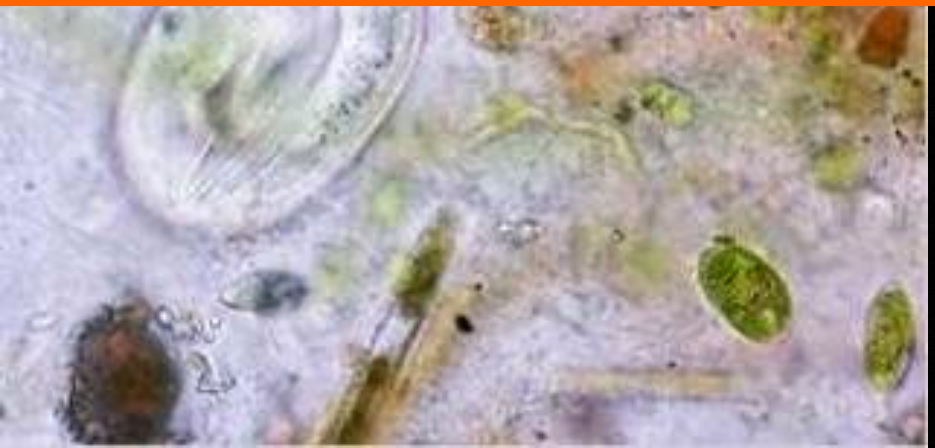
Pharmaceutical care in the prevention and treatment of the most common Helminthiasis



Helminthiasis

The wise man will avoid diseases,
Instead choose medicine for them
Tomas Morr

1. *The relevance of worm invasions*
2. *Who are the causative agents of parasitic diseases?*
3. *The spread of helminthic infections*
4. *Symptoms and syndromes of the diseases*
5. *Diagnostics*
6. *The main directions of therapy*
7. *The advantages and disadvantages of antihelmintic drugs*
8. *Pharmaceutical care*

Actuality of the problem of parasitic invasions

- According to WHO, there are more than 4.5 billion people with parasitic infections in the world
- Every third resident affect by worms in Europe
- During the life almost everyone suffering from a parasitic disease
- Human can infect up to 15 species of pathogenic protozoa and over 250 species of helminths
- 89% of all parasitic infections accounted for helminthiasis
- 20% of children attending kindergardens each year get helminthiasis
- The cause of death of 16 million people per year are infectious and parasitic diseases

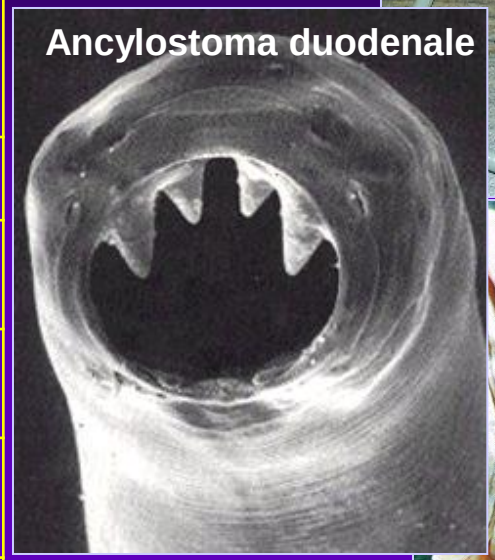
Actuality of the problem of parasitic invasions

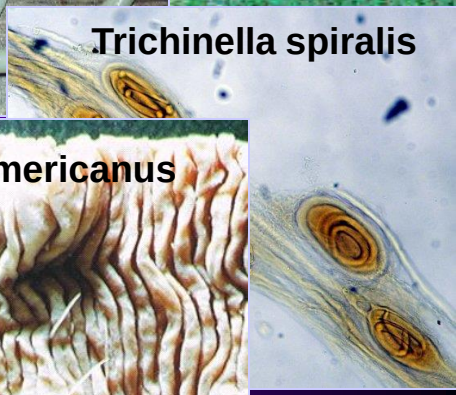
- Pinworms are one of the most immunosuppressive human body helminths
- Opisthorchiasis is the most dangerous disease from helminthiasis now
- Causative agent of opisthorchiasis classified by the International Agency for Research of Cancer to the first group of the human carcinogen
- Opisthorchosis worm live 20-40 years in the human body

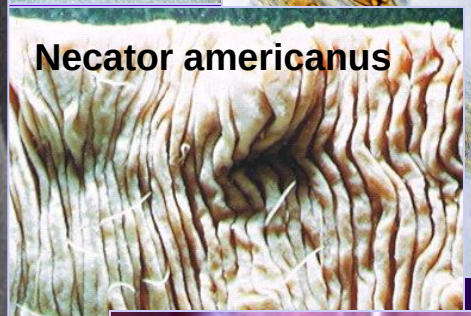
Classification of helminthes

1. Nematodes (Type Roundworms)

Nematodes (Roundworms)	
intestinal	**fabric**
Enterobius vermicularis	Trichinella spiralis
Ascaris lumbricoides	Filarioidea
Trichocephalus trichiurus	Toxocara cants
Ancylostoma duodenale	Onchocerca volvulus
Necator americanus	Dracunculus medinensis
Stronguloides stercoralis	Cutaneos larva migrans



