

Cytokine Profile of Preschool Children with Helminthiasis

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Abstract The authors studied in detail the cytokine profile of children with different types of helminthiasis, and compared it with the results of healthy children. The results showed significantly high values of IL-8 in enterobiosis, in the group of mixed invasions there was a three-fold increase in IL-4 against the background of a twofold increase in IL-8.

Keywords Hymenolepidosis, Enterobiosis, Helminthiasis, Children

1. Introduction

Helminthiasis is a group of diseases caused by parasitic worms (helminths). Children's helminthiasis is an actual pediatric problem. It is faced not only by specialists of the relevant profile (infectious disease specialists, epidemiologists, parasitologists), but also by medical workers of the district service, preschool and school institutions, hospitals and centers of sanitary and epidemiological surveillance. Human helminthiasis pathogens represent an extremely diverse group of animal organisms leading a parasitic lifestyle, a certain stage of development of which is carried out in the soil (geohelminths) or requires a change of host (bio helminths).

According to the World Health Organization, intestinal helminths among parasites are in 2nd place after diarrhea-their frequency is more than 3.5 billion. cases per year. Experts of the World Bank put intestinal helminthiasis on the 4th place among the leading causes of damage caused by human diseases. At the same time, the importance of helminths in human pathology has been underestimated until recently. Helminths are one of the most ancient and numerous forms of life on our planet.

The purpose of the study: To study the cytokine profile of preschool children with helminthiasis.

2. Materials and Methods

In order to identify the prevalence of helminthiasis among 510 preschool children aged 3-7 years, worm infestations were detected in 194 (38%). All 194 children with helminthiasis made up the main group of clinical observations, 31 practically healthy preschool children were selected for the control group. All 225 examined children underwent general clinical, laboratory (general analysis of blood, urine, feces) and instrumental (ultrasound of abdominal organs: liver, gallbladder, pancreas and kidneys) methods of research.

To increase the information content and quality of the anamnesis collection, a double questionnaire was conducted by interviewing parents /guardians of children in a preschool educational institution and at the reception of a pediatrician.

3. Results and Discussions

The distribution of the groups of examined children was as follows: 1-control group consisted of 31 healthy children, 2-group consisted of 120 children with enterobiosis, 3-group – 43 children with hymenolepidosis and 4-group of 31 children with mixed invasions, i.e. mixed helminthiasis.

Taking into account the influence of the above pathological conditions on the body of children, an immunological study was conducted to determine the cytokine status.

The results of the immunological examination of children showed that a characteristic feature for children of the first group (children with enterobiosis) was a significant increase in the level of IL-4 - 5.96 ± 2.2 pg/l ($p < 0.001$) compared with the control group - 4.50 ± 1.2 pg/l, which is 1.3 times more, and IL-8 - 78.75 ± 8.8 pg/l relative to healthy children - 46.92 ± 2.7 pg/l, the concentration of which is 1.7 times higher ($p < 0.001$) (Table 1).

IL-8, being a powerful pro-inflammatory cytokine, indicates the presence of acute inflammatory processes in the body, which is directly related to the cyclic clinical course of enterobiosis associated with constant reinvasions, when helminthiasis causes an acute phase of the inflammatory response with each repeated ingestion.

The concentration of cytokines in patients with hymenolepidosis indicated a higher IL-4 content (12.05 ± 4.75 pg/l) in the main group, which was almost 3 times higher than the values of the control group (4.50 ± 1.2 pg/l) ($P < 0.001$). Considering that IL-4 is a key regulator of humoral and adaptive immunity and provokes the switching of B cells in the ID, the hyper production of this cytokine is directly related to allergic reactions. In our study, an increase in the level of proinflammatory cytokine IL-4 is associated with

helminthic sensitization of the body of children, which is especially pronounced in hymenolepidosis. Consequently, symptoms such as itching of the skin, difficulty in nasal

breathing, food allergic reactions, which are often found in children of this group, are associated with a sharp increase in IL-4 levels and have an allergic genesis.

Table 1. The content of cytokines in the blood of children with enterobiosis

Cytokines	Healthy children (n=31)		Children with enterobiosis (n=31)	
	Min-max pkg/l	Average pkg/l	Min-max pkg/l	Average pkg/l
IL-4	2,02-7,08	4,50±0,23	3,83-13,98	5,96±0,4***
IL-8	19,23-78,85	46,92±2,72	16,64-158,10	78,75±8,8

Note: * - differences relative to healthy group data are significant
(* - P<0.05, ** - P<0.01, *** - P<0.001)

Table 2. The content of cytokines in the blood of children with hymenolepidosis

Cytokines	Healthy children (n=31)		Children with hymenolepidosis (n=31)	
	Min-max pkg/l	Average pkg/l	Min-max pkg/l	Average pkg/l
IL-4	2,02-7,08	4,50±0,23	4,58-24,12	12,05±0,85***
IL-8	19,23-78,85	46,92±2,72	24,50-114,54	64,59±4,59

Note: * - differences relative to healthy group data are significant
(* - P<0.05, ** - P<0.01, *** - P<0.001)

