

**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 34: «PRINCIPLES OF TREATMENT OF ACUTE DRUG  
INTOXICATIONS»**

Time: 3 hours

Approved at the meeting of the department of general and clinical pharmacology  
the protocol № 18 of 30.06.2022

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

Various poisons are widespread in nature as a human habitat. The number of toxic substances is constantly increasing as society, its productive forces, chemistry, technology and technology develop. In case of improper storage or use, toxic properties may also be acquired by medicinal products. Due to the frequent use of medicines as self-medication, the topic of household use of a number of chemicals with potentially toxic properties is becoming particularly relevant. This fact is confirmed by the fact that the number of acute exogenous poisonings increases every year, and the number of people discharged to the hospital with this pathology now is 1 person per 1,000 people per year.

Acute poisoning is characterized by a sudden onset, polymorphic clinical manifestations, rapid dynamics and a fairly frequent development of critical conditions. A characteristic feature of critical states in acute poisoning is the involvement in the pathological process of such tissues, organs and systems, to which selective action of the poison is not initially spread. In a state of deep coma and shock, the kinetics of poisons is disrupted and the period of their elimination from the patient's body increases. For this reason, the treatment of a patient with acute poisoning is often multifaceted and requires the involvement of various agents and methods of medical therapy. At the same time, timely and adequate treatment in most cases guarantees the salvation of life and the return of health to the majority of patients with acute exogenous poisoning.

### **Learning objective:**

- formation of scientific knowledge about scientific achievements regarding epidemiology, causes, diagnosis, clinic and main directions of emergency care and intensive care of acute exogenous poisoning.

### **Educational purpose:**

- to develop their value-personal, spiritual potential, to form the qualities of a patriot and a 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 observe educational and labor discipline, the norms of medical ethics and deontology.

### **Tasks:**

As a result of the training session, the student should:

#### **know:**

- possible causes of acute exogenous poisoning and symptoms of acute poisoning with drugs of different pharmacological groups;
- basic principles of pharmacotherapy of acute drug poisoning;
- how to stop the entering of poison into the body, how to remove unabsorbed and absorbed poison from the body;
- definition of antidote and types of antidote therapy;
- methods of efferent therapy and the basis of symptomatic therapy of acute poisoning.

#### **be able to:**

- compile and analyze the causes of acute poisoning and the main principles of pharmacotherapy of acute drug poisoning;
- interpret the symptoms of poisoning with various toxic substances;

- create an algorithm for helping patients with acute poisoning;
- write prescriptions and make a pharmacotherapeutic analysis of 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 concept of poisons and poisoning. Classification of poisons. Enter of poisons into the body.
2. Types and stages of poisoning. The term "lethal synthesis".
3. Clinical manifestations of acute insufficiency of vital organs and systems (cardiovascular and respiratory systems, liver and kidneys).

## **CONTROL QUESTIONS ON THE TOPIC OF THE LESSON**

1. Classification of pharmacological substances according to the degree of toxicity and hazard (lists A, B). Toxicokinetics, toxicodynamics. The main mechanisms of toxic action.
2. Causes of acute poisoning. Symptoms of acute poisoning with drugs of different pharmacological groups.
3. Principles of drug poisoning treatment. Emergency medical care, depending on the route of entry of substances into the body.
4. The concept of antidotes. The main groups of antidotes: toxicotropic antidotes, toxic kinetic antidotes, pharmacological antagonists, immunological antidotes (antitoxic serum).
5. Mechanisms of action of antidote drugs, conditions and restrictions for their use. Types of antidote therapy. Prevention of acute drug poisoning.

## **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. Exotic poisoning (dioxins and tetrodotoxin) (complete the teaching workbooks).
2. Characteristics of neurotoxic poisons, treatment.

### **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. Конорев, М. Р. Курс лекций по фармакологии. В 2 т. Т. 2, ч. 1 : для студентов 3 и 4 курсов фармацевт. фак. учреждений высш. образования, обучающихся по специальности 1 - 79 01 08 "Фармация" / М. Р. Конорев, И. И. Крапивко, Д. А. Рождественский ; УО "ВГМУ", Каф. общей и клинической фармакологии с курсом ФПКиПК. - Витебск: ВГМУ, 2019. - 294 с.: ил., табл. - Рек. УМО по высш. мед., фармацевт. образованию.