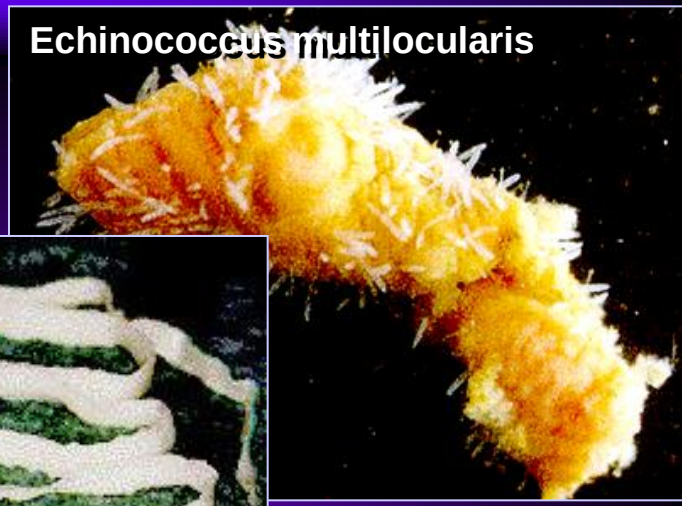


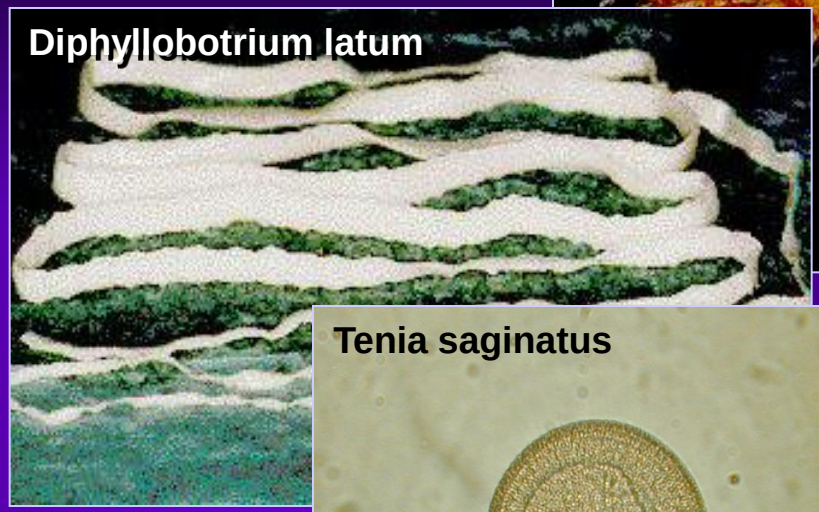


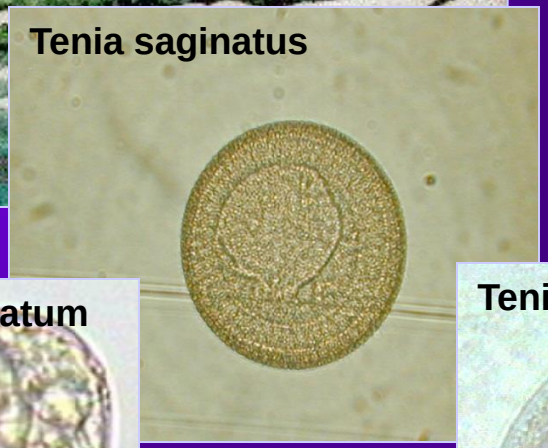
Classification of helminthes

1. Nematodes (Type Roundworms)
2. Cestodes (tapeworms)
   Type Flatworms

Cestodes (tapeworms)
Diphyllobotrium latum (broad tapeworm)
Tenia saginatus (bovine tapeworm)
Tenia solium (pork tapeworm)
Hymenolepis nana (dwarf tapeworm)
Echinococcus granulosus
Echinococcus multilocularis



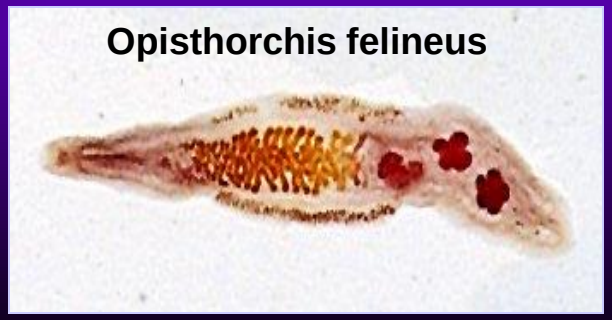




Classification of helminthes

1. Nematodes (Type Roundworms)
2. Cestodes (tapeworms)
3. Trematoda (flukes)
   Type Flatworms

Trematoda (flukes)
Opisthorchis felineus
Opisthorchis viverrini
Clonorchis sinensis
Fasciola hepatica (liver fluke)
Fasciola gigantica



The general scheme of the life cycle of worms

The final owner

(Adult worms lives)

Helminth eggs or larvae

Further development of the egg is determined by to which group includes worms:

GEOGELMINTY, BIOGELMINTY, CONTACT HELMINTHS

Belonging to these groups is determined by the biological characteristics of worms and pathways

Geogelminty: roundworm, whipworm

Contact worms: dwarf tapeworm, pinworm

Biogelminty: chain, tapeworms, flukes

Helminths get into the body in case of:

EATING

- **unwashed vegetables, fruits and berries**
- **unboiled water from stagnant sources**
- **raw, not enough salted and dried fish, caviar of pike**
- **meat of domestic and wild animals that have not been monitoring the sanitary epidemiological service**
- **exotic dishes with unknown components in Asia and Africa**

DIRTY HANDS **not only his own, but the sellers**

The presence of constant contact with *PETS*

SWIMMING **in open water in the area of infection**

WORKS **related to the constant contact with the animals, the soil, travel to exotic countries, children and military groups, in the mine**

PRESENCE OF HOBBY : hunting, fishing, football, beach volleyball (walking barefoot and lying on the ground without litter in areas of hookworm)

FERTILIZER BY FECES of soil of the gardens, orchards, berry fields, greenhouses

The impact of parasites on the body

GENERAL TOXICITY

- Chronic intoxication products of vital activity
- Immune dysfunction and allergization of the organism
- Dyspepsia
- Pulmonary syndrome
- lymphadenopathy
- Myalgia
- Iron deficiency anemia
- Carcinogenesis

