SPECIAL PHARMACOLOGY
I. NEUROTROPIC DRUGS
1. DRUGS ACTING ON THE PERIPHERAL NERVOUS SYSTEM
1.1. DRUGS ACTING ON THE EFFERENT DIVISION OF PNS
1.1.1. DRUGS ACTING ON CHOLINERGIC TRANSMISSION
- **CHOLINERGIC AGONISTS AND ACETYLCHOLINESTERASE INHIBITORS**

A. Actuality. The drugs of these groups are widely used in ophthalmology, neurology, anesthesiology, gastroenterology, urology, etc.

B. The purpose of the training is to familiarize the student with the main drugs of these groups, the principles of their selection according to the baseline indications, as well as the possible adverse reactions and measures to prevent them.

C. Learning objectives:

1) The student must **know:** characteristic of cholinomimetics and anticholinesterase medicines (classification, mechanism of action, doses, indications, contraindications, adverse reactions, clinical picture of intoxication and treatment of intoxication).

2) The student must **be able to:** make out prescriptions of mandatory drugs in various forms and indicate them in various diseases and pathological conditions.

D. Initial level of knowledge required for interdisciplinary integration:

Human physiology. Efferent innervation. The vegetative and somatic pathway of excitatory efferent transmission. Ultrastructure of cholinergic synapse. Mechanism of transmitting the nervous impulse through the synapse. The role of acetylcholine in this process. The importance of acetylcholinesterase in the process of transmitting the nervous impulse. The postsynaptic potential of the terminal end plate. Structural and functional particularities of the vegetative (parasympathetic) nervous system. Influence of the parasympathetic nervous system on the innervated organs. Types and subtypes of cholinergic receptors, their localization and effects of their activation.

Biochemistry. Mediators of nerve impulse transmission (acetylcholine, noradrenaline).

Histology. Structure and histochemical characteristic of the synapse. Classification of synapses.

E. Self-training questions:

1. Classification of cholinomimetic drugs (parasympathomimetics) by type of action and type of receptor.
2. Pharmacodynamics of M-colinomimetics. Mechanism of action. Their action at the level of the eye (pupil diameter, intraocular tension, accommodation), heart, smooth muscles of the internal organs (bronchi, digestive tract, urinary bladder, etc.), gland secretion (stomach, intestines, sweat etc.).
3. Indications, contraindications and adverse reactions of M-colinomimetics.
4. Toxic action of muscarin (picture of poisoning with fly agaric mushrooms, first aid measures).
5. N-cholinomimetics. Mechanism of action. Action on sinocarotid receptors, vegetative ganglia, striated muscles, adrenal medulla, organs and systems.

Indications. Contraindications. Adverse reactions. Their physiological importance and toxic action.

6. The main components of cigarette smoke. Smoking-related diseases. Use of N-cholinomimetics for smoking cessation.
7. Anticholinesterase drugs. Definition, classification, mechanism of action, effects. Interaction of anticholinesterases with cholinesterase. Particularities of the action of organophosphorus compounds.
8. Indications, contraindications and side effects of anticholinesterase medications. Toxic action of organophosphorus compounds. Cholinesterase reactivators, mechanism of action, indications. Clinical picture of intoxication with organophosphorus compounds. Particularities of atropine use.

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

1.) Brief characteristics of compulsory drugs:

Down: Drug name. 1. Pilocarpine hydrochloride. 2. Aceclidine. 3. Cytiton. 4. Neostigmine. 5. Galanthamine hydrobromide. 6. Physostigmine salicylate. 7. Trimedoxime. 8. Lobelin hydrochloride.

Across: 1. Medicinal form. 2. Way of administration. 3. Doses (therapeutic, maximal for one intake and for 24 hours). 4. Spectrum of action 5. Mechanism of action. 6. Indications and contraindications. 7. Side effects.

2.) Questions on medical prescriptions.

To prescribe the following drugs in all the possible medicinal forms: 1. Pilocarpine hydrochloride. 2. Aceclidine. 3. Cytiton. 4. Neostigmine. 5. Galanthamine hydrobromide. 6. Physostigmine salicylate. 7. Trimedoxime. 8. Lobelin hydrochloride.

Drugs used in (for): glaucoma, urinary bladder atony, intestinal atony, breathing stimulation, myasthenia gravis, xerostomia, residual phenomena of traumatic central and peripheral nervous system injury, residual phenomena of poliomyelitis, Alzheimer's disease, intoxication with organophosphorus compounds, intoxication with fly agaric mushrooms, smoking cessation.

