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IMMUNOLOGICAL FEATURES OF THE INFLAMMATORY PROCESS IN HEMOCOLITIS SYNDROME IN CHILDREN

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Annotation
Hemocolitis syndrome in children is a serious pathology associated with inflammatory processes in the intestine and activation of the immune response. The present study analyzes the immune mechanisms involved in the development of acute diarrheal syndrome with hemocolitis in children aged 6 months to 7 years. The studied indicators of the nonspecific immune response and cytokine profile reveal significant changes in both pro-inflammatory and anti-inflammatory mechanisms. The results obtained demonstrate the activation of the inflammatory process in children with hypertension and may be useful for the development of new approaches to therapy.

Introduction. Immune mechanisms play a key role in the development and severity of inflammatory reactions in the intestine. Disorders in the cellular and humoral components of the immune system, as well as changes in cytokine levels, can increase the inflammatory process, which leads to tissue damage and the development of systemic complications [1,6].

Hemocolitis syndrome (HC) in young children is an urgent problem in infectology, pediatric gastroenterology, and immunology. This disease is characterized by inflammatory changes in the intestine, leading to mucosal damage and systemic complications [1, 3]. Studies of the immune response in children with CH are especially important at the age of 6 months-7 years, which belongs to the third critical period of immune system development according to J.V. Solomon, when adaptive immunity is actively formed [2]. Recent studies show that acute diarrhea (OD) causes hyperactivation of the immune system, which leads to damage to the intestinal mucosa and the development of pronounced inflammatory changes [2,5]. Given the increasing prevalence of intestinal infections and the resistance of microorganisms to traditional antibiotics, the study of immune responses in such conditions is necessary to develop new treatments that could effectively control the inflammatory process and prevent its complications.

Based on the above, the purpose of this study was to analyze the characteristics of the nonspecific immune response and cytokine profile in children with acute hemocolitis-type diarrhea.

MATERIALS AND METHODS. In the framework of this study, 120 children aged 6 months to 7 years with acute diarrhea of the hemocolitis type were examined. The control group consisted of 25 practically healthy children of the same age. Immunological studies were conducted in the laboratory of Experimental Immunology at the Institute of Human Immunology and Genomics of the Academy of Sciences of the Republic of Uzbekistan. The determination of serum levels of nonspecific factors (CRP, PCT), immune response mediators (IL-4, IL-6, IFN-γ) and vascular endothelial growth factor (VEGF-A) was carried out by solid-

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phase enzyme immunoassay using the test systems of VECTOR-BEST JSC (Russia), in accordance with with the manufacturer's recommendations. The quantitative assessment of the results was carried out by constructing a calibration curve reflecting the dependence of optical density on concentration for a standard antigen and allowing comparison with it of the studied samples.

Statistical processing of the research results was carried out by methods of variation statistics implemented by the standard package of application programs “BioStat LE 7.6.5". The data were statistically processed using conventional approaches, the results are presented as the sample mean (M) and the standard error of the mean (m). The reliability of the differences in the average values (P) of the compared indicators was assessed by the Student's criterion (t).

THE RESULTS AND THEIR DISCUSSION. Innate humoral immune response factors are components of the innate immune system that protect the body quickly and without prior exposure to the pathogen. They circulate in the blood and intercellular fluid, providing the first line of defense until adaptive immunity is activated [4]. The study of these factors in acute diarrhea in children with hemocolitis syndrome helps to understand the mechanisms of protection and identify markers predicting the transition of the disease to a more severe form.

Table 1.

Parameters of nonspecific immune factors in the examined children with CH.

Indicator	The control group, (n=25)	Легкое течение SG, (n=25)	Moderate current With SG, (n=95)
SRB, mg/l	3,51±1,42	9,83±1,78**	15,61±3,22***
PCT, ng/ml	0,25±0,17	0,64±0,43^	0,89±0,61^

*Note: * - the values are significant relative to the data of the control group (* - P<0.05, ** - P<0.01,*** - P<0.001). ^- the values are not reliable in relation to the data of the control group (^ - P>0.05).*

Table 2.

The serum content of the studied mediators of the immune response in the examined children with hypertension CH..

