Ministry of health of the Republic of Belarus
Educational institution
«Gomel State Medical University»

Department of general and clinical pharmacology

Authors:
A.V.Sennikava, senior lecturer
E.I.Mikhailova, head of department, DMS, prof.

METHODOLOGICAL RECOMMENDATIONS

for a practical lesson on the discipline "Pharmacology"
for the third-year students of the Faculty of Foreign Students,
studying at the specialty 1-79 01 01 "General medicine"

TOPIC 9: **«CHOLINERGIC AGENTS. NICOTINIC AGONISTS AND NICOTINIC ANTAGONISTS (GANGLIONIC BLOCKERS, NEUROMUSCULAR BLOCKERS»**

Time: 3 hours

Approved at the meeting of the department of general and clinical pharmacology

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LEARNING AND EDUCATIONAL GOALS, OBJECTIVES, MOTIVATION FOR LEARNING THE TOPIC

Drugs acting on the parasympathetic nervous system are widely used in many areas of medical practice (ophthalmology, neurology, therapy, surgery) and play an important role in the complex therapy of emergency conditions. For this reason, knowledge of the pharmacology of these substances is necessary for the future doctor regardless of the chosen specialty.

Learning objective:

– formation of scientific knowledge about the main pharmacological effects, providing therapeutic and preventive effect of drugs on the topic of the class, indications and contraindications for their use, the interaction of drugs, their combined use for use in medical and preventive activities.

Educational purpose:

– to develop their value-personal, spiritual potential, to form the qualities of a patriot and citizen, ready for active participation in the economic, industrial, socio-cultural and public life of the country; to realize the social significance of their future professional activities, to learn to follow academic and work discipline, standards of medical ethics and deontology.

Tasks:

As a result of the study lesson, the student should

know:

– classification and basic characteristics of the studied drugs, pharmacodynamics and pharmacokinetics, indications and contraindications for their use, side effects;

– features of pharmacokinetics and pharmacodynamics, advantages and disadvantages of different dosage forms of these drugs;

– principles of research and testing of new drugs; information and reference and search systems;

be able to:

– analyze the effect of the studied drugs on the set of their pharmacological properties and the possibility of their use in medical practice; to write them in prescriptions;

– use different dosage forms of these drugs, based on the peculiarities of their pharmacodynamics and pharmacokinetics;

– work with scientific literature, search for information about the use and action of the studied drugs;

possess:

– skills in choice of drugs on the topic of the lesson;

– the rules of prescribing the studied drugs in the treatment of various diseases and pathological conditions, taking into account the indications;

– skills of dosage regime correction in case of pathological changes in functions of organs or systems responsible for biotransformation and elimination of drugs or in case of joint use of different drugs;

– skills to search, analyze and summarize information about the use and effects of the studied drugs.

Motivation for learning the topic:

– the specifics of training doctors in this specialty determines the need for students to purposefully study the main pharmacological effects, providing therapeutic and preventive effects of drugs on the topic of the class, indications and contraindications for their use, the interaction of drugs, their combined use, which will successfully complete the specialized disciplines of the specialty.

MATERIAL EQUIPMENT

Reference and informational literature, charts, tables, presentations, drug collections.

CONTROL QUESTIONS FROM RELATED DISCIPLINES

1. General scheme of structure, neurotransmitters and receptors of peripheral (somatic and autonomic) nervous system. Cholinergic transmission of signals.
2. Structure of cholinergic synapses and mechanism of nerve impulse transmission. Mechanism of acetylcholine release and its regulation.
3. Molecular structure and heterogeneity of choline receptors: muscarinic (M1-M4) and nicotinic (Nm, Hn) choline receptors. Localization and effects of physiological and pharmacological stimulation.