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

4.) Clinical case (Guidelines for Laboratory Work in Pharmacology).

5.) Virtual situations (Guidelines for Laboratory Work in Pharmacology).

6.) Virtual didactic movie.

7.) Tables

Table 1

Indicate the pharmacological effects of the cholinomimetic and anticholinesterase drugs

Systems and organs	Parameters	M-cholinomimetics	M and N-cholinomometics	Anticholinesterases
Eye	Diameter of the pupil			
	Accommodation			
	Intraocular pressure			
Exocrine glands	Tear			
	Salivary			

	Sweat			
Bronchi	Tone			
	Secretion			
Heart	Heart rate			
	A-V conduction			
Blood vessels	Tone			
GIT	Sphincter tone			
	Peristalsis			
	Secretion			
Urinary bladder	The tone of the detrusor			
	Urine elimination			
Myometrium	Tone			
Striated muscle	Neuromuscular transmission			

Table 2

Provide indications for the use of cholinomimetic and anticholinesterase drugs

Indications	Pilocarpine	Aceclidine	Neostigmine	Galanthamine	Physostigmine	Paraoxon
Glaucoma						
GIT atony						
Urinary bladder atony						
Myasthenia						
Neurological disorders						
Residual phenomena of poliomyelitis						
Alzheimer's disease						
Overdose of antidepolarizing miorelaxants						
Overdose of M-cholinoblockers						

8.) Solve the case:

The patient with the urinary bladder atony was given a drug, the dose of which the patient increased himself. Diuresis has normalized, but sweating, intense salivation, and frequent defecation has occurred.

What medicine was administered? What was the cause of the complications that occurred?

From what group is it?

- **CHOLINERGIC ANTAGONISTS**

A. Actuality. The autonomic nervous system is involved in regulating physiological processes by controlling basic life functions of various organs and metabolic processes. Cholinergic antagonists (cholinoblockers, parasympatholytics) drugs are widely used in ophthalmology, neurology, anesthesiology, gastroenterology, urology, surgery, etc. They exhibit various pharmacodynamic actions on the vegetative nervous system and have a broad pharmacotherapeutic use.

B. The purpose of the training is to familiarize the student with the main medicines of these groups, the principles of their selection according to the main indications, as well as the possible adverse reactions and measures to prevent them.

C. Learning objectives:

1) The student must **know:** cholinoblockers, characteristics, classification, mechanism of action, dosage forms and routes of administration, doses, indications, contraindications, adverse reactions, clinical picture of intoxications and their treatment.

2) The student must **be able to:** make out prescriptions of mandatory drugs in various forms and indicate them in various diseases and pathological conditions.

D. Initial level of knowledge required for interdisciplinary integration:

Biochemistry. The neurotransmitter of the cholinergic synapse (acetylcholine). Structure, regulation of neurotransmitter biosynthesis, and its inactivation, action of acetylcholine on lipid, carbohydrate and protein metabolism.

Histology. Parasympathetic vegetative nervous system, morpho-functional features. Structure of cholinergic synapse.

Human physiology. Functions of sympathetic and parasimpatic vegetative systems. Their action on the functions of the innervated organs.

Pathophysiology. Deregulation of the excitability and conductivity of neurons. Synaptic conduction disorders. Pathology of the vegetative nervous system.

E. Self-training questions:

1. Classification of cholinoblocking medicines.
2. Sources of M-cholinoblockers (antimuscarinics).
3. Classification of M-cholinoblockers.
4. The action of M-cholinoblockers on the cardiovascular and the central nervous systems. Changes of eye function caused by M- cholinoblockers.
5. The action of M-cholinoblockers on the tone of the bronchi, gastrointestinal tract, bile ducts and urinary system.
6. The action of M-cholinoblockers on the secretion of sweat, gastric, intestinal and salivary glands.
7. Clinical picture of poisoning with atropine and plants, containing this alkaloid. First aid measures in these intoxications.
8. Indications, contraindications and adverse reactions of M-cholinoblocking medicines.
9. N-cholinoblockers (antinicotinics). Classification. Mechanism of action. Indications. Contraindications. Adverse reactions.

