

Immunological Mechanisms of Development of Complicated Forms of Atopic Dermatitis

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Abstract Examination of 32 children with atopic dermatitis, complicated by staphylococcal infection. Revealed violations of B-cell, humoral immunity and phagocytic activity of neutrophils. The revealed violations of immunological parameters in children suffering from atopic dermatitis complicated by staphylococcal infection are the basis for the appointment of immunomodulators as part of complex therapy aimed at stimulating the B-cell and humoral immunity, as well as the phagocytic activity of neutrophils.

Keywords Atopic dermatitis, Immunology, Complications

1. Introduction

In recent years there has been a significant increase in the frequency of atopic dermatitis in children, a pronounced tendency to recurrence, chronic process and resistance to the therapy [5]. Currently, in conditions of environmental trouble, irrational use of glucocorticosteroids in patients with atopic dermatitis, there are often secondary bacterial complications [2,3,4]. In the development of complicated forms of this pathology, an important role belongs to immunological disorders [1,6,7,8]. Therefore, the characteristic disorders in the immune system with atopic dermatitis are a kind of diagnostic criterion and reflect the depth of the lesion.

Objective: to study the immune disorders in atopic dermatitis, complicated by secondary staphylococcal infection in children.

2. Materials and Research Methods

A comprehensive immunological examination of 32 children with atopic dermatitis complicated by a staphylococcal infection was performed. The comparison group included 35 children with uncomplicated course of atopic dermatitis. There were no statistically significant differences in the compared groups by sex, age, and severity of the course. Comprehensive immunological examination included assessment of cellular immunity parameters: absolute and relative T- (CD3 +) and B-lymphocytes (CD19

+, T-helper cells (CD4 +), T-cytotoxic cells (CD8 +), natural killer cells (CD56 +), ratios CD4 + / CD8 +, humoral (IgA, IgG, IgM, CIC), neutrophil phagocytic activity (phagocytic index, phagocytic number, spontaneous and stimulated NBT-test). Evaluation of cellular immunity was performed using monoclonal antibodies (MCAT) to various CD-antigens using flow cytometry. The content of immunoglobulins a, M, G (IgA, IgM, IgG) in blood serum was assessed by the conventional method of ELISA monospecific sera of MonobindInc (Germany) (TsNIL AGMI and diagnostic center "Farm StandartLyuks").

For the study of neutrophil phagocytosis, nitro-blue tetrazolium reduction reaction (NBT-test) was used. We used the technique of Viksman M., Mayansky A.N. (1983). Spontaneous and stimulated NBT-test was determined (the stimulator was used - Ser. Marseeceus vaccine. To determine the phagocytic activity of neutrophils, a suspension of *Staphylococcus aureus* was used with counting the phagocytic index (percentage of phagocytic neutrophils) and phagocytic number (the average number of microorganisms absorbed by one FFG (average number of microorganisms absorbed by a single object)).

3. Results and Discussion

Mean values of immunological parameters in the examined group, comparison group and control group were determined. Immunological examination showed that in children with atopic dermatitis complicated by a staphylococcal infection, in comparison with the comparison group, deeper changes in the indices of B-cell and humoral immunity, as well as neutrophil phagocytic activity, were revealed.

Analysis of the data of the complex immunological examination showed that in children with atopic dermatitis complicated by staphylococcal infection, in comparison with the comparison group, deeper changes in the indices of the B-cell and humoral parameters of the immune system, as well as neutrophil phagocytic activity were revealed. The study of indicators of cellular immunity (Table 1) did not reveal significant differences between the main group and the comparison group, $P > 0.05$. Whereas, the relative ($p < 0.001$) and absolute ($p < 0.05$) number of CD19 + -B lymphocytes in children with atopic dermatitis complicated by a staphylococcal infection is significantly lower than with uncomplicated forms of the disease. In general, in patients of the main group, a decrease in the total number of B-lymphocytes was observed in 67.8% of cases.

