Original Article

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Features of Immunological Status in Children with Chronic Bronchitis

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Abstract

Background : Chronic bronchitis in children is manifested by a number of specific and nonspecific immune responses. In children, there are changes in the system of both cellular and humoral immunity, which are characterized by T-cell immunodeficiency. The aim of the study was to assess the state of the immune status in chronic bronchitis in children. **Subjects and Methods**: To achieve this goal, 60 children aged 7 to 18 years with chronic bronchitis were examined, who were hospitalized in the pulmonology department of the Republican Specialized Scientific and Practical Medical Center of Pediatrics during 2020-2021. **Results:** During the period of exacerbation of the disease, a significant decrease in the number of leukocytes, the relative and absolute number of lymphocytes was established. **Conclusion:** Serum immunoglobulins are one of the main indicators of humoral immunity. In children with chronic bronchitis, on the part of humoral immunity, pronounced hypoimmunoglobulinemia, a sharp increase in the level of IgM, IgA and IgG were noted.

Keywords: Immune Status, Chronic Bronchitis, Children.

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Introduction

In recent years, there has been an increase in the proportion of chronic respiratory diseases in children, which are the cause of disability and disability.[1,2] Chronic bronchitis in children can be a manifestation of a number of bronchopulmonary diseases (acquired, congenital, hereditary), the differentiation of which often presents certain difficulties.[3,4] Among the important factors in the pathogenesis of chronic bronchitis, a certain role belongs to nonspecific and specific immune responses, through cytokines, the nature, depth, duration of inflammation and the immune response are regulated.[5,6] With a deficiency of immunoregulatory cells, antigen-specific effector reactions of the humoral and cellular type develop, they increase several times, the level of antigen-specific lymphocytes, directed not only against the antigens of pathogens, but also against the lung tissue itself, sharply increases. A decrease in the function of T-cytotoxic lymphocytes in chronic bronchitis is a key mechanism in the development of immunopathological reactions in various diseases in children.[7] The main shifts in the system of immunoglobulins in chronic bronchitis are expressed in an increase in their level, especially IgG. The cause of chronic bronchopulmonary process in children may be primary immune deficiency. Lower respiratory tract infection in children can be one of the main manifestations of a deficiency in the immune system. Features of the course of the inflammatory process, its prognosis depend on the state of specific and nonspecific immunity.[8] Understanding the immunopathological mechanisms underlying chronic bronchitis in children is necessary both for identifying the mechanisms of frequent chronicity and a high incidence of complications, and for prescribing pathogenetically based therapy. The results of studying the contents of bronchoalveolar lavage and bronchoalveolar biopsy showed that inflammation in bronchiectasis is characterized by tissue neutrophilic infiltration, represented mainly by T cells (CD4 +, CD8 +) and macrophages, in addition, by a significant increase in the level of interleukin-8 (IL-8) and IL-6, TNF-α. Among the factors of the humoral link of local immunity, immunoglobulins (Ig) are of great importance. The main role in the processes of protection of the tracheobronchial tree belongs to secretory Ig A. It has been established that a significant decrease in IgA during long-term inflammation of the bronchus is due to the absence of cells in the bronchial epithelium capable of synthesizing the secretory component.[9] Thus, chronic bronchitis in children is characterized by general and local immunological insufficiency. The

role of the immune system in the occurrence, course and outcome of chronic nonspecific lung diseases in children is so great that at present we can probably speak of a whole group of immunopulmonological diseases.

The aim of the study was to study and evaluate the features of the immune status in children with chronic bronchitis.

Subjects and Methods

To achieve this goal, 60 children aged 7 to 18 years with chronic bronchitis were examined, who were hospitalized in the pulmonology department of the Republican Specialized Scientific and Practical Medical Center of Pediatrics during 2020-2021. The control group consisted of 20 practically healthy children of the same age who did not have chronic foci of infection, did not suffer from chronic bronchopulmonary diseases. The diagnosis of chronic bronchitis was made on the basis of anamnesis data, clinical symptoms, results of bacteriological, radiological, functional, biochemical, immunological and bronchological studies. The study of the immune status is a multicomponent study, which consists of several stages: assessment of humoral immunity, cellular immunity, nonspecific resistance of the organism. To assess the immune status of children, the following studies of immunological parameters were carried out: determination of the number of T-lymphocytes and their subpopulations (CD3 +, CD4 +, CD8 +), natural killer cells (CD16 +), B-lymphocytes (CD20 +) by a modified method; concentration of serum Ig A, G, M in peripheral blood by the method. [10]

Results and Discussion

A decrease in the function of T-cytotoxic lymphocytes (CD8 +) in chronic bronchitis is a key mechanism in the development of immunopathological reactions in various diseases in children. As can be seen from Table 1, in children with chronic bronchitis, there are changes in the system of both cellular and humoral immunity: unidirectional immunological changes, characterized by T-cell immune deficiency. In children with chronic bronchitis during the period of exacerbation of the disease, a significant decrease in the absolute number of leukocytes was established to (5362 ± 625.0), respectively (P <0.001). Compared to the norm, such indicators as the relative and absolute number of lymphocytes to (31.8 ± 1.1), respectively, are significantly reduced, however, no significant differences were found between the groups.