10. Ganglion blocking drugs (ganglioblockers). Classification by chemical structure, duration of action, location and mechanism of action. Peculiarities of absorption depending on the chemical structure.
11. The action of ganglioblockers on the cardiovascular system, the digestive tract, and on the uterus.
12. Indications, contraindications and adverse reactions of ganglioblockers.
13. Miorelaxants with peripheral action (neuromuscular blocking agents). Classification of miorelaxants by duration of action and by the mechanism of action.
14. Mechanism of action of depolarising, nondepolarizing and mixed miorelaxants. Indications, contraindications and side effects of miorelaxants.
15. Miorelaxants' antagonists and principles of decurarization.
16. Centraly acting M,N-cholinoblockers. Mechanism of action. Indications, contraindications and adverse reactions.
17. Peripheraly acting M,N-cholinoblockers. Mechanism of action. Indications, contraindications and adverse reactions.

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

1.) Brief characteristics of compulsory drugs:

Down: Drug name. 1. Atropine sulphate. 2. Scopolamine hydrobromide. 3. Platyphylline hydrotartrate. 4. Hexamethonium. 5. Trepirium iodide. 6. Suxamethonium. 7. Melictine. 8. Pirenzepine. 9. Tubocurarine chloride. 10. Ipratropium bromide. 11. Trihexifenidyl hydrochloride. 12. Adifenine. 13. Tropicamide.

Across: 1. Medicinal form. 2. Way of administration. 3. Doses (therapeutic, maximal for one intake and for 24 hours). 4. Spectrum of action 5. Mechanism of action. 6. Indications and contraindications. 7. Side effects.

2.) Questions on medical prescriptions.

To prescribe the following drugs in all the possible medicinal forms: 1. Atropine sulphate. 2. Scopolamine hydrobromide. 3. Platyphylline hydrotartrate. 4. Hexamethonium. 5. Trepirium iodide. 6. Suxamethonium. 7. Melictine. 8. Pirenzepine. 9. Tubocurarine chloride. 10. Ipratropium bromide. 11. Trihexifenidyl hydrochloride. 12. Adifenine. 13. Tropicamide.

Drugs used in (for): intoxication with atropine containing plants, intestinal spasms, gastric ulcer disease with hypersecretion, fundoscopic eye examination, premedication, hypersalivation, prophylaxis of kinetosis, skeletal muscle relaxation, tracheal intubation, bone fragments reposition, hypertensive crisis, controlled hypotension, bronchial asthma.

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

4.) Clinical case (Guidelines for Laboratory Work in Pharmacology).

5.) Virtual situations (Guidelines for Laboratory Work in Pharmacology).

6.) Virtual didactic movie.

7.) Tables

Table 1

Pharmacological effects, indications and side effects of M-cholinoblockers

Systems and organs	Parameters	The effect	Indications	Adverse effects
Eye	Diameter of the pupil			
	Accommodation			
	Intraocular pressure			
Exocrine glands	Tear			
	Salivary			
	Sweat			
Bronchi	Tone			
	Secretion			
Heart	Heart rate			
	A-V conduction			
Blood vessels	Tone			
GIT	Sphincter tone			
	Peristalsis			
	Secretion			
Urinary bladder	The tone of the detrusor			
	Urine elimination			
Myometrium	Tone			

Table 2

Comparative characteristic of M-cholinoblockers used in ophthalmology

Drug's name	Duration of midriasis (hours, days)	Duration of accommodation paralysis (cycloplegia) (hours, days)
Atropine sulphate		
Homatropine hydrobromide		
Tropicamide		

Table 3

Indications of M-cholinoblockers

Indications	Atropine	Scopola-mine	Homatro-pine	Tropica-mide	Methoci-nium iodid	Ipratro-pium	Pirenze-pine
Iritis, iridocyclitis							
Fundoscopic eye exam							
Eye refraction exam							
Spasms of smooth muscles of internal organs							
Bronchial asthma							
Hypersalivation							
Ulcer disease							
Bradicardia and							

AV block							
Premedication							
Kinetosis							
Overdose of cholinomimetics							

Note! The presence of the indication is marked with the "+"

Table 4

Pharmacological effects, indications and side effects of ganglioblockers

Systems and organs	Parameters	The effect	Indications	Adverse effects
Eye	Diameter of the pupil			
	Accommodation			
	Intraocular pressure			
Exocrine glands	Tear			
	Salivary			
	Sweat			
Bronchi	Tone			
	Secretion			
Heart	Heart rate			
	A-V conduction			
Blood vessels	Tone			
GIT	Sphincter tone			
	Peristalsis			
	Secretion			
Urinary bladder	The tone of the detrusor			
	Urine elimination			

Table 5

The comparative characteristic of antidepolarizing and depolarizing miorelaxants

Parameters	Peripheral non-depolarizing miorelaxant (ex. tubocurarine)	Peripheral depolarizing miorelaxant (ex. suxamethonium)
Influence on cell membrane (stabilization or depolarization)		
Duration of action (min)		
Fasciculations of muscles (+/-)		
Interaction with anticholinesterase drugs (synergism, antagonism, clinical importance)		

8.) Solve the case:

A patient with a gastric ulcer was given a medicine. But immediately after disappearance of heartburn and abdominal pain, xerostomia, cardiac palpitations, anddecreased visual acuity occurred.

