V. MEDICATIONS WITH ACTION ON THE EFFECTOR ORGANS FUNCTIONS

DRUGS WITH ACTION ON THE RESPIRATORY SYSTEM

A. Actuality. According to WHO statistics, respiratory system disorders are observed in every 3rd–4th patient who visits a doctor. Treatment of acute and chronic respiratory diseases plays an important role in medical practice and involves the use of medications from various pharmacological groups (bronchodilators, expectorants, mucolytics, antitussives, antiallergics, etc.).

B. The purpose of the training is familiarization of students with the pharmacological properties of the preparations used in respiratory system disorders.

C. Learning objectives:

a) The student **must know:** classification, mechanism of action, effects, indications, contraindications, and adverse reactions of antitussive, expectorant, mucolytic, and bronchodilator drugs, as well as medications used in pulmonary edema.

b) The student **must be able to**: prescribe all required drugs from this group in various pharmaceutical forms and indicate them for the corresponding diseases and pathological conditions.

D. Knowledge of previous and related disciplines necessary for interdisciplinary integration.

Physiology: Automatism of the respiratory center; neurohumoral influence on the respiratory center; importance of vascular chemoreceptors in respiratory regulation; control of breathing; breathing during physical exertion and in hypo/hyperbaric conditions.

Pathophysiology: Main causes of respiratory failure; obstruction of the upper airways; disturbances of alveolocapillary gas diffusion; disturbances in lung perfusion.

Internal medicine and semiology: Concepts of acute and chronic bronchitis, bronchial asthma, pulmonary hyperinflation syndrome (pulmonary emphysema), COPD.

E. Self-training questions:

1. Antitussives: definition and classification.
2. Opioid antitussives: mechanism of action, indications, contraindications, and adverse reactions.
3. Non-opioid central antitussives: mechanism of action, indications, contraindications, and adverse reactions.
4. Peripheral antitussives: classification.
5. Antitussives with specific action: mechanism of action, indications, and adverse reactions.
6. Expectorants: classification.
7. Secretostimulants with reflex action: mechanisms of expectorant action, indications, contraindications, and adverse reactions.
8. Secretostimulants with direct or mixed action: classification, mechanism of action, indications, contraindications, and adverse reactions.
9. Secretolytics (mucolytics): classification, mechanism and pecularities of action of bromhexine, acetylcysteine, proteolytic enzymes. Indications, contraindications and adverse reactions.
10. Classification of drugs used in broncho-obstructive diseases.
11. Bronchodilators: classification.
12. Adrenomimetics: classification by group and duration of action, mechanism of action, effects in bronchial asthma, indications, and adverse reactions (alpha-, beta-adrenomimetics, beta-2-adrenomimetics).
13. M-cholinoblockers: classification by duration of action, effects in bronchial asthma, indications, and adverse reactions.
14. Glucocorticoids: classification by route of administration, effects in bronchial asthma, indications, and adverse reactions of inhaled glucocorticoids.
15. Mast cell degranulation inhibitors and leukotriene antagonists: effects, indications, contraindications, and adverse reactions.

16. Respiratory stimulants. Classification. Mechanism of action. Comparative characteristics of respiratory stimulants from the analeptic and N-cholinomimetic groups. Specifics of etimizole. Indications, contraindications, and adverse reactions.
17. Groups of drugs used in the treatment of pulmonary edema.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms:1. Niketamide. 2. Epinephrine. 3. Ipratropium bromide. 4. Aminophylline. 5.Salbutamol. 6. Disodium cromoglycate. 7. Codeine. 8. Ketotifen. 9. Etimizol. 10. Prenoxdiazine.11. Bromhexine. 12.Acetylcysteine. 13. Dextromethorphan.

Nr.	*Medicine ' name*	*Medicinal forms, dosages*
1.	**Niketamide**	Sol. 1 ml; 2ml in amp. (i/v or s/c) Sol. 30 ml in vials (internal)
2.	**Epinephrine**	Sol. 0,1% - 1ml in amp. Sol. 0,1% - 10ml in vials
3.	**Ipratropium bromide**	Sol. 0,02% - 2,5ml in vials (inhalatory) Aerosol 15ml
4.	**Aminophylline**	Tablets 0,15 Sol. 2,4% - 5ml şi 10ml in amp.
5.	**Salbutamol**	Sol. 0,1% - 5ml in amp. (i/v) Sol. 0,1%- 50ml in vials (inhalatory). Tablets 0,002; 0,004 Syrup 0,04% - 60ml Aerosol 15ml and 20ml
6.	**Disodium cromoglycate**	Capsules 0,1 (internaly) ; 0,02 (inhalatory) Sol. 1% - 2ml in amp. (inhalatory) Aerosol 10ml and 15ml
7.	**Codeine**	Tablets 0,015
8.	**Ketotifen**	Tablets / capsules 0,001 Syrup 0,02% - 100ml in vials
9.	**Etimizol**	Tablets 0,1 Sol. 1% - 2ml in ampoules
10.	**Prenoxdiazine**	Tablets 0,1
11.	**Bromhexine**	Tablets / Dragee 0,004; 0,008 Sol. 60ml in vials (internaly)
12.	**Acetylcysteine**	Tablets 0,2; 0,6 (internally) Capsules 0,2; 0,6 (internally) Granules 0,2; 0,6 in sacches Sol. 10% - 3ml in amp. (i/v sau inhalatory)
13.	**Dextrometorphan**	Tablets / Capsules 0,01; 0,015 Syrup 100ml in vials

2) List the groups and drugs used in (for): irritating and dry cough in acute respiratory infections, whooping cough; cough associated with inoperable lung cancer, secretostimulants in acute respiratory infections; secretostimulants in exacerbations of broncho-obstructive diseases, mucolytics in cystic fibrosis, secretolytics in acute respiratory infections, secretolytics in exacerbations of broncho-obstructive diseases, secretolytics in bronchopneumonia, paracetamol intoxication, antifoaming agents in pulmonary edema, pulmonary edema, mild asthma attacks, bronchodilators in systematic treatment of bronchial asthma, bronchodilators in treatment of chronic obstructive bronchopneumopathy, prevention of bronchospasm during surgical interventions or drug inhalation, anti-inflammatory and antiallergic drugs in bronchial asthma, combined preparations in broncho-obstructive diseases, allergic rhinitis and conjunctivitis, status asthmaticus, newborns asphyxia.

G. Individual Work for Knowledge Consolidation

1) Tests (Guidelines for Laboratory Work in Pharmacology).

2) **Tables** (knowledge summary)

Table 1

Characteristics of drugs used in bronchial asthma

Pharmacological group	Drugs	Route of administration	Mechanism of action	Indications
Beta-2-adrenomimetics				
M-cholinoblockers				
Methylxantines				
Glucocorticoids				
Mast cell stabilizers				
H1-histamine receptor blockers				

H. Interactive activity

1) **Experimental and virtual didactic film** (elaboration of minutes, conclusions)
2) **Clinical cases** (Guidelines for Laboratory Work in Pharmacology).
3) **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).
4) **Solve the case:**

A patient with irritating and harrowing tinnitus was prescribed an antitussive tablet. For faster installation of the effect, the patient chewed the tablet and swallowed it. But from the moment of using the tablet, the patient felt a numbness in the oral cavity.

What medicine did he use?

What particularities of the medication did it need to be explained to the patient to avoid the complication that occurred?

Cardiac glycosides and cardiostimulant drugs.

A. Actuality. Acute and chronic heart failure represent a frequent cause of emergency conditions and mortality in patients with cardiovascular, pulmonary, neurological diseases, etc. The pathogenesis of heart failure is complex, which requires the use of a wide range of positive inotropic drugs, vasodilators, diuretics, and others.

B. The purpose of the training is: to familiarize students with the groups of inotropic-positive drugs, which reduce pre- and afterload used in the treatment of heart failure.

C. Learning objectives:

a) The student **must know**: classification, mechanism of action, effects, indications, contraindications and adverse reactions of inotropic-positive drugs.

b) The student **must be able to**: prescribe cardiotonic and cardiostimulating preparations in all medicinal forms and indicate the groups and preparations in diseases and pathological conditions.

D. Knowledge of previous and related disciplines necessary for interdisciplinary integration.

Physiology. The cardiac muscle; the pumping function of the heart and the function of cardiac valves. Rhythmic excitation of the heart. Physiological properties of the myocardium (automaticity, excitability, contractility, conductivity). The cardiac conduction system. Characterization of positive inotropic, negative chronotropic, positive bathmotropic, negative dromotropic, and positive tonotropic actions. Influence of the sympathetic and parasympathetic autonomic nervous system on cardiac activity.

Pathophysiology. Cardiogenic circulatory failure, non- coronary, coronary, metabolic, hematogenous. Vasogenic circulatory failure.

Internal medicine and semiology. The concept of clinical syndrome of heart failure. Acute and chronic heart failure. Pulmonary edema.

E. Self-training questions:

1. Classification of drugs used in heart failure.
2. Classification of inotrope-positive drugs.
3. Cardiac glycosides. The sources of obtaining. Classification of cardiac glycosides according to solubility and duration of action.
4. Mechanism of cardiotonic action of cardiac glycosides. The influence of cardiac glycosides on heart parameters (positive inotropic action, positive bathmotropic action, negative -dromotropic, negative chronotropic, positive tonotropic action) and the mechanisms of these phenomena. Changes on the electrocardiography (ECG) when using cardiac glycosides in therapeutic doses.
5. Influence of cardiac glycosides on systemic and regional hemodynamics, CNS, kidneys, respiratory system and gastrointestinal tract.
6. Pharmacokinetic of cardiac glycosides (digitoxin, digoxin and strophanthin).
7. Indications, adverse effects and contraindications of cardiac glycosides.

8. Principles of cardiac glycoside dosing, saturation and maintenance phase. Digitalization methods. The concept of elimination ratio.
9. Intoxication with cardiac glycosides. Clinical picture and treatment.
10. Non-glycosidic (synthetic, non-steroidal) cardiotonics. Classification, mechanisms of action, effects, indications, contraindications and adverse reactions.
11. Cardiostimulators (α, β,- and β-adrenomimetics, dopaminomimetics). Classification, mechanisms of action, effects, indications, contraindications and adverse reactions.
12 Comparative characterization of steroidal, non-steroidal cardiotonics and cardiostimulators
13. Drugs that increase the sensitivity of contractile proteins to calcium ions. Mechanisms of action, effects, indications, contraindications and adverse reactions.
14. Drugs that reduce pre- and after-load in heart failure. Classification. The principle of action.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms: 1. Strophanthin. 2. Digitoxin. 3. Digoxin. 4. Corglycon. 5. Amrinone. 6. Levosimendan. 7. Dopamine. 8. Dobutamine. 9. Epinephrine.

Nr.	***Drug's name***	***Medicinal forms, dosage***
1.	**Strophanthin**	Sol. 0,025% and 0,05% - 1 ml in amp. (i/v)
2.	**Amrinone**	Sol. 0,5% - 20 ml in amp. (i/v)
3.	**Corglycon**	Sol. 0,06% - 1 ml in amp. (i/v)
4.	**Digitoxin**	Tabl. 0,0001 Rectal supp. 0,00015
5.	**Digoxin**	Tablets 0,000125 and 0,00025 Sol. (for internal use) 0,75% - 10 ml in vials Sol. 0,025% - 1 ml and 2 ml in amp. (i/v)
6.	**Levosimendan**	Concentrate for infusion 2,5 mg/ml (0,25%)– 5 and 10 ml in vials
7.	**Dopamine**	Sol.0,5% and 4% - 5 ml in amp. (i/v)
8.	**Dobutamine**	Sol. 0,5%-50 ml in amp.(i/v) lyophilized powder in vials 0,25 (i/v)
9.	**Epinephrine**	Sol. 0,1%-1 ml in amp. (i/v; s/c; i/m)

2) List the groups and drugs used in (for): decompensated chronic heart failure; chronic congestive heart failure; paroxysmal supraventricular tachycardia; tachysystolic atrial fibrillation**,** correction of hypokalemia in cardiac glycoside intoxication, elimination of arrhythmias in cardiac glycoside intoxication, inactivation and elimination of cardiac glycosides in cardiac glycoside intoxication, reduction of calcium levels in cardiac glycoside intoxication, acute heart failure, cardiostimulants in acute myocardial infarction, cardiogenic shock, cardiac arrest, vasodilators used in heart failure, diuretics in heart failure

G. Individual Work for Knowledge Consolidation

1) Tests (Guidelines for Laboratory Work in Pharmacology).