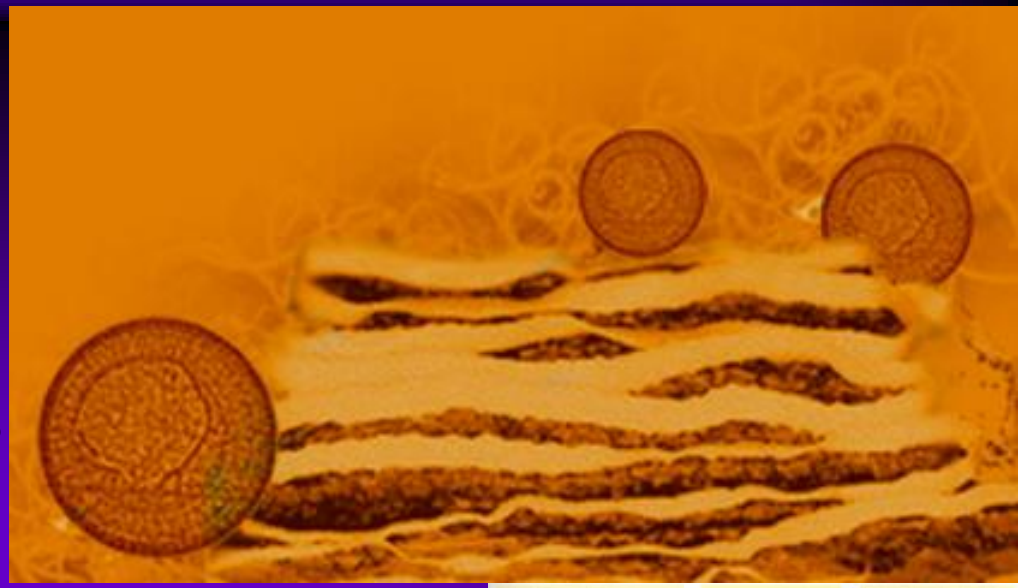
MECHANICAL

- Blockage of the bile and pancreatic duct
- Abscess (purulent focus) of the liver and pancreas
- Ileus (intestinal obstruction)
- Appendicitis
- Perforations (rupture) of the intestine
- Peritonitis

The clinical manifestation in intestinal nematodes

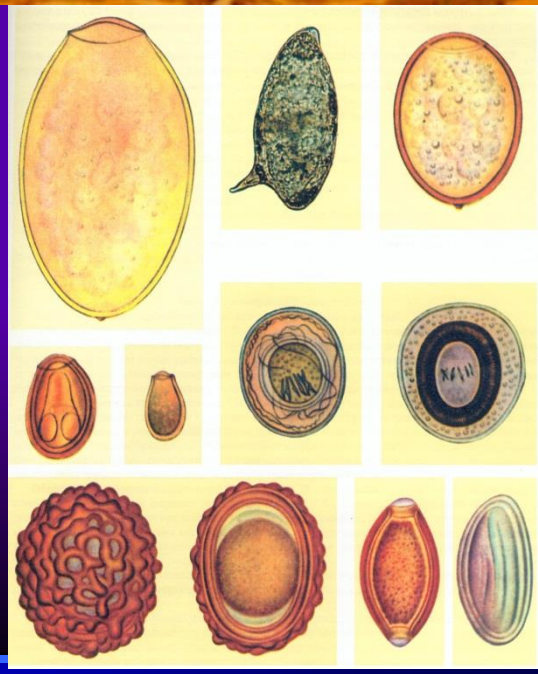
COMPLAINTS	% of total number
Allergic reactions	71,3
Gastrointestinal dysfunction	75,3
Abdominal pain syndrome	40
Appetite disorders	44
Bruxism (teeth grinding)	16,7
Insomnia	54
Anal escoriation and / or itching	36
Signs of suppression of immune system	19,3
Ether symptoms	32,7

Diagnosis of helminth infections



- *Biological materials for testing in presence of helminths, and their fragments, larvae and eggs are the feces, urine, bile, phlegm, mucus rectum, blood, muscle tissue*

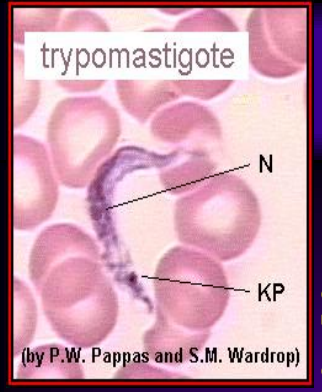
- *IT IS NECESSARY to analyze of three stool samples taken sequentially at intervals of 1 day, or, to save time, for straight 3 days*



Diagnosis of helminth infections

- Eggs and larvae of worms, parasites in the liver, biliary tract, pancreas and duodenum are found in BILE and DUODENAL CONTENTS

- For the diagnosis of filariasis examine BLOOD, for onchocerciasis use SECTIONS OF THE SKIN



The simplest (Protozoa)

Type Sarcomastigophora

Subtype Zoomastigophora (flagellates)

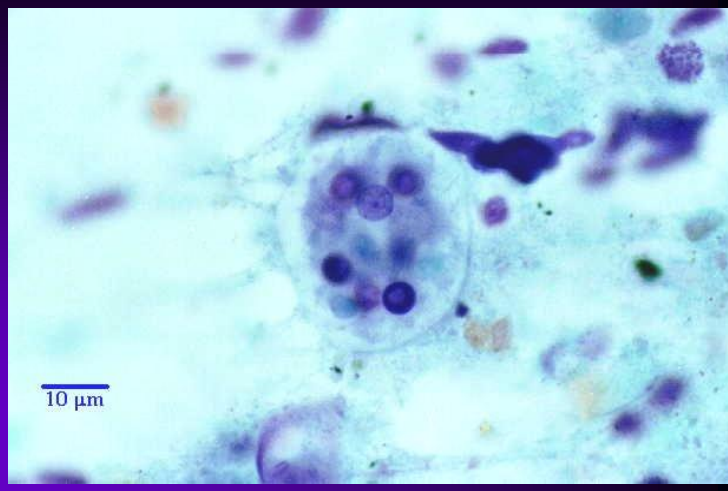
Subtype Sarcodina (amoeboid)