What drug was given to the patient? What was the cause of the complications that occurred? Which medicine can be used instead without causing these undesirable effects?

1.1.2. DRUGS ACTING ON ADRENERGIC TRANSMISSION

- **ADRENERGIC AND DOPAMINERGIC AGONISTS. ADRENERGIC AND DOPAMINERGIC ANTAGONISTS. SYMPATHOLYTICS.**

A. Actuality. The sympathetic nervous system is involved in regulating the function of internal organs and metabolic processes. Drugs that act on the sympathetic system exhibit various pharmacodynamic actions and have a broad pharmaco-therapeutic use.

B. The purpose of the training is to familiarize students with the pharmacological properties of adrenomimetics, dopamine mimetics, adrenoblockers, dopamine blockers and sympatholytics.

C. Learning objectives:

1) The student must **know:** the general characteristic of adrenomimetics, dopamine mimetics, adrenoblockers, sympatholytics and dopaminolytics; principles of classification, mechanism of action, indications, contraindications, adverse reactions, the picture of acute and chronic poisoning with some drugs of these groups and their treatment.

2) The student must **be able to:** make out prescriptions of mandatory drugs in various forms and indicate them in various diseases and pathological conditions.

D. Initial level of knowledge required for interdisciplinary integration:

Biochemistry. Neurotransmitters of adrenergic and dopaminergic synapses (noradrenaline, dopamine). Structure, biosynthesis and inactivation of mediators, actions on lipid, carbohydrate and protein metabolism.

Histology. The sympathetic autonomic nervous system, morpho-functional features. The structure of the adrenergic synapse.

Human physiology. Adrenergic synapse. Types and subtypes of adrenergic receptors. Their location. The effects of activation of adrenergic receptors of tissues innervated and non-innervated by the autonomic nervous system.

Pathophysiology. Deregulation of the excitability and conductivity of neurons. Disruptions of synaptic conductivity. Pathology of the vegetative nervous system.

E. Self-training questions:

1. Principles of classification of adrenergic drugs: according to the mechanism of action, the chemical structure, the type of predominant action.
2. α-adrenomimetics. Classification. Pharmacodynamics (mechanism of action, pharmacological effects). Indications and contraindications. Adverse reactions.
3. β-adrenomimetics. Classification. Pharmacodynamics (mechanism of action, pharmacological effects). Indications. Contraindications. Adverse reactions.
4. α,β-adrenomimetics. Pharmacodynamics (mechanism of action, pharmacological effects). Indications, contraindications, side effects.
5. α-adrenoblockers. Classification. Pharmacodynamics (mechanism of action, pharmacological effects). Indications and contraindications. Adverse reactions.
6. β-adrenoblockers. Classification. Pharmacodynamics (mechanism of action, pharmacological effects). Indications and contraindications. Adverse reactions.
7. α,β -adrenoblockers. Pharmacodynamics (mechanism of action, pharmacological effects). Indications and contraindications. Adverse reactions.

8. Sympatholytics. Classification, mechanisms of action, pharmacological effects. Indications, contraindications, and adverse reactions.
9. Drugs with influence on the dopaminergic system. Classification. Pharmacodynamics (mechanism of action, pharmacological effects). Indications, contraindications and adverse reactions.

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

1.) Brief characteristics of compulsory drugs:

Down: Drug name. 1. Norepinephrine hydrotartrate. 2. Epinephrine hydrochloride. 3. Isoprenaline. 4. Salbutamol. 5. Dopamine. 6. Dobutamine. 7. Phenylephrine. 8. Ephedrine hydrochloride. 9. Naphazoline. 10. Phentolamine. 11. Prazosin. 12. Propranolol. 13. Atenolol. 14. Nebivolol. 15. Carvedilol. 16. Reserpine. 17. Guanethidine. 18. Dihydroergotoxin.

Across: 1. Medicinal form. 2. Way of administration. 3. Doses (therapeutic, maximal for one intake and for 24 hours). 4. Spectrum of action 5. Mechanism of action. 6. Indications and contraindications. 7. Side effects.

2.) Questions on medical prescriptions.

