

I. GENERAL PRESCRIPTION SOLID MEDICINAL FORMS

A. Actuality. To optimize the treatment of patients with various pathologies, it is necessary to administer drugs in appropriate dosage forms. Scientific and technological progress has enabled the pharmaceutical industry to diversify dosage forms according to the route of administration. For these reasons, knowledge of the characteristics of dosage forms and methods of prescribing various dosage forms used in medical practice is essential.

B. The purpose of the training consist in familiarizing the students with basic concepts in the field of drugs and prescriptions, prescription forms, and methods for prescribing solid dosage forms.

C. Learning Objectives

- a) The student **must know**: basic concepts in the field of drugs; the notion of raw medicinal material, active substance, and dosage form; drug nomenclature; chemical, commercial, international nonproprietary (INN), and official (pharmacopoeial) names of drugs; latin abbreviations and symbols used in prescriptions; structure of a prescription, magistral and official prescription; characteristics and rules for prescribing solid dosage forms.
- b) The student **must be able to**: prescribe correctly solid dosage forms; to differentiate between correct and incorrect prescriptions.

D. Initial level of knowledge required for interdisciplinary integration

Latin language: noun declensions; prepositions used in prescriptions; main abbreviations and symbols.

E. Self-training questions:

1. Medical prescription. The prescription and prescription forms. General rules for prescribing prescriptions. Structure of the prescription. Auxiliary words and symbols. Main abbreviations. Preservation of prescription forms.
2. Pharmacopoeia. International Pharmacopoeia. Their content and importance.
3. Notions of “remedy,” “drug,” “active principle” (active substance, medicinal substance), “medicine” and “pro-medicine.” Components of a medicine. Storage of medicines.
4. Magistral, official, industrial medicines. Medicines: non-toxic, strongly active, toxic, and narcotic. Natural, semi-synthetic, synthetic medicines. Essential and non-essential medicines. OTC medicines.
5. **Compensated medicines. Compensation levels for medicines. List of reimbursed medicines. Beneficiaries of compensated medicines.**
6. Drug nomenclature: chemical name, international common name, official, commercial (brand) name.
7. Pharmacography. Drug prescriptions. Notion of dosage (drug administration). Dose and types of doses.
8. Raw medicinal material. Dosage forms and classification (by consistency, **number of contained drugs**, and route of administration).
9. Solid dosage forms:
 - a) powders for internal use: requirements for dosed powders.
 - b) powders for external use.
 - c) capsules.
 - d) granules. Powders and granules in sachets (packages).
 - e) tablets. Types of tablets.
 - f) dragees.
 - g) films (pellicles or plaques).
 - h) briquettes.
 - i) herbal mixtures (species).
 - j) other solid dosage forms: caramels, pencils.

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

General Prescription Exercises

Prescribe the recommended drugs in the following dosage forms:

a) *Powders for internal use:*

1. 30 powders of rifampicin, 150 mg each. Administer 1 powder 3 times daily.
2. 20 powders of acetylsalicylic acid, 250 mg each. Administer 1 powder twice per week.

3. Niclosamide powder, 2 g. Administer as a single dose.
4. 10 powders of ascorbic acid 50 mg and rutoside 20 mg. Administer 1 powder twice daily.
5. 10 powders of nicotinic acid, 50 mg each. Administer 1 powder 3 times daily.
6. 10 sachets of Magurlit granules, 2 g each. Dissolve contents in a glass of fruit juice. Administer 1 sachet 3 times daily.
7. Granules with Urodan, 100 g. Dissolve 1 teaspoon in a glass of water; administer 3 times daily.

b) Powders for external use:

1. "Galmanine" 50.0 g. Apply to affected areas.
2. Sulfacetamide 20.0 g. Apply to affected areas.
3. Etacridine lactate 2.5% – 10.0 g. For external use.

c) Capsules:

1. 10 capsules with loperamide, 2 mg each. Administer 1 capsule daily.
 2. 20 capsules with doxycycline hydrochloride, 50 mg each. Administer 2 capsules twice daily.
 3. 20 capsules with piracetam, 400 mg each. Administer 1 capsule 3 times daily.
- **Inhalation capsules:**
 1. 10 capsules of cromoglicic acid disodium, 20 mg each. Administer via inhalation device 1 capsule 4 times daily.
 - **Soft capsules:**
 1. 15 capsules with castor oil, 1 ml each. Administer 5 capsules as a single dose as a laxative.
 2. 10 capsules with fern extract, 500 mg each. Administer 10 capsules as a single dose as an antihelminthic.

d) Tablets:

1. 15 tablets of isoniazid, 300 mg each. Administer 1 tablet daily.
2. 20 tablets of diphenhydramine, 10 mg each. Administer 1 tablet twice daily.
3. 30 tablets of clonidine hydrochloride, 75 µg each. Administer 1 tablet 3 times daily.
4. 10 tablets "Theofedrine." Administer 1 tablet 3 times daily.
5. 10 tablets "Tempalgin." Administer 1 tablet for headache.

e) Dragees:

1. 10 dragees with chlorpromazine, 25 mg each. Administer 1 dragee 3 times daily.
2. 10 dragees with retinol acetate, 1 mg each. Administer 1 dragee 3 times daily.
3. 21 dragees "non-ovlon." Administer 1 dragee daily.

f) Films (pellicles or plaques):

1. 10 films with pilocarpine hydrochloride, 25 mg each. Administer 1 film 3 times daily retropalpebrally.
2. 10 films "nonoxinol-9." Administer 1 intravaginally for contraception.

g) Pencils:

1. 10 pencils with nystatin, 250 mg each. Administer 1 pencil in the urethral canal daily.
2. 20 pencils with metronidazole, 500 mg each. Administer 1 pencil in the fistula canal 3 times daily.

h) Caramels:

1. 20 caramels with ketoconazole, 50 mg each. Administer 1 caramel orally twice daily.
2. 20 caramels Septotele. Administer 1 caramel orally twice daily.

i) Herbal mixtures (species):

1. 100 g antitussive mixture. Prepare an infusion from 1 tablespoon in 100 ml water. Administer 100 ml orally at 6:00 PM.
2. 20 sachets, 1.5 g each, antispasmodic mixture. Prepare an infusion from 1 sachet in 100 ml water; administer orally twice daily.

j) Briquettes:

1. 20 calendula bricks, 1 g each. Prepare infusion from 1 brick in 100 ml water; use for oral cavity gargle twice daily.
2. 10 chamomile flower bricks, 5 g each. Prepare infusion from 1 brick in 500 ml water; use for baths twice daily.

