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Current State of the Problem of Helminthiasis in Children

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Abstract: The World Bank estimates that the economic cost of intestinal helminthiasis, the most common parasitic disease, is fourth in the list of costs of treating all diseases and injuries; The incidence of helminthiasis is comparable to the incidence of acute respiratory viral infections and influenza. According to the World Health Organization, about 5 billion people in the world are affected by protozoal diseases and helminthiases, i.e. the overwhelming majority of the inhabitants of our planet. At the same time, according to WHO experts, helminthiases have now, to some extent, become “forgotten diseases”—there is an underestimation of their medical and social significance throughout the world. Even in endemic countries, they receive insufficient attention from both health authorities and the population.

Key words: helminths, children, ascariasis.

Helminths are parasitic multicellular organisms belonging to the lower worms. Their characteristic feature is the presence of complex individual development in the life cycle. From a fertilized egg, as a result of fragmentation of germ cells and the formation of germ layers, an adult organism is formed with the subsequent formation of organs and tissues. Sexually mature individuals of helminths of various species have a length from several millimeters to 10–14 m. Female helminths can lay tens and hundreds of thousands of eggs per day, which can maintain their viability for a long time even in unfavorable conditions. The organism in which helminths develop to the sexually mature stage is usually called the final or definitive host.

Adults of some species live in the final host from several months to several decades. The organism in which a certain stage of worm development occurs is called an intermediate host. Both humans and carnivores, fish, and shellfish can play the role of both.

Depending on the biological development cycle of the helminth, biohelminthiasis and geohelminthiasis are distinguished. Geohelminthiases are characterized by the absence of a developmental stage in the intermediate host. In this case, the parasite eggs are able to survive and develop into invasive forms in the soil. A distinctive feature of biohelminthiases is the development cycle of the parasite from a lower form to a mature individual in different species organisms. That is, in geohelminths the development cycle is associated with environmental conditions, while biohelminths develop with the obligatory participation of an intermediate host.

Human infection occurs when mature parasite eggs are ingested, i.e. through contaminated food, water, hands. Less commonly, eggs enter the human body through the air when inhaled with dust. There are helminths whose larvae are able to penetrate the skin, for example, nematodes of the Ancylostomatidae family - contagious helminths. In countries with tropical and subtropical climates, mosquitoes of various genera act as intermediate hosts of the Wuchereria bancrofti helminths. Trematodes can enter the human body through consumption of contaminated meat, fish, and shellfish that have not been sufficiently processed to completely destroy viable invasive forms of helminths. The spread of helminthiases is facilitated not only by natural and climatic factors, but also by social factors, in particular national nutritional characteristics.

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Helminths can infect almost all organs and tissues of the human body. Localization depends on the stage of development of the helminth. For many species of helminths (about a hundred), the favorite place of parasitism is the gastrointestinal tract, and each species is localized in strictly defined sections.

More pronounced pathological changes are caused by the larval and developing stages of helminths. Larvae are capable of parasitizing in various organs and tissues or completing a complex migration path in the body, while adult individuals are characterized by stable localization. Larvae can also undergo encapsulation with the formation of granulomas (toxocariasis, trichinosis), but more often the developing stages of helminths migrate in the body to places of stable localization.

Today, when the mechanisms of the main pathogenetic reactions in parasitic diseases are known, we can say that they cause severe allergic manifestations, cause pathology of the digestive and respiratory organs, have a sensitizing and immunosuppressive effect, which provides a favorable background for the occurrence of somatic and infectious pathologies. The most common pathological effect of all helminths is allergization and suppression of the immune response. Helminths, their structures, and waste products are allergens, cause inflammatory changes, have an immunosuppressive effect and induce intense production of IgE antibodies [4]. All this supports or initiates chronic allergic diseases such as urticaria, atopic dermatitis, and bronchial asthma. Of course, helminthiases cannot be classified as truly allergic diseases, but we must remember that these are diseases in the pathogenesis of which allergy is involved as an obligatory component of the main pathological process.

According to numerous studies, parasitosis contributes to a more frequent occurrence of somatic diseases and exacerbation of chronic diseases, having a multifaceted effect on the host's body, including its immune system. A feature of most helminthiases is the chronic course of the disease, associated with the long-term presence of the pathogen in the body and repeated repeated infections.

In the chronic phase of helminthiasis, changes in metabolic processes occur in the host's body due to the absorption by parasites of metabolically valuable nutrients: proteins, fats, carbohydrates, vitamins, minerals, as well as due to disturbances in neurohumoral regulation and food absorption processes in the intestine. Some intestinal helminths secrete substances that neutralize digestive enzymes (for example, a substance that neutralizes the effects of pepsin and trypsin was found in the tissues of roundworms). Almost half of the world's population suffers from protein-calorie deficiency, which has a huge impact on human development and physical condition. In a number of helminthiases, there is a pronounced causal relationship with anemia and vitamin deficiency (hookworm disease, diphyllobothriasis, trichocephalosis, schistosomiasis). Metabolic products of helminths contribute to changes in intestinal biocenosis and an increase in the proportion of opportunistic and pathogenic microflora. The chronic course of helminthiasis is always accompanied by metabolic disorders in the form of a decrease in protein content, metabolism of fats and carbohydrates, hypoxia in organs, a decrease in the concentration of vitamins, microelements, folic acid, which can cause irreversible changes in organs.

