CARDIOTONIC AND CARDIOSTIMULATOR DRUGS

A. Actuality. Decompensation of chronic heart failure and chronic heart failure is a frequent cause of emergencies and the death of patients with cardiovascular, pulmonary, neurological diseases. The pathogenesis of heart failure is complex, which requires the use of a wide range of inotrope-positive drugs, vasodilators, diuretics, etc.

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

C. Didactic purposes.

1) The student **must know**: classification, mechanism of action, effects, indications, contraindications and adverse reactions of inotropic-positive drugs.
2) 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 physiological properties of the myocardium (automaticity, excitability, contractility, conductivity). The excito-conductive system of the heart. Characterization of inotropic-positive, chronotropic-negative, bathmotropic-positive, dromotropic-negative and tonotropic-positive actions. The influence of the sympathetic and parasympathetic autonomic nervous system on the activity of the heart.

Pathophysiology. Heart failure indexes. Tonogenic and myogenic dilation of the heart. Dysregulation of heart rhythm (automaticity, excitability, contractility and conductivity). Myocardial hypertrophy, types and mechanism of evolution.

E. Questions for self-training:

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 features of cardiac glycosides (digitoxin, digoxin and strophanthin(ouabain)).
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. **Student's individual work** (is made in writing during the training process)

1) Medical prescription exercises

To prescribe the following drugs in all forms of delivery**:**

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; poisoning with cardiac glycosides; cardiostimulants in acute myocardial infarction; cardiogenic shock; cardiac arrest; groups of vasodilators used in heart failure; diuretics in chronic heart failure.

G. Individual work to consolidate knowledge

1) Tests (Guide for laboratory works in pharmacology).

2) Tables

Table 1

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

Pharmacological groups	Drugs	Pozitive inotrop-Mecanism of 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) Hydrosoluble (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 (Guide for laboratory work in pharmacology).

3. Virtual situations (Guide for laboratory work in pharmacology).

ANTIARRHYTHMIC DRUGS

A. Actuality. Cardiac arrhythmias are some of the most common symptoms of cardiovascular diseases, 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:

1) 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.

2) 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. Heart – functional anatomy, abnormalities.

Histology and embryology. Heart. Development, structure, histophysiology. Age-related changes in the heart.

Biophysics. Bioelectric phenomena. Membrane potential.

Biochemistry. Structural organization of biological membranes.

Physiology. Rhythmic excitement of the heart. Normal electrocardiogram. The principles of vector analysis of the electrocardiogram. Electrocardiographic interpretation of cardiac conditions.

Toxicology. Toxins and drugs that cause cardiac arrhythmias.

The pathophysiology. Pathogenic chain of compensatory reactions and blood circulation disturbances in heart rhythm disorders.

Semiology - internal medicine. Tachycardia, bradycardia, sinus arrhythmia, extrasystole, atrial and ventricular flutter, atrial and ventricular fibrillation, atrioventricular block.

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. Indications, contraindications and precautions, adverse reactions, pharmacokinetics;
   b. Subclass IB (lidocaine group): antiarrhythmic effect, indications, contraindications and precautions, adverse reactions, pharmacokinetics;
   c. 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: antiarrhythmic effect, influence on the heart. The indications.
9. Antiarrhythmic drugs from various groups (analogues of nucleosides, cardiac glycosides, potassium drugs, magnesium drugs, etc.)
10. Antiarrhythmic drugs used in brady arrhythmias and atrioventricular block: classification, mechanism of action, effects, indications.

F. **Student's individual work** (is made in writing during the training process)

1) Medical prescription exercises

To prescribe the following drugs in all forms of delivery**:**

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 to consolidate knowledge

1) Tests (Guide for laboratory work in pharmacology).

2) Tables

Table 1

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.

Table 2

The comparative characteristic of antiarrhythmic preparations

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.

H. Interactive activity

1. **Experimental and virtual didactic movie** (elaboration of minutes, conclusions)
2. **Clinical cases** (Guide for laboratory works in pharmacology).
3. **Virtual situations** (Guide for laboratory works in pharmacology).

ANTIANGINAL DRUGS

A. Actuality. Ischemic heart diseases (ischemic heart disease or coronary insufficiency) are the most frequent causes of disability and mortality of patients. For the treatment of these pathologies, are used drugs that improve the work of the heart and coronary circulation, blood coagulability 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 in all forms of delivery the mandatory preparations from this group and list the groups and drugs in the respective diseases and pathological conditions.

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

Human anatomy. Vascularization and innervation of the heart. Functional anatomy of the cardiovascular system.