CONTROL QUESTIONS ON THE TOPIC OF THE CLASS

1. N-cholinomimetics: nicotine, cytisine. Effects of stimulation of H-cholinoreceptors of the sinocarotid zone, chromaffin cells of the adrenal medulla. Pharmacodynamics. Clinical application.
2. Pharmacology and toxicology of nicotine, treatment of nicotine addiction. Nicotinism. Application of nicotinomimetics for smoking cessation.
3. Ganglioblockers (Hn-cholinoblockers): trimethaphan, hexamethonium benzosulfonate. Mechanism of action. Pharmacological effects, indications for use, side effects of ganglioblockers.
4. Agents blocking neuromuscular transmission (Nm-cholinoblockers): pipecuronium bromide, atracurium, suxamethonium chloride. Classification, mechanisms of myorelaxant action, use, side effects, pharmacological antagonists. Measures of care in case of overdose.
5. Central cholinolytics (trihexyphenidyl, biperiden): pharmacological and side effects, use.

PROCESS OF THE STUDY

Theoretical part

Theoretical questions are described in the appendix to the methodological recommendations.

Practical part

1. Take notes on theoretical material demonstrated by the teacher.

2. Master the methods of solving the tasks and writing out prescriptions on the topic of the class.

Theme learning control

Conducted in the form of independent written work (solution of practical problems and prescriptions for individual task).

METHODOLOGICAL RECOMMENDATIONS FOR ORGANIZATION AND EXECUTION OF STUDENTS' INDEPENDENT WORK (SIW)

The time given for independent work can be used by students for:

– preparing for the practical classes;
– completing the tasks on the topic of the class in the workbook;
– preparing thematic reports, essays and presentations;
– taking notes from academic literature.

The main methods of organizing independent work:

- completing tests and practical tasks of the electronic educational-methodical complex (EEMC) for self-monitoring and self-assessment.

The list of tasks of the SIW:

- solving practical problems in the EEMC;
- completing the test tasks of the EEMC.

Control of the SIW is carried out in the form of:

- assessment of an oral answer to a question, report, report, or solution of a task in a practical class;
- individual conversation.

METHODOLOGICAL RECOMMENDATIONS FOR ORGANIZATION AND EXECUTION OF CONTROLLED INDEPENDENT WORK OF STUDENTS (CIWS)

Recommended forms of CIWS organization:

- doing exercises on the topic of the class in the workbook;
- writing an essay on a given topic;
- preparing a report and a multimedia presentation on a given topic.

The list of tasks of the CIWS:

Topics of essays / multimedia presentations:

1. Modern pharmacotherapy of nicotine addiction.
2. Botulinum toxin type A - a new word in clinical neuropharmacology.

Forms of control of CIWS realization:

- checking and grading an essay on a given topic;
- checking and grading a multimedia presentation on a given topic.

LIST OF REFERENCES

1. Kharkevitch, D.A. Pharmacology: textbook for med. students: transl. of 12th ed. of Russ. textbook "Pharmacology" (2017) / D.A. Kharkevitch. - 2nd ed. - Москва: ГЭОТАР-Медиа, 2019. - 676 с.: ил., табл. - Рек. ФГАУ "ФИРО". – Режим доступа: http://www.studmedlib.ru/book/ISBN5970402648.html – Дата доступа: 23.05.2022.

2. Кратко о лекарственных средствах: учебно – методическое пособие для студентов 3 и 6 курсов факультета иностранных студентов, учреждений высшего

мед. образования: в 2 ч.=Drugs in short: partical workbook for 3 and 6 year students Faculty for International Students of medical higher educational institutions: in 2 parts / Е.И. Михайлова [и др.]. – Ч. 1. – Гомель: ГомГМУ, 2020. – 56с. – Режим доступа: http://elib.gsmu.by/xmlui/handle/GomSMU/7128 – Дата доступа: 23.05.2022.

3. Кратко о лекарственных средствах: учебно – методическое пособие для студентов 3 и 6 курсов факультета иностранных студентов, учреждений высшего мед. образования: в 2 ч.=Drugs in short: partical workbook for 3 and 6 year students Faculty for International Students of medical higher educational institutions: in 2 parts / Е.И. Михайлова [и др.]. – Ч. 2. – Гомель: ГомГМУ, 2020. – 76с. – Режим доступа: http://elib.gsmu.by/xmlui/handle/GomSMU/7129 – Дата доступа: 23.05.2022.