The presence of helminthiasis in a child leads to the suppression of nonspecific resistance of the body, which leads to an increase in acute respiratory and infectious diseases, prolongation and severity of their course. False changes in tuberculin tests are more often recorded. The immune system always reacts to the action of a parasitic antigen, and prolonged chronic invasion causes depletion of its functions. A decrease in the activity of T-lymphocytes in a patient leads to the development of bacterial-viral and allergic diseases. In the WHO report, among the causes that can cause a secondary immunodeficiency state, the leading place is occupied by protozoal and helminthic diseases. Currently, cases of massive infestation are rare, when diagnosis does not cause difficulties, and balls of helminths obstruct the intestinal lumen. Much more often, helminths have become the cause of the development of allergic conditions, chronic pathology of the gastrointestinal tract, anemia, and asthenia. At the same time, helminthiases are among those diseases that are difficult to diagnose due to objective and subjective difficulties (long periods of absence of oviposition, the

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possibility of the absence of females among the parasitic individuals, the likelihood of technical errors).

Therefore, it is important to know the clinical picture of these diseases in order to be able to prescribe an in-depth examination or effective therapy based on a combination of indirect signs, even without direct evidence of the presence of helminthiasis.

In children, the most common forms of helminthiasis are ascariasis and enterobiasis.

Ascariasis. According to official WHO data, ascariasis affects about 1.2 billion people in the world every year. Ascariasis is associated with lack of proper sanitation, poor personal hygiene and the practice of using human feces as fertilizer. Infection is caused by eating food or drinks contaminated with roundworm eggs. Worm eggs that enter the human intestine release parasite larvae. The development of the causative agent of ascariasis in the human body occurs with the migration of larvae emerging from eggs along the bloodstream through the lungs; the larvae are then swallowed with sputum and develop into adults in the intestines. The lifespan of roundworm in the human body is several months. Ascaris allergen is the most powerful of allergens of parasitic origin. It can cause reactions in the bronchi, skin, conjunctiva, and gastrointestinal tract. Allergic reactions can be so severe that they can sometimes pose a threat to the child's life.

The immunosuppressive effect of roundworms causes a decrease in the effectiveness of vaccination and revaccination against measles, diphtheria, tetanus, and polioviruses in children.

The leading mechanisms of pathogenesis of the migratory stage of ascariasis are the traumatic effect of larvae and sensitization by parasitic antigens. In this case, 2 main types of lesions occur in different organs and tissues:

- traumatic effect of migrating larvae in organs and tissues along the migration route. At the beginning of migration, still small larvae cause limited hemorrhages in the wall of the small intestine and in the liver. By the end of migration, the larvae reach 2 mm in size and, penetrating into the alveoli and bronchioles, and then into the bronchi, cause more significant hemorrhages;
- eosinophilic inflammation of the tissues in which the larvae develop.

The tissue phase of ascariasis occurs during the migration of ascaris larvae to the liver and lungs. The metabolites released during this process cause immune disorders and inflammatory reactions. In the migration phase, ascariasis can cause hepatomegaly and broncho-obstructive syndrome.

In the intestinal phase of ascariasis, important pathogenetic factors are the ability of roundworms, reaching a length of 20–40 cm, to spiral forward movements and the desire to penetrate small openings (Vater's nipple, drainage tubes, etc.). The presence of invasion leads to hypertrophy of the muscular layers of the intestinal wall, a decrease in the depth of the crypts, changes in the chemical composition of the intestinal contents, and disruption of the motor-secretory function of the stomach and intestines. Roundworms secrete inhibitors of trypsin and chemotrypsin, as a result of which the absorption of nutrients, proteins, and fats worsens. With ascariasis, functional deficiency of pyridoxine develops, the level of retinol and ascorbic acid decreases, and lactase tolerance decreases. Often symptoms of the intestinal phase of ascariasis are nausea, vomiting, diarrhea, fatigue, dizziness, poor sleep, and abdominal pain. An increased level of eosinophils in the peripheral bloodstream is characteristic of the migratory phase of ascariasis.

Complications of the intestinal phase of ascariasis can cause intestinal obstruction caused by a ball of adult roundworms; peritonitis due to perforation of the intestinal wall or penetration of roundworms into the abdominal cavity through a surgical suture; obstructive jaundice during migration of helminths into the common bile duct; blockage of the pancreatic ducts; asphyxia due to the migration of roundworms into the upper respiratory tract.

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