To prescribe the following drugs in all the possible medicinal forms: 1. Norepinephrine hydrotartrate. 2. Epinephrine hydrochloride. 3. Isoprenaline. 4. Salbutamol. 5. Dopamine. 6. Dobutamine. 7. Phenylephrine. 8. Ephedrine hydrochloride. 9. Naphazoline. 10. Phentolamine. 11. Prazosin. 12. Propranolol. 13. Atenolol. 14. Nebivolol. 15. Carvedilol. 16. Reserpine. 17. Guanethidine. 18. Dihydroergotoxin.

Drugs used in (for): acute hypotension, anaphylactic shock, asthma attacks, hypertensive crisis, heart failure, trophic ulcers of leg and foot, prostate adenoma, rhinitis, cardiogenic shock, myocardial infarction, migraine, metrorrhagia, cerebral circulatory insufficiency, pheochromocytoma, vascular spasms, hypertension , angina pectoris, cardiac arrhythmias, hyperthyroidism, endarteritis, hypoglycemic coma, conjunctivitis, acute respiratory infections.

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

4.) Clinical case (Guidelines for Laboratory Work in Pharmacology).

5.) Virtual situations (Guidelines for Laboratory Work in Pharmacology).

6.) Virtual didactic movie.

7.) Tables

Table 1

Indicate receptor affinity for epinephrine and norepinephrine

Receptor type	Epinephrine	Norepinephrine
Alpha 1		
Alpha 2		
Beta 1		
Beta 2		

Table 2

Comparative characteristic of ephedrine and epinephrine

Parameters	Ephedrine	Epinephrine
Stability in per os administration (+/-)		
Duration of action (min., hours)		
Location of action (presynaptic / postsynaptic)		
Influence on CNS		
Influence on blood pressure after denervation		
Tachyphylaxis (+/-)		
Drug addiction (+/-)		

Table 3

Indications of adrenomimetic drugs

Indications	Phenylephrine	Nafazoline	Isoprenaline	Dopamine	Phenoterol	Epinephrine	Norepinephrine	Efedrine
Heart attack								
Cardiogenic shock								
Acute heart failure								
AV block								
Anaphylactic shock								
Bronchial asthma								
Conjunctivitis								
Rhinitis								
Closed angle glaucoma								
Hypoglycemic coma								
Prolongation of action of local anesthetics								
Acute hypotension								
Imminent abortion								
Acute kidney failure								
Bronchial asthma attack								

Note! The presence of the indication is marked with the "+"

Table 4

Indications of alpha-adrenoblockers

Indications	Phentolamine	Dihydroergotoxin	Prazosin	Tamsulosin
Hypertensive crisis				
Hypertension				
Pheochromocytoma				
Migraine				
Spasm of peripheral vessels				
Heart failure				
Urination disorders in prostate adenoma				

Note! The presence of the indication is marked with the "+"

Table 5

Mechanism of action of guanethidine and reserpine

Mechanism of action	Guanethidine	Reserpine
Deregulates the release of NA from presynaptic nerve endings		
Competitively blocks reuptake of NA by presynaptic nerve endings		
Is accumulated in the vesicles of the nerve terminal and displaces NA		
Inhibits vesicular monoamine transporter and consequently storage in vesicles of noradrenaline, dopamine and serotonin		

Note! The presence of the mechanism is marked with the "+"

Table 6

Comparative characteristic of guanethidine and reserpine

Parameters	Guanethidine	Reserpine
Sedative effect (+/-)		
Drug induced Parkinson syndrome (+/-)		
Depression (+/-)		
Influence on adrenal medulla (does not influence / decreases the content of catecholamines)		
Orthostatic (postural) hypotension (+/-)		

8.) Solve the case:

The patient with recurrent bouts of tachycardia and asthma predisposition has been given a drug. The tachycardia has disappeared, but dyspnea has appeared.

What medicine was indicated?

What was the cause of dyspnea?

1. 2. DRUGS ACTING ON THE AFFERENT DIVISION OF PNS

- **LOCAL ANESTHETICS. ASTRINGENTS. MUCILAGINOUS MEDICINES AND EMOLLIENTS. ADSORBENTS. IRRITATING DRUGS**

A. Actuality. Local anesthetics are widely used to prevent and calm pain (in surgery, dentistry, urology, gastroenterology, ophthalmology, etc.). Mucilages and astringents provide protection for sensitive receptors against irritating agents. Adsorbents prevent or retain the absorption of toxic substances in the body (acute poisoning, bronchial asthma, diabetes mellitus, hemosorption and lymphosorption, etc.). Irritating drugs through the revulsion effect, improve the trophicity of the tissues.