- **Most Protozoa have a generation time (from multiplication to multiplication) from 6 to 24 hours**
- **Reproduction in the host organism is accompanied by an exponential increase in the size of their population**
- **One parasitic organism can after multiply to cause the death of the owner.**

Protozoal diseases: Amebiasis

Subtype Sarcodina (amoeboid) Genus **Amoebia**

- **Amebiasis (amebic dysentery)**- Shigellosis like disease with characteristic frequent watery diarrhea, sometimes with blood and mucus, abdominal pain, fever, and dehydration
- The most frequent complications is massive gastrointestinal bleeding and perforation of the wall of the intestine, liver abscess



E.histolytica: (forma magna)
Absorbed by the red blood cells are seen

Amoebiasis is a disease of tropical and subtropical countries (incidence is 50%, including southern Spain, the Balkans, European Turkey).

In Vietnam, India, the prevalence of 60-80%.

In European countries now observed some sporadic cases, usually Imported.

Protozoal diseases: Leishmaniasis

Subtype Zoomastigophora (flagellates)

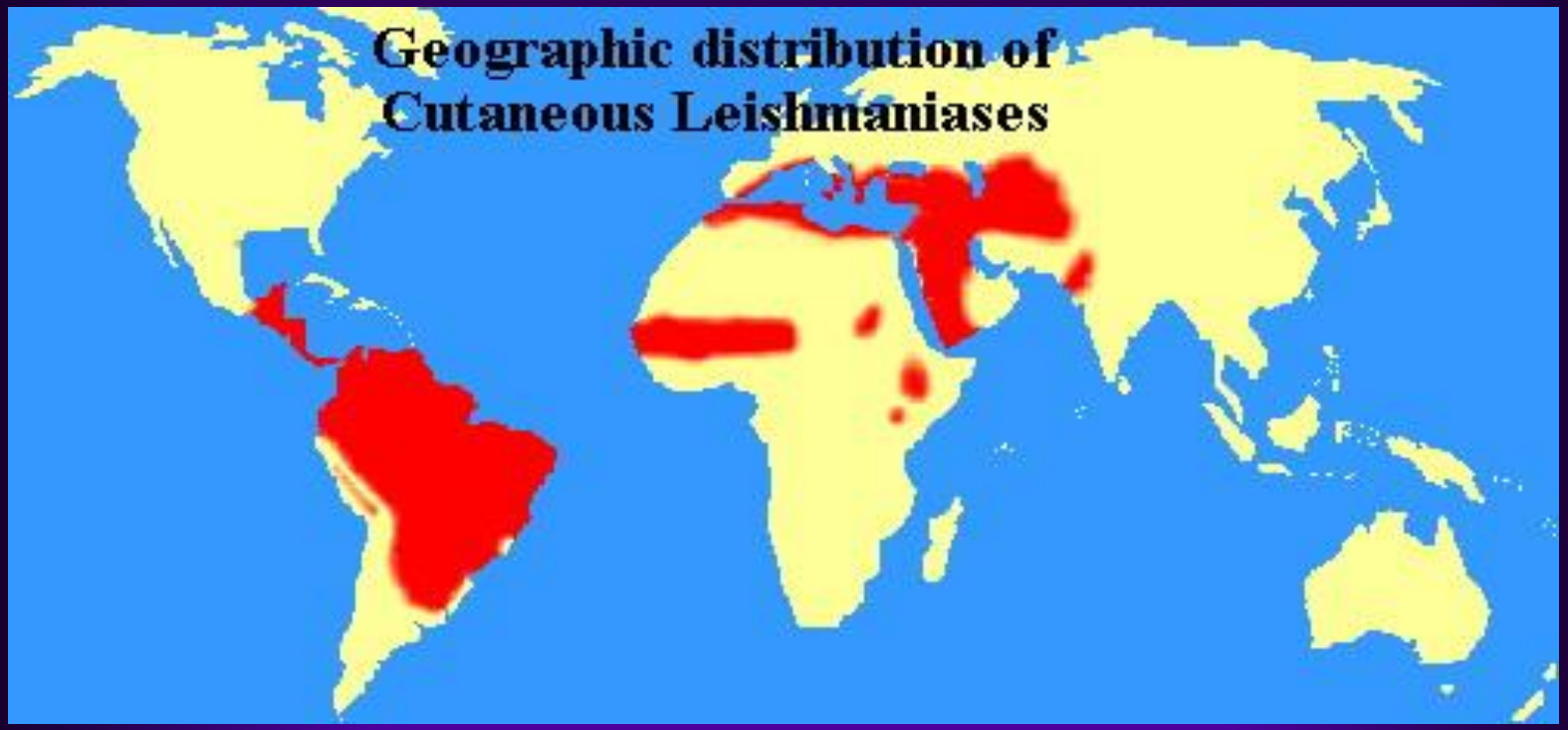
Mastigophora Genus Leishmania

- **The incubation period** lasts from 2 weeks up to 5 months
- After the incubation period, on the skin forms a node enlarged to fill the hazelnut
  - Papules are ulcerate, lesions may form subsidiaries
  - Depending on the pathogen observed the formation of "dry» (*L. tropica major*) or "wet» (*L. tropica tropica*) painless ulcers

- After 3-12 months of spontaneous cure to form a rough pigmented scar ("seal the devil")