SEMISOLID MEDICINAL FORMS

MODIFIED RELEASE DOSAGE FORMS (Part I)

A. Actuality. To optimize the treatment of patients with various pathologies, it is necessary to administer drugs in appropriate dosage forms. Scientific and technological progress has allowed the pharmaceutical industry to diversify dosage forms according to routes of administration. For these reasons, knowledge of the characteristics of dosage forms and the methods of prescribing various dosage forms used in medical practice is essential.

B. The purpose of the training. Familiarize students with basic concepts in the field of drugs and compounding, prescription forms, and methods for prescribing semisolid dosage forms.

C. Learning objectives

- a) The student should know: magistral and officinal prescriptions of semisolid dosage forms; Latin abbreviations and symbols used in prescriptions; modified release dosage forms.
- b) The student should be able to: correctly prescribe semisolid (soft) dosage forms and differentiate correct from incorrect prescriptions.

D. Initial level of knowledge required for interdisciplinary integration:

Latin language: declension of nouns; prepositions used in prescriptions; main abbreviations and symbols.

E. Self-training questions:

1. Semisolid dosage forms (soft) and their uses.
2. Ointments. Excipients for ointments. Ophthalmic and nasal ointments; less common ointment types: pomades, creams, balms, gels.
3. Pastes.
4. Suppositories.
5. Liniments.
6. Plasters.
7. Cataplasma.
8. Soaps.
9. Therapeutic (pharmaceutical) systems. Characteristics of pharmaceutical forms with modified drug release and transport:
 - a) Therapeutic systems with controlled release of active substances (monolithic systems, reservoir systems, pump systems);
 - b) Drug delivery and targeting systems (vectorized systems, drug carriers).

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

General Prescription Exercises

Ointments:

1. Oxoline 0.25% – 10 g. Apply to affected areas of the skin.
2. Hydrocortisone 1% – 10 g. For application on affected areas of the skin.
3. Fluorocort 15 g. For application on affected areas of the skin.

b) Pastes:

1. Zinc oxide 25% – 30 g. Apply to affected areas of the skin.
2. Dermatol 10% – 15 g. Apply to affected areas of the skin.
3. Nitrofurazone 0.2% – 50 g. For application on affected areas of the skin.

Creams:

1. Fluocinolone cream 15.0 g. Apply to affected areas.
2. Triderm cream 20.0 g. Apply to affected areas.

Gels:

1. Diclofenac gel 30.0 g. Apply to affected areas.
2. Apizatron gel 50.0 g. Apply to affected areas.

Balms:

1. Livian balm 50.0 g. Apply to affected areas.

Suppositories:

1. Rectal suppositories with procaine 100 mg – 10 pcs. One suppository 3 times per day.
2. "Anusol" suppositories – 10 pcs. One suppository 2 times per day per rectum.
3. Vaginal suppositories with metronidazole 500 mg – 10 pcs. One suppository 2 times per day.

Plasters:

1. Tramadol plasters 50 mg – 10 pcs. Apply one plaster per day on the forearm.
2. Lidocaine plasters 100 mg – 10 pcs. Apply one plaster per day on the forearm.

LIQUID AND GASEOUS MEDICINAL FORMS MODIFIED RELEASE DOSAGE FORMS (Part II)

A. Actuality. To optimize the treatment of patients with various pathologies, it is necessary to administer drugs in appropriate dosage forms. Scientific and technological progress has allowed the pharmaceutical industry to diversify dosage forms according to routes of administration. Therefore, knowledge of the characteristics of dosage forms and the methods of prescribing various dosage forms used in medical practice is essential.

B. The purpose of the training Familiarize students with basic concepts in the field of drugs and compounding, prescription forms, and methods for prescribing liquid and gaseous dosage forms.

C. Learning objectives

- a) The student should know: magistral and officinal prescriptions of liquid and gaseous dosage forms; Latin abbreviations and symbols used in prescriptions; modified release dosage forms.
- b) The student should be able to: correctly prescribe liquid and gaseous dosage forms and differentiate correct from incorrect prescriptions.

D. Initial level of knowledge required for interdisciplinary integration:

Latin language: declension of nouns; prepositions used in prescriptions; main abbreviations and symbols.

E. Self-training questions:

1. Solutions for internal use (oral solutions). Classification. Requirements. Methods of dosing and concentration calculations.
2. Solutions for external use. Classification. Methods for expressing concentration. Excipients for these solutions.
3. Suspensions. Classification. Methods of prescription. Difference from solutions.
4. Drops for internal use. Requirements. Prescription methods. Concentration calculation.
5. Drops for external use. Classification. Vehicles.
6. Injections. Requirements for injectable forms.
7. Magistral injectable solutions (prepared ex tempore). Prescription methods. Dose calculation for administration.
8. Officinal injectable forms: ampoules, vials. Prescription (solutions, suspensions, lyophilized powders).
9. Injectable drugs with special names.
10. Extractive solutions: aqueous (decoctions, infusions), alcoholic (tinctures, extracts), oily (medicinal oils).
11. Standardized drugs. Prescription methods.
12. Emulsions, syrups, aromatic waters, medicinal juices, mixtures, aerosols, organic drugs, prefilled syringes.
13. Dosage forms with modified release and transport systems (Part II):
 - a) Basic functions of targeted release transport systems.
 - b) Mechanisms and factors determining drug release from transport systems.
 - c) Characteristics of carrier particles.
 - d) Therapeutic use of carrier particles.
14. Gaseous dosage forms. Aerosols.

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

1. General prescription exercises

External solutions

• Aqueous solutions:

1. Psoralen 0.1% – 50 ml. External. For affected skin areas.
2. Nitrofurazone 1:5000 – 500 ml. External. For washing wounds.

Internal solutions

1. Calcium chloride. Dose per administration – 75 centigrams. Oral. One tablespoon 3 times per day.
2. Potassium orotate. Dose per administration – 1.5 grams. Oral. One tablespoon 3 times per day.

Suspensions for internal use

1. Magnesium oxide 20% – 150 ml. Oral. One tablespoon 3 times per day. Shake before use.
2. Co-trimoxazole 100 ml. Oral. 2 teaspoons 2 times per day.

Drops for internal use

1. Potassium iodide. Dose per administration – 30 mg. Oral. 20 drops 3 times per day.
2. Atropine sulfate. Dose per administration – 0.5 mg. Oral. 10 drops 3 times per day.

Drops for external use

• Aqueous solutions:

1. Pilocarpine hydrochloride 1% – 10 ml. Conjunctival sac. One drop 7 times per day.

• Alcoholic solutions:

1. Resorcin 0.25% – 100 ml (in 25% ethyl alcohol). External.

Otic drops

• Oily solutions:

1. Clofosfol 5% – 10 ml. Otic drops.

• Glycerol solutions:

1. Phenol 5% – 10 ml. Otic drops.

Magistral injectable solutions

1. Sodium salicylate 15% – 10 ml. Intravenous, 10 ml.
2. Procaine 0.25% – 500 ml. Local infiltration anesthesia.
3. Glucose 5% – 500 ml. Intravenous slow infusion over 3 hours.

