

ANTIVIRAL, ANTIMYCOTIC AND ANTI-SPIROCHETE DRUGS.

A. Actuality. Viruses are pathogens that cause an increasing range of pandemic diseases. The peculiarities of the evolution of viral infections and frequent mutations determine the development and intensive research of antiviral drugs, including the rigorous development of new drugs against new viruses with extremely rapid pathogenicity and infectivity. The incidence and speed of development of resistance impose needs in perfecting the arsenal of antiviral drugs.

Pathogenic and conventionally pathogenic fungi cause local and systemic mycoses, the treatment of which is difficult. The effectiveness of antifungal drugs depends on their spectrum of action, their pharmacokinetic characteristics and the location of the fungi.

Diseases caused by spirochetes, leptospire and borrelia are also of epidemiological interest and require the in-depth study of drugs with specific action.

B. The aim of the training is to familiarize students with the pharmacological properties of antiviral drugs, necessary for the prophylaxis and treatment of viral diseases; familiarizing students with the pharmacological properties of antimycotic drugs, with the formation of the skills and perception of selecting medicines according to the shape and location of fungi; familiarizing students with the pharmacological properties of antispirochete drugs, necessary for the prophylaxis and treatment of diseases caused by the respective pathogens.

C. Learning objectives:

1) The student must **know**: definition, classification, mechanisms of action, pharmacological effects, indications, contraindications, adverse reactions and pharmacokinetics of antiviral, antimycotic, antispirochete drugs.

2) 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 from previous and related disciplines necessary for interdisciplinary integration.

Microbiology. The viruses. Taxonomy and nomenclature. Ultrastructure and properties of viruses. Classification and general characteristic of virosis.

Pathogenic fungi - agents of dermatomycoses, systemic mycoses, candidomycoses.

Microbiology and laboratory diagnosis of spirochetoses. Classification of leptospire.

Transmission routes of leptospire. The pathogenic agents of recurrent typhus.

E. Self-training questions:

1. Antiviral drugs: classification according to the influence on the type of virus.
2. Antiviral drugs active against orthomyxoviruses (influenza virus): classification, mechanisms of action, indications, adverse reactions.
3. Antiviral drugs active against the herpes virus: classification, mechanisms of action, indications, adverse reactions.
4. Antiviral drugs active against the human immunodeficiency virus (antiretrovirals): classification, mechanisms of action, indications, adverse reactions.
5. Antiviral drugs used in the treatment of viral hepatitis B: classification, mechanisms of action, indications, adverse reactions.
6. Antiviral drugs used in the treatment of viral hepatitis C: classification, mechanisms of action, indications, adverse reactions.
7. Interferon drugs: spectrum and mechanism of action, indications, adverse reactions. Recombinant interferon drugs.
8. Antiviral drugs used in cytomegalovirus infections: spectrum and mechanism of action, indications.
9. Antiviral drugs active in papillomavirus infections: spectrum and mechanism of action, indications.

10. Drugs used in coronavirus infection (SARS CoV-2 virus): classification, mechanisms of action and particularities of the antiviral effect, indications, adverse reactions.
11. Antimycotic drugs. Principles of classification by origin, way of administration, and mechanisms of action.
12. Antimycotic antibiotics. Spectrum and mechanism of action. Indications. Side effects.
13. Imidazole derivatives. Spectrum and mechanism of action. Indications. Side effects.
14. Triazole derivatives: spectrum and mechanism of action, indications, adverse reactions.
15. Echinocandins: spectrum and mechanism of action, indications, adverse reactions.
16. Antimycotic drugs used in dermatomycosis: spectrum and mechanism of action, indications, adverse reactions.
17. Classification of antispirochete drugs.
18. Drugs used in the treatment of syphilis: classification, mechanism of action, indications, adverse reactions.
19. The drugs used in the treatment of leptospirosis and recurrent typhus: mechanism of action, indications, adverse reactions.