Histology and embryology. Cardiovascular system. Blood vessels. The general principles of structure. Arteries. The vessels of the microcirculatory bed. The veins. Heart. Development, structure, histophysiology.

Physiology. Cardiac output, venous return and their regulation. Muscle blood flow and cardiac output in exercise, coronary circulation.

Pathophysiology. Etiology, pathogenesis, compensatory reactions and manifestations of cardiogenic-non-coronarogenic, coronarogenic, metabolic, hematogenous circulatory insufficiency.

Semiology - internal medicine. Notion about ischemic heart diseases. Risk factors of ischemic heart diseases. The main clinical forms of angina pectoris (stable, unstable, mixed, vasospastic angina (Prinzmetal). Acute myocardial infarction.

E. Self-training questions:

1. Definition and classification of antianginal drugs.
2. Drugs that decrease myocardial oxygen demand and increase oxygen supply: classification.
3. Organic nitrates. Molecular and systemic mechanism of action, pharmacological effects. Indications. Contraindications. Adverse reactions (early and late). Pharmacokinetics.
4. Sydnones (molsidomine group): molecular and systemic mechanism of action, pharmacodynamic advantages, indications, adverse reactions.
5. Calcium channel blockers: classification, molecular and systemic mechanism of action, pharmacological effects. Indications. Contraindications. Adverse reactions. Pharmacokinetics.
6. Second-line antianginal drugs: antianginal action and indications of ivabradine, ranolazine, nicorandil.
7. β-adrenergic blockers as antianginal drugs: classification, antianginal effect. Indications. Contraindications. Adverse reactions.
8. Drugs that increase oxygen supply (coronary vasodilators): mechanisms of action, effects, indications.
9. Cardioprotective drugs: mechanism of action, antianginal effect, indications.
10. Groups of drugs used for the treatment of acute myocardial infarction. Principles of action.

F. Student's individual work (is made in writing during the training process)

1) Medical prescription exercises

To prescribe the following drugs in all forms of delivery:
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.	**Dipiridamol**	Tabl/ Dragee 0,025; 0,075 Sol. 0,5% - 2 ml in amp.

2) List the groups and drugs used in (for): treatment of angina pectoris attacks; prophylaxis of angina pectoris attacks; 1st line medicines that are used in treatment of angina pectoris; 2nd line medicines that are used in treatment of angina pectoris; drugs to reduce the need for oxygen in angina pectoris; cardioprotective drugs in angina pectoris; pain relief in acute myocardial infarction; fear relief in acute myocardial infarction; thrombosis prophylaxis in acute myocardial infarction.

G. Individual work to consolidate knowledge

1) Tests (Guide for laboratory work in pharmacology).

2) Tables

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	Nitrogly-cerine	Propranol ol	Nifedipine	Verapamil	Dipiridamol
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

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 4

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				
Increased 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 movie (**elaboration of minutes, conclusions).
2. **Clinical cases** (Guide for laboratory works in pharmacology).
3. **Virtual situations** (Guide for laboratory works in pharmacology).

ANTIHYPERTENSIVE AND ANTIHYPOTENSIVE DRUGS

A. Actuality. According to WHO data, high blood pressure is among the disease that lead to disability and death. For the treatment of this pathology, a wide range of drugs is used, which requires deep knowledge of the pharmacological properties of antihypertensive drugs.

The treatment of acute arterial hypotension, frequently encountered in practice, surgical interventions, etc., requires special attention and complex urgent treatment. Thus, a more thorough research of the existing medicinal drugs is necessary, as well as the development of new, more effective and more acceptable drugs in the medication of hypotensive states.

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, mechanisms of action, effects, indications, contraindications and adverse reactions of antihypertensive and antihypotensive drugs.

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. Cardiovascular system (heart, arteries, veins and capillaries). Structural peculiarities of blood vessels. Arteries and veins of the large and small circuit. Congenital malformations of the major blood vessels.

Histology. The structure of the muscular, musculo-elastic and elastic arteries. The functional importance of muscular and fibrous (muscular) veins.

Human physiology. Hemodynamics. Blood circulation speed. Laminar and turbulent circulation. Blood pressure as a physiological constant of the body. Functional blood pressure self-regulation system. The afferent and effector influence of the vasomotor centers. The role of the vegetative nervous system and hormones in the mechanisms of extrinsic regulation of cardiac activity and the mechanisms of maintaining arterial pressure.

Biochemistry. Peculiarities of smooth muscle metabolism. The pathophysiology. The pathogenesis of essential hypertension, symptomatic hypertension. Acute arterial hypotension: collapse, shock.

