, cross-allergy
Autoimmune diseases - causes, pathogenesis, symptoms and consequences, examples
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
- Types of transplant rejection, their course and mechanisms
- Prevention of transplant rejection

Pathophysiology of thermoregulation

Control and mechanisms of thermoregulation

Overheating (hyperthermia) 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 characteristics, 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 effects of tumors on the organism

Expansive and invasive tumor growth

Tumor metastasis - ways and consequences

Paraneoplastic phenomena - definitions, mechanisms, examples

Tumor markers

Principles of tumor therapy and prevention

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 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 fluid

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 involvement 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

- Risk factors of inborn heart defects
- Classification, division and characteristics of inborn heart defects
- Cyanotic, non-cyanotic, late cyanotic defects
- Hemodynamic consequences, manifestations and complications of individual heart defects, secondary changes and reactions of the organism as consequences of inborn heart defects

Acquired heart defects

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

Disturbances of peripheral blood circulation

- Factors influencing tissue blood perfusion under physiological and pathological conditions
- Angiopathy, vasculitis – causes, consequences, examples of diseases
- 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, ischemic disease of the lower extremities, brain ischemia etc.)

Endothelial dysfunction – causes, consequences

Ischemic heart disease

- Definition, classification, diagnostics
- Causes, risk factors, pathogenesis
- Specifics of coronary circulation, mechanisms of subendocardial and subepicardial ischemia
- Myocardial infarction
 - Pathogenesis, manifestation, types, consequences
 - Acute and chronic complications of the myocardial infarction and their pathogenesis
 - Factors determining affection extent
- Angina pectoris stable and unstable, Prinzmetal (variant) type – pathogenesis, manifestations
- Arrhythmic form of the ischemic heart disease
- Sudden death

Arrhythmias

- Classification, characteristics of individual types of arrhythmias, causes and mechanisms of origin, hemodynamic consequences, impact on the organism, manifestations, ECG diagnosis

Arterial hypertension

- Definition, normal and pathological values of blood pressure
- Factors determining systolic and diastolic blood pressure under normal and pathological conditions
- Systolic and diastolic hypertension
- Essential hypertension - etiological and risk factors, prevention, manifestation and consequences
- Secondary hypertension - definition, causes, examples of diseases, complications
- Malignant hypertension

Cardiac insufficiency and failure

- Causes, pathogenesis
- Acute and chronic form
- Functional disturbances of the right and left heart
- Systolic and diastolic dysfunction – causes, pathogeny, consequences
- Volume and pressure overload of the heart
- Compensatory mechanisms, their importance and role in pathogenesis of consequences of the heart overload and insufficiency
- Consequences and manifestations of individual disorders of the heart function
- Cor dextrum translatum
- Heart tamponade
- Asthma cardiale

Hypertrophy and dilatation of individual parts of the heart – causes, pathogenesis, manifestations and consequences

Kardiomyopathy

Pulmonary hypertension - causes, pathogeny, manifestation and consequences, cor pulmonale

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

Circulatory shock cardiogenic, hypovolemic, septic, anaphylactic

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

Syncope

Multiorgan dysfunction and multiorgan failure

- Definition of the terms, characteristics, causes, pathogenesis and consequences

Pathophysiology of the lymphatic system

- Importance and disorders of the lymphatic system
- Lymphedema – causes, consequences and manifestations

Pathophysiology of the blood

Changes of blood volume and composition

- Normo-, hypo- a hypervolemia normocytic, oligocytic and hypercyclic
- Causes, pathogenesis, manifestation and consequences

Changes of blood plasma composition – disorders of protein spectrum, changes of organic and anorganic substances

Pathophysiology of red blood cells (RBC)