4. Rang and Dale's Pharmacology / J.M. Ritter [et al.]. - 9th ed. - Edinburg [et al.]: Elsevier, 2020. - xvi, 789 p.: ill., tab. + Student consult online.

Nicotinic agents are drugs that directly or indirectly block or stimulate nicotinic cholinergic receptors.

Classification	Nicotinic agonists	Nicotinic antagonists		
		Ganglionic blockers (nerve-type nicotinic receptor antagonists)	Neuromuscular-blocking drugs (muscle-type nicotinic receptor antagonists)	
			Non-depolarizing	Depolarizing
Drugs	**1. Cytisine (Cititon, Tabex)** **2. Lobelina hydrochloride (Lobesil)** **3. Nicotine (Nicorette)**	*Bis-quaternary ammonium salts:* **4. Benzohexonium (Hexamethonium)** **5. Azamethonium bromide (Pentamine)** **6. Trepirium iodid (Hygronium)** **7. Trimethafan (Arfonad)** *Tertiary amines:* **8. Pirilen (Pempidine)** **9. Pachycarpine hydroiodide**	**10. Tubocurarine chloride** **11. Pancuronium bromide (Pavulon)** **12. Piperecuronium bromide (Ardouan)**	**13. Suxamethonium iodide (Ditiline)**
Mechanism of action	Stimulate nicotinic receptors in vegetative ganglia (sympathetic and parasympathetic), sino-carotid zone, adrenal medulla, CNS.	Block nicotinic receptors of all vegetative ganglia	Blosk nicotinic receptors of the postsynaptic membrane of neuromuscular synapses and prevent depolarization of the motor end plate	Lead to a permanent depolarization of the postsynaptic membrane (there is no repolarization and subsequent pulses do not pass)
Pharmacological effects	**1. Stimulation of the CNS** (improves mood, increases the surge of energy – promotes the development of mental and physical dependence) **2. Stimulation of respiration** **3. ↑ BP, tachycardia** **4. ↑ tone of skeletal muscles** **5. ↑ tone and motility of the GIT**	**1. ↓ BP** **2. ↑ HR and myocardial contractility** **3. Mydriasis, ↑ IOP, accomodation paralysis** **4. ↓ secretion of exocrine glands** **5. ↓ bronchus and smooth muscles tone, GIT motility**	**1. Relaxation of skeletal musculature** Sequence of relaxation: Muscles of the face and neck → muscles of the limbs and trunk → intercostal muscles and diaphragm → respiratory arrest	
Indications for use	1. Tobacco addiction treatment 2. Reflex respiratory arrest	1. Hypertensive crisis 2. Controlled hypotension (4-7) 3. Cerebral and pulmonary edema (5)	1. Relaxation of the musculature during the operation, setting of fracture dislocations	1. Tracheal intubation 2. Reduction of dislocations
Side effects	1. Nausea, vomiting 2. Dizziness	1. Orthostatic hypotension 2. Atony of the intestines, bladder 3. Mydriaz, paralysis of accommodation 4. ↓ blood flow velocity (risk of thrombosis)	1. Allergic reactions 2. Bronchospasm (10, 11) 3. ↑ BP (11) 4. ↓ BP (10,12)	1. Prolonged respiratory depression (in *genetically determined* pseudocholinesterase defficiency) 2. Muscle pain 3. Arrhythmias, tachycardia 4. ↑ IOP, ICP
Contraindications	1. Exacerbation of gastric and duodenal ulcers 2. Organic diseases of the cardiovascular system, AH	1. Myocardial infarction 2. Atony of the stomach, intestines, bladder	1. Myasthenia gravis 2. AH, tachycardia (11) 3. Cardiac, renal and hepatic impairment	1. Infants 2. Glaucoma 3. ↓ cholinesterase activity of blood plasma
Overdose treatment	ALV, anticonvulsants, antihypertensives, antiarrhythmics	ALV, anticholinesterase agents (proserine)		Transfusion of donor blood containing pseudocholinesterase

IOP – intraocular pressure; ICP – intracranial pressure; ALV – artificial lung ventilation; GIT – gastrointestinal tract