Officinal injectable solutions

Ampoules

• Aqueous injectable solutions:

1. Calcium chloride 10% – 10 ml. Intravenous, 10 ml.
2. Lidocaine 10% – 2 ml. Intramuscular, 2 ml.

• Oily injectable solutions:

1. Hexestrol 0.1% – 1 ml. Intramuscular, 1 ml.
2. Oxiprogesterone caproate 12.5% – 1 ml. Intramuscular, once weekly.

• Aqueous injectable suspensions:

1. Deoxycorticosterone trimethylacetate 2.5% – 1 ml. Intramuscular, 1 ml once every 2 weeks.

• Powder in ampoules:

1. Etacrynic acid 50 mg. Dissolve in 1 ml sterile injectable water. Intramuscular, 1 ml.
2. Prednisolone hemisuccinate 25 mg. Dissolve in 5 ml sterile water and administer intravenously.

Vials

• Aqueous solutions:

1. Insulin 5 ml, 100 IU/ml. Subcutaneous. 50 IU 3 times per day.

• Suspensions:

1. Cortisone acetate 2.5% – 10 ml. Intramuscular, 1 ml per day.

• Sterile solutions:

1. Aminocaproic acid 5% – 100 ml. Intravenous.
2. Mannitol 15% – 400 ml. Intravenous.

• Lyophilized powders:

1. Sodium benzylpenicillin 250,000 IU. Dissolve in 2 ml injectable water. Intramuscular, 250,000 IU 6 times per day.
2. Vincristine 0.5 mg. Dissolve in 1 ml injectable water. Intravenous, 1 ml once per week.

External suspensions

1. Dexamethasone 0.1% – 10 ml. Conjunctival sac. One drop in each sac 2 times per day.

Emulsions

1. Bismuth subnitrate 3 g in 250 ml almond oil. Oral. One tablespoon 3 times per day for 7 days.

Mixtures

1. Sodium benzoate 1 g, bromhexine 1.5 g, cherry syrup 45 ml. Oral. One tablespoon 3 times per day for 5 days.

Syrups

1. Amoxicillin 28 g, strawberry syrup 30 ml, final volume 150 ml. Oral. One teaspoon every 8 hours for 10 days.

Decoctions

1. Oak bark 20 g – 200 ml. For gargling.

Infusions

1. Chamomile flowers 2 g/day for 4 days. Oral. One teaspoon 4 times per day.

Tinctures

1. Valerian (Odolean) 30 ml. Oral. 30 drops 3 times per day.

Liquid extracts

1. St. John's Wort 25 ml. Oral. 25 drops 3 times per day.

II. GENERAL PHARMACOLOGY. GENERAL PHARMACOKINETICS, PHARMACOGENETICS, PHARMACOGENOMICS, GENERAL PHARMACODYNAMICS

A. Actuality. General pharmacology studies the fundamental principles of pharmacokinetics, pharmacogenetics, and pharmacodynamics of drugs and the results of their interactions with the organism. Knowledge of these principles is essential for mastering and understanding special pharmacology (mechanisms of action, pharmacological effects, indications, contraindications, and adverse reactions) to select appropriate routes of administration and dosage forms. Pharmacokinetic, pharmacogenetic, and pharmacodynamic principles form the basis for experimental and clinical research of new drugs.

B. The purpose of the training To understand the basic principles of pharmacokinetics, pharmacogenetics, and pharmacodynamics.

C. Learning objectives

a) The student should know: General laws of pharmacokinetics (pharmacokinetic parameters, general principles of absorption, transport, distribution, and elimination of drugs), pharmacogenetics (enzyme disorders, enzyme induction and suppression), and pharmacodynamics (types and subtypes of receptors, typical mechanisms of action, types of drug actions, dosages and their variations, principles of dosing, safety parameters, effects of co-administration and repeated administration).

b) The student should be able to: characterize pharmacokinetic parameters, drug administration routes, absorption and transport mechanisms, metabolic and elimination pathways, types of drug action and typical mechanisms of action, dosages and variations, principles of dosing, safety parameters, and phenomena triggered by co-administration and repeated administration of drugs.

D. Initial level of knowledge required for interdisciplinary integration:

General Chemistry: Ionization constant of molecules (pKa), ionized and non-ionized forms depending on pH (Henderson-Hasselbalch equation), chemical reactions (oxidation, reduction, hydrolysis, conjugation), surfactants.

Molecular Biology and Human Genetics: Biological membranes, membrane transport, cell contacts, gene mutations – classification, nomenclature, consequences.

Human Anatomy: Digestive system, stomach, small intestine, liver (biotransformation processes), kidneys.

Histology: Cell membrane. Barrier, reception and transport cell system. Intercellular junctions.

Physiology: Functional organization of the human body, internal environment control, cell functions, membrane potentials, blood circulation, GI tract, liver, body fluids, kidney functions, receptors, biological rhythms.

Biochemistry: Membrane structure, substance transport, blood biochemistry, liver and kidney functional biochemistry, enzymes, amino acids, proteins, chemical mediators.

Pathophysiology: Typical cellular pathological processes, cell injury, dystrophy, microcirculation disorders, transcapillary exchange disturbances, digestive system, kidney, liver, and acid-base balance pathophysiology.