- Factors determining amount and concentration of erythrocytes in the blood
- Anemias
 - Definition of anemia, laboratory indicators
 - Anemic syndrome
 - Classification of anemias
 - Normocytic, microcytic, macrocytic; normochromic, hypochromic
 - Anemias caused by insufficient RBC production
 - Anemias caused by increased loss of RBC
 - Anemia caused by acute and chronic bleeding
 - Hemolytic anemias corpuscular and extracorporeal
 - Characteristics, etiology, pathogenesis and manifestations of individual types of anemias
 - List of diseases involved in individual types of anemias and their pathophysiology
- Disorders of erythrocytes
 - Hereditary defects of erythrocytes (hemoglobinopathies, enzymatic defects, membrane defects, cytoskeleton defects)
 - Intoxications with change of hemoglobin properties
- Polycythemia, polyglobulia – definition of the terms, etiology, pathogenesis, manifestations and consequences
- Intravascular and extravascular hemolysis
 - Causes, mechanisms, consequences
 - Corpuscular and extracorporeal hemolytic anemias
- Acute and chronic bleeding – causes, manifestation on blood composition, response of the organism
- Blood groups, transfusion, incompatibility, fetal erythroblastosis

Pathophysiology of leukocytes

- Classification and function of leukocytes
- Leukocyte function disorders, congenital and acquired leukocyte-related immune deficiencies
- Changes of leukocytes number (total and individual types of leukocytes) – causes, consequences
- Leukemias, lymphomas – classification, etiology, pathogeny, manifestation, consequences

Hemorrhagic diathesis

- Definition, classification
- Inborn and acquired hemorrhagic diathesis: bleeding related to platelets (thrombocytopenia, thrombocytopathies), coagulopathies (including pharmacological influence of hemostasis), vasculopathies - causes, pathogeny, manifestations, different types and characteristic

Thrombotic states

Pathophysiology of breathing

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

Basic processes in the lungs (ventilation, diffusion, perfusion) and 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

- Manifestations and consequences, response of the organism, compensatory mechanisms and their efficiency

Central and peripheral cyanosis - definition, mechanism of origin, factors determining its development

Respiratory insufficiency partial and global

- Definition, etiology and pathogenesis, mechanisms of changes of respiratory gases

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

Disorders of lung diffusion and perfusion

- Description of individual diseases, etiology, pathogenesis

- Relation between ventilation and perfusion and its changes in pathological states

Disorders of breathing regulation, disorders of respiratory muscles and their innervation

Pathophysiology of the asthma bronchiale

Pathophysiology of the chronic obstructive pulmonary disease

Pathophysiology of emphysema

Pathophysiology of the acute respiratory distress syndrome

Pathophysiology of altitude sickness

Acute and chronic adaptations to environment with low atmospheric pressure

Pathophysiology of the decompressive disease

Pathophysiology of the pleural cavity

- Pathophysiology of open, closed and tension pneumothorax

- Hemothorax, hydrothorax

Pathophysiology of the lung edema and inflammation

Pathophysiology of lung fibrosis

Lung manifestation of the cystic fibrosis

Respiratory reflexes

Pathophysiology of the syndrome of sleep apnea

Pathophysiology of symptoms of respiratory diseases (cough, chest pain, dyspnea, cyanosis)

Pathophysiology of the excretory system

Assessment 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

Autoregulation of kidney perfusion and glomerular filtration and its disorders

The role of the kidneys in regulation blood pressure under physiological and pathological conditions.

Disorders of kidney perfusion, glomerular and tubular functions – etiology, pathogenesis, consequences

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
- Nephrotic and nephritic syndrome
- Pathophysiology of kidney endocrine functions
- Methods of substitution of renal functions – hemodialysis principle, peritoneal dialysis
- Inflammatory renal diseases
- Proteinuria – causes and consequences
- Hematuria and its causes
- Infections of the uropoietic system – risk factors, manifestations and consequences
- Urolithiasis – etiology, risk factors, factors supporting concretum development, consequences
- Obstruction of the urinary tract – causes, consequences, hydronephrosis

Pathophysiology of the reproductive system

- Disorders of man and woman fertility, sterility, infertility
- Disorders of sex differentiation
- Pathophysiology of gonads
- Preliminary puberty (pubertas and pseudopubertas praecox) and delayed puberty
- Disorders of menstruation – terminology, causes and pathogenesis
- Pathophysiology of gravidity and parturition
- Complications of gravidity
- Early and late gestosis
- Perinatal complications – causes and consequences
- Fetal erythroblastosis