2) **Tables** (knowledge summary)

Table 1

Characteristic of the groups of positive inotropic drugs used in heart failure

Pharmacological groups	Drugs	Mecanism of pozitive inotrop action	Effects on the heart
Cardiac glycosides			
Non-glycosides cardiotonics			
Alfa-beta-adrenomimetics			
Dopaminomimetics			
Beta-1-adrenomimetics			
Drugs that increase the sensitivity of contractile proteins to calcium ions			

Table 2

Pharmacological effects of cardiac glycosides

Effects	Mecanism of effects	Characteristic modification on ECG
Pozitive Inotrop		
Negative Chronotrop		
Negative Dromotrop		
Pozitiv Bathmotrop		

Table 3

Pharmacokinetics of cardiac glycosides

Drugs	Rout of administration	Fat-soluble (F) Hydroso-luble (H)	Bioavailability (%)	Binding with plasma proteins (%)	Half-life (hours)	Elimination ratio
Digitoxin						
Digoxin						
Strophanthin						

Table 4

The principles of treatment of cardiac glycoside poisoning

Group of medicines	Drugs	Principles of action
Anti-digoxin antibodies		
Adsorbents		
Chelate-forming compounds		
K^+ preparations		
Antiarrhythmic drugs		
M-cholinoblockers		
β-adrenomimetics		
Hydrogen sulphide group donors		

H. Interactive activity

1) **Experimental and virtual didactic film** (elaboration of minutes, conclusions)
2) **Clinical cases** (Guidelines for Laboratory Work in Pharmacology).
3) **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).
4) **Solve the case:**

Case 1. For the treatment of experimental heart failure, drug A was administered. After its use, the following ECG changes were observed: prolongation of the PQ interval, increased R wave amplitude, reduction of the QRS complex, and prolongation of the R–R interval.

Determine the group of drugs to which preparation A belongs and list the drugs in this group.

List the cardiac effects observed on ECG caused by preparation A and explain the mechanisms of these effects.

Case 2. In an experimental model of chronic heart failure, the following cardiac and hemodynamic parameters were recorded: decreased stroke volume and cardiac output, increased heart size, tachycardia, increased pulmonary artery pressure, and increased venous pressure.

Which group of positive inotropic drugs can be used for treatment?

How will the drugs from this group influence the cardiac and hemodynamic parameters?

ANTIARRHYTHMIC DRUGS

A. Actuality. Cardiac arrhythmias are some of the most common symptoms of cardiovascular diseases and acute intoxications, etc., which in turn can cause severe cardiodynamic and systemic hemodynamic disturbances, often being a major factor in lethality. The treatment of cardiac arrhythmias is a problem of major importance for medical practice and requires knowledge of the pharmacokinetic and pharmacodynamic aspects of antiarrhythmic drugs.

B. The purpose of the training is: familiarization of the student with the pharmacological properties of antiarrhythmic drugs.

C. Learning objectives:

a) The student **must know:** the name of the main antiarrhythmic drugs, the principles of classification, pharmacokinetic aspects, the mechanism of action and pharmacological effects, indications and contraindications, adverse reactions, optimal routes of administration depending on the situation, substitution of one drug with another that is analogous in terms of pharmacological properties.

b) The student **must be able to:** prescribe antiarrhythmic drugs in all forms of delivery, indicate drugs in various heart rhythm disorders, apply the acquired knowledge to solving situational problems.

D. Knowledge from previous and tangential disciplines necessary for interdisciplinary integration.

Human Anatomy: Structure of the heart, cardiac conduction system (sinoatrial node, atrioventricular node, His bundle, Purkinje fibers), innervation and vascularization of the heart (coronary arteries).

Histology: Cardiovascular system. Heart development, structure, histophysiology.

Biophysics: Bioelectrogenesis. Recording of biopotentials. Transmission of nerve impulses through biological communication channels.

Biochemistry: Metabolism of structural lipids: biosynthesis and catabolism of cholesterol, phospholipids, sphingolipids. Tissue lipidoses.

Physiology: Cardiac muscle, pump function of the heart and valve function. Rhythmic excitation of the heart. Role of the sinus and atrioventricular nodes, His bundle and Purkinje fibers. Normal electrocardiogram. Principles of vector analysis of the ECG. ECG interpretation of cardiac disorders.

Pathophysiology: Cardiac arrhythmias: sinus tachycardia and bradycardia, extrasystole, atrial and ventricular flutter, atrial and ventricular fibrillation, incomplete and complete atrioventricular block.

Internal Medicine – semiology: Concepts of cardiac dysrhythmias, clinical examination changes in dysrhythmias and the role of etiological factors.

E. Self-training questions:

1. Definition and classification of antiarrhythmic drugs.
2. Drugs used in tachyarrhythmias and extrasystoles: classification.
3. Drugs that block ion channels of cardiomyocytes, classification.
4. Sodium channel blockers (membrane stabilizers): mechanism of action.

a. Subclass IA (quinidine group): antiarrhythmic effect, influence on conductivity, contractility, excitability, automatism, the frequency of cardiac and vascular contractions. Indications, contraindications and precautions, adverse reactions, pharmacokinetics;

a. Subclass IB (lidocaine group): antiarrhythmic effect, indications, contraindications and precautions, adverse reactions, pharmacokinetics;

b. Subclass IC (flecainide group): antiarrhythmic effect, indications, contraindications and

precautions, side effects, pharmacokinetics.

5. Calcium channel blockers (class II): antiarrhythmic effect, indications, contraindications and precautions, adverse reactions.

6. Potassium channel blockers (drugs that mainly increase the effective refractory period - class III). Amiodarone: antiarrhythmic and antianginal effect, indications, contraindications, adverse reactions, pharmacokinetics. The particularities of sotalol and bretylium tosylate.

7. Drugs that reduce the tone of adrenergic innervation: classification.

8. Beta-blockers (class II): antiarrhythmic effect, influence on the heart. The indications.

9. Antiarrhythmic drugs from various groups (adenosine, cardiac glycosides, potassium drugs, magnesium drugs, etc.)

10. Antiarrhythmic drugs used in bradyarrhythmias and atrioventricular block: classification, mechanism of action, effects, indications.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms:1. Quinidine. 2. Procainamide. 3. Lidocaine. 4. Mexiletine. 5. Flecainide. 6. Verapamil. 7. Amiodarone. 8. Sotalol. 9. Metoprolol. 10. Propranolol. 11. Potassium chloride.

Nr.	*Drug name*	*Dosage, medicinal forms*
1.	**Quinidine**	Tab. 0,1; 0,2
2.	**Procainamide**	Tab. 0,25 Sol. 10% - 5 ml in amp.
3.	**Lidocaine**	Sol. 2%; 10% - 5 ml in amp. (i/v)
4.	**Mexiletine**	Caps. 0,05; 0,2 Sol. 2,5% - 10 ml in amp.
5.	**Flecainide**	Tab. 0,05; 0,1
6.	**Verapamil**	Tab. / Caps. 0,04; 0,12; 0,24 Sol. 0,25% - 1 ml; 2 ml in amp.
7.	**Amiodarone**	Tab. 0,2 Sol. 5% - 3ml in amp.
8.	**Sotalol**	Tab. 0,08; 0,16 Sol. 1% - 4 ml in Amp. Sol. 1,5% - 10 ml in vials
9.	**Metoprolol**	Tab. 0,025; 0,05; 0,1 Sol. 0,1% - 5 ml in amp.
10.	**Propranolol**	Tab. / Caps. 0,04; 0,08 Sol 0,1%- 1 ml in amp.
11.	**Potassium chloride**	Tab. 0,5; 0,1 Sol. 4% - 100 ml in vials Sol. 4% - 10 ml in amp.

2) List the groups and drugs used in (for): membrane stabilizers in supraventricular and ventricular arrhythmias; ventricular tachyarrhythmias of sympatho-adrenal (neurogenic) type; tachy systolic atrial flutter and fibrillation, ventricular arrhythmias; digital arrhythmias (cause by cardiac glycosides overdose); ventricular arrhythmias in myocardial infarction; rebellious supraventricular and ventricular arrhythmias to other antiarrhythmics; ventricular arrhythmias refractory to other antiarrhythmics; sinus bradycardia; atrio-ventricular block; cardiac arrest.

G. Individual Work for Knowledge Consolidation

1) Tests (Guidelines for Laboratory Work in Pharmacology).

2) **Tables** (knowledge summary)

Table 1

The comparative characteristic of antiarrhythmic drugs

Parameters		Group of antiarrhythmic drugs					
		IA	IB	IC	II (Ca^{2+}CB)	III (amio-darone)	β-AB
Blocking	Na channels						
	K channels						
	Ca channels						
Influence on the action potential of Purkinje fibers	phase 0						
	phase 1						
	phase 2						
	phase 3						
	phase 4						
	action potential duration						
Influence on heart parameters	automaticity						
	excitability						
	conductibility						
	contractility						
	duration of the effective refractory period						
Efficacy in arrhythmias	supraventricular						
	ventricular						

Note: to complete the table use the following signs:

"↑" - increase, "↓" - decrease, "-" - lack of effect, "+" - presence.

Table 2

Adverse reactions of antiarrhythmic drugs

Adverse reactions	IA	IB	IC	II (Ca^{2+}CB)	III (amio-darone)	β -AB
Reduction of myocardial contractility						
Bradicardia, AV block						
Arterial hypotension						
Headache						
Bronchospasm						
Haematotoxicity						
Hipo- / hyperthyroidism						
Deposition of microcrystals on the						
retina						
Alveolitis, pulmonary fibrosis						
Proarrhythmic effect						

Note: the presence of the effect is indicated by the "+" sign.

H. Interactive activity

1) **Experimental and virtual didactic film** (elaboration of minutes, conclusions)
2) **Clinical cases** (Guidelines for Laboratory Work in Pharmacology).
3) **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).
4) **Solve the case:**

A patient with acute myocardial infarction developed ventricular fibrillation. The drug of choice was urgently administered to restore the heart rhythm.

Which antiarrhythmic drug was indicated for this purpose?

What is the mechanism of action and effects on the heart?

Which other groups and second-line antiarrhythmic drugs can be used?

ANTIANGINAL DRUGS

A. Actuality. Ischemic heart disease (angina pectoris, acute myocardial infarction) is one of the most frequent causes of disability and mortality. For the treatment of this pathology, drugs are used that improve cardiac function and coronary circulation, blood coagulation, and myocardial metabolism.

B. The purpose of the training is: familiarization of the student with the pharmacological properties of antianginal drugs, emergency medical care problems (treatment and prophylaxis of angina pectoris attacks, principles of drug treatment of acute myocardial infarction).

C. Learning objectives:

a) The student **must know:** the definition, classification, mechanism of action, effects, indications, contraindications and adverse reactions of antianginal drugs, the principles of treatment in acute myocardial infarction, the optimal routs of administration and the principles of dosing depending on the situation.

b) The student **must be able to:** prescribe the main mandatory drugs in possible dosage forms, select drugs depending on the disease and pathological states.

D. Knowledge from previous and related disciplines necessary for interdisciplinary integration.

Human Anatomy: Coronary arteries and their branches, cardiac veins, vascular anastomoses, systemic and pulmonary circulation, myocardial structure.

Histology: Structural and functional characteristics of the myocardium.

Human Physiology: Cardiac output, venous return and their regulation; muscular blood flow and cardiac output during physical effort; coronary circulation; circulating blood volume, stroke volume and minute volume, venous return (preload), left ventricular diastolic pressure, peripheral resistance (afterload).

Pathophysiology: Non-coronary and coronary cardiogenic circulatory failure, metabolic and hematogenic insufficiency, vasogenic circulatory failure.

Internal Medicine – Semiology: Coronary insufficiency syndrome; ischemic heart disease and angina pectoris; acute myocardial infarction and its etiological factors.

E. Self-training questions:

1. Definition and classification of antianginal drugs.
2. Drugs that reduce myocardial oxygen demand and increase oxygen supply: classification.
3. Organic nitrates. Mechanism of action at the molecular and systemic levels; pharmacological effects; indications; contraindications; adverse reactions (early and late); pharmacokinetics.
4. Sydnonimines (molsidomine): mechanism of action at the molecular and systemic levels; pharmacodynamic advantages; indications; adverse reactions.
5. Calcium channel blockers: classification; mechanism of action at the molecular and systemic levels; pharmacological effects; indications; contraindications; adverse reactions; pharmacokinetics.
6. Second-line antianginal drugs (ivabradine, ranolazine, nicorandil): mechanism of action; effects; indications.
7. Beta-adrenergic blockers as antianginal agents: classification; characteristics of the antianginal effect; indications.
8. Coronary vasodilators: mechanisms of action; effects; indications; adverse reactions.
9. Drugs that improve myocardial metabolism (cardioprotective agents): mechanism of action; effects; indications.

10. Drugs used for the relief of anginal attacks.
11. Groups of drugs used in the treatment of acute myocardial infarction. Principles of action.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms:1. Nitroglycerin. 2. Isosorbide dinitrate. 3. Molsidomine. 4. Propranolol. 5. Nebivolol. 6. Nifedipine. 7. Verapamil. 8. Dipyridamole.

Nr.	***Drugs name***	***Dosage form, dose***
1.	**Nitroglycerine**	Tabl. 0,0005 (sublingual) Aerosol 1% - 10 ml (sublingual) Sol. 0,1% - 5 ml in amp. Sol. 0,1% - 50 ml in vials
2.	**Isosorbide dinitrate**	Tabl./ Caps. 0,02; 0,04 Sol. 0,1% - 10 ml in amp.
3.	**Molsidomine**	Tabl. 0,002; 0,004; 0,008
4.	**Nifedipine**	Tabl. 0,01; 0,02 Sol. 2% - 25 ml in vials (internal)
5.	**Verapamil**	Tabl. 0,04; 0,08; Caps. 0,12; 0,24 Sol. 0,25% - 2 ml in amp.
6.	**Nebivolol**	Tabl. 0,005
7.	**Propranolol**	Tabl./ Caps. 0,01; 0,04; 0,08 Sol. 0,1% - 1 ml in amp.
8.	**Dipyridamole**	Tabl/ Dragee 0,025; 0,075 Sol. 0,5% - 2 ml in amp.