B. The purpose of the training is to familiarize students with pharmacological properties and principles of use of astringent drugs, local anesthetics, mucilaginous, emollients, adsorbents and irritants.

C. Learning objectives:

1) The student must **know:** definition, classification principles, mechanism of action, effects and indications of local anesthetics, mucilaginous, emollient, astringent, adsorbing and irritant drugs.

2) The student must **be able to:** make out prescriptions of mandatory drugs in various forms and indicate them in various diseases and pathological conditions.

D. Initial level of knowledge required for interdisciplinary integration:

General surgery. Local anesthesia. Types of local anesthesia (surface anesthesia, by infiltration, conduction or regional, spinal). Mechanism of revulsive action.

E. Self-training questions:

1. Local anesthetics. Classification by chemical structure, types of local anesthesia, activity, toxicity, latency and duration of action.
2. Pharmacokinetics of local anesthetics
3. Mechanism of action and effects of local anesthetics.
4. Indications of local anesthetics. Adverse reactions. Acute and chronic poisoning with cocaine.
5. Comparative characteristic according to the solubility, potency and duration of action, toxicity. The principle of choice of local anesthetics for different types of local anesthesia. Requirements for local anesthetics.
6. Astringent drugs. Classification. Mechanism of action and pharmacological effects. Indications.
7. Mucilaginous and emollient drugs. Mechanism of action and pharmacological effects. Indications.
8. Adsorbent drugs. Mechanism of action and pharmacological effects. Indications. The notion of hemosorbents.
9. Irritating drugs. Mechanism of action and pharmacological effects. Indications.

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

1.) Brief characteristics of compulsory drugs:

Down: Drug name. 1. Procaine. 2. Lidocaine. 3. Benzocaine. 4. Tetracaine. 5. Medicinal charcoal. 6. Mustard plaster. 7. Articaine. 8. Trimecaine. 9. Bupivacaine.

Across: 1. Medicinal form. 2. Way of administration. 3. Doses (therapeutic, maximal for one intake and for 24 hours). 4. Spectrum of action 5. Mechanism of action. 6. Indications and contraindications. 7. Side effects.

2.) Questions on medical prescriptions.

To prescribe the following drugs in all the possible medicinal forms: 1. Procaine. 2. Lidocaine. 3. Benzocaine. 4. Tetracaine. 5. Medicinal charcoal. 6. Mustard plaster. 7. Articaine. 8. Trimecaine. 9. Bupivacaine.

Drugs used in (for): surface anesthesia, spinal anesthesia, epidural anesthesia, infiltration anesthesia, conduction anesthesia, treatment of wounds and burns, mucilaginous drug enema, treatment of myositis, acute intoxication.

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

4.) Clinical case (Guidelines for Laboratory Work in Pharmacology).

5.) Virtual situations (Guidelines for Laboratory Work in Pharmacology).

6.) Virtual didactic movie.

7.) Tables

Table 1

Select drugs for various types of anesthesia

Drugs	Surface anesthesia	Conduction anesthesia	Infiltrative Anesthesia
Benzocaine (anesthesine)			
Tetracaine			
Procaine			
Lidocaine			
Articaine			

Note: Indicate the concentration range and volume of medication used in these types of anesthesia. If the medicine is not used in the respective type of anesthesia, the "-" sign is indicated.

Table 2

The comparative feature of local anesthetics

Drugs	Chemical structure	Water solubility	Anesthetic activity	Duration of action	Toxicity	Release of p-aminobenzoic acid
Benzocaine (anesthesine)						
Tetracaine						
Procaine						
Trimecaine						
Lidocaine						
Articaine						

Note: (use the symbols): "++" - the maximum importance of the effect; "+" - less significance of the effect

8.) Solve the case:

Epidural anesthesia was performed in one patient and surgery was initiated in the small basin of the pelvis. Suddenly, blood pressure dropped. Surgery was interrupted.

What drug was used for anesthesia?

What caused the fall in blood pressure?

What should be done to prevent this complication?

Which emergency measures should be considered in this situation in order to continue the intervention?

#2 TEST ON THE TOPIC:
"DRUGS ACTING ON THE PERIPHERAL NERVOUS SYSTEM"

A. Actuality. Drugs of this group are widely used in the ophthalmology, neurology, anesthesiology, gastroenterology, urology, etc.

B. The purpose of the training consists in strengthening students' knowledge about pharmacodynamics of drugs that affect peripheral innervation, their selection according to indications, knowledge of adverse reactions and first aid measures in case of overdosage.