Protozoal diseases: Leishmaniasis

- Transmitted by mosquitoes Genus Lutzomyia



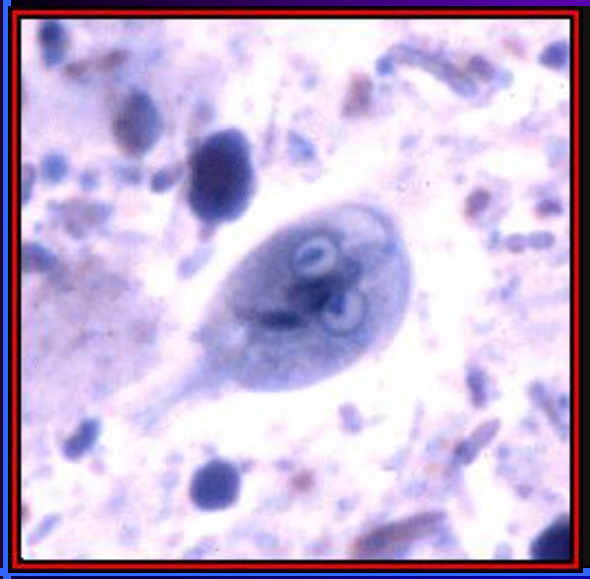
Prevention:

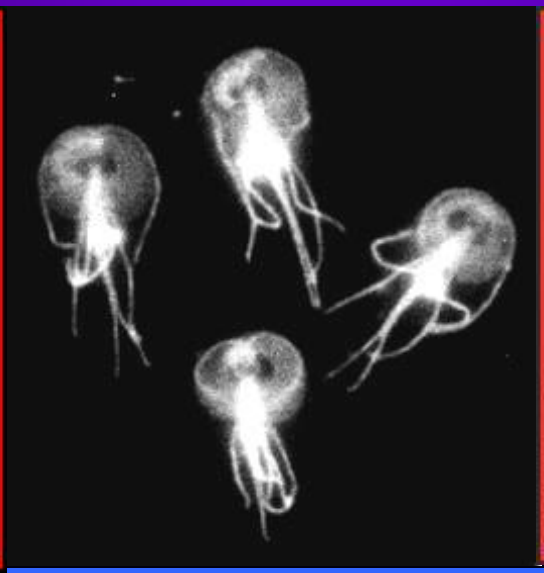
- **destruction of animal carriers leishmaniasis (wild rodents) in the areas surrounding to populated areas**
- **action of protection from bites (repellents, mosquito nets)**

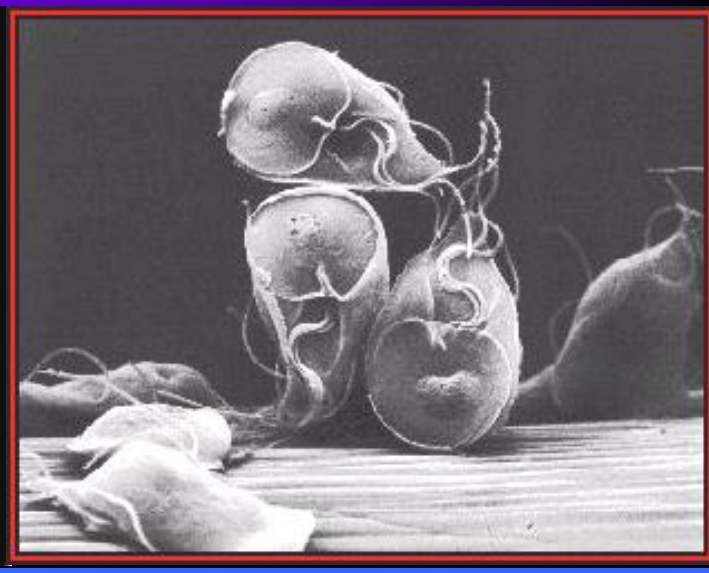
Protozoal diseases: Lambliosis

Subtype Zoomastigophora (flagellates) Genus **Lamblia**

- Giardiasis (lambliosis) is parasitic invasion occurring in the form of latent carriers of the parasite and the clinical forms, mainly in the form of intestinal dysfunction
- It has been discovered by D.F. lamblia in 1859







Protozoal disease: Lambliosis

- Pathogens are **widespread**, especially in regions with a low sanitary culture
- **The main mechanism of infection** is the fecal-oral way by the polluted arms, food and water
- The disease is registered in all age groups, but the main contingent is pre-school children
- **Cysts are resistant** to different influences, particularly in water. For removal of Giardia from water it is needed **to stand her** because they are resistant to chlorination.

Clinical manifestations of lambliosis

MALABSORPTION SYNDROME

- The state with the various manifestations: diarrhea, fatigue, edema, lethargy, weight loss, decreased appetite, pallor, bleeding tendency, paresthesia and muscle twitching

GIARDIASIS usually asymptomatic, but in massive infection may develop enterocolitis with catarrhal symptoms that appear 1-3 weeks after infection

General principles of treatment of worm invasion

- ***THE MAIN COMPONENT*** **of the antihelmintic therapy is a specific treatment, that is the prescription of** ***ANTHELMINTIC DRUGS***
- **Acceptance of antihelmintic drugs must be based on the** ***PARASITE SPECIES***
- ***THERAPY*** **must be** ***COMPLEX*** **and not just aimed at the destruction of worms, but also to eliminate the impact of their life (allergy, anemia, biliary dyskinesia, etc.)**
- **Treatment should be** ***MONITORED*** **(parasitological methods)**

General principles of treatment of worm invasion

- Benchmark analysis should be conducted not earlier than 2 weeks after treatment has finished
- *ANTIBIOTICS, CONTRAST AGENTS, LAXATIVES OR ANTACIDS* difficult to identify parasites or reduce their numbers in the feces to undetectable levels
- If you are receiving these drugs analysis of feces conducted a few weeks later, when these substances from the body would be displayed