E. Self-training questions:

1. Definition of pharmacology; relationships with other disciplines, importance for medical practice.

2. Concept of drug, prodrug, remedy, placebo, and drug substances; types (allopathic, homeopathic, original, generic, orphan, vital, essential, non-essential, OTC), active principle, classification by origin and systemic principle, drug sources, nomenclature.
3. Main steps in drug development, evaluation of efficacy and safety.
4. Subdivisions of pharmacology (general and special), fundamental and applied branches.
5. Pharmacokinetics: parameters (bioavailability, plasma concentration, apparent volume of distribution, half-life, clearance, elimination rate constant) and their importance.
6. Classification of drug administration routes. Characteristics of enteral routes (sublingual, internal [oral] rectal), topical routes (cutaneous, ocular, auricular, electrophoresis), intracavitary and parenteral routes (subcutaneous, intramuscular, intravenous, etc.) of drug administration. Concept of transdermal therapeutic systems. Particularities of routes of administration in children.
7. Drug absorption. Mechanisms of absorption and their characteristics. Pharmacokinetic parameters of absorption (bioavailability, bioequivalence, time to maximum concentration). Factors influencing drug absorption. Importance of pH and the ionization constant (pKa) for drug absorption. Influence of food on drug absorption and effect. Interaction of drugs with components of food products. Systems involved in drug absorption (P-glycoprotein, etc.). Particularities of drug absorption during combined administration.
8. Penetration of drugs through biological membranes and barriers. Mechanisms of transport across membranes and their characteristics. Factors influencing membrane permeability to drugs. Characteristics of biological barriers. Particularities of drug penetration and transport mechanisms across the blood–brain barrier, placenta, and mammary gland epithelium. Accumulation of drugs in tissues.
9. Distribution of drugs into the body (transport, distribution, and storage). Pharmacokinetic parameters of distribution (volume of distribution, plasma concentration). Free and bound fractions of drugs in blood and tissues.
10. Concept of drug clearance. Drug metabolism (biotransformation) in the body. Phases of biotransformation (metabolic transformation, conjugation), their characteristics and importance. Cytochrome P-450 and conjugation enzymes and their importance in drug metabolism. Concept of presystemic metabolism (first-pass effect) and its importance.
11. Drug excretion. Pharmacokinetic parameters of excretion. Main routes of drug excretion. Renal excretion: importance of urine pH and other factors in drug elimination. Renal and hepatic clearance. Elimination of drugs via the gastrointestinal tract, lungs, skin, and milk.
12. Pharmacogenetics and pharmacogenomics. Involvement of genetic factors in drug effects. Enzymopathies. Genetic polymorphism (types of metabolizers). Induction and suppression of hepatic microsomal enzymes. Drugs with enzyme-inducing and enzyme-inhibiting effects.
13. Pharmacodynamics. Factors influencing drug pharmacodynamics. Pharmacodynamic action, primary action of drugs, and overall pharmacological effect. Concept of receptors. Types and subtypes of receptors. Drug–receptor interactions. Typical mechanisms of drug action (mimetic, lytic, allosteric; modification of the functional structure of DNA and RNA macromolecules, membrane permeability, and enzyme activity). Types of drug action: local (topical) and systemic (resorptive), direct and indirect (reflex), primary and secondary, selective and nonselective, reversible and irreversible drug actions. Drug dosages: therapeutic, toxic, lethal, minimum/average/maximum, loading dose, maintenance dose, treatment course dose, safety indices, dosing in children and elderly.
14. Concept of dose and its varieties. Therapeutic doses: minimum, average, and maximum for a single administration and for 24 hours; loading dose, maintenance dose, and dose for a course of treatment. Toxic and lethal doses. Safety parameters (therapeutic index, safety margin, therapeutic range) and their importance. Principles of drug dosing in children and the elderly.
15. Drugs and factors influencing their action: sex, age, physiological state of the body, heredity, and biorhythms. Drug action during pregnancy (embryotoxic, teratogenic, and fetotoxic effects).
16. Chronopharmacology: chronopharmacokinetics and chronopharmacodynamics, dosing according to biological rhythms.
17. Phenomena triggered by co-administration: synergy (direct, indirect, additive, potentiation), antagonism (direct, indirect, unidirectional, bidirectional, physiological, chemical, competitive).

18. Phenomena triggered by repeated drug administration: sensitization, tolerance, drug dependence, tachyphylaxis, accumulation.
19. Phenomena triggered by **sudden cessation of therapy**: withdrawal syndrome, rebound effect, functional insufficiency.

F. Independent work

1) Tests (Guidelines for Laboratory Work in Pharmacology)

2) Tables (knowledge review)

Table 1

Dependence of onset and duration of drug effect on administration route

Drug	Dosage Form	Route of administration	Onset of Effect (min)	Duration of Effect (min/hours)
Nitroglycerine	Sublingual tablets			
	Internal use tablets			
	Injectable solution			
	Plasters			
Tramadol	Capsules			
	Injectable solution			
	Suppositories			

Table 2

Comparative characteristics of drug biotransformation reactions

Parameters	Phase I reactions (metabolic transformation)	Phase II reactions (conjugation)
Types of chemical reactions		
Synthetic/non-synthetic reactions		
The enzymes involved in the catalysis of these reactions		
Energy expenditure (high/low)		

Table 3

Examples of receptors and their locations

Receptors	Type	G-protein coupled	Enzyme coupled	Ion channel coupled	DNA coupled
	Location (on membrane or intracellular)				
	Examples of receptors				

Table 4

Choose for each notion with the numbers from 1 to 9 the appropriate statements denoted by the letters a to i.

Dose range	Doses	Definition
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Therapeutic	1. Minimal	a) the dose that causes death in 10% of experimental animals
	2. Medium	b) the minimum amount of drug causing the pharmacological effect
	3. Maximum	c) the dose that causes intoxication in 100% of experimental animals
Toxic	4. Minimal	d) the dose that causes death in 100% of experimental animals
	5. Medium	e) the dose that causes the necessary therapeutic effect in the patient
	6. Maximum	f) the maximum amount of medicine that does not cause intoxication of the body
Lethal	7. Minimal	g) the dose that causes intoxication in 10% of experimental animals
	8. Medium	h) the dose that causes intoxication in 50% of experimental animals
	9. Maximum	i) the dose that causes death in 50% of experimental animals

G. Interactive activities

1. **Experimental didactic film** (preparation of minutes and conclusions).
2. **Clinical cases** (Guidelines for laboratory work in pharmacology).
3. **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).
- 4.) **Solve the case:**

What amount of drug will be in the body after 1, 2, and 3 minutes, if it is known that initially the drug was injected intravenously in an amount of 100 mg, and the elimination rate constant of the given drug is 0.1 mg/minute?

III. DRUGS ACTING ON THE PERIPHERAL NERVOUS SYSTEM CHOLINOMIMETIC AND ANTICOLINESTERASIS DRUGS (parasympathomimetics)

A. Actuality. The vegetative nervous system intervenes in the regulation of the body's fundamental physiological processes by controlling the functions of different organs and metabolic processes. Cholinomimetic and anticholinesterase medications exhibit various pharmacodynamic actions on the autonomic nervous system and are widely used in ophthalmology, neurology, anesthesiology, gastroenterology, urology, surgery, etc.

B. The purpose of the training consists in familiarizing the student with the pharmacology of cholinomimetic and anticholinesterase drugs, with the principles of use in medical practice and the toxicological aspects of their.

C. Learning objectives:

- a) The student must **know**: the characteristics of cholinomimetics and anticholinesterases (classification, mechanism of action, pharmacological effects, indications, contraindications, adverse reactions, the clinical picture of intoxication and the treatment).
- b) 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. Knowledge of previous and related disciplines necessary for interdisciplinary integration.

