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Immunity Indicators of Children Infected with Helminths

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Annotation. The study comprehensively analyzed the parameters of immunity in case of worm infestations in children. The leukocyte formula of blood and indicators of cellular immunity were studied, represented by subpopulations of CD3+, CD4+, CD8+, CD16+, CD25+, CD95+ apoptosis receptor, indicators of humoral immunity CD20+ and immunoglobulins of the IgA, IgM, IgG, IgE class depending on the type of helminthiasis. A differentiated approach to the distribution of pathogens makes it possible to study the effect of each parasitic agent on the child's immune system separately.

Keywords: hymenolepidosis, enterobiosis, helminthiasis, immune system of children.

One of the promising directions in modern immunology is the search, evaluation and subsequent determination of the role of the most significant surface antigens expressed on immunocompetent cells in the implementation of a normal immune response and in pathology. To date, the method of determining cellular receptors in immunology, widely used in both clinical and experimental immunology, allows us to analyze the processes of cellular activation of immunocompetent cells based on the identification of the main "early" and "late" surface activation molecules, markers of proliferative activity of cells of the immune system, apoptosis, intercellular cooperation, etc.

In case of parasitic invasion, the following stages of the development of the immune defense of the human body are distinguished. Stage I – reduction of nonspecific factors of resistance and barrier function of the intestine as a result of invasion of the parasite into the intestinal mucosa and damage to its integrity. Stage II – activation of phagocytosis. It should be emphasized that classical phagocytosis in parasitic diseases is impossible due to the large size of the parasites. As a result, the cellular mechanism of action on a multicellular parasite is determined by the adhesion of immunocompetent cells and the release of enzymes, highly active oxygen species, myeloperoxidase of neutrophil leukocytes and a number of other active molecules. Stage III is the sensitization of the body by synthesizing IgE and IgG antibodies in response to the introduction of helminth as an "antigen". IgE antibodies with their Fab fragments are fixed on the surface of helminth larvae and simultaneously bind to eosinophils with an Fc fragment.

The purpose of the study: comprehensive study of immunity parameters in case of helminthic infestations in children

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.

The results of the study:

In order to comprehensively study the parameters of immunity in helminthic infestations in children, the leukocyte blood formula and cellular immunity indicators were studied, represented by CD3+, CD4+, CD8+, CD16+, CD25+ subpopulations, CD95+ apoptosis receptor, CD20+ humoral immunity indicators and immunoglobulins of the IgA, IgM, IgG, IgE class depending on from the type of helminthiasis. A differentiated approach to the distribution of pathogens makes it possible to study the effect of each parasitic agent on the child's immune system separately.

Leukocyte formula of children's blood depending on the type of helminthiasis

Table 1

Blood counts	Control 1-group (n=31)	2-group with enterobiosis	n=31) 3-group with hymenolepidosis (n=31)	(4-group with mixed helminthiasis (n=31)
Wand nuclear neutrophils, %	3,26 ±0,28	2,74 ±0,21	1,94 ±0,17	2,0 ±0,16**
senment nuclear neutrophils, %	55,87 ±1,06	52,23 ±1,2**	53,45 ±1,24**	48,41 ±0,98**
Eosinophils, %	2,94 ±0,23	5,03 * ±0,4	6,35 ±0,47	14,83 ±1,01
Basophils, %	0,42 ±0,11	0,58 ±0,14	0,26 ±0,08	0,59* ±0,11-
Monocytes, %	6,13 ±0,39	5,23 ±0,4	6,52 ±0,41	5,28 ±0,39
Lymphocytes, %	31,39 ±0,99	33,55 ±1,53	31,48 ±1,36	28,90 ±1,58