Table 1. Indicators of cellular immunity in complicated forms of atopic dermatitis in children with staphylococcal infection

Indicator	Maingroup	Comparisongroup
CD3+%	58,3 ± 1,8	59,4 ± 2,2
CD3+ 109/л	0,90 ± 0,21	0,92 ± 0,23
CD4+%	31,8 ± 0,8	32,3 ± 1,1
CD4+ 109/л	0,58 ± 0,1	0,59 ± 0,2
CD8+%	19,3 ± 2,1	19,6 ± 2,4
CD8+ 109/л	0,82 ± 0,12	0,83 ± 0,17
CD4+ /CD8+	1,6 ± 0,08	1,6 ± 0,1
CD19+%	8,3 ± 1,2***	15,2 ± 1,4
CD19+,109/л	0,26 ± 0,08*	0,48 ± 0,1
CD56+%	19,9 ± 1,5	20,2 ± 1,7

Note: * - $p < 0.05$; ** - $p < 0.01$; *** - $p < 0.001$ - significance of the difference between the main and comparison group

When studying indicators of the humoral immunity in patients with complicated forms of atopic dermatitis (Table 2), there was a significant decrease in the level of Ig A ($p < 0.01$) and Ig G ($p < 0.001$) compared with uncomplicated forms of the disease. Pronounced changes were established when analyzing the indices of phagocytic activity of neutrophils (Table 3). Thus, in patients of the main group, in comparison with the comparison group, there was a significant decrease in the HF ($p < 0.01$) and FI ($p < 0.001$). An increase in the spontaneous NBT test and a decrease in the stimulated NBT test ($p < 0.05$) were also detected.

Table 2. Indicators of humoral immunity in children with complicated forms of atopic dermatitis by staphylococcal infection

Indicator	Maingroup	Comparisongroup
Ig A г/л	0,52 ± 0,1**	0,85 ± 0,2
Ig M г/л	6,0 ± 0,2***	12,3 ± 0,3
Ig G г/л	2,0 ± 0,3	1,8 ± 0,4
ЦИК ед.оп.пл	0,048 ± 0,005	0,046 ± 0,005

Note: * - $p < 0.05$; ** - $p < 0.01$; *** - $p < 0.001$ - significance of the difference between the main and control groups.

The activation of the spontaneous NBT test is likely due to the stimulation of polymorphonuclear lymphocytes by

bacterial flora. The decrease in the indices of the induced NBT-test may be due to the persistent inhibition of the activity of neutrophilic granulocyte. Based on the above, it should be noted that in patients with atopic dermatitis complicated by secondary staphylococcal infection, there is a marked inhibition of the phagocytic activity of neutrophils with impaired metabolic potential and functional reserve of the cell with the development of depression of neutrophil phagocytes. In general, in the patients of the main group, phagocytic dysfunctions occurred in 75% of cases.

Table 3. Indicators of phagocytes activity of neutrophils in atopic dermatitis in children, complicated by staphylococcal infection

Indicator	Maingroup	Comparisongroup
ФИ%	28,6 ± 1,2**	36,3 ± 1,5
ФЧ	2,3 ± 0,05***	6,2 ± 0,09
НСТ сп-тест%	19,6 ± 1,2*	14,8 ± 1,3
НСТ ст-тест%	33,2 ± 1,5*	40,2 ± 1,6

Note: * - $p < 0.05$; ** - $p < 0.01$; *** - $p < 0.001$ - significance of the difference between the main and control groups.

Thus, it can be assumed that the basis for the development of secondary staphylococcal infection in atopic dermatitis in children is a violation of the B-cell, humoral links of immunity and phagocytic activity of neutrophils. This is reflected in a decrease in the total number of CD19 + - B lymphocytes, IgA and IgG and phagocytic dysfunctions, manifested in the inhibition of phagocytic number, phagocytic index and stimulated NBT-test.

Findings. The revealed impaired immunological parameters in children suffering from atopic dermatitis complicated by staphylococcal infection are grounds for administering immunomodulators as part of complex therapy aimed at stimulating B-cell and humoral immunity, as well as phagocytic activity of neutrophils.

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