Pathophysiology of the endocrine system

- Principles of function of the endocrine system, principles of endocrine regulations
- General causes of diseases of the endocrine glands, mechanisms of endocrine disorders
- Classification of diseases of the endocrine glands, hypofunction, hyperfunction, eufunction
- Pathophysiology of endocrine function of the hypothalamus
- Pathophysiology of the neurohypophysis
- Oxytocin
- Vasopressin (ADH)
 - Origin, function and regulation of secretion of ADH
 - Central and peripheral diabetes insipidus
 - Syndrome of inappropriate secretion of ADH
- Disorders of the hypothalamus-pituitary-adrenal axis
 - Primary, secondary and tertiary disorders
 - Hypothalamic statins and liberins and disorders of their production
 - Adenohypophyseal hyper- and hypofunction syndromes – causes, pathogenesis, manifestations
 - Dysfunction of the adenohypophysis
 - Manifestations and consequences of tumors of the adenohypophysis
 - Manifestations and consequences of interruption of the hypothalamic-pituitary junction
- Pathophysiology of the thyroid gland – thyroid hormones
- Regulation of the thyroid gland function, effects of thyroid hormones, the importance of iodine
- Reverse T3 and its role in normal and pathological situations, euthyroid sick syndrome
- Hyperthyroidism – causes, pathogenesis, manifestations and consequences, thyrotoxic crisis

- Hypothyroidism - inborn (acquired in childhood) and acquired in adulthood
 - Causes, manifestation, cretinism, endemic cretinism, myxedema, myxedema coma
- Inflammations of the thyroid gland – Graves-Basedow disease, Hashimoto's thyroiditis
- Goiter
 - Eufunction, hyperfunction and hypofunction goiter – causes, mechanisms of origin, manifestations
 - Endemic goiter, ectopic goiter
 - Goitergenes

Pathophysiology of the sex hormones

- Production of the sex hormones and its regulation, metabolism of sex hormones and disorders of these processes
- Hypergonadotropic and hypogonadotropic hyper- and hypogonadisms and their manifestations in dependence on the stage of the ontogenetic development

Pathophysiology of the adrenal cortex

- Structure and function of the adrenal cortex in relation to adrenal disorders
- Regulation of the adrenal cortex and its disorders
- Hypercorticalisms
 - Classification according to individual hormones and origin of the disorder
 - Cushing's syndrome - causes, pathogenesis, manifestations and consequences
 - Conn's syndrome - causes, pathogenesis, manifestations and consequences
 - Secondary hyperaldosteronism
 - Mechanisms of origin, manifestations, role in pathogenesis of diseases
 - 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
 - The Addison's disease – causes, pathogenesis, manifestations and consequences, Addisonian crisis

Pathophysiology of the adrenal medulla and sympathoadrenal system

Pathophysiology of the parathyroid glands

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

Pathophysiology of calcitonin

Pathophysiology of the endocrine pancreas (Langerhans islets)

- Hyper- and hypofunction syndromes of individual hormones of the pancreas

Pathophysiology of natriuretic factors – their role in regulation of natremia and homeostasis of body fluids in physiological and pathological situations

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, emaciation

Metabolic (Raven's) syndrome and its pathophysiology, insulin resistance

Disorder of glycaemia regulation

- Mechanisms of glycemia 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, gestation diabetes, steroid diabetes, renal diabetes and other types of diabetes mellitus
- Acute and chronic complications of diabetes mellitus
- Diabetic hyperosmolar and ketoacidotic coma – occurrence, mechanisms, manifestations
- Pathophysiologic aspects of the treatment of diabetes mellitus

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
- Role of the kidneys and disorders of their function in calcium metabolism
- Syndrome of hypercalcemia and hypocalcemia – causes, mechanisms of origin, manifestations and consequences
- Impact of calcium metabolism disorders on the bones
- Tetany – characteristics, causes and mechanisms of its origin
- Calcification of the tissues and its causes

Pathophysiology of sodium, potassium and chloride metabolism

- Causes and mechanisms of development of increased or decreased content of the ions in the organism and increased and decreased concentrations of the ions in extracellular fluid
- Manifestations and consequences of disorders of sodium, potassium and chloride metabolism

Pathophysiology of protein and amino acid 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, hypercholesterolemia and its causes and consequences

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.)

