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

Department of general and clinical pharmacology

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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 4: « SUBJECT OF PHARMACOLOGY. GENERAL PHARMACOLOGY. BASICS OF PHARMACOKINETICS. PRINCIPLES OF DOSAGE OF MEDICINES »

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

Rational choice of drugs is impossible without knowledge of the features of pharmacodynamics, pharmacokinetics and their interactions. The mechanism of action, side and main effects, dose, metabolism of the drug, especially with prolonged use should be taken into account when prescribing medications, especially in conditions of altered sensitivity of the body.

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. The influence of the pH of the medium on the degree of ionization of the substance.
2. The structure of the cell membrane.
3. Passive transport through biomembranes.
4. Metabolic transformation, conjugation.
5. The Henderson-Hasselbach ionization equation.

CONTROL QUESTIONS ON THE TOPIC OF THE CLASS

1. Pharmacology: definition, sections of modern pharmacology (pharmacokinetics, pharmacodynamics, clinical pharmacology). Areas of pharmacology (neuropharmacology, immunopharmacology, chronopharmacology, etc.).
2. Fundamentals of pharmacokinetics, significance for rational pharmacotherapy.
3. Transfer of medicinal substances in the body - absorption, distribution, metabolism, excretion; movement of medicinal substances through barriers. Determinants of transference. Water diffusion. Diffusion in lipids. Transfer of substances with variable ionization through membranes. Active transfer of substances. The main factors affecting the transfer of drugs in the body.
4. Bioavailability: definition, principles of definition, clinical significance. Presystemic elimination of medicines. Distribution of medicinal substances in the body (water spaces and cellular compartments), the speed of distribution. Factors affecting bioavailability.
5. Ways of introducing drugs into the body: enteral (oral, sublingual, transbuccal, rectal, duodenal), parenteral (subcutaneous, intramuscular, intravenous, intraarterial, subarachnoid, intraosseous, intracavitary, inhalation, transdermal, etc.), their goals, advantages, disadvantages.
6. The main pharmacokinetic parameters: bioavailability, volume of distribution (connection with the body's water spaces, variability of the volume of distribution depending on the properties of medicinal substances and the state of the organism), clearance, half-life, elimination constant; their essence, principles of definition and quantitative expression, dimension, relationship, value for management of the dosage regimen of medicines.
7. Pharmacokinetic models (single-chamber, two-chamber). Quantitative laws of absorption and elimination of medicinal substances. The central dogma of

pharmacokinetics: "The concentration of a medicinal substance in the blood is the main parameter for controlling the therapeutic effect of a medicinal product."

8. Principles, goals of drug dosing and variables: dose, types of doses, methods and intervals of administration. Introductory (loading, shock) dose: therapeutic meaning, calculation of the individual loading dose according to pharmacokinetic parameters. Conditions and restrictions on the use of loading doses. Maintenance doses: therapeutic meaning, calculation of maintenance doses to ensure optimal dosing regimen.

9. The introduction of drugs into the bloodstream at a constant rate. The kinetics of the concentration of the drug in the blood and its dependence on pharmacokinetic parameters, the concentration of the solution and the rate of administration. Stationary equilibrium concentration of a medicinal substance in the blood (CSS), the time of its achievement, calculation and management of CSS.

10. Intermittent (discrete) dosing: fluctuations in the concentration of the medicinal substance in the blood, therapeutic and toxic concentration ranges. Calculation of the CSS of the medicinal substance and the boundaries of its fluctuations (minimum (CSSmin) and maximum (CSSmax)) with discrete dosing of medicines, control of the concentration of the medicinal substance. Adequate interval of administration of discrete doses.

11. Biotransformation. The necessity of biotransformation of medicines and its biological meaning, the main focus, tissue localization. The effect of biotransformation on the activity of drugs. Phases of metabolic transformations of drugs. Microsomal systems of xenobiotic metabolism: molecular organization, induction and inhibition. The concepts of "lethal synthesis", "prodrug".

12. The main types of biotransformation of medicines. The metabolism of drugs into toxic products. Clinical significance of biotransformation of drugs (population dispersion and genetic polymorphism of xenobiotic metabolism, influence on biotransformation of drugs of gender, age, body weight, environmental factors, smoking, alcohol); metabolic interaction of drugs. Diseases affecting the biotransformation of medicines.

13. Elimination of medicines. Clearance as the main determinant of pharmacokinetics. Renal clearance of drugs and its components: filtration, active secretion, reabsorption; their quantitative and qualitative characteristics. Factors affecting renal clearance. The dependence of clearance on the physico-chemical properties of drugs. Clearance of drugs by the liver: metabolic transformation and secretion into bile. Biological strategy of metabolic clearance. The main properties of substances secreted with bile; determinants and limitations of hepatic clearance (enterohepatic cycle of drugs). Factors that modify the clearance of drugs. Drug interactions: competition for secretory mechanisms, metabolic enzymes, protein-ligands, induction and inhibition of drug metabolism.

14. Individual characteristics of the distribution and metabolism of drugs. Diseases affecting the pharmacokinetics of drugs. Strategy of individual pharmacotherapy aimed at maintaining the therapeutic concentration of the drug in the blood. Corrections for calculating individual values of the volume of distribution taking into account age, gender, body weight, overweight (obesity), fluid sequestration, dehydration.

15. Principles of correction of dosage regimens of medicines for liver and kidney diseases (general approaches). Correction of the dosage regimen under the control of the total clearance of the drug; preferred options. Correction of the dosage regimen under the

control of residual kidney function, liver damage and other pathological conditions, drug interaction.

PROCESS OF THE STUDY

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Theoretical part

Theoretical part is described in the study guide of the department "General pharmacology"

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. The main stages of the development of pharmacology as a science (filling out workbooks).

2. The concept of medicine and poison.

3. New directions of development of modern pharmacology.

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

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2. Кратко о лекарственных средствах : учеб.-метод. пособие для студентов 3 курса лечеб., мед.-диагност. фак. и фак. подг. спец. для зарубеж. стран, 6 курса лечеб. фак. и фак. подг. спец. для зарубеж. стран, аспирантов, магистрантов, учреждений мед. образования : в 2 ч. / Е. И. Михайлова [и др.]. – Гомель : ГомГМУ, 2019. – Ч. 1. – Гомель : ГомГМУ, 2020. – 56с. – Режим доступа: http://elib.gsmu.by/xmlui/handle/GomSMU/7128 – Дата доступа: 23.05.2022.
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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.