Table 3. The content of cytokines in the blood of children with mixed helminthiasis

Cytokines	Healthy children (n=31)		Children with mixed helminthiasis (n=31)	
	Min-max (pkg/l)	Average pkg/l	Min-max pkg/l	Average pkg/l
IL-4	2,02-7,08	4,50±0,23	31,36-5,95	15,52±1,11***
IL-8	19,23-78,85	46,92±2,72	24,50-114,54	78,23±8,08

Note: * - differences relative to healthy group data are significant
(* - P<0.05, ** - P<0.01, *** - P<0.001)

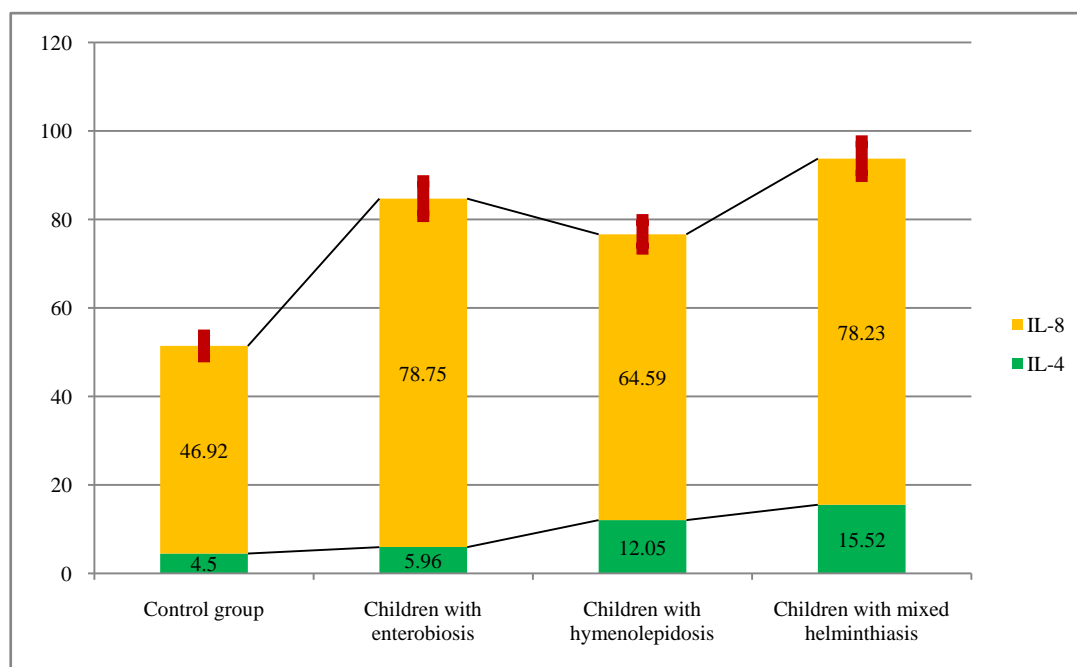


Figure 1. Cytokine profile of children with helminthiasis

IL-8 was increased by 1.4 times in hymenolepidosis, which is also significantly higher than in healthy children (Table 3). As is known, the increase in IL-8 is primarily associated with the formation of a neutrophilic type of inflammation, expressed in the activation of granulocytes, primarily neutrophils, in response to toxic and bacterial pathogens.

IL-4 was significantly increased by 2.7 times 12.05 ± 0.85 pg/l compared with the control group 4.50 ± 0.23 pg/l, which indicates the predominance of allergic sensitization as a trigger mechanism of pathogenetic manifestations in this invasion.

In the group of mixed helminthiasis, cytokine concentrations repeated similar trends as in hymenolepidosis invasion. At the same time, IL-4 was increased by 3.5 times compared to the control group of 15.52 ± 1.11 pg/l versus 4.50 ± 0.23 pg/l, respectively. As for IL-8, this cytokine was also statistically significantly increased by 1.7 times compared to the indicators of healthy people. As is known, the key role in the implementation of allergic inflammation is played by an imbalance of cytokines produced by type 1 (Th1)- and type 2 (Th2) T-helpers and, as a result, hyper activation of the Th2 immune response with the production of immunoglobulins of class E and G.

Thus, significantly high values of IL-8 in enterobiosis indicate about the acute inflammatory nature of the course of helminthiasis, which is confirmed by the cyclical course and reinvasions of the parasite.

Predominantly high concentrations of IL-4 in the blood serum of patients with hymenolepidosis are associated with the sensitizing properties of both the parasite and its metabolites, where it is advisable to use the term "parasitic allergy".

In the group of mixed invasions, there was a threefold increase in IL-4 against the background of a twofold increase in IL-8.

4. Conclusions

Thus, the reactivity of signaling systems of this type is associated with a high antigenic load and a combination of several types of parasites that cause local eosinophilic

inflammation in the intestine and systemic allergic reactions. The study of the cytokine profile with the choice of pro-inflammatory IL-4 and anti-inflammatory IL-8 and the reliable results obtained justify the need for further, more extensive immunological examination of the infected children.

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