Human physiology. Efferent innervation. The vegetative and somatic efferent way of transmission of excitation. Ultrastructure of the cholinergic synapse. The mechanism of nerve impulse transmission through the synapse. The role of acetylcholine in this process. The importance of acetylcholinesterase in the process of nerve impulse transmission. The postsynaptic potential of the terminal plate. The structural and functional peculiarities of the vegetative (parasympathetic) nervous system. The influence of the

parasympathetic nervous system on the organs. The types and subtypes of cholinoreceptors, their location and the effects upon their excitation.

Biochemistry. Mediators of impulse transmission in the parasympathetic nervous system (acetylcholine).

Histology. The structure and histochemical characteristic of the synapse. Classification of synapses.

E. Self-training questions:

1. Classification of cholinomimetics (parasympathomimetics) according to the type of receptors and the type of action.
2. Pharmacodynamics of M-cholinemimetics. The mechanism of action. Their action at the level of the eye (pupil diameter, intraocular tension, accommodation), the heart, the smooth muscles of the internal organs (bronchi, digestive tube, urinary bladder, etc.), the secretion of the glands (stomach, intestinal, sweating etc.).
3. Indications, contraindications and adverse reactions of M-cholinomimetics.
4. The toxic action of muscarine (the picture of poisoning with fly agaric mushrooms, the antidote and the principle of action).
5. N-cholinomimetics. The mechanism of action. Action on sinocarotid receptors, vegetative ganglia, striated muscles, adrenal medulla, organs and systems. The indications. Contraindications. SIDE adverse.
6. Physiological importance and toxic action of N-cholinemimetics.
7. The main components of cigarette smoke. Diseases caused by smoking. The use of N-cholinomimetics in combat smoking.
8. Anticholinesterase drugs. Definition, classification, mechanism of action, effects. Interaction of anticholinesterases with cholinesterase. The particularities of the action of the compounds organophosphorus.
9. Indications, contraindications and adverse reactions of anticholinesterase drugs. The toxic action of organophosphorus compounds. The clinical picture of poisoning with organophosphorus compounds. Antidotes: the particularities of action and use.

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

- 1) Questions on medical prescriptions.

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

No.	The name of the medicine	Form of delivery, dose
1.	Pilocarpine hydrochloride	Sol. (ophthalmic drops) in vials 1%-10 ml and 2%-10 ml Ointment (ophthalmic) 1%-5.0 and 2%-5.0 Ophthalmic films 0.0027
2.	Aceclidine	Amp. sol.0, 2%-2ml. Vials (ophthalmic drops) sol.2%-5ml
3.	Cytiton	Sol in vials. 1 ml Tablets 0.0015 Films 0.0015
4.	Neostigmine	Powder (for internal use) 0.015 Tablets 0.015 Sol. in vials. 0.05%-1ml Granules (for internal use) 60.0
5.	Galantamine hydrobromide	Sol. in vials. 0.1%-1ml and 1%-1ml
6.	Physostigmine salicylate	Sol. in vials. 1%-1ml and 0.1%-1ml Sol. (ophthalmic) in vials. 1%-5ml Ophthalmic ointment 0.25%-10.0 Tablets 0.001 and 0.005.
7.	Trimedoxime	Sol. in amp. 15%-1ml

- 2) **List the groups and drugs used in (for):** glaucoma, 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.

G) Individual work for knowledge consolidation

- 1) **Tests** (Guidelines for Laboratory Work in Pharmacology).
2) **Tables** (knowledge summary)

Table 1

Indicate the pharmacological effects of the cholinomimetic and anticholinesterase drugs

Systems and organs	Parameters	M-cholinomimetics	M and N-cholinomimetics	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			

Note! The presence of the effect is indicated with the sign ↑ or ↓

Table 2

Select the indications for the use of cholinomimetic and anticholinesterase drugs

Indications	Pilocarpine	Aceclidine	Neostigmine	Gаланthамine	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						

Note! The presence of the indication is noted with the sign "+ "

H) Interactive activity

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

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?

CHOLINOLYTIC DRUGS (anticholinergics, cholinolytics, parasympatholytics)

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:

a) 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.

b) 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. Knowledge of previous and related disciplines necessary 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 the sympathetic and parasympathetic autonomic systems. Their effects on the functions of the innervated organs. Neuromuscular transmission and excitation–contraction coupling. Skeletal muscle contraction. The motor unit. Summation of muscle contraction. Metabolism of skeletal muscle. Excitation and contraction of smooth muscle.

Pathophysiology. Parasympathetic autonomic disorders. The autonomic reflex arc. Pathology of the autonomic nervous system.

E. Self-training questions:

1. Classification of cholinoblocking drugs.
2. Classification of M-anticholinergic drugs by chemical structure, selectivity, and main pharmacological effect).
3. The action of M-cholinoblockers on the cardiovascular and the central nervous systems. Effects on eye function caused by M- cholinoblockers and their mechanisms.
4. The action of M-cholinoblockers on the tone of smooth muscles of the bronchi, gastrointestinal tract, bile ducts and urinary system. Action on the secretion of sweat, gastric, intestinal and salivary glands.
5. Indications, contraindications and adverse reactions of M-cholinoblocking drugs.
6. Clinical picture of poisoning with atropine and plants, containing this alkaloid. First aid measures in these intoxications. Antidots and their mechanism.
7. N-cholinoblockers (antinicotincs). Classification. Mechanism of action.
8. Ganglioblockers. Classification by chemical structure and duration of action. The action of ganglioblockers on the cardiovascular system, the digestive tract, and on the uterus..
9. Indications, contraindications and adverse reactions of ganglioblockers.
10. Miorelaxants with peripheral action (neuromuscular blocking agents). Classification of miorelaxants by duration of action and by the mechanism of action.
11. Mechanism of action of depolarising, nondepolarizing and mixed miorelaxants. Indications, contraindications and side effects of miorelaxants.
12. Miorelaxants' antagonists and principles of decurarization.

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

1.) Questions on medical prescriptions.