2) List the groups and drugs used in (for): anginal pectoris attacks (acute angina pectoris), prophylaxis of anginal attacks, first-line drugs that reduce myocardial oxygen demand and increase oxygen supply in angina pectoris, **s**econd-line drugs that reduce myocardial oxygen demand and increase oxygen supply in angina pectoris, **d**rugs that reduce myocardial oxygen demand in angina pectoris, cardioprotective agents in angina pectoris, relief of pain in acute myocardial infarction, **e**limination of anxiety (fear) in acute myocardial infarction, **p**rophylaxis of thrombosis in acute myocardial infarction.

G. Individual Work for Knowledge Consolidation

1) Tests (Guidelines for Laboratory Work in Pharmacology).

2) **Tables** (knowledge summary)

Table 1

Groups of drugs used in the treatment of acute myocardial infarction

Purpose of pharmacotherapy	Drugs group	Drugs
Reduce pain syndrome		
Removing arrhythmias		
Thrombosis prophylaxis and treatment		
Stimulation of myocardial contractile function		
Improved cardiac circulation		
Pulmonary edema therapy		

Table 2

Side effects of antianginal drugs

Adverse reactions	Nitroglycerine	Propranolol	Nifedipine	Verapamil	Dypiridamole
Headache					
Vertigo					
Tachycardia					
Bradicardia					
Hypotension					
Bronhospasm					
Maleolar oedema					
Facial skin hyperemia					
The"stealing" phenomenon					
Withdrawal syndrome					

Note: the presence of the effect is indicated by a "+" sign.

Table 3

Comparative characteristics of organic nitrates

Parameters	Pharmaceutical form	Route of administration	Onset of action (sec, min)	Duration of action (min, hours)	Indications
Nitroglycerine					
Isosorbide dinitrate					
Isosorbide mononitrate					

Table 4

Tissue selectivity of calcium channel blockers

Chemical structure	Drugs	Predominant blockage of calcium channels:		
		Cardiomyocytes	Peripheral arterial vessels	Cerebral arterial vessels
Dihydropyridine derivatives				
Phenylalkylamine derivatives				
Benzothiazepine derivatives				
Diphenylpiperazine derivatives				

Note: use the following signs to complete the table: "↑" - increase, "↓" - decrease, "-" - no effect.

Table 5

Mechanism of action of various groups of antianginal drugs

Principles of treatment of ischemic heart disease	Effects	Nitrates	β-AB	Ca^{2+}CB	Dipyridamole
Decreasing myocardial O2 demand by:	lowering of preload				
	lowering of afterload				
	lowering of HB				
Increase O2 supply to the myocardium by:	dilation of the coronary vessels of large caliber				
	dilation of the coronary vessels of small caliber				
	improvement of subendocardial circulation				
	blocking the central levels of coronaryoconstrictor reflexes				

Note: the presence of the effect is indicated by a "+" sign.

H. Interactive activity

1) **Experimental and virtual didactic film** (elaboration of minutes, conclusions)
2) **Clinical cases** (Guidelines for Laboratory Work in Pharmacology).
3) **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).
4) **Solve the case:**

Two patients presented to the emergency admission department with a sensation of acute pain in the cardiac region. Prior to admission, they had self-administered a sublingual drug that produced only a minimal reduction of pain and a sensation of cold in the oral cavity. In the admission department, drug A was administered sublingually to one patient in the form of tablets and to the other in the form of an aerosol. The pain was relieved, but shortly afterwards palpitations, vertigo, facial flushing and headache occurred. On objective examination, tachycardia (100 beats per minute) and a decrease in blood pressure to 100/60 mmHg were noted.

What drug did the patients use on their own and what is its mechanism of action?

Which drug is drug A used in the admission department?

What is the cause of the observed adverse effects?

What drugs could be used if drug A is not tolerated?

CEREBRAL AND PERIPHERAL VASODILATOR DRUGS.

DRUGS USED IN MIGRAINE. VENOTROPIC DRUGS.

A. Actuality. Disorders of cerebral and peripheral circulation represent a significant proportion of medical practice, for their treatment, multiple groups of drugs are used that influence vascular tone, blood coagulability, metabolic and energy processes. Migraine affects a considerable proportion of the population, including individuals of working age, and represents a major emergency and prophylactic problem, requiring the prevention of migraine attacks through the use of a wide variety of medications. Venous pathology, caused by a wide range of factors, requires a comprehensive approach using drugs that influence vascular tone, vascular elasticity and permeability, blood coagulability, and metabolic processes.

B. The purpose of the training: to familiarize the student with pharmacological properties of cerebral and peripheral vasodilators**,** antimigraine drugs**, and** venotropic agents**.**

C. Learning objectives:

a) The student **must know**: definition, classification, mechanism of action, effects, indications, contraindications and adverse reactions of cerebral and peripheral vasodilators, antimigraine and venotropic drugs, optimal routes of administration and dosing principles depending on the clinical situation.

b) The student **must be able to**: prescribe mandatory medicines in the possible medicinal forms, select the medicines according to the disease and the pathological conditions.

D. Knowledge of previous and related disciplines necessary for interdisciplinary integration.

Human Anatomy: Cerebral and peripheral arteries, veins and capillaries, vascular anastomoses, brain structure, and innervation of blood vessels.

Histology: Nervous tissue. Morphofunctional characteristics. Developmental sources and histogenesis. Neurons and classification of neurocytes. Neuroglia: general characteristics and main types. Nerve fibers. Afferent and efferent nerve endings: classification and structure. Concept of synapse. Interneuronal synapses: classification and structure. Neurotransmitters. Neuronal theory.

Human Physiology: Physiology of cerebral and peripheral circulation.

E. Self-training questions:

1. Classification of drugs used in cerebral and peripheral circulatory disorders.
2. Myotropic vasodilators:
   - *Vinca minor* alkaloids: mechanism of action, effects, indications and adverse reactions.
   - Xanthine derivatives: mechanism of action, effects, indications and adverse reactions.
   - Calcium channel blockers used as cerebral antiischemics : mechanism of action, effects, indications and adverse reactions.
3. Neurotropic vasodilators:

a) ergot alkaloids: mechanism of action, effects, indications and side effects;
b) α-adrenoblockers: mechanism of action, effects, indications and side effects;
c) antiserotonin drugs: mechanism of action, effects, indications and side effects.

4. Classification of antimigrainous drugs. Drugs used in migraine relief: mechanisms of action. Groups of drugs used in migraine prophylaxis.
5. Venotropic drugs: classification. Mixed-action drugs (venotonic and venoprotective): effects and mechanisms of action, indications.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms:1. Vinpocetine. 2. Pentoxifylline. 3. Xanthinol nicotinate. 4. Nicergoline. 5. Cinnarizine. 6. Sumatriptan. 7. Ravimig. 8. Piracetam. 9. Troxerutin. 10. Piricarbate.

No.	***The name of the drug***	***Medicinal form, dose***
1.	**Vinpocentine**	Tablets 0.01 Sol. 0.5% - 2 ml in ampoules
2.	**Pentoxifylline**	Tablets 0.2; 0.4 Sol. 2% - 5 ml in ampoules
3.	**Xanthinol nicotinate**	Tablets 0.15 Sol. 15% - 2 ml in ampoules
4.	**Nicergoline**	Tablets 0.005; 0.01 Lyophilized powder 0.004 in ampoules
5.	**Cinnarizine**	Tablets/ Capsules 0.025
6.	**Sumatriptan**	Tablets/Capsules 0.05; 0.1 Sol. 1.2% - 0.5 ml in pre-filled syringes (subcutaneous) Aerosol 10% 2 ml (intranasal, 10mg/dose)
7.	**Ravimig**	Tablets 0,05
8.	**Piracetam**	Tablets / Capsules 0.4; 0.8; 1.2 Granules 56.0 or 2.8 in sachets Sol. 20% - 125ml in bottles (internal use) Sol. 20% - 5ml in ampoules Sol. 20% - 60ml in bottles.
9.	**Troxerutin**	Capsules 0.3 Gel 2%-100.0
10.	**Piricarbate**	Tablets 0.25 Ointment 5% - 30.0

2.) List the groups and drugs used in (for): migraine attacks, treatment of migraine, hypertensive encephalopathy, vestibulocochlear disorders, ischemic stroke, chronic cerebral circulatory insufficiency, sequelae of traumatic brain injury, Raynaud's syndrome, obliterative endarteritis, cerebral atherosclerosis, ischemic ophthalmologic disorders, chronic venous insufficiency, trophic ulcers of the lower limbs.

G. Individual Work for Knowledge Consolidation

1) Tests (Guidelines for Laboratory Work in Pharmacology).

H. Interactive activity

1) **Experimental and virtual didactic film** (elaboration of minutes, conclusions)
2) **Clinical cases** (Guidelines for Laboratory Work in Pharmacology).
3) **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).

SYSTEMIC VASODILATOR AND VASOCONSTRICTOR DRUGS

(ANTIHYPERTENSIVE AND ANTIHYPOTENSIVE DRUGS)

A. Actuality. According to WHO data, **arterial hypertension (AH)** occupies a primary position among cardiovascular diseases. The treatment of this pathology involves a wide range of drugs, requiring a deep understanding of the pharmacological properties of antihypertensive agents.
Special attention is also required for the treatment of **acute and chronic arterial hypotension,** pathological conditions frequently encountered in therapeutic and surgical practice, which require complex and urgent treatment. Therefore, detailed study of existing drugs, as well as the development of new, more effective and clinically acceptable hypotensive agents, is necessary.

B. The purpose of the training: is to familiarize students with pharmacological properties of antihypertensive and antihypotensive drugs, with formation of the skills to select the most effective drugs in the treatment of different forms of blood pressure disorder.

C. Learning objectives:

a) The student **must know**: classification of antihypertensive and antihypotensive drugs, mechanisms of action of antihypertensive and antihypotensive effects, indications, contraindications, and adverse reactions.
b) The student **must be able to**: prescribe the mandatory antihypertensive and antihypotensive drugs in all possible medicinal forms and doses; to indicate the groups and antihypertensive drugs or antihypotensive drugs in emergency situations and different forms of blood pressure disorders.

D. Knowledge of previous and related disciplines necessary for interdisciplinary integration.

Human Anatomy: Heart, arteries and veins of systemic and pulmonary circulation, capillaries, vascular wall structure, vasomotor centers of the brainstem.

Histology: Structure of muscular, musculoelastic, and elastic arteries. Functional significance of muscular and fibrous veins (amuscular). Cardiovascular system: general principles of vessel structure, arteries, microcirculatory bed vessels, veins, lymphatic vessels, heart development, structure, histophysiology.

Human Physiology: Hemodynamics: pressure, flow, and resistance. Vascular distensibility and functions of arterial and venous systems. Neural regulation of circulation and rapid control of blood pressure. Dominant role of the kidneys in long-term blood pressure regulation and hypertension: integrated blood pressure control system. Functional autoregulation of blood pressure (central and peripheral components). Afferent and efferent influences of vasomotor centers. Vasomotor nerves (constrictor and dilator). Characteristics of vascular baroreceptors. Humoral influences on vascular tone (adrenaline, vasopressin, renin, angiotensin, histamine, and kinins).

Pathophysiology: Primary and secondary arterial hypertension. Chronic and acute hypotension: collapse, shock. Renin-angiotensin-aldosterone system.

Internal Medicine – Semiology: Clinical syndrome of arterial hypertension. Essential and secondary hypertension. Arterial hypotension.

E. Self-training questions:

1. Classification of antihypertensive drugs (neurotropic, musculotropic, drugs regulating water-salt metabolism, renin-angiotensin-aldosterone system inhibitors).
2. Classification of neurotropic antihypertensive drugs:
   a) Centrally acting antihypertensive drugs: classification, mechanisms of action, pharmacological effects, indications, adverse reactions;
   b) Ganglioblockers: mechanism of action, antihypertensive effect, indications;

c) Sympatholytics: mechanisms of action, antihypertensive effect, indications;
d) α-adrenoblockers: classification, mechanism of action, effects, indications, adverse reactions;
e) β-adrenoblockers: classification, mechanism of action, effects, indications, adverse reactions;
f) α,β-adrenoblockers: mechanism of action, effects, indications, adverse reactions.