Semiology of internal diseases. Hypertension. Notion about hypertension of the small circuit. Classification and clinical forms of arterial hypertension. General principles of treatment.

E. **Self-training questions:**

1. Classification of antihypertensives (neurotropic, musculotropic drugs, drugs that regulate hydrosaline metabolism, inhibitors of the renin-angiotensin-aldosterone system).
2. Classification of neurotropic antihypertensive drugs.

a) Neurotropic antihypertensive drugs with central action: classification, mechanisms of action, pharmacological effects, indications, adverse reactions.

b) Neurotropic antihypertensive drugs with peripheral action: classification.

- Ganglioplegics: mechanism of action, antihypertensive effect, indications.
- Sympatholytics: mechanisms of action, antihypertensive effect, indications.
- a-adrenoblockers: classification, mechanism of action, effects, indications, adverse reactions.
- β-adrenoblockers: classification, mechanism of action, effects, indications, adverse reactions.
- a, 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) Myotropic antihypertensives with direct action: classification. Arteriodilators: mechanism of action, effects.

c) Nitric oxide donors: mechanism of action, effects, indications, adverse reactions.

d) Calcium channel blockers: mechanism of action, effects, indications, adverse reactions.

4. Diuretics as antihypertensives: mechanism of action, indications, adverse reactions.
5. Antihypertensive drugs with influence on the renin-angiotensin-aldosterone system: classification.

a) Converting enzyme inhibitors: mechanism of action, effects, indications, adverse reactions.

b) Angiotensin receptor blockers: mechanism of action, effects, indications, adverse reactions.
c) Renin antagonists: mechanism of action, effects, indications, adverse reactions.
6. Drugs used in hypertensive crises and hypertensive emergencies. Characteristic.
7. The general principles of hypertension treatment.
8. Classification of antihypotensive (hypertensive) drugs according to the mechanism
9. Vasoconstrictor antihypotensives: classification.
a) alpha and alpha, beta-adrenomimetics: mechanism of action, antihypotensive effect, indications, adverse reactions.
b) isothiourea derivative: mechanism of action, effects, indications, contraindications, adverse reactions.
c) vasoactive peptides: mechanisms of action, effects, indications, adverse reactions.
d) vasoconstrictor drugs with central action: bulbar stimulants, particularities of action and use, adverse reactions.
e) CNS stimulants (methylxanthines): mechanism of action, influence on the heart, vessels, blood pressure, indications, adverse reactions.
10. Antihypotensive drugs with influence on the heart: classification.
a) dopaminomimetics: effects, indications, adverse reactions.
b) beta-1-adrenomimetics: effects, indications, adverse reactions.
11. Antihypotensives with permissive action: the particularities of the antihypotensive action of glucocorticoids.
12. Plasma volume substitutes: mechanism of action, effects, indications.

F. **Student's individual work** (is made in writing during the training process)

1) Medical prescription exercises

To prescribe the following drugs in all forms of delivery**:**

1. Azamethonium. 2. Caffeine sodium benzoate. 3. Captopril. 4. Carvedilol. 5. Clonidine. 6. Dobutamine. 7. Dopamine. 8. Enalapril. 9. Epinephrine. 10. Phenylephrine. 11. Hydralazine. 12. Isoturon. 13. Labetalol. 14. Losartan. 15. Methyldopa. 16. Metoprolol. 17. Moxonidine. 18. Nebivolol. 19. Nifedipine. 20. Sodium nitroprusside. 21. Norepinephrine. 22. Prazosin. 23. Propranolol

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.	Metoprolol	Tablets 0.025; 0.05; 0.1 Sol. 0.1% - 5 ml in ampoules
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; pheochromocytoma treatment; neurotropic drugs with central action in arterial hypertension; peripheral neurotropic drugs in arterial hypertension; musculotropic drugs in hypertension; inhibitors of renin-angiotensin-aldosterone system in arterial hypertension; converting enzyme inhibitors in arterial hypertension, arterial hypertension with arrhythmias, arterial hypertension with hyperaldosteronism, arterial hypertension with hyperreninemia, vasoconstrictors with central action in arterial hypotension; peripheral vasoconstrictors in arterial hypotension; cardiostimulators in arterial hypotension; hemorrhagic hypotension, cardiogenic shock with hypotension, hypotension resistant to sympathomimetics, orthostatic hypotension caused by ganglioblockers and alpha-adrenoblockers; hypovolemic shock, chronic arterial hypotension.

G. Individual work to consolidate knowledge

1) Tests (Guide for laboratory work in pharmacology).