The market structure of anthelmintic drugs

Medicine used in trematodosis P 02 B

Biltricid (Praziquantel), Bayer

Medicine used in cestodiasis P 02 D

Flores tanaceti vulgaris (The flowers of tansy)

Medicine used in nematodes P 02 C

P 02 CA **Benzimidazole derivatives**

- **Vermox**
- **Vormil**
- **Nemozol**

P 02 CB **Piperazine and its derivatives**

- **Piperazine Adipinate**

P 02 CC **Derivative of Tetrohydro-pyrimidine**

- **Helmintox**
- **Nemocid**
- **Pyrantelum**

P 02 CE **Derivative of imidazo-thiazoles**

- **Levamisol**

The spectrum of action of anthelmintic drugs

Helminthosis \ Drug	Albendazole №3 400 mg	Mebenda-zole №6 400 mg	Prazyquan-tel№6 600 mg	Piperasine adipinate №10 500 mg	Pyrantel №3 250 mg	Levamisole hydrochloride №1 150 mg
Nematodos						
Ascaridosis						
Enterobiosis						
Trichocephalus						
Ankilostomidosis						
Necatorosis						
Strongiloidosis						
Cutaneos						
Trichinosis						
Cestodiasis						
Gimenolipidosis						
Teniarinchosis						
Teniosis						
Gnatostomosis						
Difilobotriosis						
Neurocystecirosis						
Capilarosis						
Echinococcosis						
Trematodosis						
Opistorchosis						
Clonorchosis						
Phascylopsidosis						
Phascyolosis						
Protosoal diseases						
Giardiasis intestinal						
Giardiasis duodenal						

The main criteria in choosing an anthelmintic drug

- The active substance
- Reliability - the lowest percentage of required of re-treatment
- Broad spectrum of activities - preference to those that destroy all the worms at different stages of development and / or different location
- Safety
- Reasonable price
- The efficiency and fast treatment
- Ease of dosing and comfort of receiving
- European quality product

Albendazole (Vormil)

Features of pharmacokinetics	Advantages of the drug
Sparingly soluble in the water → slightly absorbed in the digestive tract → the optimum concentration of the drug in the digestive tract ▶	high therapeutic activity
Rapidly metabolized in the liver during the first pass ▶	low toxicity (the main metabolite - sulfate albendazole retains ½ pharmacological activity of the primary substance)
It is excreted mainly with the bile after it again reabsorbes in the gastrointestinal tract ▶	purposeful action on the helminth parasites in the liver and bile ducts
Drug accumulation in organs and tissues of worms (30-45 days) ▶	high activity against eggs, larvae and adults of cysts of the parasite
The mechanism of action based on inhibition of two biological processes in the helminth body ▶	broad spectrum of activity and high efficacy of the drug

Mebendazole (Vermox)

Features of pharmacokinetics	Advantages of the drug
Sparingly soluble in the water → slightly absorbed in the digestive tract → the optimum concentration of the drug in the digestive tract ▶	high therapeutic activity
Rapidly metabolized in the liver during the first pass ▶	low toxicity (in this case it is formed inactive metabolites)
It is excreted mainly with the faeces (small part with the bile) ▶	low activity against helminth parasites in the liver and bile ducts
Rapidly excreted from the body (within 24-48 hours) ▶	high activity against only adult parasite
The mechanism of action based on inhibition of only one biological process in helminth's body ▶	less broad spectrum of action and less efficacy than albendazole

Mechanisms of action

Albendazole

INHIBITION of fumarate reductase in muscle tissue

VIOLATION of ATP synthesis in mitochondria

VIOLATION of the glucose synthesis and utilization

Mebendazole

INHIBITION of tubulin protein synthesis

VIOLATION of microtubule structure cells of the intestinal epithelium

BREAKING connections between the membrane and organelles

VIOLATION of transport processes inside the cell

VIOLATION of the cytoskeleton

THE DEATH OF HELMINTHES

Mechanisms of action

Praziquantel

Opening of Ca2 +-channels of the cell membranes

Hypertonus helminth's muscle

vacuolization and disintegration external covers

The death of the helminth

Piperazine, Pyrantel

blockade of acetylcholine transmission in the neuromuscular junction

paralysis of the worm's muscles

The expulsion of the helminth from the body

levamisole

INHIBITION of fumarate reductase in muscle tissue

VIOLATION of ATP synthesis in mitochondria

VIOLATION of the glucose synthesis and utilization

The death of the helminth

Pharmacoeconomic analysis

Drug	Drug form	Manufactured	Price, $	The amount of packagin	The cost of 1 tablet, $	The cost of treatment of enterobiosis, $	The cost of treatment of ascaridosis, $
Biltricid	C. tab. 600mg # 6	Bayer	18,38	6	3,06		
Vermox	Tab. 100 mg # 6	Cedeon Richter	1,78	6	0,30	0,89	1,78
Vermox	Tab. 100 mg # 6	Janssen-Cilag	2,26	6	0,38	1,13	2,26
Piperazine Adipinate	Tab. 200 mg, 500 mg # 10	Darnitsa, Borshagovka, Lugansk, Halichpharm, Agrofarm (UA), Borisov Pharm.	0,08	10	0,01	0,10	0,13
Pyrantelum	Tab. 250 mg # 3	Genom Biotech	0,60	3	0,20	0,60	0,60
Nemocid	Tab. 250 mg # 3	IPCA Laboratories	0,57	3	0,19	0,57	0,57
Helmintox	Tab. 250 mg # 3, 125 mg #6	Innotech International	0,89	3	0,30	0,89	0,89
Pyrantelum	Tab. 250 mg # 3	Polpharma	0,92	3	0,31	0,92	0,92
Levamisol	Tab. 50 mg, 150 mg # 1	Cedeon Richter, Zdorovie, Elegant India (Radius Union)	0,42	1	0,42		0,42
Vormil	Tab. 400 mg # 3	Mili Healthcare	1,50	3	0,50	0,50	1,50
Nemozol	Tab. 400 mg # 10	IPCA Laboratories	5,20	10	0,52	1,56	1,56