3. Musculotropic antihypertensive drugs – classification:
   a) Potassium channel activators: mechanism of action, effects, indications, adverse reactions;
   b) Nitric oxide donors: mechanism of action, effects, indications, adverse reactions;
   c) Calcium channel blockers: mechanism of action, effects, indications, adverse reactions.
4. Diuretics as antihypertensives: mechanism of action, indications, adverse reactions.
5. Antihypertensive drugs affecting the renin-angiotensin-aldosterone system – classification:
   a) ACE inhibitors: classification by pharmaceutical form, mechanism of action, effects, indications, adverse reactions;
   b) Angiotensin receptor blockers: mechanism of action, effects, indications, adverse reactions;
   c) Vasopeptidase inhibitors: mechanism of action, effects, indications, adverse reactions;
   d) Renin antagonists: mechanism of action, effects, indications, adverse reactions.
6. Drugs used in hypertensive crises – characteristics.
7. General principles of arterial hypertension treatment.
8. Classification of antihypotensive (vasopressor) drugs according to mechanism of action.
9. Vasoconstrictive antihypotensives – classification:
   a) α and α,β-adrenomimetics: mechanism of action, antihypotensive effect, indications, adverse reactions;
   b) Isothiourea compounds: mechanism of action, effects, indications, contraindications, adverse reactions;
   c) Vasoactive peptides: mechanisms of action, effects, indications, adverse reactions;
   d) Centrally acting vasoconstrictors: medullary stimulants, characteristics, mechanisms, adverse reactions;
   e) CNS stimulants (methylxanthines): mechanism of action, influence on heart, vessels, blood pressure, indications, adverse reactions.
10. Antihypotensive drugs affecting the heart – classification:
    a) Dopaminomimetics: effects, indications, adverse reactions;
    b) Beta-1 adrenomimetics: effects, indications, adverse reactions.
11. Permissive antihypotensives: characteristics of glucocorticoid antihypotensive action.
12. Plasma volume substitutes: mechanism of action, effects, indications.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms: 1**.** Clonidine. 2. Methyldopa. 3. Moxonidin, 4. Azamethonium, 5. Prazosin, 6. Propranolol, 7. Atenolol, 8. Carvedilol, 9. Nebivolol, 10. Labetalol, 11. Hydralazine, 12. Nifedipine, 13. Sodium nitroprusside, 14. Captopril, 15. Enalapril, 16. Losartan, 17. Epinephrine, 18. Norepinephrine, 19. Phenylephrine, 20. Isoturon, 21. Dopamine, 22. Caffeine sodium benzoate, 23. Dobutamine.

Nr.	Name of the drugs	***Forms of delivery / dose***
1.	Azamethonium	Sol. 5% - 1 ml in ampoules
2.	Caffeine sodium benzoate	Tablets 0.1 Sol. 10% - 1 ml in ampoules
3.	Captopril	Tablets 0.025; 0.05; 0.1
4.	Carvedilol	Tablets 0.0125; 0.025
5.	Clonidine	Tablets 0.000075; 0.00015 Sol. 0.01% - 1 ml in ampoules;

6.	Dobutamine	Sol. 0.5% - 50 ml in ampoules Lyophilized powder 0.25 in vials
7.	Dopamine	Sol. 4% - 5 ml in ampoules
8.	Enalapril/ Enalaprilat	Tablets 0.0025; 0.005; 0.01 Sol. 0.125% - 1 ml in ampoules
9.	Epinephrine	Sol.0.1% - 1 ml in ampoules
10.	Phenylephrine	Sol.1% - 1 ml in ampoules Sol. 0.25% - 10 ml (nasal drops)
11.	Hydralazine	Tablets/ dragees 0.01; 0.025 Sol. 2% - 1 ml in ampoules
12.	Isoturon	Sol. 10% - 1 ml in ampoules
13.	Labetalol	Tablets 0.1; 0.2 Sol. 0.5% - 4 ml in ampoules
14.	Losartan	Tablets 0.05; 0.1
15.	Methyldopa	Tablets 0.25; 0.5
16.	Atenolol	Tablets 0.05; 0.1
17.	Moxonidine	Tablets 0.0002; 0.0004
18.	Nebivolol	Tablets 0.005
19.	Nifedipine	Tablets/ Dragees/ Capsules 0.01; 0.02
20.	Sodium nitroprusside	Lyophilized powder 0.03 in ampoules Lyophilized powder 0.05 in vials
21.	Norepinephrine	Sol. 0.2% - 1 ml in ampoules
22.	Prazosin	Tablets 0.001; 0.002
23.	Propranolol	Tablets/ Capsules 0.01; 0.02; 0.04

2.) List the groups and drugs used in (for): hypertensive crisis; hypertensive emergencies; treatment of pheochromocytoma; centrally acting neurotropic drugs in arterial hypertension; peripherally acting neurotropic drugs in arterial hypertension; myotropic drugs in arterial hypertension; inhibitors of the renin–angiotensin–aldosterone system in arterial hypertension; angiotensin-converting enzyme inhibitors in arterial hypertension, arterial hypertension with arrhythmias; arterial hypertension with hyperaldosteronism; arterial hypertension with hyperreninemia; centrally acting vasoconstrictors in arterial hypotension; peripheral vasoconstrictors in arterial hypotension; cardiostimulants in arterial hypotension; hemorrhagic arterial hypotension; cardiogenic shock with arterial hypotension; arterial hypotension resistant to sympathomimetics; orthostatic hypotension caused by ganglion blockers and alpha-adrenoceptor blockers; hypovolemic shock; chronic arterial hypotension.

G. Individual Work for Knowledge Consolidation

1) Tests (Guidelines for Laboratory Work in Pharmacology).

2) **Tables** (knowledge summary)

Table 1

The influence of hypotensive drugs on vascular tone, cardiac output and renin secretion

Parameters	Vascular tone		Cardiac output	Renin secretion
	Arterial	Venous		
Clonidine				
Azamethonium				
Reserpine				
Doxazosin				
Propranolol				
Hydralazine				
Minoxidil				
Nifedipine				
Verapamil				
Sodium nitroprusside				

Note: to complete the table use the following signs

"↑" – increase, "↓" – decrease, "-" – absence of the effect.

Table 2

Adverse reactions of myotropic hypotensives

Adverse reactions	Hydralazine	Minoxidil	Sodium Nitroprusside	Nifedipine	Verapa-mil
Headache					
Skin hyperemia					
Tachycardia					
Bradycardia					
Orthostatic hypotension					
Edema of lower limbs					
Constipation					
Acute rheumatoid syndrome					
Hyperglycemia					
Rebound syndrome					

Note: mark the presence of the effect using the sign "+".

Table 3

The comparative characteristic of clonidine and moxonidine

Comparative parameters		Clonidine	Moxonidine
Mechanism of action	Stimulation of central α2-adrenoceptors		
	Stimulation of Imidazoline-I1central receptors		
Use	Control of hypertensive crises		
	Systemic therapy of hypertension		
Adverse reactions	Obvious sedative-hypnotic effect		
	Dry mouth		
	Rebound syndrome		

Note: mark the presence of the effect using the sign "+".

Table 4

The comparative characteristic of angiotensin converting enzyme inhibitors and angiotensin receptor blockers

Comparative parameters		ACE	Angiotensin receptor blockers
Content in blood	Angiotensin II		
	Aldosterone		
	Norepinephrine		
	Bradykinin		
	Prostaglandin E2		
Use	Hypertension treatment		
	Treatment of heart failure		
Adverse Reactions	Dry cough		
	Skin rash		
	Angioneurotic edema (Quinke)		
	Vertigo		

Note: to complete the table use the following signs

"↑" – increase, "↓" – decrease, "-" – absence of the effect, "+" – presence of the effect

Table 5

Medicines used in hypotension. Their mechanism of action

Medicines	Acute hypotension	Chronic hypotension	Cardiogenic shock	Mechanism of action
Caffeine sodium benzoate				
Izoturon				
Dopamine				
Angiotensinamide				
Deoxycorticosterone acetate				
Epinephrine				

Note: mark the presence of the effect using the sign "+".

H. Interactive activity

1) **Experimental and virtual didactic film** (elaboration of minutes, conclusions)
2) **Clinical cases** (Guidelines for Laboratory Work in Pharmacology).
3) **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).
4) **Solve the case:**

Case 1

A patient suffered a road traffic accident and was urgently admitted to the intensive care unit. Blood pressure was 60/20 mmHg, heart rate 140 beats/min, and pO□ – 75%.

Indicate the possible drugs for this patient to increase arterial blood pressure.

Explain the mechanisms of action of the selected drugs.

Case 2

Under experimental conditions, the following variants of arterial hypertension were modeled:

a) Immobilization of animals with development of stress

b) Stimulation of sympathetic nerves with peripheral vasoconstriction and tachycardia

c) Induction of vasoconstriction by administration of substances acting on smooth muscle

d) Stimulation of the juxtaglomerular apparatus of the kidneys

e) Development of a tumor of the adrenal medulla

f) Administration of angiotensin II

Which groups of drugs and specific preparations would you select for the treatment of the induced arterial hypertension?

What are the mechanisms of action of these drugs?

Case 3

Under experimental conditions, the following variants of arterial hypotension were modeled:

a) Decreased cardiac output

b) Vasodilation due to sympathetic denervation
c) Traumatic shock with hemorrhage
d) Administration of alpha-adrenoceptor blockers
List the groups of drugs and possible medications used to manage arterial hypotension.

DIURETICS. DRUGS USED IN THE TREATMENT OF GOUT AND UROLYTHIASIS. DRUGS WITH INFLUENCE UPON ACID-BASE AND/OR WATER-ELECTROLYTE BALANCE. PLASMA VOLUME EXPANDERS.

A. Actuality. The retention of salts and water in the body is responsible for tissue hydration, and in kidney diseases, cardiovascular insufficiency, liver pathologies and emergency situations (acute intoxications, hypertensive crises, cerebral edema, etc.) and the formation of edema. In order to solve the respective situations, it is necessary to select the appropriate diuretics according to their place and mechanism of action, pharmacodynamic and pharmacokinetic properties.

Gout is a disease caused by the formation and excessive deposition of uric acid in the tissues and requires the use of drugs to control attacks and prophylaxis (treatment) of gout. Urolithiasis states, determined by the formation of various endogenous metabolites with precipitation in the form of stones, require systematic treatment to prevent the formation and/or dissolution of kidney stones. Disturbances of the hydro-electrolytic and acid-base balance, present in various diseases and pathological conditions, require appropriate correction. Hypovolemia states accompany a varied range of pathologies (shocks, arterial hypotension, dehydration, intoxication, etc.) and present emergency states with the appropriate selection of plasma volume substitutes depending on the pharmacological effects and adverse reactions.

B. The purpose of the training is: to familiarize students with the pharmacological properties of diuretics, anti-gout drugs and drugs used in urolithiasis, hydro-electrolytic and acid-base balance disorders, plasma volume substitutes, as well as prescribing recipe and selecting drugs according to pathology.

C. Learning objectives:

a) The student **must know**: definition, classification, mechanisms of action, pharmacological effects, indications, contraindications, adverse reactions and pharmacokinetics of diuretics, antigout drugs, drugs used in urolithiasis, drugs used in hydro- electrolytic and acid-base balance disorders, plasma volume substitutes.

b) The student **must be able to:** prescribe drugs from the respective groups in various pharmaceutical forms and indicate them according to the disease and pathological conditions.

D. Knowledge from previous and related disciplines necessary for interdisciplinary integration.

Human anatomy. Structure of the kidneys, urinary tract, renal vascularization.

Histology. Urinary system. Development, structure, and histophysiology. The nephron as the morpho-functional unit of the kidney. Morpho-functional bases of regulation of urine

formation. The juxtaglomerular complex: structure and function. Development, structure, and histophysiology.

Human physiology. Body fluid compartments. Edema. Regulation of extracellular osmolarity and extracellular sodium concentration. Main mechanisms of urine excretion (formation). Acid–base status and hydro-electrolyte balance. Urine formation: I. Glomerular filtration, renal blood flow, and their control. II. Tubular processing of the glomerular filtrate. Renal regulation of ion levels. Integrated actions for the control of volemia and extracellular fluid volume.

Pathophysiology. Disorders of hydro-electrolyte and acid–base balance. Pathogenesis of edema and hypovolemia.