3. Конорев, М. Р. Курс лекций по фармакологии. В 2 т. Т. 2, ч. 2 : для студентов 3 и 4 курсов фармацевт. фак. учреждений высш. образования, обучающихся по специальности 1 - 79 01 08 "Фармация" / М. Р. Конорев, И. И. Крапивко, Д. А. Рождественский ; УО "ВГМУ", Каф. общей и клинической фармакологии с курсом ФПКиПК. - Витебск: ВГМУ, 2019. - 165 с.: ил. - Рек. УМО по высш. мед., фармацевт. образованию.

4. 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.

5. 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.

**Poison** is a toxic alien substance impairing biochemical processes in the body.

Poisoning classification	By origin						
	Unintentional			Intentional			
	Industrial	Household	Iatrogenic (medical error)	Homicidal		Suicidal	
	By the route of poison entry						
	Oral		Inhalational		Percutaneous (through the skin)		Parenteral
	By area of application						
	Industrial poisons	Agricultural poisons	Household poisons	Biological poisons	Medicinal products	Chemical warfare agents	
	By selective toxicity						
	Cardiotoxic	Neurotoxic	Nephrotoxic	Hepatotoxic	Hematotoxic	GIT-toxic	Pulmonary
	Mechanism of action	Cause disorders of rhythm and conduction, toxic dystrophy of the myocardium	Cause disruption of mental activity, toxic hyperkinetic diseases, paralysis	Cause toxic nephropathy	Cause toxic hepatopathy	Cause hemolysis and methemoglobinemia	Cause toxic gastroenteritis, mucous burns
Toxic substances	Cardiac glycosides, adre-noblockers, calcium channel blockers, tricy-clic antidepressants, hel-lebore	Psychotropics, or-ganophosphorus compounds, isoniazid, alcohol and its surrogates	blalts of heavy metals, chlorin-ated hydrocar-bons, oxalic acid	Chlorinated hydrocarbons, muschrooms, phenols, aldehydes	Carbon monox-ide, nitrates, ar-senic hydride, phenacetin, ani-line	Salts of heavy metals, acid and alkali, arsenic	Chemical warfare agents, chlorine and nitrogen oxides
By the toxicity							
Extremely toxic Lethal dose <15 mg / kg		Highly toxic Lethal dose 15-150 mg / kg		Moderately toxic Lethal dose 150-1500 mg / kg		Low-toxic Lethal dose >1500 mg / kg	

**Toxicokinetics** is a section of toxicology that studies the patterns of resorption, distribution, biotransformation and routes of eliminating xenobiotics from the human body.

**Toxicodynamics** is a section of toxicology that studies the mechanism of toxic action, the patterns of development and manifestations of various forms of the toxic process.

## *Basic principles of acute intoxication treatment*

1. Evaluation of vital functions and correction of their disorders	Correction of life-threatening respiratory and circulatory disorders (providing airway patency, cardiopulmonary resuscitation if necessary)
2. Cessation of poison intake into the body	Removal of the victim from the zone of toxic pollution; use of personal protective equipment (gas mask); termination of injection of toxic substance
3. Removal of unabsorbed poison from the body	<p><b>From the stomach</b></p> <ol style="list-style-type: none"> <li>1. Simple lavage <b>NB! Contraindicated:</b> when poisoning with acids, alkalis, gasoline, turpentine → repeated damage to mucous membranes; when poisoning with cardiotoxic chrononegative poisons → pronounced bradycardia.</li> <li>2. Disadvantage of the method: gastric spasm → toxin remains in the gastric folds → preservation of xenobiotic in the body.</li> <li>3. Tube gastric lavage</li> </ol> <p><i>Basic principles of gastric lavage:</i> T<sup>0</sup>fluid 18-24 °C, V<sub>single</sub> &lt; 600 ml, V<sub>total</sub> ~7-15 l After gastric lavage, a suspension of activated carbon (0.5-1.0 / kg body weight) is given</p> <p><b>From the intestine</b></p> <ol style="list-style-type: none"> <li>1. Siphon enema</li> <li>2. Intestinal lavage</li> <li>3. Saline laxatives</li> </ol> <p><b>From the lungs</b></p> <ol style="list-style-type: none"> <li>1. Removal of the victim from the zone of toxic pollution</li> <li>2. Use of personal protective equipment (gas mask)</li> <li>3. Ventilation, assisted breathing, oxygen inhalation</li> </ol> <p><b>From the surface of the skin and mucous membranes</b></p> <ol style="list-style-type: none"> <li>1. Washing with running water (T<sup>0</sup> &lt; 200 T<sup>0</sup>C) or fluid from the skin decontamination kit.</li> <li>2. Chemical neutralization of poison (acids - alkali and vice versa). <b>NB!</b> ↑ risk of localized skin and mucous membrane damage</li> </ol> <p><b>When administered subcutaneously</b></p> <ol style="list-style-type: none"> <li>1. Cooling the injection site (icepack)</li> <li>2. Injections of the adrenaline solution around the site of administration of the toxic substance</li> <li>3. Overlapping of the tourniquet above the injection site → venous stasis → slowing the flow of poison into the systemic circulation</li> </ol>
4. Removal of absorbed poison from the body	<p><b>Acceleration of excretion of poison from the body:</b></p> <ol style="list-style-type: none"> <li>1. Infusion therapy</li> <li>2. Forced diuresis - hydration therapy followed by intravenous injection of osmotic (mannitol) or loop (furosemide) diuretics → substances that do not bind to proteins and lipids of the blood plasma are eliminated.</li> </ol> <p><b>NB! Contraindications:</b> acute cardiac insufficiency, pronounced impaired renal function, danger of cerebral and pulmonary edema</p> <ol style="list-style-type: none"> <li>1. Methods of intraocorporal correction of homeostasis: peritoneal dialysis, enterosorption using adsorbents; intravenous administration of rheopolyglucin, gemodez or preparations based on polyethylene starch.</li> <li>2. Methods of extracorporeal correction of homeostasis: hemodialysis, plasmapheresis, lymphophoresis, hemosorption, plasmosorption and others.</li> <li>3. Hyperventilation of the lungs. <b>NB!</b> is effective in poisoning with toxic substances that are largely removed from the body through the lungs</li> </ol>