- To prescribe** the following drugs in all the possible medicinal forms: 1. Atropine sulphate. 2. Scopolamine hydrobromide. 3. Tropicamide. 4. Platifylline hydrotartrate. 5. Hexamethonium. 6. Treprium iodide. 7. Suxamethonium. 8. Pirenzepine. 10. Tubocurarine chloride. 11. Ipratropium bromide

<i>Nr.</i>	<i>Drug's name</i>	<i>Delivery forms, doses</i>
1.	Atropine sulphate	Amp. sol. 0.05%-1ml and 0.1%-1ml Vials (for internal use) sol.0.1%-10ml Tablets 0.0005 Vials (ophthalmic drops) sol.0.1%-10ml Ointment (ophthalmic) 1%-5.0 Ophthalmic films 0.0016
2.	Scopolamine hydrobromide	Amp. sol.0.25%-1ml Vials (ophthalmic drops) sol.0.25%-5ml Ointment (ophthalmic) 0.25%-5.0
3.	Tropicamide	Vials (ophthalmic drops) sol.0.5%-15ml and 1%-15ml
4.	Platifylline hydrotartrate	Tablets 0.005 Amp. sol.0.2%-1ml Sup. rectal 0.01 Vials (ophthalmic drops) sol.1%-5ml and 2%-5ml
5.	Hexamethonium	Tablets 0.1 and 0.25
6.	Treprium iodide	Vials (liof.powder) 0.1
7.	Suxamethonium	Sol vials. 2%-5ml and 10ml Vials (lyof.powder) 0.1 and 0.2
8.	Pirenzepine	Tablets 0.025 and 0.05 Amp. sol.0.5%-2ml
9.	Tubocurarine chloride	Amp. sol.1%-1.5 ml
10.	Ipratropium bromide	Vials (for inhalations) sol.0.025%-20ml Aerosol 15ml

2) List the groups and drugs used in (for): intoxication with atropine containing plants, bronchial obstructive diseases, intestinal spasms, biliary colics, gastric and duodenal ulcer disease with hypersecretion, fundoscopic eye examination, premedication, AV-block, prophylaxis of kinetosis, skeletal muscle relaxation in surgery, tracheal intubation, bone fragments reposition, hypertensive crisis, controlled hypotension.

G. Individual work for knowledge consolidation

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

2) Tables ((knowledge summary)

Table 1

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 2

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 3

Indications of M-cholinoblockers

Indications	Atropine	Scopolamine	Homatropine	Tropicamide	Methocinium iodid	Ipratropium	Pirenzepine
Iritis, iridocyclitis							
Fundoscopic eye exam							

Eye refraction exam							
Spasms of smooth muscles of internal organs							
Bronchial asthma							
Hypersalivation							
Ulcer disease							
Bradycardia 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)		
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H. Interactive activity

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

A patient with a gastric ulcer was given a medicine. But immediately after disappearance of heartburn and abdominal pain, xerostomia, cardiac palpitations, and decreased 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?

DRUGS ACTING ON ADRENERGIC TRANSMISSION ADRENERGIC AND DOPAMINERGIC AGONISTS.

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 and dopaminemimetics.

C. Learning objectives:

a) The student must **know**: the general characteristic of adrenomimetics, dopaminomimetics, classification, mechanisms of action, pharmacological effects, indications, contraindications, adverse reactions and the clinical picture of acute and chronic poisoning with some drugs of these groups and their treatment.

b) 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 of previous and related disciplines necessary 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.

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. Classification of adrenergic drugs (sympathomimetics): according to the mechanism of action, the chemical structure, the type of predominant action.
2. Classification of direct-acting adrenoceptor agonists (α -adrenomimetics). Mechanism of action, pharmacological effects, indications and contraindications. Adverse reactions.
3. Classification of indirect-acting sympathomimetic agents. Mechanism of action, pharmacological effects, indications and contraindications. Adverse reactions.
4. Mixed acting sympathomimetic agents. Mechanism of action, pharmacological effects, indications and contraindications. Adverse reactions.

5. Classification of β -adrenomimetics. Mechanism of action, pharmacological effects, indications and contraindications. Adverse reactions.
6. α, β -adrenomimetics. Mechanism of action, pharmacological effects, indications and contraindications. Adverse reactions.
7. Classification of drugs with influence on the dopaminergic system. Mechanism of action, pharmacological effects, indications and contraindications. Adverse reactions.

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

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms: 1. Norepinephrine hydrotartrate. 2. Epinephrine hydrochloride. 3. Isoprenaline. 4. Salbutamol. 5. Dopamine. 6. Dobutamine. 7. Phenylephrine. 8. Ephedrine hydrochloride. 9. Naphazoline.

<i>N/O</i>	<i>Name of drug</i>	<i>Form of delivery, dose</i>
1	Norepinephrine hydrotartrate	Sol. in amp. – 0,2%- 1ml (intravenous)
2	Epinephrine hydrochloride	Sol. in amp. amp. - 0,1% -1 ml Sol. in phials - 0,1%-10ml; 0,18%-10 ml; Sol. amp. (hidrotartrat)-0,18%- 1 ml (intravenous)
3	Fenoterol	Tabl. 0,005 Sol. 0,005% - 10ml in amp. Aerosol 0,1%-20 ml
4	Salbutamol	Aerosol 10ml Sol in amp. -0,1%- 2,5 ml (for inhalation) Sol in phials -0,1%- 2,5; 5; 10; 50 ml; Tab. 0,002; 0,004; 0,006 ; 0,007; 0,008 Syrup - 0,04%- 50ml Sol. in amp. - 0,1%- 5 ml (intravenous)
5	Dopamine	Sol. in amp – 0,5%; 1%- 2ml (intravenous) Sol. in phials - 2% - 10ml; 4%- 5ml (intravenous)
6	Dobutamine	Sol. in amp – 0,5%- 50ml; 1,25% -20ml; (intravenous) Powder for injection in phials – 0,25; 0,53; (intravenous)
7	Phenylephrine	Sol. in amp. – 1% -1ml; (intravenous)
8	Ephedrine hydrochloride	Tablets 0,002; 0,003; 0,01; 0,025; Sol. in amp - 5% -1 ml; (i/m; i/v; s/c) Nasal drops - 2%; 3%- 10ml; Aerosol 10ml
9	Naphazoline	Sol. in amp – 0,05%; 0,1%- 1,5 ml; (nasal drops) Sol. in phials -0,05%; 0,1%- 5; 10 ml; (nasal drops)

- 2) **List the groups and drugs used in (for):** acute hypotension, anaphylactic shock, bronchial asthma attack, bronchial asthma treatment, acute heart failure, rhinitis, conjunctivitis, cardiogenic shock, hypoglycemic coma, prolongation of action of local anesthetics.

G. Individual work for knowledge consolidation

- 1) **Tests** (Guidelines for Laboratory Work in Pharmacology).
- 2) **Tables** (knowledge summary)

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	Dopamine	Fenoterol	Epinephrine	Norepinephrine	Efedrine
Heart attack							
Cardiogenic shock							
Acute heart failure							
AV block							
Anaphylactic shock							
Bronchial asthma							
Conjunctivitis							
Rhinitis							
Hypoglycemic coma							
Prolongation of action of local anesthetics							
Acute hypotension							
Imminent abortion							
Bronchial asthma attack							

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

H. Interactive activity

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

2.) **Clinical cases** (Guidelines for Laboratory Work in Pharmacology).

3.) **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).