E. Self-training questions:

1. Diuretics. Concept of diuretics and saluretics.
2. Classification of diuretics according to mechanism of action, site of action in the nephron, onset and duration of effect, and intensity of action.
3. Diuretics with predominant action on the glomerulus. Characterization of the diuretic action of cardiac glycosides, xanthines, and vasodilators. Indications.
4. Diuretics with predominant action on the proximal convoluted tubule. Carbonic anhydrase inhibitors: mechanism of action, effects, indications, contraindications, adverse reactions.
5. Diuretics acting along the entire nephron, predominantly on proximal tubules. Osmotic diuretics: mechanism of action, effects, indications, contraindications, adverse reactions, pharmacokinetics.
6. Diuretics with predominant action on the ascending limb of the loop of Henle (saluretics): mechanism of action, effects, indications, contraindications, adverse reactions, pharmacokinetics.
7. Diuretics with influence on the cortical segment of the loop of Henle and the distal convoluted tubule. Thiazide and thiazide-like (non-thiazide) diuretics: mechanism of action, effects, indications, contraindications, adverse reactions, pharmacokinetics.
8. Diuretics with predominant action on the terminal segment of the distal convoluted tubule and the collecting duct. Classification. Competitive and non-competitive aldosterone antagonists: mechanism of action, effects, indications, contraindications, adverse reactions, pharmacokinetics.
9. Antigout drugs. Classification. Drugs with specific action used in acute gout attack: mechanism of action, anti-inflammatory effect, indications, adverse reactions. Classification of drugs used in gout prophylaxis (treatment): mechanisms of action, effects, indications, and adverse reactions of urate synthesis inhibitors, uricosuric agents, and uricolytic agents.
10. Drugs used in urolithiasis: classification; characteristics of drugs that modify urine pH and herbal antispasmodics.
11. Classification of drugs used in disorders of hydro-electrolyte balance. Crystalloid solutions used in isotonic, hypotonic, and hypertonic dehydration: pharmacological properties, indications, contraindications, adverse reactions. Drugs used to correct hypokalemia, hypomagnesemia, and hypocalcemia.
12. Drugs used in acid–base balance disorders. Classification. Characteristics of drugs used in the treatment of acidosis and alkalosis.
13. Plasma volume expanders. Classification.
14. Dextrans as plasma volume expanders: classification, mechanism of action, effects, indications, contraindications, adverse reactions.
15. Hydroxyethyl starch preparations as plasma volume expanders: classification, mechanism of action, effects, indications, contraindications, adverse reactions.
16. Polypeptide polymer preparations as plasma volume expanders: mechanism of action, effects, indications, contraindications, adverse reactions.
17. Blood products as plasma volume expanders: mechanism of action, effects, indications, contraindications, adverse reactions.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms:1. Mannitol, 2. Furosemide, 3. Torasemide, 4. Hydrochlorothiazide, 5. Indapamide, 6. Triamterene, 7. Spironolactone, 8. Colchicine, 9. Allopurinol, 10. Cystenal, 11. Ammonium chloride, 12. Sodium bicarbonate, 13. Dextran 40, 14. Dextran 70, 15. Sulfinpyrazone, 16. Sodium chloride, 17. Potassium chloride, 18. Calcium chloride, 19. Rehydron, 20. Hydroxyethyl starch (Refortan), 21. Trometamol

Nr.	*Name of drug*	*Form of delivery, dose*
1	**Mannitol**	Sol. 20%-250ml and 500ml in vials (intravenous)
2	**Furosemide**	Tablets 0,04 Sol. 1%-2ml in ampoules (intravenous, intramuscularly)
3	**Torasemide**	Tablets 0,005 and 0,01 Sol. 0,5%; 1 -1 ml in ampoules (intravenous)
4	**Hydrochlorothiazide**	Tablets 0,025 and 0,05
5	**Indapamide**	Tablets 0,0025; 0,0015 Capsules 0,0025
6	**Spironolactone**	Tablets / Capsules 0.025; 0.05 Sol. 0.2% - 10ml in ampoules
7	**Triamteren**	Capsules 0,05
8	**Colchicine**	Tablets 0,001
9	**Allopurinol**	Tablets 0,1; 0,3
10	**Cystenal**	Solution 10 ml in vials (oral drops)
11	**Ammonium chloride**	Sol. 5%-200ml in vials (internaly)
12	**Sodium bicarbonate**	Tablets 0.5 Sol. 4% - 200; 400ml in bottles Powder 50.0
13	**Dextran-40**	Sol. 10%-100 ml in vials (intravenous)
14	**Dextran-70**	Sol. 6% - 100ml; 200ml in bottles
15	**Sodium chloride**	Sol.0,9%-200; 500ml in vials (intravenous) Sol. in ampoules 0,9%-5;10ml (intravenous)
16	**Potassium chloride**	Tablets 0,5; 1,0 Sol. 4%-10ml in ampoules (intravenous)
17	**Calcium chloride**	Sol.10%-5ml in ampoules Sol.10%-200 ml in vials (intravenous)
18	**Rehydron**	Powder for oral solution in packets 18.9
19	**Hydroxyethylstarch**	Sol.10%-250ml in vials
20	**Trometamol**	Sol. 3.66% - 250ml in bottles
21	**Sulfinpyrazone**	Tablets 0.1; 0.2

2) List the groups and drugs used in (for): cerebral edema, pulmonary edema of toxic origin, diuretics in acute renal failure, diuretics in chronic renal failure, forced diuresis, diuretics in arterial hypertension, diuretics in arterial hypertension with hyperaldosteronism, diuretics in glaucoma, diuretics in acute heart failure, diuretics in chronic congestive heart failure, gout attack, prophylaxis of gout, treatment of gout, uricoinhibitor in gout, uricosuric in gout, alkalinization of urine in urolithiasis, acidification of urine in urolithiasis, treatment

of acidosis, treatment of alkalosis, treatment of isotonic dehydration, treatment of hypotonic dehydration, treatment of hypertonic dehydration, hypovolemic shock, detoxification of the body in peritonitis, detoxification of the body in food poisoning, hypokalemia, hypocalcemia.

G. Individual Work for Knowledge Consolidation

1) Tests (Guidelines for Laboratory Work in Pharmacology).

2) **Tables** (knowledge summary)

Table 1

Localization of the predominant action of diuretics and their clinical efficacy

Location of action	Drugs	Efficacy (high, moderate, low)
Proximal convoluted tubules	a)…	
The ascending limb of the loop of Henle	a)… b)… c)…	
The cortical segment of the loop of Henle and the distal tubules	a)… b)… c)… d)… e)…	
The terminal segment of the distal tubules and collecting tubules	a).. b)… c)…	
Throughout the entire nephron	a)… b)…	

Table 2

The influence of diuretics on the elimination of ions and uric acid

Group of diuretics	Na^+	K^+	Ca^{2+}	Mg^{2+}	Cl^-	HCO_3^-	Uric acid
Thiazides and related drugs							
Loop diuretics							
Carbonic anhydrase inhibitors							
Competitive aldosterone antagonists							
Non-competitive aldosterone antagonists							
Osmotic diuretics							

Table 3

Pharmacological characteristics of diuretic drugs

The drug	Route of administration	Onset of action (min, hours)	Duration of action (min, hours)
Hydrochlorothiazide			
Indapamide			
Chlortalidone			
Furosemide			
Torasemide			
Spironolactone			
Triamterene			
Mannitol			

Table 4

Select the main indications for administration of diuretics

Indication	Thiazides and thiazide-like diuretics	Loop diuretics	Osmotic diuretics	Carbonic anhydrase inhibitors	Competitive aldosterone antagonists
Chronic heart failure					
Arterial hypertension					
Pulmonary edema					
Cerebral edema					
Acute renal failure					
Acute heart failure					
Secondary hyperaldosteronism					
Glaucoma					
Acute intoxication					

Table 5

Adverse reactions of diuretics

Adverse reactions	Hydrochl orothiazi de	Furose- mide	Acetazolami- de	Triamteren	Spironolactone
Hypokalemia					
Hyperkalemia					
Hyperuricemia					
Hyperglycemia					
Ototoxicity					
Haematotoxicity					
Gynecomastia					
Hypotension					
Hepatotoxicity					
Acidosis					
Alkalosis					

Table 6

Indications for plasma volume substitutes

Indications	Dextran 40	Dextran 70	Gelatinol	Trisol
Hypovolemic shock				
Acute arterial hypotension				
Acute intoxication				
Pathologies with microcirculation disorders				
Prophylaxis and treatment of thrombosis and thromboembolism				
Dehydration of the body				

Table 7

Plasma volume substitutes: effects and mechanisms

Substituent group	Pharmacological effect	Mechanism of effect
Isotonic sodium chloride solution		
Dextran 40		
Hydroxyethylamidone (Refortan)		
Albumin		

H. Interactive activity

1) **Experimental and virtual didactic film** (elaboration of minutes, conclusions)
2) **Clinical cases** (Guidelines for Laboratory Work in Pharmacology).
3) **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).
4) **Solve the case:**

Case 1.
Under experimental conditions, cerebral edema was induced. To eliminate the edema, mannitol was administered to animal A, and urea to animal B. After one hour, the cerebral edema was corrected in both animals. During further observation, after 6 hours, a recurrence of cerebral edema was noted in animal B.
What is the cause of the observed effects?
Explain the mechanisms of the observed phenomena.
Case 2. Which groups of medications should the physician use to correct hypovolemic states in the following cases:
a) isotonic dehydration;
b) hypotonic dehydration;
c) hemorrhagic shock;
d) endotoxic shock;
e) liver cirrhosis with ascites.
Justify the selection of drug groups and the principles of their use.
Case 3. Under experimental conditions, a state of acidosis was induced. For its correction, a 4% sodium bicarbonate solution was administered. On examination, blood pH normalized, but relative hypernatremia and intracellular acidosis were observed.
What was the cause of the relative hypernatremia and the persistence of intracellular acidosis?
What would you recommend for the correction of intracellular acidosis?

MEDICINES AFFECTING BLOOD AND HEMATOPOIETIC ORGANS

A. Actuality. Disorders of blood coagulation, fibrinolysis, and hematopoiesis are frequent and often severe (acute hemorrhages, surgical interventions) or fatal (pulmonary artery thrombosis, cerebral vessel thrombosis, disseminated intravascular coagulation, leukoses, leukemias).

B. The purpose of the training: To familiarize students with the pharmacological properties of medicines used in disorders of fibrinolysis and hematopoiesis.

C. Learning objectives:

a) The student must **know**: The definition, classification, mechanisms of action, effects, indications, contraindications, and adverse reactions of antithrombotic agents, hemostatic agents, and drugs used in disorders of hematopoiesis.

b) The student must **be able to:** prescribe medicines in different dosage forms and select appropriate drugs from these groups for various pathologies of the blood system.

D. Knowledge from previous and related disciplines necessary for interdisciplinary integration.

Physiology: Hemostasis and blood coagulation. Stages of blood coagulation. Origin and physiological role of heparin.

Biochemistry: Cascade mechanisms of enzyme action involved in blood coagulation. Metabolic functions of cyanocobalamin and folic acid.

Pathophysiology: The anticoagulant system of blood. Mechanisms of thrombogenesis. Formation of white and red thrombi. Anemias, leukopenias, thrombocytopenias—their forms, causes, and mechanisms of development. Leukemias and thrombocytopenias—their causes and mechanisms of development.

E. Self-training questions:

1. Definition and classification of antithrombotic drugs.
2. Classification of direct-acting anticoagulants.
3. Standard heparin preparations: mechanism of action, effects, indications, contraindications, adverse reactions, and pharmacokinetics. Heparin antagonists.
4. Low-molecular-weight heparins: pharmacodynamic and pharmacokinetic features, comparative characteristics with standard heparins. Indications.
5. Direct thrombin inhibitors: classification, mechanism of action, effects, indications.
6. Factor Xa inhibitors: mechanism of action, effects, indications, adverse reactions.
7. Indirect-acting anticoagulants: classification by group and duration of action, mechanism of action, indications, contraindications, adverse reactions. Comparative characteristics of indirect-acting and direct-acting anticoagulants. Antagonists of indirect anticoagulants.
8. Antiplatelet agents: classification, mechanisms of action, indications, contraindications, adverse reactions of cyclooxygenase inhibitors, thromboxane A□ receptor blockers, purinergic and glycoprotein receptor blockers.
9. Fibrinolytic agents: classification, mechanism of action, indications, adverse reactions.
10. Definition and classification of hemostatic agents.
11. Classification of locally acting hemostatic agents. Characteristics of vasoconstrictors, astringents, agents with thromboplastic and thrombin activity.
12. Classification of systemically acting hemostatic agents.
13. Direct-acting coagulants: mechanism of action, indications.
14. Indirect-acting coagulants: mechanism of action, indications, adverse reactions.
15. Antifibrinolytic agents: classification, mechanism of action, indications, adverse reactions.

16. Aggregating agents: classification, mechanism of action, indications, adverse reactions.
17. Classification of anti-anemic drugs.
18. Drugs used in hypochromic (iron-deficiency) anemia: classification, pharmacokinetics, indications, adverse reactions.
19. Drugs used in vitamin B□□-deficiency megaloblastic anemia: pharmacodynamic and pharmacokinetic properties, indications.
20. Drugs used in folate-deficiency megaloblastic anemia: pharmacodynamic and pharmacokinetic properties, indications.
21. Drugs used in hemolytic anemia: pharmacodynamic and pharmacokinetic properties.
22. Drugs used in hypo- or aplastic anemias and erythropoietins: pharmacodynamic properties, indications, adverse reactions.
23. Classification of drugs affecting leukopoiesis. Leukopoiesis stimulators: pharmacodynamic properties, indications, adverse reactions.
24. Classification of angioprotective agents. Mechanism of action, effects, indications of plant-derived, animal-derived, and synthetic preparations.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms: 1. Heparin, 2. Nadroparin, 3. Enoxaparin, 4. Protamine sulfate, 5. Ethyl biscoumacetate, 6. Warfarin, 7. Alteplase, 8. Streptokinase, 9. Ticlopidine, 10. Acetylsalicylic acid, 11. Fibrinogen, 12. Menadione, 13. Aminocaproic acid, 14. Aprotinin, 15. Carbazochrome, 16. Ferrous sulfate, 17. Fercoven, 18. Cyanocobalamin (vitamin B□□), 19. Folic acid, 20. Sodium nucleinate.