C. Learning objectives:

1) The student must **know:** the pharmacological characteristics of these groups of drugs (pharmacokinetics and pharmacodynamics), the main indications for administration, adverse reactions and first aid measures in overdosage.

2) The student must **be able to:** make out prescriptions of mandatory drugs of this group, indicate them in various diseases and pathological conditions, and primarily in emergencies.

D. Self-training questions:

1. Classification of drugs with influence on cholinergic synapses.
2. M-cholinomimetics. Mechanism of action. Influence on the eye, heart, smooth muscles of the internal organs, exocrine glands. Indications. Contraindications. Adverse reactions. Muscarinic intoxication, clinical picture and treatment.
3. N-cholinomimetics. Mechanism of action. Influence of N-cholinomimetics on sino-carotid chemoreceptors, vegetative ganglia, striated muscles, adrenal medulla, organs and systems. Indications. Toxic action of nicotine. Use of N-cholinomimetics for smoking cessation.
4. Anticholinesterase drugs. Classification and mechanism of action. The characteristic of interaction with cholinesterase. Effects. Indications. Contraindications and adverse reactions. Particularities of the action of organophosphorus compounds. Clinical picture of intoxications with organophosphorus compounds and first aid measures. The peculiarities of atropine use. Cholinesterase reactivators: mechanism of action, indications.
5. Classification of cholinoblockers. M- cholinoblockers. Classification, mechanism of action. Their influence on CNS, eye, cardiovascular system, bronchial tone, smooth muscles of the digestive tract, biliary and urinary tract, bladder detrusor and sphincter, gastric secretion, etc. Particularities of action of M-cholinoblockers. Indications. Contraindications and adverse reactions. Clinical picture of poisoning with plants, containing atropine and its treatment.
6. Classification of N- cholinoblockers. Ganglioblockers. Classification by location, duration of action, mechanism of action and chemical structure. Influence on cardiovascular system, digestive tract, myometrium. Indications, contraindications and adverse reactions.
7. Miorelaxants with peripheral action. Classification by duration and mechanism of action. Indications, contraindications and adverse reactions. Antagonists of miorelaxants and principles of decurarization.
8. Adrenomimetics that predominantly stimulate peripheral α and β adrenoreceptors. Their influence on the cardiovascular system, microcirculation,

organs with smooth muscles, metabolism. Indications, contraindications and adverse reactions.

9. Adrenomimetics that predominantly stimulate α adrenoreceptors. Classification. Their influence on the cardiovascular system, microcirculation. Indications. Contraindications. Adverse reactions.
10. Adrenomimetics with influence on β adrenoreceptors. Classification. Their actions on the tonus of the bronchi, myometry, vessels and heart. Indications, contradictions and adverse effects.
11. Alpha-adrenoblockers. Classification. Pharmacodynamics. Main properties, indications and contraindications. Adverse reactions.
12. Beta-adrenoblockers. Classification. Mechanism of action. Effects. Indications. Contraindications. Adverse reactions.
13. Alpha- and beta-adrenoblockers. Effects. Indications. Contraindications. Adverse reactions.
14. Classification of medicines that influence the dopaminergic system. Dopaminomimetics, dopaminoblockers: mechanism of action, effects, indications.
15. Sympatholytics. Classification, mechanism of action, effects. Their influence on the cardiovascular system, the gastrointestinal tract, the CNS and the catecholamine content. Indications. Contraindications. Adverse effects.
16. Local anesthetics. Classification by mechanism of action. Effects. Comparative characteristic of drugs. Indications. Adverse reactions. Pharmacokinetics.
17. Astringent drugs. Classification. Mechanism of action, pharmacological effects. Indications.
18. Adsorbent drugs. Mechanisms of action, pharmacological effects. Indications.
19. Irritating drugs. Mechanisms of action, effects. Indications.
20. Mucilaginous drugs. Mechanism of action, pharmacological effects. Indications.