As can be seen from the presented data, in children with chronic bronchitis during the height of the disease, the following deviations were revealed: a significant decrease in CD3 + T-lymphocytes to 44.8 ± 0.2% in children with chronic bronchitis, with 61.5 ± 2.2% in practically healthy children (P <0.001); their subpopulations: T-helpers CD4 + up to 21.2 ± 3.2% in children with chronic bronchitis and 39.2 ± 2.1% in practically healthy children (P <0.001); T-cytotoxic lymphocytes CD8 + up to 13.0 ± 0.1% in children with chronic bronchitis, with 19.5 ± 1.8% in practically healthy children (P <0.01). Changes in CD3 + -, CD4 + -, CD8 + lymphocytes were more pronounced in children with chronic bronchitis (P <0.001). In these patients, T-cell immunodeficiency is characterized by a low level of T-cytotoxic lymphocytes. The immune regulation index (IRI) (CD4 / CD8) in the group of patients was reduced by 1.3 times, mainly due to CD4 + lymphocytes. There was a significant increase in natural killer cells of CD16 + lymphocytes in comparison with practically healthy children: 19.7 ± 2.1% in children with chronic bronchitis and 10.2 ± 1.3% in practically healthy children (P <0.001). There was a tendency to an increase in B-lymphocytes (CD20 + lymphocytes) in the peripheral blood, up to 37.3 ± 2.2% in children with chronic bronchitis and 16.4 ± 0.5% in practically healthy children (P <0.001). This was especially noted in the group of children with chronic bronchitis. When studying the level of phagocytosis, we noted that phagocytosis in most children with chronic bronchitis was significantly reduced to 43.7 ± 0.8%, with a norm of 58.5 ± 2.3% (P <0.001). Serum immunoglobulins are known to be one of the main indicators of humoral immunity. Being included in the chain of immunological reactions, immunoglobulins play a certain role in the pathogenesis of chronic bronchitis. From the side of humoral immunity in children with chronic bronchitis, there was a pronounced hyperimmunoglobulinemia, a sharp increase in the level of IgM to 212.3 ± 4.2 mg /% versus 90.7 ± 2.8 mg /% in practically healthy children (P <0.001); also in children with chronic bronchitis, the levels of IgA and IgG increased (P <0.001).

Conclusion

In children with chronic bronchitis, there are changes in the system of both cellular and humoral immunity, which are unidirectional immunological changes that characterize T-cell immunodeficiency. A significant decrease in the number of leukocytes in children with chronic bronchitis in the period of exacerbation of the disease was established. Compared to the norm, indicators such as the relative and absolute number of lymphocytes are significantly reduced. Serum immunoglobulins are one of the main indicators of humoral immunity. Being included in the chain of immunological reactions, immunoglobulins play a certain role in the pathogenesis of chronic bronchitis. From the side of humoral immunity in children with chronic bronchitis, there was a pronounced hyperimmunoglobulinemia, a sharp increase in the level of IgM, IgA and IgG in comparison with the group of practically healthy children. The main disruption in the functioning of the immune system is the autoimmune process, which, in combination with inflammatory reactions,

Table 1: Immunological parameters of children with chronic bronchitis (M ± m)

Indicators	Practically healthy children (I), (n = 20)	Children with chronic bronchitis during an exacerbation of the disease (II), (n = 60)	P
Leukocytes, abs.	8540 ± 421,0	5362 ± 625,0	<0,001
Lymphocytes,%	34,6 ± 2,3	31,8 ± 1,1	<0,01
CD3+ lymphocytes,%	61,5 ± 2,2	44,8 ± 0,2	<0,001
CD4+,%	39,2 ± 2,1	21,2 ± 3,2	<0,001
CD8+,%	19,5 ± 1,8	13,0 ± 0,1	<0,01
CD4/CD8	2,0 ± 0,2	1,6 ± 0,5	>0,05
CD16+,%	10,2 ± 1,3	19,7 ± 2,1	<0,001
Phagocytosis,%	58,5 ± 2,3	43,7 ± 0,8	<0,001
CD20+,%	16,4 ± 0,5	37,3 ± 2,2	<0,001
IgG, mg/%	938,3 ± 17,6	2118,2 ± 40,7	<0,001
IgA, mg/%	107,9 ± 3,6	184,4 ± 3,2	<0,001
IgM, mg/%	90,7 ± 2,8	212,3 ± 4,2	<0,001

Note: P - reliability of differences between groups I and II.

destroys organs and tissues. Therefore, violations of the immune status in chronic bronchitis should be considered not in isolation, but in combination with other important systems of the body's vital activity. A comprehensive assessment of the state of various parts of the immune system should take into account both quantitative and qualitative changes in immunity indicators. Thus, the study of the immune status in children with chronic bronchitis reveals profound changes in the T-cell link of immunity in the form of a significant decrease in the number and functional activity of neutrophils, which is a predetermining endogenous moment in the formation and progression of chronic bronchitis in children.

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