Nr.	***Name of drug***	***Form of delivery, dose***
1.	**Heparin**	Sol. 5ml (5000 IU/ml) in vials Ointment 10.0; 25.0 (100IU/g) Gel 25.0; 50.0 (1000 IU/g) Cream 40.0 (500 IU/g)
2.	**Nadroparin**	Sol. 0.3ml; 0.6 ml (9500 IU antiXa/ml) in prefilled syringe Sol. 9500 IU/ml - 5 ml in ampoules
3.	**Enoxaparin**	Sol. 0.4 ml; 0.6 ml (10000 IU antiXa/ml) in pre-filled syringe
4.	**Protamine sulfate**	Sol. 1% - 2ml; 5 ml in ampoules Sol. 1% - 10ml in vials
5.	**Ethyl biscoumacetate**	Tablets 0.05; 0.1; 0.3
6.	**Warfarin**	Tablets 0.0025;
7.	**Alteplase**	Lyophilized powder 0.01; 0.05 in vials
8.	**Streptokinase**	Lyophilized powder 500000UI; 1500000UI in vials
9.	**Ticlopidine**	Tablets 0.25; 0.125
10.	**Acetylsalicylic acid**	Tablets 0,075; 0,1; 0,15
11.	**Fibrinogen**	Powder 1.0; 2.0 in vials
12.	**Menadione**	Tablets 0.01; 0.015 Sol. 1% - 1 ml in ampoules

13.	**Aminocaproic acid**	Tablets 0.5 Granules 50.0; 100.0 Sol. 5% - 100 ml in bottles; Powder 1.0; 3.0 (for internal use)
14.	**Aprotinin**	Sol. 10 ml (10,000 UIK/ml) in vials / ampoules
15.	**Carbazochrome**	Sol. 0.025% - 1 ml in ampoules
16.	**Ferrous sulfate**	Tablets 0.105 and 0.2; Syrup 1.5% - 100 ml Solution 12.5% - 50 ml in bottles (for internal use)
17.	**Fercoven**	Sol. in ampoules 5 ml
18.	**Cyanocobalamin (vitamin B□□)**	Tablets 0.0005; 0.001 Sol. 0.05 % - 1 ml in ampoules
19.	**Folic acid**	Tablets 0,001; 0,005
20.	**Sodium nucleinate**	Tablets 0,25 Powder. 0,5 in vials

2) List the groups and drugs used in (for): Treatment and prophylaxis of deep vein thrombosis, treatment and prophylaxis of pulmonary artery thromboembolism, disseminated intravascular coagulopathy, overdose of indirect-acting anticoagulants, overdose of direct-acting anticoagulants, prevention of postoperative thromboembolism, prophylaxis of peripheral arterial thrombosis, prophylaxis of thrombosis in myocardial infarction, prophylaxis of thromboembolism in atrial fibrillation, prophylaxis of cerebrovascular accidents (stroke), control of parenchymal and capillary, hemorrhage, hemophilia, gastrointestinal and pulmonary hemorrhages, hemorrhages caused by hyperfibrinolysis, iron-deficiency anemia, vitamin B12-deficiency anemia, folic acid-deficiency anemia, aplastic anemia, hemolytic anemia, leukopenia.

G. Individual Work for Knowledge Consolidation

1) Tests (Guidelines for Laboratory Work in Pharmacology).

2) **Tables** (knowledge summary)

Table 1

Comparative characteristics of anticoagulants

Parameters		Direct-acting anticoagulants	Indirect-acting anticoagulants
Mechanism of action			
Activity	"in vivo"		
	"in vitro"		
Presence of latency period in action			
Presence of cumulative properties			
Duration of action after drug discontinuation (hours)			
Specific antagonists			

Table 2

Comparative characteristics of standard heparin and low molecular weight heparins

Parameters	Standard heparin	Low molecular weight heparins
Molecular mass kDA		
Inactivation of factor IIa:Xa		
Anticoagulant effect		
Duration of action s/c		
Maximum effect s/c		
Treatment monitoring		
Subcutaneous bioavailability (%)		
Frequency of bleeding risk Half-life		
Capacity to cause thrombocytopenia		

Table 3

Comparative characteristics of fibrinolytic drugs

Parameters		Streptokinase	Strepto-decase	Urokinase	Alteplase
Activation of the conversion of profibrinolysin to fibrinolysin	predominantly in thrombus				
	in plasma				
Duration of action (hours)					
Risk of bleeding (uncommon/rare)					
Presence of pyrogenic and allergic reactions					

Table 4

Indications for hemostatic drugs

Indications	Thrombin	Fibrinogen	Menadione	Aminocaproic acid	Protamine sulfate
Small vessel hemorrhages					
Hemorrhages caused by hyperfibrinolysis					
Hemorrhages caused by hypofibrinogenemia					
Overdose of direct anticoagulants					
Overdose of indirect anticoagulants					
Treatment of varicose veins of the lower extremities					

Table 5

Comparative characteristics of antianemic drugs

Parameters	Iron medications	Vitamin B12 medications	Folic acid medications
Drugs			
Pharmacokinetic properties			
Pharmacodynamic properties			
Indications			
Adverse Reactions			

Table 6

Comparative characteristics of drugs that regulate erythropoiesis and leukopoiesis

Growth factors	Medications	Route of administration	Indications	Adverse effects
Erythropoietin				
Granulocyte macrophage colony-stimulating factor				
Granulocyte-colony-stimulating factor				

H. Interactive activity

1) **Experimental and virtual didactic film** (elaboration of minutes, conclusions)
2) **Clinical cases** (Guidelines for Laboratory Work in Pharmacology).
3) **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).
4) **Solve the case:**

Two patients with thrombosis were admitted to the hospital. Patient A – with deep vein thrombosis, patient B – with thrombosis of the arteries of the lower extremities.

Which groups of drugs (and medicines) will you use for the treatment of patients?

Justify the selection of groups by mechanisms of action and pharmacodynamic properties.

DRUGS INFLUENCING THE GASTROINTESTINAL TRACT. ANTISPASTIC DRUGS.

A. Actuality. Gastrointestinal diseases associated with disruptions in the secretory function of glands, tone and motility of smooth muscles, bile formation and secretion, as well as liver functions, are prevalent in medical practice. Treating diseases and pathological conditions of the digestive tract involves utilizing a wide array of drug groups, necessitating extensive knowledge for the rational selection of effective and safe pharmacotherapy.

B. The purpose of the training: is to familiarize students with drug classes that influence gastrointestinal tract functions and the principles of selecting the appropriate drugs for specific diseases.

C. Learning objectives:

a) The students **must know:** classification, mechanisms of action, effects, indications, contraindications and side effects of drugs with influence on the functions of gastrointestinal tract.

b) The students **must be able to:** prescribe the drugs influencing the gastrointestinal tract and choose them in specific pathologies.

D. Knowledge of previous and related disciplines necessary for interdisciplinary integration.

Histology. The digestive system. Morpho-functional characteristics. Development of the primitive digestive tube. Oral cavity. Stomach. Histophysiology of secretory cells. Small intestine. The crypt–villus system as a morpho-functional unit. Histophysiology of the digestive process. Large intestine. Development, structure, histophysiology. Pancreas. Structure of the exocrine and endocrine portions. Liver. Structure of the lobule as a morpho-functional unit. Hepatocytes, their histochemical features and functions. Gallbladder and biliary cells.

Human physiology. General principles of gastrointestinal tract functioning. Motor and secretory functions. The importance of digestion for the organism. Physiological basis of gastric secretion. Composition and properties of gastric juice, its significance. Enzymes of gastric juice and their action. Mechanism of gastric secretion and its regulation. Phases of gastric juice secretion. Influence of humoral factors on the gastric glands. Duodenal digestion. Role of the duodenum in digestion. Composition and properties of pancreatic juice, its action on proteins, carbohydrates, lipids, and nucleic acids. Enterokinase. Mechanism of regulation of smooth muscle tone and motility. Physiology of the autonomic nervous system (sympathetic and parasympathetic). Regulation of tone and motility of internal organs (stomach, intestines, gallbladder, and bile ducts). Role of bile in digestion. Mechanism of bile formation in the liver. Bile secretion into the duodenum. Stimuli of bile secretion. Digestion in the small and large intestines. Intestinal juice. Absorption in the gastrointestinal tract. Motility of the digestive tube. Antiperistaltic movements, vomiting. The liver as an organ. Nutritional balances; regulation of food intake; obesity and starvation.

Pathophysiology. Disorders of secretion, motility, and gastric emptying. Gastric and duodenal ulcerogenesis. Impaired digestive function in the duodenum due to pancreatic juice and bile insufficiency (acholia). Diarrhea, constipation. Liver failure. Etiology, pathogenesis, manifestations, and consequences.

Internal Medicine – Semiology. Clinical syndromes in gastrointestinal tract disorders. Concepts of hepatic syndromes: jaundice, portal hypertension, and liver failure. Concepts of chronic hepatitis and liver cirrhosis.

E. Self-training questions:

1. Classification of drugs affecting the functions of the digestive tract.
2. Substitution drugs in pancreatic hypofunction: classification, components and mechanism of action, effects, indications, adverse reactions.
3. Drugs used in gastric hypersecretion: classification.
4. Gastric antisecretory drugs: mechanisms of action.
5. H2-histamine blockers as antiulcer agents: classification, mechanism of action, antiulcer effect, indications, adverse reactions.
6. Proton pump inhibitors as antiulcer agents: classification, mechanism of action, antiulcer effect, indications, adverse reactions.
7. Prostaglandin analogues and somatostatin analogues as antiulcer agents: mechanism of action, antiulcer effect, indications.
8. Classification of antiulcer drugs.
9. Antacids: classification by group and mode of action, mechanism of action, effects, indications, adverse reactions.
10. Gastroprotective and cytoprotective drugs: classification, mechanism of action, effects, and indications of sucralfate, bismuth-containing drugs, prostaglandin analogues, plant-based and synthetic drugs, vitamins, and anabolic agents.
11. Classification of drugs that enhance digestive tract peristalsis.
12. Prokinetic drugs: classification, mechanisms of action, effects, indications.

13. Antiflatulents: classification. Mechanisms of action and indications of adsorbent, surfactant, parasympathomimetic drugs, enzymes, and plant carminatives.
14. Laxatives and purgatives: classification. Mechanism of action, effects, indications, and adverse reactions of bulk-forming and emollient laxatives, osmotic and irritant purgatives.
15. Drugs that inhibit digestive tract motility: classification.
16. Classification of smooth muscle antispasmodics (spasmolytics). Neurotropic spasmolytics: mechanism of action, indications.
17. Myotropic spasmolytics**:** classification, mechanism of action, indications.
18. Antiemetics: classification by group. Mechanisms of action and indications of neuroleptics, M-cholinoblockers, H1-antihistamines, dopamine and serotonin antagonists.
19. Antidiarrheal drugs: classification. Mechanisms of action, effects, and indications of M-cholinoblockers, opioids and related drugs, astringents, adsorbents, and protective agents.
20. Hepatotropic drugs: classification.
21. Hepatoprotective drugs: classification by origin, mechanisms of action, indications. Effects of silymarin, ademetionine, ursodeoxycholic acid. Hepatoprotective drugs of entomological origin.
22. Drugs affecting bile formation, secretion, and excretion: classification.
23. Cholesecretory drugs: classification, mechanisms of action, effects, indications.
24. Cholecystokinetic drugs**:** classification, mechanisms of action, effects, indications.
25. Cholelitholytic drugs: mechanism of action, effects, indications.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms:1. Pancreatin. 2. Creon. 3. Famotidine. 4. Omeprazole. 5. Almagel. 6. Sucralfate. 7. Bismuth subcitrate. 8. Regesan. 9. Aprotinin. 10. Metoclopramide. 11. Simethicone. 12. Magnesium sulfate. 13. Bisacodyl. 14. Sodium picosulphate. 15. Thyethylperazine. 16. Ondansetron. 17. Lactulose. 18. Macrogol. 19. Loperamide. 20. Enterol. 21. Bactisubtil. 22. Essentiale. 23. Ademetionine. 24. Silymarin. 25. Ursodeoxycholic acid. 26. Holosas. 27. Papaverine hydrochloride. 28. Drotaverine. 29. Atropine sulfate. 30. Platiphylline. 31. Baralgin.