* - Calculation of an adult patient weighing 60 kg

Pharmacoeconomic analysis

Drug	Drugs Form	Manufactured	Price, $	The amount of packaging	The cost of 1 ml	The cost of treatment of enterobiosis, $	The cost of treatment of ascaridosis, $
Vermox	Oral susp. vial 20 mg/ml # 1	Janssen-Cilag	2,2	30	0,073	0,367	0,733
Pyrantelum	Susp. vial 750 mg/15 ml # 1	Genom Biotech	0,83	15	0,055	0,208	0,208
Nemocid	Susp. vial 50 mg/ ml - 10 ml	IPSA Laboratories	0,76	10	0,076	0,285	0,285
Helmintox	Susp. vial 50 mg/ ml - 15 ml	Innotech International	2,11	15	0,141	0,528	0,528
Pyrantelum	Susp. vial 750 mg/15 ml # 1	Terpol Works Pharm	1,08	15	0,072	0,270	0,270
Vormil	Susp. vial 200 mg/ 5 ml - 10 ml	Mili Healthcare	2,2	10	0,220	1,100	1,100

* - Payment for a child age 2 years (15 kg)

The algorithm of the conversation of pharmacist with the visitor of pharmacy

The visitor come to the pharmacy with complaints of fatigue, weakness, nausea, decreased appetite, irritability, insomnia

– Do you have a chronic disease of the digestive tract, hemorrhoids?
– Are you taking any medications nowadays?
– Do you have contact with toxic substances in your job?
– Have you had recently an infection (odds dysbiosis)?
– Are you pregnant?

yes

You should consult in your doctor to receive prescription of therapy

no

Is any member of your family who suffers from helmintosis?

yes

Have you received appropriate antiparasitic treatment?

yes

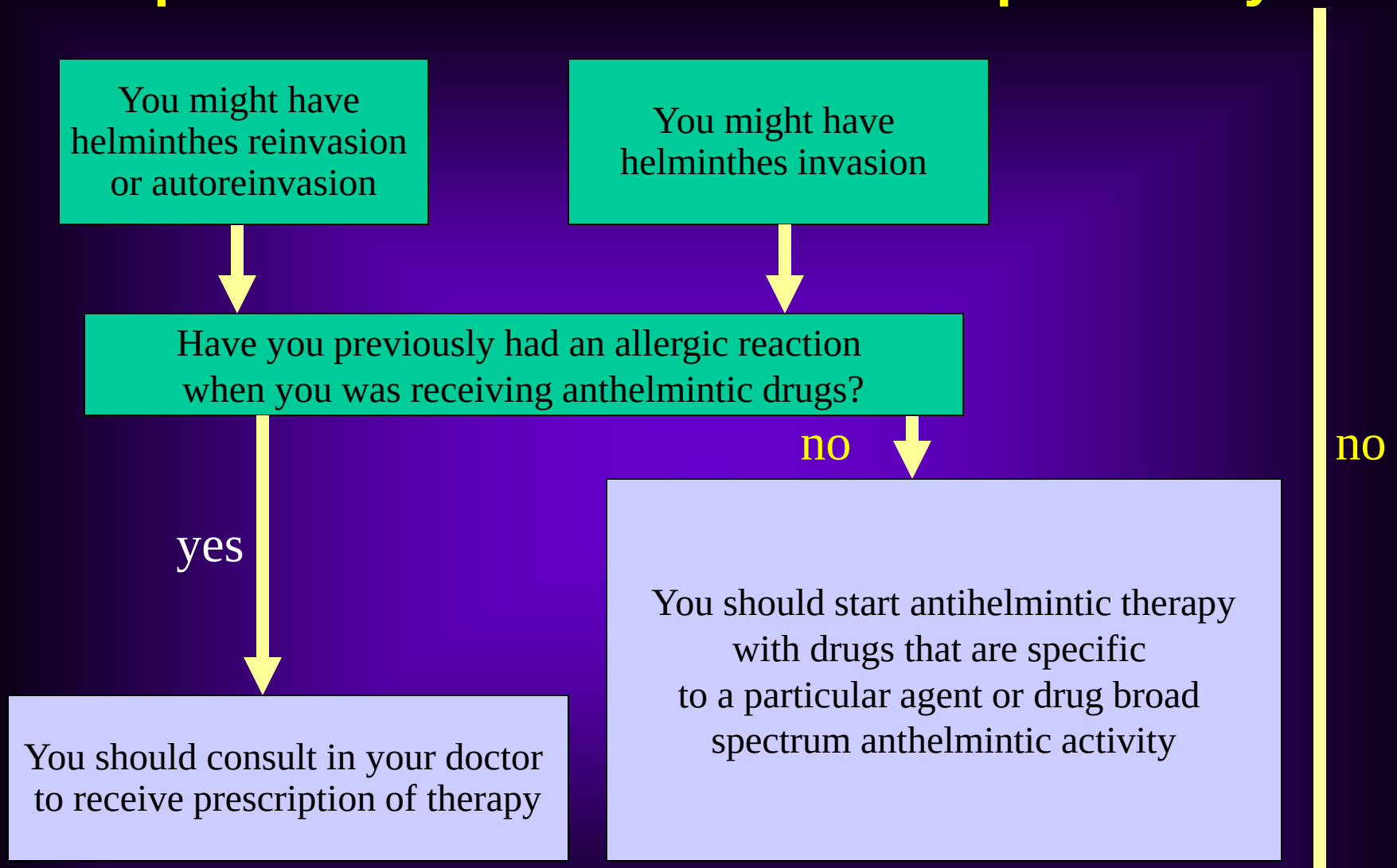
You might have helminthes reinvasion or autoreinvasion

