OPTIMIZATION OF MODERN METHODS FOR DIAGNOSING HELMINTHIC AND PARASITIC INVASIONS IN CHILDREN

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Relevance: Helminthic and parasitic invasions, especially helminthiasis, are widespread among children. In our country, the most common helminthiases are nematodoses-parasitic diseases caused by roundworms (nematodes) that are transmitted through the fecal-oral route. The most well-known representatives of this group of helminths are Ascaris lumbricoides (roundworms), Enterobius vermicularis (pinworms), and Trichocephalus trichiurus (whipworms). Currently, helminthiases remain one of the major public health issues but are among the diseases that are least detected and inadequately assessed.

Keywords: helminthic and parasitic invasions, nematodoses, children, method, diagnosis.

An analysis of the incidence of infectious diseases (excluding influenza and ARVI) and parasitic diseases indicates a significant predominance of helminthiases over other nosological forms [1,2].

Currently, routine methods are used for the diagnosis and study of intestinal nematodoses (ascariasis, enterobiasis, etc.). To improve the low sensitivity of coproscopic methods, a three- to fifteen-fold examination of feces from the same individual has been proposed. This approach prolongs and increases the cost of coproscopic analyses. Early diagnosis of intestinal nematodoses is challenging, as methods for detecting juvenile and pre-adult parasites have not been developed [2,3].

In many infectious diseases, methods for detecting pathogens are used for early diagnosis.

Therefore, an important task in the diagnosis of helminthiases is the development of immunological methods and tools for determining the level of humoral antibodies and detecting helminth antigens in the early stages of the disease and in various biological substrates.

The aim of the study is to experimentally justify approaches to enhancing the effectiveness of diagnosing nematodoses based on their pathogenic features.

It has been established that Ascaris and Enterobius contain a factor that induces agglutination of staphylococci. In experiments on agglutination inhibition using antibodies against the antigens of Ascaris and Enterobius, it was found that the factor causing staphylococcal agglutination possesses antigenic properties. The feasibility of using the microbe agglutination inhibition reaction (MAIR) to detect coproantigens of Ascaris and Enterobius has been demonstrated.

It has been shown that in nematodoses with intestinal stages of parasite development (Ascaris, Enterobius, Trichinella), coproantigens can be detected, while circulating antigens can be found in the blood of patients during the phase of migrating larvae (trichinosis). The presence of circulating antigens in significant amounts in the blood of patients with trichinosis may explain the development of toxic-allergic syndrome in this disease.

The feasibility of using immunological reactions (ELISA, MAIR) to detect coproantigens and antigens of nematodes circulating in the blood of patients has been established, allowing for the practical application of these serological reactions for the early diagnosis of nematodoses.

Helminths have a diverse impact on the host, causing functional disturbances in the organs where they localize, as well as general disorders of metabolic processes and neurohumoral regulation in the body [3,5,7].

Naturally, various functional disturbances are accompanied by corresponding morphological changes, which throughout the invasive process often shift in their causal relationships with functional changes [4,6,8].

The general patterns in the development of morphological and immunological reactions in helminthiases are very complex. First, helminths vary in size, biological characteristics, migration pathways, and localization in the host's organs and tissues. Second, during the development of parasites, transformations occur that result in essentially new organisms that exert qualitatively different effects on the host. Third, the ways in which helminths impact the host's body are extremely diverse, which can influence the development of specific pathomorphological changes [7,8,9]

For immunological studies, blood and feces were collected from patients with ascariasis, enterobiasis, trichinosis, and other helminthiases such as hymenolepidosis, diphyllobothriasis, opisthorchiasis, strongyloidiasis, trichocephalosis, toxocariasis, and echinococcosis.

Helminth antigens have a complex structure and consist of multiple components: glycoproteins, lipoproteins, glycolipid proteins, proteins, and sugars. A small portion of the antigens is specific to a given species of helminth, while the other components are shared with other helminth species, bacteria, viruses, and host tissue antigens, a

specific protein fraction isolated from Ascaris with a molecular weight of 105 kDa binds to specific IgG class antibodies [9,10,11,12].