Pathophysiology of nutrition

Food intake 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
- List 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, mechanisms, manifestations and consequences of their lack and surplus

Pathophysiology of the gastrointestinal tract

Pathophysiology of the oral cavity

- Saliva secretion disorders, Sjögren's syndrome

Disorders of swallowing and dysphagia

Pathophysiology of the oesophagus

- Achalasia
- Hiatus hernia
- Pathophysiology of the gastroesophageal reflux
- Consequences of perforation of the esophagus
- Esophageal varices

Pathophysiology of the stomach

- Disorders of stomach secretion and motility
- Pathophysiology of gastroduodenal ulcer disease and its complications
- Gastritis, pernicious anemia
- 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
- Crohn's disease, ulcerous colitis, gluten intolerance
- Intestinal tumors – etiology, risk factors, consequences

Bleeding into the gastrointestinal tract – causes, manifestations and consequences, diagnosis and source location

Pathophysiology of exocrine pancreas

- Acute and chronic pancreatitis - etiology, pathogenesis, course and consequences
- Pancreatic secretion disorders - etiology, pathogenesis, consequences of decreased secretion
- Cystic fibrosis of the pancreas

Pathophysiology of digestion

Role of the microbial colonization

Pathophysiology of the liver

Hepatic function indicators

Causes and mechanisms of hepatic disorders

Symptoms and consequences of hepatic dysfunction, acute and chronic hepatic insufficiency

Hepatic encephalopathy

Hepatorenal syndrome

Liver cirrhosis - etiology, pathogenesis, symptoms and consequences

Viral and autoimmune hepatitis

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 bile tract – obstruction, lithiasis, inflammation

Pathophysiology of the muscles

Myopathy

Myositis

Causes and consequences of muscle destruction (rhabdomyolysis, crush syndrome)

Muscle cramps

Pathophysiology of the nervous system

Specifics of the nervous system from pathophysiology point of view, general principles of disorders of the nervous system, irritation and extinction disorders

General causes of disorders and illnesses of the nervous system, functional, organic and metabolic affections of the nervous system

Pathophysiology of the cerebrospinal fluid

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

Abnormal excitation and inhibition and their role in pathologic states

Disorders of peripheral nerves

- Causes and mechanisms of peripheral nerve damage

- Mononeuropathy, polyneuropathy, neuritis

- Manifestations of damage peripheral motor, sensitive, vegetative and mixed nerves, manifestations of damage of important head nerves and spinal nerves

- Process of degeneration of an injured nerve fiber and its manifestations

- Causes and manifestations of spinal roots affection

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

- Amyotrophic lateral sclerosis

- Poliomyelitis anterior acuta

- Syringomyelia

Pathophysiology of the brain stem

- Causes and mechanisms of brain stem damage and disease

- Disorders of the respiratory center

- Disorders of the cardiovascular center

- Alternating brain stem syndromes, bulbar and pseudobulbar paralysis

- Pathophysiology of the reticular formation

- Manifestations of functional disturbance of ascendent and descendent reticular formation, system, decerebrate and decorticate rigidity, syndromes „cerveau isolé“, „encéphale isolé“, apallic syndrome