Indicator	The control group, (n=25)	Легкое течение SG, (n=25)	Moderate current With SG, (n=95)
IL-4	2,39 ±0,87	5,86 ±0,49***	1,63 ±1,47^
IL-6	3,51±1,93	7,03±0,45*	9,28±1,39**
IFN-γ	12,59±2,18	21,68±2,51**	25,01±1,71***
VEGF-A	169,57±16,87	320,29±30,09***	390,57±19,57***

Analysis of cytokine status showed significant changes in the levels of cytokines studied in children with HYPERTENSION compared with the control group.

Thus, in children with mild hypertension, the level of IL-6 was 2 times higher (P<0.05), IFN-γ was 1.7 times higher (P<0.01), and VEGF—A was 1.9 times higher (P<0.001) compared to the indicators of practically healthy children in the control group (Table.2). It was also found that in children with moderate hypertension, the synthesis of the levels of the studied cytokines

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was increased in IL-6 by almost 2.6 times (P<0.01), IFN-γ by 2 times (P<0.001), VEGF-A by more than 2.3 times (P<0.001) (Table 2.).

However, analysis of the serum content of the anti-inflammatory cytokine IL-4, on the contrary, showed differently directed changes. So, if the concentration of IL-4 in the group of children with mild hypertension was 2.45 times higher than in the control group (P<0.001), then the level of this interleukin b was reduced in children with moderate hypertension by 31.8%, which is 1.5 times lower than in the control group (P>0.05) (Table 2).

The study of innate humoral immune response factors such as CRP and PCT, combined with cytokine profile analysis, provides a more complete understanding of the pathogenesis of inflammatory processes in hemocolitis syndrome, as the studied biomarkers allow us to assess the degree of inflammation.

CRP, synthesized in response to inflammation and activated by pro-inflammatory cytokines [6], reflects acute inflammation, and its significant increase in children with various forms of HYPERTENSION indicates the presence of a pronounced inflammatory process.

Procalcitonin (PCT), although more specific for bacterial infections, also increases in severe inflammatory reactions [1]. It is important to note that its level in this study did not reach statistical significance, which may indicate that the inflammatory process in hypertension is not always bacterial in nature, especially in mild forms, which probably confirms the hypothesis that inflammation in hemocolitis may be caused by other factors unrelated to bacterial agents.

Cytokines play a key role in regulating the inflammatory response [4]. IL-6, one of the main pro-inflammatory cytokines, stimulates the synthesis of CRP [4,5], which confirms the relationship between the cytokine profile and CRP levels. The observed increase in IL-6 and IFN-γ in children with hemocolitis reflects increased activation of the cellular immune response. Considering that IFN-γ, by activating macrophages and enhancing antigen presentation, enhances the inflammatory process and can lead to tissue damage in chronic inflammation [5,7], we assume that an increase in the levels of these cytokines correlates with the severity of the inflammatory response, which may be confirmed by high levels of CRP.

On the other hand, VEGF-A, an angiogenic factor, stimulates the restoration of the vascular network in response to tissue damage [4], but its pronounced excess can exacerbate inflammation by increasing vascular permeability, which is also confirmed in children with more severe forms of hypertension.

A decrease in IL-4 levels in children with severe forms of HYPERTENSION indicates a lack of anti-inflammatory mechanisms, which leads to an imbalance between pro- and anti-inflammatory processes. The imbalance probably contributes to the progression of inflammation and complications of the disease [5,6].

Thus, the imbalance between IL-6, IFN-γ, VEGF-A and IL-4 cytokines in children with hemocolitis syndrome confirms the complexity of the pathogenesis of this disease. These changes can be used as markers to assess the severity of the inflammatory process and develop more targeted therapeutic strategies aimed at correcting immune disorders and restoring the balance between inflammatory and anti-inflammatory mechanisms.

Conclusions. 1.The immunopathogenesis of hemocolitis syndrome in children with acute diarrhea is associated with a pronounced imbalance of pro-inflammatory and anti-inflammatory mechanisms, which is reflected in increased levels of CRP, IL-6, IFN-γ and VEGF-A.

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2.The combination of the analysis of innate humoral factors such as CRP and PCT with the cytokine profile allows for a deeper understanding of the pathogenesis of inflammation in hemocolitis syndrome in children.

3. The studied biomarkers can be used to predict the severity of the inflammatory process and develop more targeted therapeutic approaches aimed at balancing pro-inflammatory and anti-inflammatory mechanisms.

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