no

You might have helminthes invasion

no

The algorithm of the conversation of pharmacist with the visitor of pharmacy



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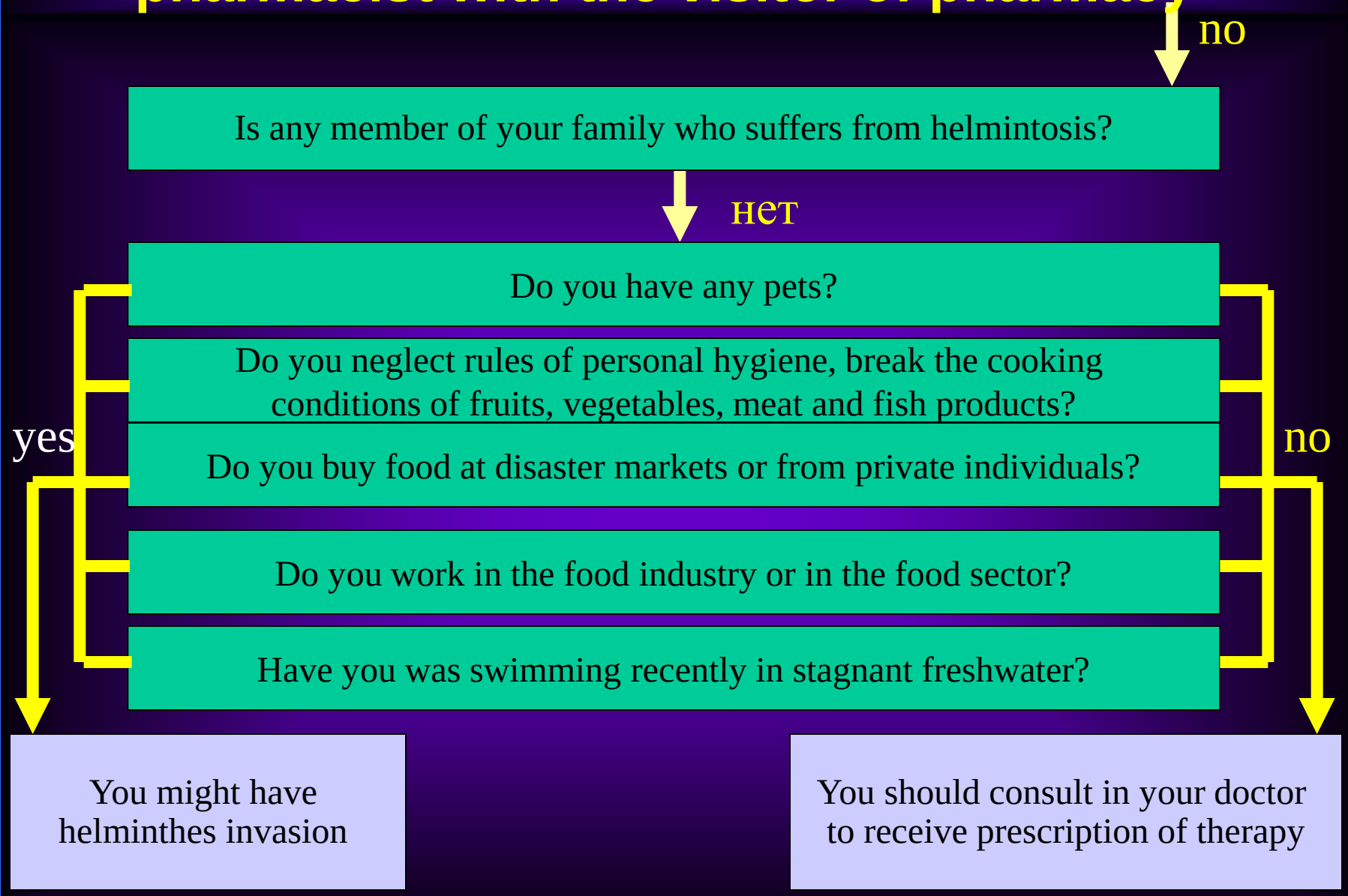

Threatening symptoms that require going to a doctor

- The development of symptoms of the disease, not related to act of damaging factors (e.g., symptoms of SARS in the summer, dyspeptic symptoms without previous errors in the diet);
- Symptoms of disease in the presence of constant contact with pets;
- Appearance of the symptoms after being in the countryside, where widespread infestation of specific helminth;
- The appearance of symptoms after eating unwashed vegetables and fruits, raw, undercooked or not enough roasted meat and fish;
- High levels of eosinophils in the clinical analysis of blood;
- Detection of eggs or segments of worms in stool

Pharmaceutical Care

- Successful dehelminthization (especially In enterobiosis) is possible only with simultaneous treatment of all family members and observing sanitary rules
- Each family member must have an individual bath and bedding
- During making the bed after sleeping you should not shake it; sheets and its accessories must be ironed
- You should conduct daily wet cleaning
- You should regularly disinfect toilet seats and pots
- You should put on a night-fitting underwear
- It is necessary to iron underwear after washing
- After each act of defecation make toilet perianal area

Pharmaceutical Care

- **It is advisable to prescribe antihelminthic medication combined with multivitamins, tonic drugs and non-specific immune stimulators to restore violated metabolism caused by the vital activity of worms**
- **After 14 days of finishing of treatment it is recommended to conduct laboratory testing to confirm the cure**
- **Choosing an antihelmintic drug for children up to 2 years old, pregnant and breastfeeding women should consult a doctor**
- If you have pets it is advisable to conduct regular preventive antihelmintic treatment every six months


Thank you for attention!