Currently, the diagnosis of parasitic diseases is retrospective and is based on the detection of humoral antibodies in tissues or eggs in intestinal helminthiases. In recent years, domestic and foreign researchers have attempted to identify soluble antigens in feces for various conditions, such as opisthorchiasis; hymenolepidosis; and schistosomiasis [4,5].

In response to the presence of somatic and metabolic antigens from helminths in the host's body, humoral antibodies are produced, which belong to the immunoglobulin classes IgG, IgA, IgE, and IgM [1,2,4,5].

The most active production of antibodies usually occurs during the parasitism of tissue and migrating intestinal helminths, particularly during the passage of larvae through internal organs and their molting. The mechanism of the humoral immune response, according to E.Kh. Daugaliyeva (1994), can be conditionally divided into three stages: activation, proliferation, and differentiation. The ratio of different classes of antibodies changes throughout the course of the invasion; in the acute phase of the disease, macroglobulin antibodies (IgM) are detected in the serum, which are later replaced by antibodies of the IgG class [6,7].

According to the literature, in ascariasis, the immune response is most pronounced during the migration of larvae. Humoral antibodies begin to be produced from the 3rd to the 5th day of invasion, and by the 15th day, the level of IgM starts to decline. The concentration of IgG antibodies reaches its maximum by the 20th to 40th day and then gradually decreases, with antibodies not being detectable in the serum by the 90th to 100th day [4,5,8,9]

The levels of IgE are measured from the 7th to the 60th day of invasion [1,5,8].

In the literature available to us, there is no information on changes in humoral immunity in enterobiasis. However, there are data indicating that in experimental infections of mice with Enterobius vermicularis eggs, antibodies began to be detected 12 days after infection. Subsequently, an increase in antibody titers was observed, with the titers closely correlating with the intensity of the invasion [4,6,9].

There are also reports of decreased production of humoral antibodies and suppression of post-vaccination immunity against measles, diphtheria, and tetanus in children infected with Ascaris lumbricoides and Enterobius vermicularis [6,8,9,10].

The levels of IgM antibodies in experimental and clinically expressed trichinosis increase from the 7th to the 30th day, while the amounts of IgG and IgE antibodies rise from the 21st to the 90th day of invasion [7,8,9]

Some studies note that by the 6th day of invasion, antibodies to newly hatched larvae aged 24 hours are detected in 96% of patients. By the 9th to 10th day, this percentage decreases to 12-13%, and by the 14th day, it again rises to 44% [5,6,7].

The immune response develops to all antigens of the invasive larvae, but highly specific antibodies, which are used for diagnostic purposes, are detected against excretory-secretory antigens with a molecular weight of 43-55 kDa [1,6,7].Trichinosis antibodies can be detected in recovering patients for up to 2 years.

The literature presents conflicting data regarding the onset of antibodies to trichinosis antigens in the indirect hemagglutination reaction (IHAR). According to O.G. Poletaeva (1994) and R.G. Zayats (1985), antibodies at titers of 1:160 and higher appear on the 7th day of invasion. In earlier works, O.G. Poletaeva (1986) detected antibodies to trichinella at diagnostic titers starting from 3 weeks after infection, while Feldmeier (1987) reported detection after 5 weeks.

Local protective factors play a significant role in providing resistance to intestinal infections in humans, with colonization resistance-supported by the normal microflora of this region—and the presence of secretory immunoglobulins (sIgA) on the intestinal mucosal surface (in the glycocalyx) being particularly important (B. Bossart, 1990). An analysis of the reasons for the ineffectiveness of treatment in patients with intestinal nematodes shows that one of the factors is the disruption of the microbiocenosis of the large intestine, dysbiosis in children infected with pinworms occurs four times more frequently than in non-infected children, primarily affecting the bifido- and lactoflora [4,5,6].

As a component of the normal human microflora, bifidobacteria and lactobacilli play an active role in maintaining the homeostasis of the macroorganism, primarily by providing colonization resistance. Bifidobacteria and lactobacilli participate in enzymatic processes, synthesizing essential vitamins and amino acids for humans. The production of lactic acid, lysozyme, and hydrogen peroxide exerts an antagonistic effect on pathogenic and opportunistic microorganisms [3,5,7,8].

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