**Antidote** is a remedy that can eliminate or reduce the specific action of the poison by its immobilization, reducing the penetration to the effector receptors by reducing its concentration or which is an antidote at the level of the receptor (WHO International Program on Chemical Safety, 1996)

5. Etiotropic therapy (Specific antidote therapy)	Antidote type	The mechanism of action	Antidotes	Type of poisoning
	1. Chemical	Directly bind to toxicants → neutralization of free-circulating poison	1. Calcium gluconate 2. Deferoxamine 3. D-Penicillamine 4. UnitiolAnti-ophidic serum 5. Black widow antidote	1. Fluoride poisoning 2. Poisoning with iron compounds 3. Poisoning with copper, bismuth, arsenic 4. Poisoning with heavy metals, cardiac glycosides 5. Snake bites 6. Bites of the black widow
	2. Biochemical	Displace the toxicant from its bond with the target molecules → restore normal biochemical processes	1. Oxygen 2. Cholinesterase reactivators 3. Methylene blue	1. Carbon monoxide poisoning 2. Poisoning with organophosphorus compounds 3. Poisoning with methaemoglobin-forming agents
	3. Physiological	Normalize the conduct of nerve impulses in synapses that are affected by toxins	1. Atropine 2. Flumazenil 3. Naloxone, naltrexone	1. Poisoning with organophosphorus compounds, muscarinic agonists 2. Poisoning with benzodiazepines 3. Poisoning with opioids
	4. Metabolism modifiers	Prevent the transformation of xenobiotic into highly toxic metabolites, or accelerate biotransformation	1. Sodium thiosulfate 2. Acetylcysteine 3. Ethyl alcohol	1. Cyanide poisoning 2. Poisoning with paracetamol, dichloroethane 3. Poisoning with methanol, ethylene glycol
6. Pathogenetic therapy	It is aimed at the pathogenesis of the development of some syndromes, for example, partial elimination of signs of cerebral hypoxia caused by asphyxiating substances during inhalation of oxygen			
7. Symptomatic therapy	Elimination or weakening of certain manifestations of intoxication when they occur: 1. Treatment of psychoneurological disorders (intravenous tranquilizers, neuroleptics) 2. Seizures treatment (intravenous tranquilizers or non-inhalational anesthetics) 3. Management of pain syndrome (narcotic or non-narcotic analgesics) 4. Treatment of respiratory disorders (ventilation, oxygen therapy, prevention of aspiration complications) 5. Therapy of cardiovascular complications (the introduction of cardiotonic drugs, antiarrhythmic, plasma-substituting agents) 6. Treatment of hyperthermic syndrome (methods of physical cooling, introduction of a lytic mixture)			

\* Therapy of the most common poisonings is discussed in other topics.