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

1) To prescribe the following drugs in all the possible medicinal forms: Pilocarpine hydrochloride. Aceclidine. Cytiton. Neostigmine. Galanthamine hydrobromide. Physostigmine salicylate. Trimedoxime. Lobelin hydrochloride. Atropine sulphate. Scopolamine hydrobromide. Platyphylline hydrotartrate. Hexamethonium. Trepirium iodide. Suxamethonium. Melictine. Pirenzepine. Tubocurarine chloride. Ipratropium bromide. Trihexifenidyl hydrochloride. Adifenine. Tropicamide. Norepinephrine hydrotartrate. Epinephrine hydrochloride. Isoprenaline. Salbutamol. Dopamine. Dobutamine. Phenylephrine. Ephedrine hydrochloride. Naphazoline. Phentolamine. Prazosin. Propranolol. Atenolol. Nebivolol. Carvedilol. Reserpine. Guanethidine. Dihydroergotoxin. Procaine. Lidocaine. Benzocaine. Tetracaine. Medicinal charcoal. Mustard plaster. Articaine. Trimecaine. Bupivacaine.

2) Drugs used in (for): glaucoma, urinary bladder atony, intestinal atony, breathing stimulation, myasthenia gravis, xerostomia, residual phenomena of traumatic central and peripheral nervous system injury, residual phenomena of poliomyelitis, Alzheimer's disease, intoxication with organophosphorus compounds, intoxication with fly agaric mushrooms, smoking cessation, intoxication with atropine containing plants, intestinal spasms, gastric ulcer disease with hypersecretion, fundoscopic eye examination, premedication, hypersalivation, prophylaxis of

kinetosis, skeletal muscle relaxation, tracheal intubation, bone fragments reposition, hypertensive crisis, controlled hypotension, bronchial asthma, acute hypotension, anaphylactic shock, asthma attacks, hypertensive crisis, heart failure, trophic ulcers of leg and foot, prostate adenoma, rhinitis, cardiogenic shock, myocardial infarction, migraine, metrorrhagia, cerebral circulatory insufficiency, pheochromocytoma, vascular spasms, hypertension, angina pectoris, cardiac arrhythmias, hyperthyroidism, endarteritis, hypoglycemic coma, conjunctivitis, acute respiratory infections, surface anesthesia, spinal anesthesia, epidural anesthesia, infiltration anesthesia, conduction anesthesia, treatment of wounds and burns, mucilaginous drug enema, treatment of myositis, acute intoxication.

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

4.) Clinical case (Guidelines for Laboratory Work in Pharmacology).

5.) Virtual situations (Guidelines for Laboratory Work in Pharmacology).

6.) Virtual didactic movie.

7.) Tables

Table 1

Pharmacological effects of sympathetic and parasympathetic stimulation

Organs and systems	Parameters	Effects of sympathetic stimulation	Effects of parasympathetic stimulation
Eye	Pupil diameter		
	Accommodation		
Heart	Heart rate		
	Strength of contraction		
	AV conduction		
	Automaticity		
Smooth muscles of blood vessels	Tone		
Smooth muscles of internal organs	Tone		
Exocrine glands	Secretion		

Note! The presence of the effect is marked with the "+"

Table 2

Mediators and receptors of efferent innervation

Type of nerve fibers	Released neurotransmitter	Sensitive receptors
Parasympathetic preganglionic		
Parasympathetic postganglionic		
Somatic		
Sympathetic preganglionic		
Sympathetic postganglionic		
Sympathetic fibers that innervate adrenal medulla		

Note! The presence of the effect is marked with the "+"

Table 3

Types, localization, and effects of stimulation of cholinergic receptors

Type of cholinergic receptors	Localization	Effects of stimulation
Nn	1. Ganglionic neurons 2. Neurons of the CNS 3. Adrenal medulla 4. Sinocarotid zone	
Nm	Skeletal muscles	
M1	1. CNS 2. Parietal cells	
M2	1. Heart 2. Presynaptic membrane	
M3	1. Smooth muscles of internal organs 2. Exocrine glands 3. Endothelium	

Note! The presence of the effect is marked with the "+"

Table 4

Types, localization, and effects of stimulation of adrenergic receptors

Type of adrenergic receptors	Localization	Effects of stimulation
Alpha 1	1. Radial muscle of the iris 2. Blood vessels	
Alpha 2	1. Blood vessels 2. Presynaptic membrane	
Beta 1	1. Heart 2. Juxtaglomerular apparatus	
Beta 2	1. Bronchi 2. Myometrium 3. Blood vessels 4. Liver 5. Presynaptic membrane	
Beta 3	Adipocytes	

Note! The presence of the effect is marked with the "+"

8.) Solve the case:

A patient suffering from hypertension, after a long-term treatment with a drug, complains of pain in the epigastric region, hypersalivation, congestion of the nasal mucosa. After the patient's investigation, the diagnosis of gastric ulcer was established.

Determine the group and the possible drug that the patient used.

What is the mechanism and cause of complication?

What groups and medications could be used to avoid this complication?