F. The student's individual work. The student's individual work (points 1, 2, 3, 4 are done in written form during the preparation process)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms:

1. Rimantadine. 2. Oseltamivir 3. Aciclovir. 4. Vidarabine. 5. Zidovudine. 6. Nevirapine 7. Interferon alfa. 8. Ribavirin 9. Foscarnet 10. Lamivudine. 11. Remdesivir. 12. Molnupiravir. 13. Amphotericin B. 14. Nystatin. 15. Griseofulvin. 16. Clotrimazole. 17. Miconazole. 18. Terbinafine. 19. Caspofungin. 20. Fluconazole. 21. Sodium benzylpenicillin. 22. Benzathine benzylpenicillin. 23. Erythromycin. 24. Doxycycline. 25. Cefazolin.

<i>Nr.</i>	<i>Name of drug</i>	<i>Form of delivery, dose</i>
1	Rimantadine	Tablets 0,05 and 0,1; Syrup 0,2% -100 ml;
2	Oseltamivir	Capsules 0,045 and 0,075;
3	Aciclovir	Tablets and capsule 0,2 and 0,4; Suspension 4% -60 and 100 ml in vials (internally); Lyophilized powder 0,25 and 0,5 in vials (i/v); Ointment, cream 5% - 5 and 10,0; Ointment ophthalmic - 3% - 4,5;
4	Vidarabine	Ointment ophthalmic 3 % -5,0; Gel 10%-10,0
5	Zidovudine	Capsules 0,25; Syrup 1% - 200 ml; Sol. 1% and 2% - 20 ml in ampoules(i/v);
6	Nevirapine	Tablets and capsules 0,2; Suspension 240 ml in vials (internally);
7	Interferon alfa	Sol. 1 000 000; 3 000 000 UI in ampoules (i/m); Lyophilized powder 1000 UI in ampoules(nasal);
8	Ribavirin	Capsules 0,2
9	Foscarnet	Sol. 2,4% -250; 500 ml in vials (i/v); Cream 3% -5,0; Ointment 3% 10,0
10	Lamivudine	Tablets 0,1
11	Remdesivir	Lyophilized powder 0,1 in vials

12	Molnupiravir	Capsules 0,2
13	Amphotericin B	Powder 50 000 UA in vials (i/v); Ointment 15,0;
14	Nystatin	Tablets 250 000; 500 000 UA; Tablets vaginal- 100 000 UA; Supp. vaginal - 125 000 UA; Supp. rectal - 250 000; 500 000 UA; Ointment 10,0 and 30,0 (100 000 UA/g).
15	Griseofulvin	Tablets 0,125
16	Clotrimazole	Tablets vaginal 0,2 and 0,5; Ointment 1% -20,0; Cream 1% and 2% - 20,0; 10% - 35,0; Cream vaginal 2% - 20,0; Gel vaginal 2%- 30,0; Sol. 1%- 20 and 40 ml in vials (external use); Aerosol - 40 ml (external use)
17	Miconazole	Cream, gel - 2% - 30,0; Aerosol 0,16%-105,0 (externally); Capsules and supp.vaginal 0,2; 0,4;
18	Terbinafine	Tablets 0,25; Sol. 1% -30 ml in vials (external use); Cream - 1% - 10,0 and 30,0;
19	Caspofungin	Lyophilized powder 0,05 in vials (i/v)
20	Fluconazole	Tablets and Capsules 0,05; 0,2; Syrup 0,5% - 50ml; Suspension 1% - 50ml (internal use); Sol. for perfusion in vials 0,2%- 50 and 200 ml;
21	Benzympenicillin sodium	Lyophilized powder - 500 000 UA; 1 000 000 UA in vials
22	Benzathine benzylpenicillin	Lyophilized powder - 1 200 000 UA; 2 400 000 UA in vials
23	Erythromycin	Tablets 0,25 and 0,5; Supp.rectal 0,05 and 0,1; Granules 30,0 in vials; Suspension 5% - 100ml in vials (internally); Sol. 2% and 4% - 100ml in vials (external use); Ointment - 10,0 and 50,0 (10 000 UA/g) (externally);
24	Doxycycline	Tablets and capsules 0,1 and 0,2; Lyophilized powder 0,1 and 0,2 in vials; Sol. 2%-5ml in vials;
25	Cefazoline	Lyophilized powder - 0,5 and 1,0 in vials;