Nr.	***The name of the drugs***	***Delivery forms***
1	**Ursodeoxycholic acid**	Tablets / Capsules 0.1; 0.25 Suspension 5% - 250ml in vials
2	**Ademetionine**	Tablets 0.4 Lyophilized powder 0.4 in vials (i/v)
3	**Atropine sulphate**	Tablets 0.0005 Sol. 0.05%; 0.1% - 1ml in ampoules Sol. 0.1% - 10ml in vials (internally)
4	**Bactisubtil**	Capsules 0,035
5	**Baralgin**	Tablets Nr. 20 Sol. 5ml in ampoules
6	**Bisacodyl**	Tablets / Dragees 0.005 Rectal suppositories 0.01
7	**Holosas**	Syrup 140 ml in bottles
8	**Drotaverine**	Tablets 0.04 Sol. 2% - 2ml in ampoules
9	**Enterol**	Capsules 0,25
10	**Essentiale**	Capsules Nr. 30 Sol. 5ml in ampoules

11	**Loperamide**	Tablets / Capsules 0.002 Sol. 0.02% - 100ml in bottles
12	**Magnesium sulfate**	Powder 10.0; 20.0 in sachets Sol. 10%; 25% - 5ml in ampoules
13	**Metoclopramide**	Tablets 0.005; 0.01 Sol. 0.1% - 100ml in bottles Sol. 0.5% - 2ml in ampoules Aerosol 20% - 2ml; 40%-4ml (intranasal)
14	**Ondansetron**	Tablets 0.004; 0.008 Rectal suppositories 0,004; 0,008 Syrup 0.8% - 50ml in bottles Sol. 0.2% - 2ml in ampoules
15	**Papaverine hydrochloride**	Tablets 0.02; 0.04 Sol. 2% - 2ml in ampoules Rectal suppositories 0.2
16	**Platiphylline**	Tablets 0.005 Sol. 0.2% - 1ml in ampoules Rectal suppositories 0.01
17	**Silymarin**	Tablets / Capsules / Dragees 0.07; 0.14
18	**Simethicone**	Tablets / Capsules 0.04 Emulsion 10% - 50ml in bottles
19	**Thyethylperazine**	Dragees 0.0065
20	**Lactulose**	Syrup 66.7%-200, 500ml in bottles Syrup 66.7% - 15ml in sachets
22	**Macrogol**	Powder 4.0 in sachets
22	**Sodium picosulfate**	Sol. 0.75% - 15ml in vials (for internal use) Tablets 0.0075
23	**Almagel**	Suspension 170ml and 200ml
24	**Aprotinin**	Lyophilized powder 10000 AU in vials Sol. (10000 AU/1ml) 10ml in ampoules
25	**Famotidine**	Tablets 0.02; 0.04 Lyophilized powder 0.02 in vials
26	**Creon**	Dragees N.50
27	**Omeprazole**	Tablets / Capsules 0.02; 0.04 Lyophilized powder 0.04 in vials
28	**Pancreatin**	Tablets / Dragees 8000UA
29	**Regesan**	Oil in bottles 50ml; 100ml
30	**Bismuth subcitrate**	Tablets 0,12
31	**Sucralfate**	Tablets 0.5; 1.0 Granules 0.5/1.0 in sachets Gel 20% - 5ml (internal) Suspension 250ml (0.5/5ml) in bottles (internal)

2) List the groups and drugs used in (for): replacement drugs in hypoacid gastritis; antisecretory drugs in reflux esophagitis; antisecretory drugs in Zollinger-Ellison syndrome; antisecretory drugs

in gastric and duodenal ulcers; antacids in duodenal ulcer; proteolytic enzymes inhibitor in acute pancreatitis; substitution drugs in chronic pancreatitis; enzymatic drugs in food abuse; gastroprotective in gastric and duodenal ulcers; gastric hypomotility; flatulence after surgery; flatulence and intestinal distention; flatulence in disorders of intestinal digestion; flatulence in functional disorders of the digestive tract; antiflatulents for radiological and ultrasonographic examination of digestive tract; laxatives in chronic functional constipation; laxatives in hepatic encephalopathy; purgatives for radiological and endoscopic examination of digestive tract; purgatives for preparation for surgery; purgatives in drug or food poisoning; vomiting induced by drugs; vomiting in motion sickness; vomiting induced by antitumor drugs; postoperative vomiting; vomiting of pregnant women; vomiting in digestive tract diseases; acute non-specific diarrhoea, toxic hepatitis; chronic diseases of biliary tract; cholelithiasis; biliary colic; intestinal colic.

G. Individual Work for Knowledge Consolidation

1) Tests (Guidelines for Laboratory Work in Pharmacology).

2) **Tables** (knowledge summary)

Table 1

Usages of antispastic drugs

	Arterial hypertension	In ophtalmological practice	Bronchial asthma attack	Algodis-menorhee	Renal, biliary and intestinal colics	Peripheral and cerebral arterial spasm
Papaverine						
Plathyfilline						
Aminofilline						
Atropine						
Drotaverine						
Baralgin						

Note: When completing the table, use the following symbols: "++" – maximum effect, "+" – minimum effect.

Table 2

Comparative characteristic of antacids

Drugs	Mechanism of action	Antiulcer effect	Indications	Side effects
Systemic				
Non-systemic - magnesium drugs				
Non-systemic – aluminum drugs				

Table 3

Comparative characteristics of gastric antisecretory drugs

Drugs	**Mechanism of action**	**Antiulcer effect**	**Indications**	**Side effects**
M-cholinoblockers				
H_2-histaminoblockers				
Proton pump inhibitors				
Gastrin antagonists				
Somatostatin analogs				

Table 4

Comparative characteristics of gastro- and citoprotective drugs

Drugs	Mechanism of action	Antiulcer effect	Indications	Side effects
Bismuth drugs				
Aluminium drugs				
Prostaglandine analougs				
Vegetable oils				
Synthetic drugs				

Table 5

Indications of antiemetic drug

Pharmacological group of drugs	Motion sickness	Postoperative vomiting	Vomiting in actinic disease	Chemotherapy-induces vomiting
M-cholinoblokers				
H_1-antihistamines				
Dopaminoblockers				
Neuroleptics				
Antiserotoninics				

Note: Sign the presence of the effect with "+"

Table N6

Comparative characteristic of laxative and purgative drugs

Group of drugs	Mechanism of action	Onset of action (hours)	Indications
Volume (bulk) laxatives			
Emollient laxatives (stool softeners)			
Osmotic (saline) purgatives			
Irritant purgatives acting on the small intestine			
Irritant purgatives acting on the large intestine			
Purgatives for rectal use			

Table 7

Mechanism of action of drugs that increase bile formation and secretion.

Mechanisms of action	True choleretics	Hidrochole-retics	Cholecisto-kinetics	Cholespas-molyticc
Stimulation of the secretory function of the hepatic parenchyma (hepatocytes)				
Increase in bile volume due to the water component (bile dilution)				
Increase in gallbladder tone				
Decrease in bile duct tone				
Decrease in the tone of the sphincter of Oddi				

Note: Indicate the presence of the effect with the symbol “+”.

Table 8

Identification of antispasmodic drugs.

Drugs	Rout of drugs administration	Time of action		Mechanism of action	Chemical group
		Onset (hour)	Duration (hour)		
A	Internal, intravenous, intramuscular, rectal	0,5 – 1 15 min	4 - 6	musculotrop	**Purine derivatives**
B	Internal, intravenous, intramuscular	0,5	10 – 12 5 - 8	musculotrop	**Combined drugs**
C	Internal, intravenous, intramuscular, rectal	20 – 30 minutes	6 - 7	musculotrop	**Isoquinoline derivatives**

H. Interactive activity

1) **Experimental and virtual didactic film** (elaboration of minutes, conclusions)
2) **Clinical cases** (Guidelines for Laboratory Work in Pharmacology).
3) **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).
4) **Solve the case:**

Case 1. Patient X, 61 years old, was admitted with the following complaints: heartburn, nausea, pain in the epigastric region occurring 1.5 hours after meals, frequent "night" pains. From the medical history: has suffered from gastric ulcer for approximately 15 years with frequent exacerbations. Biopsy of the gastric mucosa revealed Helicobacter pylori.
Name the possible treatment regimens and justify them.

Case 2. A pregnant woman with complaints of intestinal disturbances (constipation) was prescribed a purgative drug. After administration, signs of preterm labor appeared.
Which purgative was prescribed to the pregnant woman?
What was the cause of the premature onset of labor?

Case 3. In a patient with gastric ulcer, the pain became acute. A drug was prescribed. The pain was considerably relieved, but xerostomia, palpitations, and visual disturbances appeared. Which drug was prescribed to the patient?

Summary on the topic:

DRUGS WITH ACTION ON CARDIOVASCULAR SYSTEM. DIURETICS. ANTI-GOUT PREPARATIONS. DRUGS USED IN NEPHROLITHIASIS AND IN ACID-BASE BALANCE DISORDERS. CEREBRAL AND PERIPHERAL VASODILATING MEDICINES. DRUGS USED IN MIGRAINE.

VENOTROPIC DRUGS.

A. Actuality. The medication of diseases of the internal organs occupies a special place in the practical activity of the doctor. In most cases, the treatment of pathologies of the cardiovascular and urinary systems is long-term and requires drugs from various pharmacological groups (especially in elderly patients). All this requires a deep study of the drugs in the respective groups.

B. The purpose of the training consists in consolidating students' knowledge about the drugs used in the treatment of cardiovascular and urinary system diseases, systematizing the material and forming the general concept of selecting drugs in the treatment of diseases and corresponding pathological conditions.

C. Learning objectives:

a. The student **must know:** the pharmacological characteristics of the groups of drugs (pharmacodynamics and pharmacokinetics) used in diseases of internal organs, the general principles of treatment of diseases of internal organs, emergency medical assistance.

b. The student **must be able to:** prescribe the mandatory drugs, indicate drugs in various diseases and emergency situations, apply the accumulated knowledge to solving situational problems.

D. Self-training questions:

1. Antitussives: classification, mechanism of action, indications, adverse reactions.
2. Expectorants: classification, mechanism of action, indications, adverse reactions.
3. Classification of drugs used in bronchial asthma:

a) Beta-adrenomimetics as anti-asthmatics: classification, mechanism of action, effects, indications, adverse reactions;
b) M-cholinoblockers as anti-asthmatics: classification, mechanism of action, effects, indications, adverse reactions;
c) Glucocorticoids as anti-asthmatics: classification, mechanism of action, effects, indications, adverse reactions;
d) Methylxanthines as anti-asthmatics: classification, mechanism of action, effects, indications, adverse reactions;
e) Mast cell degranulation inhibitors as anti-asthmatics: mechanism of action, effects, indications, adverse reactions.

4. Groups of drugs used in pulmonary edema: principles of action.
5. Classification of drugs used in heart failure.
6. Cardiac glycosides: classification by solubility and duration of action, mechanism of action, effects on the heart and their mechanisms, influence on systemic and regional hemodynamics, organs, and body systems.
7. Indications of cardiac glycosides, dosing principles. Cardiac glycoside intoxication: clinical picture and treatment.
8. Synthetic cardiotonics (non-glycosidic): classification, mechanism of action, indications, adverse reactions.

9. Cardiostimulant drugs: classification, mechanism of action, indications, adverse reactions.
10. Drugs that increase the sensitivity of contractile proteins to calcium ions: mechanism of action, indications, adverse reactions.
11. Classification of antihypertensive drugs (neurotropic, myotropic, affecting the renin-angiotensin-aldosterone system):
    a) Centrally acting antihypertensives: mechanism of action, antihypertensive effect, indications, adverse reactions;
    b) Beta-blockers as antihypertensives: mechanism of action, antihypertensive effect, indications, adverse reactions;
    c) Alpha-blockers as antihypertensives: classification, mechanism of action, antihypertensive effect, indications, adverse reactions;
    d) Calcium channel blockers as antihypertensives: classification by chemical structure, mechanism of action, antihypertensive effect, indications, adverse reactions;
    e) ACE inhibitors as antihypertensives: mechanism of action, antihypertensive effect, indications, adverse reactions;
    f) Angiotensin receptor blockers as antihypertensives: mechanism of action, antihypertensive effect, indications, adverse reactions;
    g) Drugs used in hypertensive crises: groups and mechanisms of action.
12. Classification of antihypotensive drugs by mechanism of action:
    a) Alpha and alpha-beta adrenomimetics as antihypotensives: mechanism of action, effects on vessels, heart, hemodynamics, microcirculation, indications, adverse reactions;
    b) Dopaminomimetics as antihypotensives: mechanism of action, effects, indications, adverse reactions;
    c) Beta-adrenomimetics as antihypotensives: mechanism of action, effects, indications, adverse reactions;
    d) Isothiourea derivatives as antihypotensives: mechanism of action, effects, indications, adverse reactions;
    e) Classification of antianginal drugs:
        a. Organic nitrates: mechanism of action, antianginal effect, indications, adverse reactions;
        b. Beta-blockers as antianginals: classification, mechanism of action, antianginal effect, indications, adverse reactions;
        c. Calcium channel blockers as antianginals: mechanism of action, antianginal effect, indications, adverse reactions.
13. Drugs used in angina attacks: mechanism of action, effects. Groups of drugs used in acute myocardial infarction treatment. Principles of action.
14. Classification of antiarrhythmic drugs by mechanism of action:
    a) Sodium channel blockers 1A: mechanism of action, effects, indications, adverse reactions;
    b) Sodium channel blockers 1B: mechanism of action, effects, indications, adverse reactions;
    c) Sodium channel blockers 1C: mechanism of action, effects, indications, adverse reactions;
    d) Beta-blockers as antiarrhythmics: mechanism of action, effects, indications;
    e) Calcium channel blockers as antiarrhythmics: mechanism of action, effects, indications, adverse reactions;
    f) Potassium channel blockers as antiarrhythmics (amiodarone): mechanism of action, effects, indications, adverse reactions, pharmacokinetics.
15. Classification of drugs affecting cerebral and peripheral circulation.
16. Classification of antimigraine drugs. Drugs used to stop a migraine attack: mechanisms of action. Drug groups used in migraine prophylaxis.
17. Venotropic drugs: classification. Drugs with mixed action (venotonic and venoprotective): effects, mechanisms of action, indications.