4.) **Solve the case:**

A 45-year-old man has recently been the recipient of a heart transplant. Which one of the following drugs is least likely to cause tachycardia in this patient?

A. Amphetamine; B. Dobutamine; C. Epinephrine; D. Isoproterenol; E. Norepinephrine Give the characteristics of drug and argue the selection.

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 pharmacotherapeutic use.

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

C. Learning objectives:

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

b) 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. Knowledge of previous and related disciplines necessary 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. α -adrenoblockers. Classification. Pharmacodynamics (mechanism of action, pharmacological effects). Indications and contraindications. Adverse reactions.
2. β -adrenoblockers. Classification. Pharmacodynamics (mechanism of action, pharmacological effects). Indications and contraindications. Adverse reactions.
3. α,β -adrenoblockers. Pharmacodynamics (mechanism of action, pharmacological effects). Indications and contraindications. Adverse reactions.

4. Sympatholytics. Classification, mechanisms of action, pharmacological effects. Indications, contraindications, and adverse reactions.

5. Dopaminoblockers. 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) Medical prescription exercises.

To prescribe the following drugs in all medicinal forms: 1. Phentolamine. 2. Prazosin. 3. Propranolol. 4. Atenolol. 5. Nebivolol. 6. Carvedilol. 7. Reserpine. 8. Guanethidine. 9. Dihydroergotoxin.

Nr.o	Drug's name	Delivery forms, doses
1	Fentolamine	Tablets 0,025 Sol. 1% - 1ml in amp.
2	Prazosine	Tablets 0,001; 0,005
3	Propranolol	Tabl. 0,01; 0,04 Sol. 0,25% - 1ml in amp. Ophtalmic drops 1% - 5ml
4	Atenolol	Tabl. 0,025; 0,05; 0,1
5	Nebivolol	Tabl. 0,005
6	Carvedilol	Tabl. 0,00625; 0,0125; 0,025
7	Bisoprolol	Tabl. 0,0025; 0,005, 0,01
8	Dihydroergotoxine	Tabl. 0,0015 Sol. 0,1% - 50ml in vials (internal use) Sol. 0,03% - 1ml in amp. (i/v; s/c; i/m)

2) List the groups and drugs used in (for): trophic ulcers of leg and foot, prostate adenoma, myocardial infarction, migraine, metrorrhagia, cerebral circulatory insufficiency, pheochromocytoma, vascular spasms, hypertension, angina pectoris, cardiac arrhythmias, hyperthyroidism, endarteritis, hypoglycemic coma.

G. Individual work for knowledge consolidation

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

2) Tables (knowledge summary)

Table 1

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 2

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		

H. Interactive activity

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

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?

LOCAL ANESTHETICS, ASTRINGENTS, MUCILAGINOUS, EMOLLIENT, ADSORBENT, AND IRRITANT DRUGS

A. Actuality. Local anesthetics are widely used for preventing and alleviating pain (in surgery, dentistry, urology, gastroenterology, ophthalmology, etc.). Mucilaginous and astringent drugs protect sensory receptors against irritant agents. Adsorbents prevent or retain the absorption of toxic substances in the body (acute intoxications, bronchial asthma, diabetes mellitus, hemo- and lymphosorption, etc.). Irritant drugs, through their revulsive effect, improve tissue trophicity.

B. The purpose of training. To familiarize students with the pharmacological properties and principles of use of astringent drugs, local anesthetics, mucilaginous, emollient, adsorbent, and irritant medications.

C. Learning Objectives

- a) The student **must know**: the definition, classification principles, mechanism of action, effects, and indications of local anesthetics, mucilaginous drugs, emollients, astringents, adsorbents, and irritants.
- b) The student **must be able to**: prescribe the essential medications from this group in available pharmaceutical forms and indicate them for the relevant diseases and pathological conditions.

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

General surgery – semiology. Local anesthesia. Types of local anesthesia (surface, infiltration, conduction/regional, spinal). Mechanism of revulsive action.

E. Self-training questions:

1. Local anesthetics: classification according to chemical structure, types of local anesthesia, activity, toxicity, latency, and duration of action. Requirements for local anesthetics.
2. Pharmacokinetics of local anesthetics.
3. Mechanism of action and effects of local anesthetics.
4. Indications for local anesthetics. Adverse reactions. Acute and chronic cocaine intoxication.
5. Astringent drugs: classification, mechanism of action, pharmacological effects, indications.
6. Mucilaginous and emollient drugs: mechanism of action, pharmacological effects, indications.
7. Adsorbent drugs: classification, mechanisms of action, pharmacological effects, indications. Concept of hemosorbents.
8. Irritant drugs: mechanism of action, pharmacological effects, indications.

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

1) Medical prescription exercises

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

Nr.	Drug's name	Delivery forms, doses
1	Procaine	Tabl. 0,25; 0,5 Ointment 5%; 10% - 20,0 Sol. 0,5; 0,25% - 200 in vials Sol. 1%; 2% - 5ml in amp. Rectal sup. 0,1
2	Lidocaine	Sol. 2%; 4% - 5ml; 10% - 2ml in amp. Sol. 2%; 4% - 50 in vials Ophtalmic drops 2%; 4% - 5ml Gel 1%; 2,5% - 15;0
3	Benzocaine	Tabl. 0,3 Ointment / Gel 2,5%; 5% - 10,0
4	Tetracaine	Ophtalmic drops 0,3% - 10ml
5	Articaine	Sol. 1%; 2% - 5ml in amp/vials
6	Trimecaine	Sol. 1%; 5% - 5 ml in amp.
7	Bupivacaine	Sol. 0,5% - 4ml in amp. Sol. 0,25%; 0,5% - 20ml in vials
8	Activated charcoal	Tabl. 0,25; 0,5

2) List the groups and drugs used in (for): surface anesthesia, spinal anesthesia, epidural anesthesia, infiltration anesthesia, conduction (nerve block) anesthesia, wound and burn treatment, medicinal enema with mucilaginous substances, treatment of myositis, acute intoxications.

G. Individual Work for Knowledge Consolidation

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

2) Tables (knowledge summary)

Table 1

Select the medications for different types of anesthesia

Drugs	Superficial anesthesia	Conductive anesthesia	Infiltrative anesthesia
Benzocaine			
Tetracaine			
Procaine			
Lidocaine			
Articaine			

Note: indicate the range of concentrations and the volume of medications used in the mentioned types of anesthesia. If a medication is not used in the respective anesthesia, mark it with a “-”.