2) List the groups and drugs used in (for): prophylaxis and treatment of influenza A, prophylaxis and treatment of pandemic influenza, treatment of herpes infections, treatment of cytomegalovirus infections, treatment of human immunodeficiency virus infections, treatment of papillomavirus infections, viral hepatitis B, viral hepatitis C, treatment of SARS CoV-2 coronavirus infection, systemic mycoses, mycotic meningitis, candidiasis, dermatomycosis, onychomycosis, hair candidiasis, treatment of syphilis, prophylaxis of syphilis relapses, treatment of leptospirosis, treatment of recurrent typhus.

3) Tables (recapitulation of knowledge)

Table 1 The spectrum of action of some antiviral drugs

Virus	Rimantadine	Ribavirin	Aciclovir	Ganciclovir	Zidovudine
Influenza type A2					
Influenza type B					
Measles					
Rubella					
Herpes					
Hepatitis B					
HIV AIDS					
Smallpox					

Table 2 Mechanism of action of antiviral drugs

Mechanism	Rimantadine	Saquinavir	Gama-globulines
Inhibits viral proteases			
Inhibits the penetration of the virus into the cell			
Inhibits the release of the viral genome			

Table 3 The spectrum of action of some antimycotic drugs

Drugs	Candidiasis	Dermatomycosis	Systemic mycosis
Amphotericin B			
Nystatin			
Griseofulvin			
Ketoconazole			
Clotrimazole			
Itraconazole			
Terbinafine			
Fluconazole			

Table 4 Identify drugs after the mechanism of action

Mechanism of action	Drug
Irreversible coupling with ergosterol and other specific sterols in the fungal cell membrane with membrane permeability disruption and ion loss, macromolecules with toxic consequences	
Prevention of the synthesis of ergosterol, an essential component of the fungal membrane, by inhibiting specific enzymes (14 alpha-sterol demethylase, squalene poxidase, etc.).	
Inhibition of nucleic acid synthesis by blocking specific enzymes and microtubule functions that deregulate protein synthesis	
Inhibition of the synthesis of D-glucan, an essential component of the cell wall of fungi	
Dysregulation of the permeability of the cytoplasmic membrane for ions, amino acids, proteins necessary for fungal metabolism	

4) Situational problems:

1. On the third day of the disease, for influenza treatment, a child was given an antiviral drug. Way of administration: 3-5 drops in each nasal meatus with an interval of 2-3 hours, not less than 5 times per day. Within 3 days the child's condition slightly improved.

Which drug was indicated?
What is the cause of its non-essential efficacy?

2. A patient with systemic mycosis was given an antimycotic drug in the form of inhalator. After a short period of time, the patient had symptoms like irritation of the larynx, cough, rhinitis, and fever. The examination revealed leukopenia, thrombocytopenia, anemia, increased levels of liver enzymes and urea, creatinine.

Which drug was given to the patient?

What measures have to be undertaken to prevent complications?

3. In the case of the treatment of a patient with syphilis, a preparation with a degenerative bactericidal action was administered. On the 2nd day after the administration, the patient's condition worsened: the fever increased, the symptoms of intoxication intensified, the skin rashes characteristic of syphilis intensified.

What preparation was used and what is its mechanism of action?

What is the cause of side effects?

5) Tests for self-training: (Guidelines for Laboratory Work in Pharmacology).

G. Interactive activity

1. **Experimental and virtual didactic movie** (elaboration of protocol, conclusions).
2. **Clinical cases.** (Guide for laboratory work in pharmacology, Pharmacology book)
3. **Virtual situations** (Guide for laboratory work in pharmacology)