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

Statistically significant results were obtained in the content of eosinophils in the leukocyte formula of children, which is confirmed by the data of numerous studies. According to Grishina E.A. 2016, Eosinophils are the main effectors of antiparasitic immunity, which, with the help of their low–affinity receptors, attach to IgE antibodies associated with helminths, degranulate and secrete the following cytokines – IL-1,-3,-4,-5,-6,-8 and others, as well as the main basic protein, cationic protein, peroxidase, superoxide anions that lyse the cuticle of helminths. Thus, in patients with enterobiosis, eosinophils were within the upper limit of acceptable values of 5.03□0.4%, with hymenolepidosis, eosinophilia was observed twice higher than the values of the control group of 6.35±0.47% versus 2.94 (0.23%), respectively. At the same time, the most pronounced eosinophilia was observed in the group of mixed helminthiasis, which amounted to 14.83± 1.01% and was 5 times higher than the result of healthy children and three times the reference values. No statistically significant results were obtained with respect to other representatives of leukocytes in peripheral blood.

When studying the indicators of cellular immunity of the invaded children, an increase in the relative concentration of the total pool of CD3+ T lymphocytes in the group of mixed helminthiasis 72.66±0.61% was revealed, which was 1.3 times higher than the control values of

57.97□0.47%, in the other groups there were no significant differences. The CD4+ lymphocyte cluster was reduced by 1.4 times in all main observation groups relative to the threshold values of the control group (P<0.05) (Table 3.3.2).

The suppressive activity of CD8+ lymphocytes was doubled in hymenolepidosis, which amounted to 38.97±0.98% against the control group of 20.71±0.34%, and in enterobiosis and mixed helminthiasis it was also increased and showed almost identical concentrations in group 2 of 27.87□1.09% and 28.69±0.47% in group 4.

The relative concentration of the CD16+ subpopulation was significantly increased three-fold in the group of children with hymenolepidosis 33.97±1.33% and enterobiosis 29.23□1.04% compared with the control group 10.90□0.19%, which is a natural response of the body to invasion and a favorable prognostic indicator of the outcome of the disease. However, in the group of mixed helminthiasis, a statistically significant decrease in CD16+ lymphocytes of 7.59±0.12% was revealed by 1.4 times compared with healthy ones, most likely associated with depletion of the reactivity of the immune system as a result of chronic parasitosis (Table 1).

An increase in the relative content of CD8+ lymphocytes is associated with the probability of compensatory suppression of excessive killer activity lymphocyte activity in helminthiasis and activation of memory cells.

Indicators of T-cell immunity of children depending on the type of helminthiasis

Table 2

Blood counts	**Control 1-group (n=31)**	**2-group with enterobiosis**	**n=31) 3-group with hymenolepidosis (n=31)**	**(4-group with mixed helminthiasis (n=31)**
CD3, %	57,97 ±0,47	54,10 ±1,12	54,68 ±1,7	72,66 ±0,61**
CD4+, %	42,26 ±0,73	29,84 ±1,19**	30,06 ±0,97**	29,66 ±0,51**
CD8+, %	20,71 ±0,34	27,87* ±1,09	38,97** ±0,98	28,69* ±0,47
CD16+, %	10,90 ±0,19	29,23** ±1,04	33,97*** ±1,33	7,59* ±0,12
CD25+, %	15,68 ±0,32	28,81** ±1,01	38,97*** ±0,95	24,45** ±0,48
CD95+, %	26,06 ±0,62	28,94 ±0,72	36,74* ±1,27	31,34* ±0,76

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

In our studies, the relative concentration of CD95+ in the group of patients with hymenolepidosis was 1.4 times higher than the control values, which indicates an acceleration of the mechanisms of activation apoptosis. Compared with the 1st and 3rd main groups in hymenolepidosis, the expression of the inducer of cell death was significantly high, indicating a pronounced cytotoxic effect of the parasite metabolites. Most likely, the proportional increase in killer activity and CD95+ plays a crucial pathogenetic role in the induction of TNFa cytokine in hymenolepidosis.

Conclusion:

The imbalance of cellular immunity indicators reflects the unique response of the immune system to each type of invasion. The imbalance of cellular immunity indicators reflects the unique response of the immune system to each type of invasion.

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