Table 2

Comparative characteristics of local anesthetics

Drugs	Chemical structure	Solubility in water	Anesthetic activity	Duration of action	Toxicity	Eliberation of p-amino benzoic acid
Benzocaine						
Tetracaine						
Procaine						
Trimecaine						
Lidocaine						
Articaine						

Note: (use the symbols) “++” – maximum significance of the effect; “+” – lesser significance of the effect”

H. Interactive activity

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

A patient underwent epidural anesthesia and a surgical intervention on the pelvic organs was initiated. Suddenly, the blood pressure dropped. The surgical intervention was stopped.

Which medication was used for anesthesia?

What was the cause of the blood pressure drop?

What preventive measures could have avoided this complication?

What emergency measures should be taken in this situation to continue the intervention?

Summary on the Topic:

GENERAL PHARMACOLOGY.

MEDICATIONS INFLUENCING ON PERIPHERAL INNERVATION

A. Actuality. Medications affecting the peripheral nervous system (both autonomic and somatic) exert a wide range of pharmacological effects aimed at modulating the activity of systems and organs, as well as the perception and transmission of impulses along afferent pathways.

Cholinomimetics, anticholinesterases, cholinoblockers, adrenomimetics, adrenoblockers, sympatholytics, local anesthetics, astringents, adsorbents, mucilaginous agents, and irritants have broad applications in clinical practice.

B. The purpose of training is to consolidate students' knowledge of the pharmacodynamics of drugs affecting peripheral innervation, their selection according to indications, awareness of adverse reactions, and knowledge of first aid measures in case of overdose.

C. Learning objectives

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

b) **The student must be able to:** prescribe essential drugs from this group, indicate them for various diseases and pathological conditions, and, above all, use them in emergency situations.

D. Self-training questions:

1. Classification of drugs affecting cholinergic synapses.
2. M-cholinomimetics: mechanism of action; effects on the eye, heart, smooth muscles of internal organs, and exocrine gland secretion; indications; contraindications; adverse reactions; muscarine poisoning – clinical picture and treatment.
3. N-cholinomimetics: mechanism of action; effects on carotid chemoreceptors, autonomic ganglia, striated muscles, adrenal medulla, organs and systems; indications; toxic effects of nicotine; use of N-cholinomimetics in smoking cessation.
4. Anticholinesterase drugs: classification and mechanism of action; interaction with cholinesterase; effects; indications; contraindications and adverse reactions; peculiarities of organophosphate compounds; clinical picture of organophosphate poisoning; antidotes – mechanism and use.
5. Classification of cholinoblockers: M-cholinoblockers: classification (according to chemical structure, selectivity, main effect), mechanism of action. Influence on CNS, eye, cardiovascular system, bronchial tone, smooth muscles of the digestive tract, biliary and urinary pathways, detrusor and bladder sphincter, glandular secretion (e.g., gastric); indications; contraindications; adverse reactions. The clinical picture of atropine poisoning and poisoning with plants containing these alkaloids. Antagonists and their mechanism of action.
6. Classification of N-cholinoblockers. Ganglioblockers – classification by chemical structure and duration of action; effects on cardiovascular system, digestive tract, myometrium. Indications, contraindications, adverse reactions.
7. Peripheral muscle relaxants: classification by duration and mechanism of action; indications, contraindications, adverse reactions; antagonists and principles of reversal (decurarization).
8. Alpha and beta adrenomimetics: effects on cardiovascular system, microcirculation, organs with smooth muscles, metabolism. Indications, contraindications, adverse reactions.
9. Alpha-adrenomimetics: classification; effects on cardiovascular system and microcirculation; indications, contraindications, adverse reactions.
10. Beta-adrenomimetics: classification; Beta-1: effects on heart and kidneys; indications, contraindications, adverse effects. Beta-2: effects on bronchial tone, myometrium, vessels, and metabolism; indications, contraindications, adverse effects.
11. Alpha-adrenoblockers: classification; Non-selective alpha-adrenoblockers: mechanism of action, pharmacological effects, indications, contraindications, adverse effects. Selective alpha-1adrenoblockers: mechanism of action, pharmacological effects, indications, contraindications, adverse effects.
12. Beta-adrenoblockers: classification. Non-selective, selective, and vasodilating types of beta-adrenoblockers: mechanism of action, pharmacological effects, indications, contraindications, adverse effects.
13. Alpha and beta adrenoblockers: effects, indications, contraindications.

14. Drugs affecting dopaminergic system: dopaminomimetics – mechanism of action, effects, indications.
15. Sympatholytics: classification, mechanism of action, effects; influence on cardiovascular system, gastrointestinal tract, CNS, catecholamine content; indications, contraindications, adverse effects.
16. Local anesthetics: classification by chemical structure, types of local anesthesia, activity, toxicity, onset and duration of action; requirements for local anesthetics; mechanism of action and effects; indications; adverse reactions; pharmacokinetics.
17. Astringent drugs: classification, mechanism of action, pharmacological effects, indications.
18. Adsorbent drugs: classification, mechanism of action, pharmacological effects, indications.
19. Irritant drugs: mechanism 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) Medical prescription exercises. To prescribe the following drugs in all medicinal forms: Pilocarpine hydrochloride, Aceclidinium, Cititon, Neostigmine, Galantamine hydrobromide, Physostigmine salicylate, Trimedoxime, Atropine sulfate, Scopolamine hydrobromide, Platyphylline hydrotartrate, Hexamethonium, Trepripyridinium iodide, Suxamethonium, Pirenzepine, Tubocurarine chloride, Ipratropium bromide, Tropicamide, Norepinephrine hydrotartrate, Epinephrine hydrochloride, Fenoterol, Salbutamol, Dopamine, Phentolamine, Propranolol, Bisoprolol, Dihydroergotoxine, Dobutamine, Phenylephrine, Prazosin, Ephedrine hydrochloride, Naphazoline, Atenolol, Nebivolol, Procaine, Lidocaine, Benzocaine, Tetracaine, Articaine, Trimecaine, Bupivacaine, Carvedilol, Medicinal charcoal.

2) List the groups and drugs used in (for): Glaucoma, intestinal atony, bladder atony, respiratory center inhibition, radiological diagnostics of the gastrointestinal tract, organophosphate poisoning, residual effects of poliomyelitis, residual effects of CNS trauma, residual effects of peripheral nerve injuries, biliary colic, gastric and duodenal ulcers with hypersecretion, premedication, fundus examination, poisoning by toxic mushrooms, controlled hypotension, hypertensive crisis, asthma treatment, muscle relaxation during intubation, acute arterial hypotension, anaphylactic shock, hypoglycemic coma, rhinitis, asthma attack, imminent spontaneous abortion, cardiogenic shock, acute heart failure, arterial hypertension, cardiac arrhythmias, angina pectoris, pheochromocytoma, vascular spasms, endarteritis, infiltrative anesthesia, surface anesthesia, conduction anesthesia, acute intoxications.