2) Tables

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 bromide				
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		CEI	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 movie (elaboration of minutes, conclusions).
2. Clinical cases (Guide for laboratory works in pharmacology).
3. Virtual situations (Guide for laboratory works in pharmacology).

CEREBRAL AND PERIPHERAL VASODILATOR DRUGS. DRUGS USED IN MIGRAINE. VENOTROPIC DRUGS.

A. Actuality . Cerebral and peripheral circulation disorders constitute a considerable weight in medical practice, and for their treatment multiple groups of drugs are used with influence on vascular tone, blood coagulability, metabolic and energetic processes. Migraine affects a considerable part of the population, able to work, and constitutes a major emergency problem and the prophylaxis of migraine attacks using a wide variety of drugs. Venous pathology, caused by a wide variety of factors, requires a multilateral approach by using preparations with influence on vascular tone, vascular elasticity and permeability, coagulability and metabolic processes.

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

C. Learning objectives:

a) The student **must know**: definition, classification, mechanism of action, effects, indications, contraindications and side effects of cerebral and peripheral vasodilators, antimigraine and venotropic preparations.

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. Arteries, veins, anastomoses of cerebral vessels.
Histology. Cytochemical and functional peculiarities of the brain.
Human physiology. Physiology of cerebral and peripheral circulation.
The pathophysiology. Parameters of cerebral circulation insufficiency.
Semiology of internal diseases. Notion about dyscirculatory encephalopathy, migraine.

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

F. **Student's individual work** (is made in writing during the training process)

1) Medical prescription exercises

To prescribe the following drugs in all forms of delivery**:**

1. Vinpocetine . 2. Pentoxifylline . 3. Xantinol nicotinate . 4. Nicergoline . 5. Cinnarizine . 6. Sumatriptan . 7. Troxerutin .

No.	***The name of the drug***	***Medicinal form, dose***
1.	**Pentoxifylline**	Tablets 0.2; 0.4 Sol. 2% - 5 ml in ampoules
2.	**Nicergoline**	Tablets 0.005; 0.01 Lyophilized powder 0.004 in ampoules
3.	**Xanthinol nicotinate**	Tablets 0.15 Sol. 15% - 2 ml in ampoules
4.	**Vinpocentine**	Tablets 0.01 Sol. 0.5% - 2 ml in ampoules
5.	**Sumatriptan**	Tablets/Capsules 0.05; 0.1 Sol. 1.2% - 0.5 ml in pre-filled syringes (subcutaneous) Aerosol 2 ml (intranasal)
6.	**Troxerutin**	Capsules 0.3 Gel 2%-100.0
7.	**Cinnarizine**	Tablets/ Capsules 0.025

2.) List the groups and drugs used in (for): migraine attacks, migraine prophylaxis, vestibulocochlear disorders , acute stroke, chronic cerebral circulatory insufficiency, Raynaud's syndrome , obliterating endarteritis, chronic venous insufficiency, trophic ulcers of the lower limbs.

G. Individual work to consolidate knowledge

1) Tests (Guide for laboratory work in pharmacology).

2) Tables

H. Interactive activity

1. Experimental and virtual didactic movie (elaboration of minutes, conclusions).

2. Clinical cases (Guide for laboratory works in pharmacology).

3. Virtual situations (Guide for laboratory works in pharmacology).

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 aim 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:

1) 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.

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

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

Anatomy. Functional anatomy of the urinary system.

Histology. The structure of nephron. The morphofunctional bases of regulation of the urine formation process. Development, structure, histophysiology of the urinary system.

Physiology. The main mechanisms of urine excretion (formation). Acid-base status and hydro-electrolyte balance.

Biochemistry. Disorders of glomerular filtration, tubular reabsorption and secretion. Biochemistry of urine formation. Kidney stones, their structure, and mechanism of formation.

Pathophysiology. Disorders of hydro-electrolytic and acid-base balance. Pathogenesis of edema and hypovolemia. Iso-, hypo- and hyperosmolar hyperhydration and dehydration. Dysmineraloses (hyper- and hyponatremia, hyper- and hypokalemia, hyper- and hypocalcemia, hyper- and hypochloremia, hyper- and hypophosphatemia). Manifestations of acid-base imbalance (acidosis and alkalosis (respiratory, metabolic, excretory, exogenous).