18. Classification of diuretics by mechanism of action, site of action in nephron, onset speed, and duration of effect:
    a) Osmotic diuretics: mechanism of action, effects, indications, adverse reactions;
    b) Loop diuretics: mechanism of action, effects, indications, adverse reactions;
    c) Thiazide and non-thiazide diuretics: mechanism of action, effects, indications, adverse reactions;
    d) Carbonic anhydrase inhibitors: mechanism of action, effects, indications, adverse reactions;
    e) Aldosterone antagonist diuretics (competitive): mechanism of action, effects, indications, adverse reactions;
    f) Non-competitive aldosterone antagonist diuretics: mechanism of action, effects, indications, adverse reactions.
19. Classification of antigout drugs.
20. Drugs with specific action in gout attacks: mechanism of action, indications, adverse reactions.
21. Uricostatic drugs in gout: mechanism of action, effects, indications, adverse reactions.
22. Uricosuric drugs in gout: mechanism of action, effects, indications, adverse reactions.
23. Drugs used in urolithiasis: classification, mechanism of action, indications, adverse reactions.
24. Classification of drugs used in water-electrolyte balance disorders. Saline solutions: mechanism of action, indications, adverse reactions.
25. Drugs used in acid-base balance disorders: classification, mechanism of action, indications, adverse reactions.
26. Classification of plasma volume substitutes:
    a) Dextrans: mechanism of action, effects, indications, adverse reactions;
    b) Starch derivatives: mechanism of action, effects, indications, adverse reactions;
    c) Polypeptide polymers and blood-derived drugs: mechanism of action, effects, indications, adverse reactions.
27. Substitution drugs in pancreatic hypofunction: classification, mechanism of action, effects, indications, adverse reactions.
28. Classification of drugs that inhibit gastric secretion:
    a) H2-histamine blockers as antisecretory drugs: mechanism of action, effects, indications, adverse reactions;
    b) Proton pump inhibitors as antisecretory drugs: mechanism of action, effects, indications, adverse reactions.
29. Antacids: classification, mechanism of action, indications, adverse reactions.
30. Gastroprotective and cytoprotective drugs: classification, mechanism of action, indications, adverse reactions.
31. Classification of antiulcer drugs.
32. Classification of drugs that increase gastrointestinal motility.
33. Prokinetic drugs: classification, mechanism of action, effects, indications.
34. Antiflatulent drugs: classification, mechanisms of action, indications.
35. Classification of laxative and purgative drugs:
    a) Bulk-forming laxatives: mechanism of action, effects, indications, adverse reactions;
    b) Emollient and lubricant laxatives: mechanism of action, effects, indications;
    c) Osmotic purgatives: mechanism of action, effects, indications, adverse reactions;
    d) Purgatives acting on the small and large intestines: mechanism of action, effects, indications, adverse reactions.
36. Classification of drugs that inhibit gastrointestinal motility.
37. Classification of antiemetics by group:
    a) Neuroleptics and H1-antihistamines as antiemetics: mechanism of action, indications;
    b) Dopamine and serotonin antagonists as antiemetics: mechanism of action, indications.

38. Classification of antidiarrheal drugs:
    a) Opioids as antidiarrheals: mechanism of action, indications, adverse reactions;
    b) Adsorbents, astringents, and mucilaginous drugs as antidiarrheals: mechanism of action, indications.
39. Classification of hepatotropic drugs.
40. Classification of drugs modifying bile secretion and excretion:
    a) Cholesecretory drugs: mechanism of action, effects, indications;
    b) Cholecystokinetic drugs: mechanism of action, effects, indications;
    c) Cholelitholytic drugs: mechanism of action, indications, adverse reactions.
41. Hepatoprotective drugs: classification, mechanisms of action, indications. Effects of silymarin, ademetionine, ursodeoxycholic acid.
42. Classification of smooth muscle antispasmodics (spasmolytics). Neurotropic and myotropic spasmolytics: mechanisms of action, indications.
43. Classification of antithrombotic drugs.
44. Classification of direct-acting anticoagulants.
45. Standard heparin preparations: mechanism of action, effects, indications, contraindications, adverse reactions, pharmacokinetics. Heparin antagonists.
46. Low molecular weight heparins: pharmacodynamic and pharmacokinetic characteristics, comparison with standard heparins, indications.
47. Direct thrombin inhibitors: classification, mechanism of action, effects, indications.
48. Factor Xa inhibitors: mechanism of action, effects, indications, adverse reactions.
49. Indirect-acting anticoagulants: classification by group and duration, mechanism of action, indications, adverse reactions. Comparative characteristics of indirect vs direct anticoagulants. Antagonists of indirect anticoagulants.
50. Antiplatelet drugs: classification, mechanisms of action, indications, including cyclooxygenase inhibitors, thromboxane A2 receptor blockers, purinergic and glycoprotein inhibitors.
51. Fibrinolytics: classification, mechanism of action, indications, adverse reactions.
52. Classification of hemostatic drugs.
53. Local-acting hemostatics: characteristics of vasoconstrictors, astringents, thrombin and thromboplastin activity.
54. Systemic-acting hemostatics.
55. Direct coagulants: mechanism of action, indications.
56. Indirect coagulants: mechanism of action, indications, adverse reactions.
57. Antifibrinolytics: classification, mechanism of action, indications, adverse reactions.
58. Aggregants: classification, mechanism of action, indications, adverse reactions.
59. Classification of antianemic drugs.
60. Drugs used in hypochromic (iron-deficiency) anemia: classification, pharmacokinetics, indications, adverse reactions.
61. Drugs used in vitamin B12-deficient megaloblastic anemia: pharmacodynamic and pharmacokinetic properties, indications.
62. Drugs used in folate-deficient megaloblastic anemia: pharmacodynamic and pharmacokinetic properties, indications.
63. Drugs used in hemolytic anemia: pharmacodynamic and pharmacokinetic properties.
64. Drugs used in hypo- or aplastic anemias with erythropoietin: pharmacodynamic properties, indications, adverse reactions.
65. Drugs affecting leukopoiesis: classification. Leukopoiesis stimulators: pharmacodynamic properties, indications, adverse reactions.
66. Classification of angioprotective drugs: mechanism of action, effects, indications of plant-derived, animal-derived, and synthetic preparations.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises.

To prescribe the following drugs in all medicinal forms: Nikethamide, Epinephrine, Ipratropium bromide, Aminophylline, Salbutamol, Cromoglicic acid disodium, Codeine, Ketotifen, Etimizole, Prenoxdiazine, Bromhexine, Acetylcysteine, Dextromethorphan, Strophanthin, Digitoxin, Digoxin, Corglycon, Amrinone, Levosimendan, Dobutamine, Nitroglycerin, Isosorbide dinitrate, Molsidomine, Nifedipine, Dipyridamole, Vinpocetine, Pentoxifylline, Nicotinyl xanthinate, Nicergoline, Cinnarizine, Sumatriptan, Ravimig, Piracetam, Troxerutin, Piricarbate, Quinidine, Procainamide, Lidocaine, Mexiletine, Flecainide, Verapamil, Amiodarone, Sotalol, Metoprolol, Propranolol, Clonidine, Methyldopa, Moxonidine, Azamethonium, Prazosin, Atenolol, Carvedilol, Nebivolol, Labetalol, Hydralazine, Sodium nitroprusside, Captopril, Enalapril, Losartan, Norepinephrine, Phenylephrine, Isoturon, Dopamine, Sodium caffeine benzoate, Mannitol, Furosemide, Torsemide, Hydrochlorothiazide, Indapamide, Spironolactone, Triamterene, Colchicine, Etibenzamide, Allopurinol, Cystenal, Ammonium chloride, Sodium bicarbonate, Dextran-40, Dextran-70, Sodium chloride, Potassium chloride, Calcium chloride, Rehydron, Hydroxyethyl starch (Refortan), Tromethamine, Sulfinpyrazone, Pancreatin, Creon, Famotidine, Omeprazole, Almagel, Sucralfate, Colloidal bismuth subcitrate, Regesan, Aprotinin, Metoclopramide, Simethicone, Magnesium sulfate, Bisacodyl, Picosulfate, Thiethylperazine, Ondansetron, Lactulose, Macrogol, Loperamide, Enterol, Bactisubtil, Essentiale, Ademetionine, Silymarin, Ursodeoxycholic acid, Colosas, Papaverine hydrochloride, Drotaverine, Atropine sulfate, Platyphylline hydrotartrate, Baralgin, Heparin, Nadroparin, Enoxaparin, Protamine sulfate, Ethyl biscumacetate, Warfarin, Alteplase, Streptokinase, Ticlopidine, Acetylsalicylic acid, Fibrinogen, Menadione, Aminocaproic acid, Aprotinin, Ferrous sulfate, Fercoven, Cyanocobalamin, Folic acid, Sodium nucleinate.

2) List the groups and drugs used in (for): Neonatal asphyxia, irritant and dry cough in acute respiratory infections, secretolytics in bronchial obstructive diseases during exacerbation, mucolytics in cystic fibrosis, mild asthma attacks, bronchodilators in the systematic treatment of bronchial asthma, secretostimulants in acute respiratory infections, asthmatic status (status asthmaticus), decompensated chronic heart failure, chronic congestive heart failure, tachysystolic atrial fibrillation, cardiac glycoside intoxication, acute myocardial infarction, cardiac arrest, membrane-stabilizers in supraventricular and ventricular arrhythmias, cardiogenic shock, relief of angina pectoris attacks, prophylaxis of angina pectoris attacks, first-line drugs reducing oxygen demand and increasing oxygen supply in angina pectoris, second-line drugs reducing oxygen demand and increasing oxygen supply in angina pectoris, pain control in acute myocardial infarction, thrombosis prophylaxis in acute myocardial infarction, migraine attacks, migraine treatment, hypertensive encephalopathy, vestibulo-cochlear disorders, ischemic stroke, chronic cerebral circulatory insufficiency, post-traumatic brain sequelae, Raynaud's syndrome, obliterative endarteritis, cerebral atherosclerosis, ischemic ophthalmologic disorders, chronic venous insufficiency, trophic ulcers of the lower limbs, ventricular tachyarrhythmias of sympatho-adrenal (neurogenic) type, atrial flutter and tachysystolic atrial fibrillation, ventricular fibrillations, severe ventricular arrhythmias refractory to other antiarrhythmics, arrhythmias caused by cardiac glycoside overdose, ventricular arrhythmias in myocardial infarction, sinus bradycardia, atrioventricular block, hypertensive crisis, treatment of pheochromocytoma, mild arterial hypertension, hypertensive emergencies, arterial hypertension with arrhythmias, secondary arterial hypertension

due to hyperaldosteronism, arterial hypertension with hyper-reninemia, hemorrhagic hypotension, hypotension due to CNS depressant overdose, cardiogenic shock with hypotension, neurovegetative dystonias, hypotension resistant to sympathomimetics, orthostatic hypotension, acute rhinitis, hypovolemic shock, essential arterial hypotension, cerebral edema, pulmonary edema, acute renal failure, chronic renal failure, acute intoxication, forced diuresis, essential arterial hypertension, glaucoma, gout attack, prophylaxis (treatment) of gout, uricostatic in gout, uricosurics in gout, urine alkalinization in urolithiasis, urine acidification in urolithiasis, in acidosis, in alkalosis, isotonic dehydration, hypotonic dehydration, hypertonic dehydration, detoxification in peritonitis, detoxification in foodborne toxic infections, acute arterial hypotension, hypokalemia, hypocalcemia, hypoacid gastritis, reflux esophagitis, Zollinger-Ellison syndrome, antisecretory drugs in gastric and duodenal ulcer, antacids in duodenal ulcer, acute pancreatitis, chronic pancreatitis, dietary abuse, gastroprotectives in gastric and duodenal ulcer, gastric hypomotility, chronic functional constipation, chronic constipation, hepatic encephalopathy, bowel evacuation in surgical emergencies (acute constipation), preparation for radiologic and endoscopic examination of the digestive tract, preoperative preparation, drug or food intoxications, postoperative meteorism, flatulence and meteorism in digestive diseases, drug-induced vomiting, motion sickness vomiting, vomiting induced by cytostatics and radioprotectors, acute nonspecific diarrhea, toxic drug-induced hepatitis, hepatocolecystitis, cholelithiasis, biliary colic, intestinal colics, treatment and prophylaxis of deep vein thrombosis, treatment and prophylaxis of pulmonary artery thromboembolism, disseminated intravascular coagulation, overdose of indirect-acting anticoagulants, overdose of direct-acting anticoagulants, prevention of postoperative thromboembolisms, prophylaxis of peripheral arterial thrombosis, thrombosis prophylaxis in myocardial infarction, prophylaxis of thromboembolisms in atrial fibrillation, prophylaxis of cerebrovascular accidents, stopping parenchymal and capillary hemorrhage, hemophilia, gastrointestinal and pulmonary hemorrhages, hemorrhages caused by hyperfibrinolysis, iron-deficiency anemia, vitamin B12-deficient anemia, folate-deficient anemia, aplastic anemia, hemolytic anemia, leucopenia.