Pathophysiology of the cerebellum

- Causes and mechanisms of cerebellar damages
- Overview of hereditary cerebellar diseases
- Extinction cerebellar syndrome
 - Cerebellar motor syndrome – cerebellar ataxia, tremor, passivity, their manifestations
 - Cerebellar cognitive affective syndrome
- Cerebellar irritation syndrome
- Pathophysiology of the hypothalamus
- Pathophysiology of the thalamus
- Pathophysiology of the basal ganglia
 - Causes and mechanisms of affection of the basal ganglia and their function
 - Hypotonic-hyperkinetic syndromes
 - Hypertonic-hypokinetic (parkinsonian) syndrome
- 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 and their disorders
- 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
 - Myasthenia gravis
 - Pharmacological and toxic influence on neuromuscular transmission
 - Pathophysiology of calcium modulation of neuromuscular excitability
- Pathophysiology of behavior and affectivity
 - Disorders of drives, motivations, instincts and emotions
 - Depression, mania, neurotic disorders, posttraumatic stress disorder
 - Mental disorders of organic origin
 - Pathophysiology of the schizizophrenia
 - Symptoms of disorders of the prefrontal cortex, limbic system, amygdaloid nucleus
 - Autism spectrum disorders
- Pathophysiology of learning and memory
 - Fundamental terminology
 - Causes and mechanisms of learning and memory disorders
 - Dementias, mental retardations
- Disorders of symbolic functions
 - Disorders of phatic functions – aphasias, aprosodia, agraphia, alexia, dyslexia
 - Disorders of gnostic functions - agnosias
 - Disorders of practice functions – apraxias
- Overview of consciousness disorders and their pathophysiology
- Developmental disorders of the nervous system
 - Inborn developmental disorders of the nervous system
 - Developmental disorders of nervous system function
 - Factors determining appropriate and inappropriate development of the nervous system structure and function
- Neurodegenerative and demyelinating disorders and their pathophysiology (Alzheimer disease, Parkinson disease, sclerosis multiplex and other examples)
- Pathophysiology of the epilepsy
 - Definition of epilepsy as illness, definition of epileptic seizure
 - Causes and pathogenesis of the epilepsy and mechanisms of epileptic seizure development

- Classification of epileptic seizures, characteristics of their particular types

Pathophysiology of the motor system

- Paralysis
 - Definition, types of paralysis (spastic) and peripheral paralysis (flaccid), essence of the classification
 - 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 and mechanisms of particular types of ataxias
- Involuntary muscle contractions, convulsions and their pathophysiology

Pathophysiology of sleep and biological rhythms

- Terminology, classification of biological rhythms
- Control of biological rhythms, inner period, synchronization with external conditions
- Disorders of biological rhythms
- Sleep disorders – causes, mechanisms of origin, hypersomnia, insomnia, examples of disorders
- Sleep hygiene

Intracranial hypertension

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

Brain edema pathophysiology

- Causes and mechanisms of the brain edema origin and development
- Symptoms and consequences of the brain edema

Pathophysiology of the sensory systems

Pathophysiology of vision

- Pathophysiology of the eye
 - Disorders of the optic system of the eye – changes of transparency, disorders of accommodation, hypermetropia, myopia, astigmatism
 - Diseases of the retina
 - Pathophysiology of the glaucoma
 - Injuries of the eye ball, inflammatory and autoimmune eye affections
 - Exophthalmos
 - Oculomotor disorders, strabism, diplopia
- Pathophysiology of the visual pathway and visual cortex
 - Causes and consequences of affection of particular parts of the visual tract
 - Disorders of cortical processing of the visual stimuli

Pathophysiology of the auditory system

- Perceptive and conductive hearing disorders – causes, mechanisms, manifestations, differential diagnosis
- Disorders of the auditory pathway and cortical processing of auditory stimuli

Pathophysiology of the vestibular system

- Manifestations of vestibular disorders – nystagmus (including methods of its experimental provocation), vestibular ataxia, kinetosis

Pathophysiology of the 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 originating on individual levels of the somatosensory system
- Complex and dissociated disorder of perception (tabic and syringomyelic dissociation of sensation)

Pathophysiology of olfaction and taste

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 cephalgia) and secondary (organic)

Practical knowledge and skills

The student can present an overview of the problem and describe relevant facts in the respective 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's 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's 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

EEG manifestation of the epilepsy

Using electricity in medicine

Active and passive electrical properties of tissues

Ohm's law

Electrocardiography, electroencephalography, electromyography, electroneurography, electrooculography

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

Stereotaxis

Definition, principles

Use in medicine and biomedical research

Stereotaxic apparatus

Orientation in the stereotaxic atlas

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 the hand, with a tool

Surgical stitches

- Single simple stitch, serial stitch, single and serial mattress stitch, single and serial Donati stitch, single and serial Allgöwer stitch, intradermal 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 body fitness and response of the cardiovascular system on physical load

Step test, Letunov's test – procedure, principle

Changes of the heart rate and blood pressure in response to physical activity, stress, changes of posture, diving reflex

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

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