E. Self-training questions:

1. Diuretics. The notion of diuretics and saluretics.
2. Classification of diuretics according to the mechanism of action, place of action in the nephron, and duration of action.
3. Diuretics with predominant influence on the proximal convoluted tube. Carbonic anhydrase inhibitors: mechanism of action, pharmacological effects, indications, contraindications, adverse reactions.
4. Diuretics with a predominant influence on the ascending portion of the loop of Henle (saluretics): mechanism of action, pharmacological effects, indications, contraindications, adverse reactions.
5. Drugs with influence on the cortical segment of the loop of Henle and the distal convoluted tube. Thiazide and related (non-thiazide) diuretics: mechanism of action, pharmacological effects, indications, contraindications, adverse reactions.
6. Diuretics with predominant influence on the terminal segment of the distal convoluted tube and the collecting tube. Competitive and non-competitive aldosterone antagonists: mechanisms of action, pharmacological effects, indications, contraindications, adverse reactions.
7. Drugs with action throughout the entire nephron, but mainly in the proximal tubules. Osmotic diuretics: mechanism of action, pharmacological effects, indications, contraindications, adverse reactions.
8. Drugs used in the treatment of gout. Classification. Drugs with specific action used in gout crisis: mechanism of action, pharmacological effects, indications, adverse reactions. Classification of drugs used in the prophylaxis (treatment) of gout. Mechanism of action, pharmacological effects, indications and adverse reactions of uricoinhibitors, uricosurics and uricolytics.
9. Classification of drugs used in urolithiasis.

10. Classification of drugs used in hydro-electrolytic balance disorders. Crystalloid solutions used in isotonic, hypotonic and hypertonic dehydrations: pharmacological properties, indications, contraindications, adverse reactions. Drugs used to correct hypokalemia, hypomagnesemia, hypocalcemia.
11. Classification of drugs used in acid-base balance disorders and drugs used in the treatment of acidosis and alkalosis states.
12. Classification of plasma volume substitutes (expanders).
13. Dextrans as plasma volume substitutes: classification, pharmacological properties, indications, contraindications, adverse reactions.
14. Hydroxyethylstarch drugs as plasma volume substitutes: pharmacological properties, indications, contraindications, adverse reactions.
15. Polypeptide polymer drugs as plasma volume substitutes: pharmacological properties, indications, contraindications, adverse reactions.
16. Blood preparations as plasma volume substitutes: pharmacological properties, indications, contraindications, adverse reactions.

F. Student's individual work (is made in writing during the training process)

1) Medical prescription exercises

To prescribe the following drugs in all forms of delivery:

1. Mannitol. 2. Furosemide. 3 Torasemide. 4. Hydrochlorothiazide. 5. Indapamide. 6. Spironolactone. 7. Triamteren. 8. Eplerenone. 9. Colchicine. 10. Allopurinol. 11. Cystenal. 12. Ammonium chloride. 13. Potassium chloride. 14. Sodium bicarbonate. 15. Dextran-40. 16. Polyvinylpyrrolidone (Neohemodes). 17. Sodium chloride. 18. Calcium chloride. 19. Rehydron. 20. Hydroxyethylstarch (refortan). 21. Albumin. 22. Succinylated gelatin (gelofusin).

	Name of drug	***Form of delivery, dose***
Nr.		
1	**Mannitol**	Sol. in vials 20%-250ml and 500ml (intravenous)
2	**Furosemide**	Tablets 0,04 Sol. in ampoules 1%-2ml (intravenous, intramuscularly)
3	**Torasemide**	Tablets 0,005 and 0,01 Sol. in ampoules 0,5% -2 ml (intravenous)
4	**Hydrochlorothiazide**	Tablets 0,025 and0,05
5	**Indapamide**	Tablets 0,0025; 0,0015 Capsules 0,0025
6	**Spironolactone**	Tablets 0,025; 0,05 Capsules 0,025; 0,05
7	**Triamteren**	Capsules 0,05
8	**Eplerenone**	Tablets 0,025; 0,05
9	**Colchicine**	Tablets 0,001
10	**Allopurinol**	Tablets 0,1; 0,15; 0,2 and 0,3
11	**Cystenal**	Solution (oral drops) 10 ml in vials
12	**Ammonium chloride**	Sol. 5%-200ml in vials (internaly)
13	**Potassium chloride**	Tablets 0,5; 1,0 Sol. 4%-10ml in ampoules (intravenous)
14	**Sodium bicarbonate**	Sol. 4%-200ml in vials (intravenous) Powder 50.0 (internal use)
15	**Dextran-40**	Sol. 10%-100 ml in vials (intravenous)
16	**Polyvinylpyrrolidone**	Sol. 6% -200ml; 400ml in vials (intravenous)
17	**Sodium chloride**	Sol.0,9%-100; 500ml in vials (intravenous) Sol. in ampoules 0,9%-5;10ml (intravenous)
18	**Calcium chloride**	Sol.10%-5ml in ampoules Sol.10%-100; 200 ml in vials (intravenous)
19	**Rehydron**	Powder for oral solution in packets 18.9

20	**Hydroxyethylstarch**	Sol.10%-250ml in vials (intravenous)
21	**Albumin**	Sol. 20% -50 ml; 100 ml; 250 ml in vials (intravenous)
22	**Succinylated gelatin**	Sol. 4% -100 ml in vials (intravenous)

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 (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 to consolidate knowledge

1) Tests (Guide for laboratory work in pharmacology).

