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CHARACTERISTICS OF IMMUNOLOGICAL SHIFTS IN COMMUNITY-ACQUIRED PNEUMONIA IN FREQUENTLY ILL CHILDREN

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Abstract: The clinical and immunological status was assessed in 30 children aged 1 to 3 years who developed community-acquired pneumonia. It was revealed that in frequently ill children with community-acquired pneumonia, immunological shifts are characterized by a decrease in CD3, CD4, CD8, LNK16, PHA, IgA, an increase in CD19, IgM, IgG, CIC, which partially persist during the remission period. The decrease in IgA and increase in CIC concentration in blood serum indicate the immunocompromised state of the body and can serve as criteria for early immunodiagnosis of community-acquired pneumonia in frequently ill children.

Keywords: *frequently ill children, immunity, pneumonia*

Relevance. The high frequency of children's morbidity with recurrent acute respiratory infections of viral and/or bacterial origin has always been a very serious problem. Such patients are commonly referred to as "frequently and long-term ill" (FLI). FLI is not a nosological form. The use of this terminology in pediatrics is intended to draw the attention of clinicians of various specialties, primarily pediatricians, otorhinolaryngologists, pulmonologists, to the problems of children who have excessively frequent (recurrent) acute respiratory viral-bacterial infections of various etiologies [6,9,14].

The increase in the number of FLI children goes in parallel with a decrease in the immune resistance of the population, as in such children pathological processes have significant features of the course, the main cause of which is considered to be the immunodeficient state of patients, and in 40% of cases by the age of 7-8 years they develop chronic pathology, while the risk of chronicity is directly proportional to the increase in the frequency of ARI episodes during the year [1,3,9].

Pneumonia is one of the leading causes of child mortality worldwide, especially in developing countries. According to WHO, every year pneumonia affects 155 million children under the age of five, and about 2 million children die from it, which is much more than the mortality from any other disease, including HIV/AIDS and malaria [5,10,12].

According to the Centers for Disease Control and Prevention (CDC), pneumonia remains one of the most common causes of death among children under five years of age. Despite a decrease in pneumonia mortality from 70 deaths per 1000 children in 2000 to 43 deaths per 1000 children in 2015, 920,000 children under the age of five died from pneumonia in 2015 [8].

Community-acquired pneumonia (CAP) is an acute infectious lung disease that develops outside the hospital or is diagnosed within the first 48 hours from the moment of hospitalization. The criteria for CAP in children are fever above 38°C for more than three days with a cough and/or shortness of breath, as well as physical, laboratory, and radiological signs of focal infiltrative changes in the lungs without an obvious alternative diagnosis [2,4,7].

The development and outcome of infectious processes in children are largely determined by the state of the immune system of a sick child. Various defects of immunity are observed in frequently ill children, who often have pneumonia.

The aim of the study was to study the clinical and immunological status in frequently ill children with community-acquired pneumonia.

Materials and methods. The study included 30 children aged 1 to 3 years with community-acquired pneumonia, hospitalized in the pulmonology department of the Urgench branch of the Republican Scientific Center for Emergency Medical Aid from November 2023 to March 2024. Among them, 12 (40.0%) were children who frequently suffered from acute respiratory infections (more than 6 episodes of ARI per year). The diagnosis of pneumonia was established based on the clinical picture and the results of laboratory and instrumental studies, in accordance with the national clinical protocol for the treatment of pneumonia in children. Data on the incidence of these children are presented in Table 1.

Table 1.

Previous diseases in frequently ill children (n=30)

Pathology	**Quantity**	**%**
Otitis	4	13.3
Tonsillitis	8	26.6
Bronchitis	5	16.6
Recurrent croup	12	40
Adenoids	9	30

The control group consisted of 25 practically healthy children of the same age.

In patients, the state of cellular and humoral immunity was studied. Indicators of cellular immunity were determined by the method of Garib F.Yu. et al. [5]. Phagocytic activity of neutrophils (PHA) was determined using latex particles, according to the method of Bumagina T.K. [4]. Circulating immune complex (CIC) was studied by the precipitation method [2]. The material for the study was venous blood taken in the morning on an empty stomach. The digital data were processed by the method of variation statistics with calculation of the reliability of numerical differences.

Results and discussion. As can be seen from Table 2, frequently ill children diagnosed with CAP showed a significant decrease in the relative and absolute number of CD3 T-lymphocytes, both in the acute period and during the period of clinical recovery after traditional therapy, compared to healthy children. The number of CD4+ and CD8+ subpopulations of lymphocytes also significantly decreased both before and after treatment compared to healthy children. A decrease in the relative number of NK cells was also observed. The phagocytic activity of neutrophils in frequently ill children with CAP also decreased.

Table 2.

Dynamics of immunological indicators in community-acquired pneumonia in frequently ill children (M±m)

Indicators	Sick children, n=30		
	Control group, n=25	Before treatment, n=15 Group 1	After treatment, n=15 Group 2
CD3, %	62.68±1.43	46.90±1.32**	54.66±1.63#
CD4, %	35.76±0.93	19.13±1.17**	17.06±1.33#
CD8, %	18.64±0.49	13.16±0.78**	15.40±1.14#
CD19, %	11.16±0.73	18.21±0.53*	15.00±0.71#
LNK16, %	11.44±0.53	5.02±0.27**	7.00±0.72
IgA, g/l	1.80±0.31	0.51±0.21**	0.70±0.03
IgM, g/l	0.85±0.04	1.26±0.02*	1.00±0.04
IgG, g/l	7.10±0.53	12.75±0.40**	10.65±0.24#
CIC, units	0.021±0.002	0.055±0.002**	0.032±0.003#
PHA, %	50.50±1.11	35.25±1.33**	37.00±0.26#

*Note: *-significance of differences compared with the healthy group; **- P<0.001; *- P<0.01. #- significance of differences between groups 1 and 2. ##- P<0.001; #- P<0.01.*

The revealed immunopathological shifts are explained by the fact that the types of immune response are associated with one of the variants of lymphocyte activation with the predominant participation of clones of Th-helper lymphocytes of the first (Th1) or second (Th2) type, which differ in the patterns of cytokines produced and the role of stimulating the development of the immune response by cellular and humoral type. In frequently ill children, due to frequent intercurrent inflammatory process, the body becomes immunocompromised, which is aggravated by concomitant pathologies, including CAP. In CAP, there is also a decrease in the barrier function of the body in damaged areas of the respiratory tract.

Patients (group 2) received traditional complex therapy (antibacterial, detoxification, anti-inflammatory, symptomatic, etc.). After treatment, patients showed persistence of immunological shifts, expressed by a slight increase in the relative content of CD3, CD4, CD8, PHA (P<0.001-0.01), a significant decrease in IgM, IgG (P<0.01) as well as the concentration of CIC (P<0.001).

Conclusion. Thus, the study showed that in frequently ill children with community-acquired pneumonia, immunological shifts are characterized by a decrease in CD3, CD4, CD8, CD16, PHA, IgA, an increase in CD19, IgM, IgG, CIC, which partially persist during the remission period. The decrease in IgA and increase in CIC concentration in blood serum indicate the

immunocompromised state of the body and can serve as criteria for early immunodiagnosis of community-acquired pneumonia in frequently ill children.

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