2) Tables

Table 1

Localization of the predominant action of diuretics and their mechanism of action

Location of action	**Drugs**	**Mechanism of action**
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

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 3

Adverse reactions of diuretics

Adverse reactions	**Hydrochlorothiazide**	**Furose-mide**	**Acetazolami-de**	**Triamteren**	**Spironolac-tone**
Hypokalemia					
Hyperkalemia					
Hyperuricemia					
Hyperglycemia					
Ototoxicity					
Haematotoxicity					
Gynecomastia					
Hypotension					
Hepatotoxicity					
Acidosis					
Alkalosis					

Table 4

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 movie** (elaboration of protocol, conclusions).
2. **Clinical cases.** (Guide for laboratory works in pharmacology)
3. **Virtual situations** (Guide for laboratory work in pharmacology)

IV TH CONCLUDING

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

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:

1) 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.
2) 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. Classification of drugs used in heart failure.
2. Cardiac glycosides: classification by solubility and duration of action, mechanism of action, influence on cardiac parameters (inotropic-positive, batmotropic-positive, dromotropic-negative, chronotropic-negative, tonotropic-positive action) and mechanisms of these phenomena. Electrocardiography (ECG) changes when using cardiac glycosides in therapeutic doses.
3. Influence of cardiac glycosides on systemic and regional hemodynamics, CNS, kidney, respiratory system and gastrointestinal tract.
4. Pharmacokinetics of cardiac glycosides. Indications of cardiac glycosides. Dosing principles.
5. Poisoning with cardiac glycosides. Clinical picture and treatment.
6. Non-glycosidic (synthetic, non-steroidal) cardiotonics. Classification, mechanisms of action, effects, indications, adverse reactions.
7. Cardiostimulators (α,β and β-adrenomimetics, dopaminomimetics): classification, mechanisms of action, effects, indications, adverse reactions.
8. Drugs that increase the sensitivity of contractile proteins to calcium ions. Mechanisms of action, effects, indications, contraindications and adverse reactions.
9. Classification of antiarrhythmic drugs.
10. Drugs that block ion channels of cardiomyocytes, classification:
11. Sodium channel blockers (membrane stabilizers): mechanism of action.
    - ✓ Class IA (quinidine group): antiarrhythmic effect, influence on conductivity, contractility, excitability, automatism. Indications, adverse reactions;
    - ✓ Class IB (lidocaine group): antiarrhythmic effect, indications, adverse reactions, pharmacokinetics;
    - ✓ Class IC (flecainide group): antiarrhythmic effect, indications, side effects, pharmacokinetics.
12. Calcium channel blockers (class II): antiarrhythmic effect, indications, adverse reactions.
13. Potassium channel blockers (drugs that mainly increase the effective refractory period - class III). Amiodarone: antiarrhythmic and antianginal effect, indications, side effects, pharmacokinetics. The particularities of sotalol and bretylium tosylate.
14. Drugs that reduce the tone of adrenergic innervation: classification.
15. Beta-adrenoblockers: classification, antiarrhythmic effect, influence on the heart, indications.
16. Antiarrhythmic drugs from various groups (nucleoside analogues, cardiac glycosides, potassium preparations, magnesium preparations, etc.)
17. Antiarrhythmic drugs used in bradyarrhythmias and atrioventricular block: classification, mechanism of action, effects, indications.
18. Classification of antianginal drugs:
19. Drugs that reduce the myocardial need for oxygen and increase oxygen supply: classification:
    - ✓ Organic nitrates. Mechanism of action at molecular and systemic level, pharmacological effects. The indications. Adverse reactions. Pharmacokinetics.
    - ✓ The sydnonimines: the mechanism of action at the molecular and systemic level, the pharmacodynamic advantages, the indications, the adverse reactions.
    - ✓ Calcium channel blockers: classification, mechanism of action at molecular and systemic level, pharmacological effects. The indications. Adverse reactions.
20. Second-line antianginal drugs: antianginal action and indications of ivabradin, ranolazine, nicorandil.
21. Beta-adrenoblockers as antianginal: classification, antianginal effect. The indications. Adverse reactions.
22. Cardioprotective drugs: mechanism of action, antianginal effect, indications.
23. Groups of drugs used for the treatment of acute myocardial infarction. The principles of their action.
24. Classification of antihypertensives (neurotropic drugs, musculotropic drugs, drugs regulating hydrosaline metabolism, renin-angiotensin inhibitors).
25. Neurotropic antihypertensive drugs with central action: classification, mechanisms of action, pharmacological effects, indications, adverse reactions.

26. Neurotropic antihypertensive drugs with peripheral action: classification.

- Ganglioplegics: mechanism of action, antihypertensive effect, indications.
- Sympatholytics: mechanisms of action, antihypertensive effect, indications.
- α-adrenoblockers: classification, mechanism of action, effects, indications, reactions adverse.
- β-adrenoblockers: classification, mechanism of action, effects, indications, adverse reactions.
- αβ-adrenoblockers: mechanism of action, effects, indications, adverse reactions.

27. Musculotropic antihypertensive drugs: classification.
    - ✓ Potassium channel activators: mechanism of action, effects, indications, adverse reactions.
    - ✓ Myotropic antihypertensives with direct action: classification. Arteriodilators: mechanism of action, effects.
    - ✓ Nitric oxide donors: mechanism of action, effects, indications, adverse reactions.
    - ✓ Calcium channel blockers: mechanism of action, effects, indications, adverse reactions.
28. Antihypertensive drugs with influence on the renin-angiotensin-aldosterone system: classification.
    - ✓ Converting enzyme inhibitors: mechanism of action, effects, indications, adverse reactions.
    - ✓ Angiotensin receptor blockers: mechanism of action, effects, indications, adverse reactions.
    - ✓ Renin antagonists: mechanism of action, effects, indications, adverse reactions.
29. Groups and drugs used in hypertensive crises and hypertensive emergencies. Characteristic.
30. Classification of antihypotensive (hypertensive) drugs according to the mechanism of action.
31. Vasoconstrictor antihypotensives: classification.
    - ✓ alpha and alpha, beta-adrenomimetics: mechanism of action, antihypotensive effect, indications, adverse reactions.
    - ✓ isothiourea compounds: mechanism of action, effects, indications, adverse reactions.
    - ✓ vasoactive peptides: mechanisms of action, effects, indications, adverse reactions.
    - ✓ CNS stimulants (methylxanthines): mechanism of action, influence on the heart, vessels, blood pressure, indications, adverse reactions.
32. Antihypotensive drugs with influence on the heart: classification.
    - ✓ dopaminomimetics: effects, indications, adverse reactions.
    - ✓ beta-1-adrenomimetics: effects, indications, adverse reactions.
33. Antihypotensives with permissive action: the particularities of the antihypotensive action of corticosteroids.
34. Classification of drugs used in cerebral and peripheral circulatory disorders.
35. 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.
36. Neurotropic vasodilators:
    d) ergot alkaloids : mechanism of action, effects, indications and side effects;
    e) α-adrenoblockers : mechanism of action, effects, indications and side effects;
    f) antiserotonin drugs : mechanism of action, effects, indications and side effects.
37. Classification of antimigraine drugs . Drugs used in migraine relief : mechanisms of action. Groups of drugs used in migraine prophylaxis.
38. Venotropic preparations: classification. Mixed-action preparations (venotonic and venoprotective) : effects and mechanisms of action, indications.
39. Classification of diuretics according to the mechanism of action, place of action in the nephron, onset of action and duration of action.
40. Carbonic anhydrase inhibitors: mechanism of action, pharmacological effects, indications, adverse reactions.
41. Loop diuretics: mechanism of action, pharmacological effects, indications, adverse reactions.

42. Thiazide and thiazide-like diuretics: mechanism of action, pharmacological effects, indications, adverse reactions.
43. Competitive and non-competitive antagonists of aldosterone: mechanisms of action, pharmacological effects, indications, adverse reactions.
44. Osmotic diuretics: mechanism of action, pharmacological effects, indications, contraindications, adverse reactions.
45. Anti-gout drugs. Classification:
    a) Medicines with specific action used in gout crisis: mechanism of action, pharmacological effects, indications, adverse reactions.
    b) Medicines used in the prophylaxis (treatment) of gout. Mechanism of action, pharmacological effects, indications and adverse reactions of uricoinhibitors, uricosurics and uricolytics.
46. Classification of drugs used in urolithiasis.
47. Classification of drugs used in hydro-electrolytic balance disorders. Crystalloid solutions used in isotonic, hypotonic and hypertonic dehydrations: pharmacological properties, indications, adverse reactions.
48. Classification of drugs used in acid-base balance disorders: mechanism of action, indications.
49. Classification of plasma volume expanders.
50. Dextrans as plasma volume expanders: classification, pharmacological properties, indications, adverse reactions.
51. Hydroxyethylstarch drugs as plasma volume expanders: pharmacological properties, indications, adverse reactions.
52. Drugs of polypeptide polymers as plasma volume expanders: pharmacological properties, indications, adverse reactions.
53. Blood preparations as plasma volume expanders: pharmacological properties, indications, adverse reactions.

Exercises for the practical part:

1) To prescribe the following drugs in all forms of delivery:

Strophanthine. Digitoxin. Digoxin. Corglycon. Amrinone. Levosimendan. Dobutamine. Nitroglycerin. Isosorbide dinitrate. Molsidomine. Nifedipine. Dipyridamole. Vinpocetine. Pentoxifylline. Xanthinol nicotinate. Nicergoline. Cinnarizine. Sumatriptan. Troxerutin. Quinidine. Procainamide. Lidocaine. Mexiletine. Flecainide. Verapamil. Amiodarone. Sotalol. Metoprolol. Propranolol. Clonidine. Methyldopa. Moxonidine. Azamethonium. Prazosin. Carvedilol. Nebivolol. Labetalol. Hydralazine. Sodium nitroprusside. Captopril. Enalapril. Losartan. Norepinephrine. Phenylephrine. Isoturon. Dopamine. Caffeine sodium benzoate. Mannitol. Furosemide. Torasemide. Hydrochlorothiazide. Indapamide. Spironolactone. Triamterene. Eplerenone. Colchicine. Allopurinol. Cistenal. Ammonium chloride. Sodium bicarbonate. Dextran-40. Polyvinylpyrrolidone. Potassium chloride. Calcium chloride. Sodium chloride. Rehydron. Hydroxyethyl starch. Albumin. Gelatin succinylate.

2) List the groups and drugs used in (for):

Decompensated chronic heart failure; chronic congestive heart failure; poisoning with cardiac glycosides; cardiostimulants in acute myocardial infarction; cardiogenic shock; cardiac arrest, treatment of angina pectoris attacks; prophylaxis of angina pectoris attacks; 1st line medicines that are used in treatment of angina pectoris; 2nd line medicines that are used in treatment of angina pectoris; drugs that reduce oxygen demand in angina pectoris; cardioprotective drugs in angina pectoris; pain relief in acute myocardial infarction; fear relief in acute myocardial infarction; thrombosis prophylaxis in acute myocardial infarction; membrane stabilizers in supraventricular and ventricular arrhythmias; ventricular tachyarrhythmias of sympatho-adrenal (neurogenic) type; tachysystolic atrial flutter and fibrillation; ventricular arrhythmias; digital arrhythmias (caused by overdose of cardiac glycosides); 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, hypertensive crisis, hypertensive emergencies; pheochromocytoma treatment; neurotropic drugs with central action in arterial hypertension; peripheral neurotropic drugs in arterial hypertension; musculotropic drugs in hypertension; inhibitors of the renin-angiotensin-aldosterone system in

arterial hypertension; converting enzyme inhibitors in arterial hypertension, arterial hypertension with arrhythmias, arterial hypertension with hyperaldosteronism, arterial hypertension with hyperreninemia, vasoconstrictors with central action in arterial hypotension; peripheral vasoconstrictors in arterial hypotension; cardiostimulators in arterial hypotension; cardiogenic shock with arterial hypotension, arterial hypotension resistant to sympathomimetics, orthostatic hypotension caused by ganglioblockers and alpha-adrenoblockers; hypovolemic shock; chronic arterial hypotension; migraine attack relief, migraine prophylaxis, vestibulocochlear disorders, acute stroke, chronic cerebral circulatory insufficiency, Raynaud's syndrome, obliterating endarteritis, chronic venous insufficiency, trophic ulcers of the lower limbs; cerebral edema; pulmonary edema of toxic origin; diuretics in acute renal failure; diuretics in chronic renal failure; forced diuresis; diuretics in hypertension; diuretics in glaucoma; diuretics in acute heart failure; diuretics in chronic congestive heart failure; attacks of gout; prophylaxis (treatment) of gout; treatment of acidosis; treatment of alkalosis; isotonic dehydration treatment; treatment of hypotonic dehydration; treatment of hypertonic dehydration; detoxification of the body in peritonitis; detoxification of the body in food poisoning; hypokalemia; hypocalcemia.