Immunological reactivity in children with chronic bronchitis

Shukhrat Abdurasulovich Yusupov
Azamat Mukhitdinovich Shamsiev
Xojimuhammad Xabibulloyevich Abbasov
Abduqodir Kamalbayevich Shaxriyev
Samarkand State Medical University

Abstract: Changes in the system of not only in cell, but also in humoral immunity have been noted in children with chronic bronchitis which are going to have one-directed immunological shifts characterizing T-cell immunodeficiency. The reliably decreased amount of leucocytes have determined in children with chronic bronchitis in the period of the disease exacerbation. Such indexes as relative and absolute amount of leucocytes have reliably decreased in the comparison with normal parameters. One of the basic indexes of the humoral immunity is immunoglobulins of the blood urea. Including in the chain of the immunologic reactions immunoglobulins have been played a significant role in the pathogenesis of chronic bronchitis. Aim of investigation was the assessment of the condition of the immune status of children with chronic bronchitis. From the point of humoral immunity in children with chronic bronchitis it has been noted significant hypoglobuliemia, extremely increasing of IgM level in the comparison with the practically healthy children, the levels of IgA and IgG have increased mostly in the group of children of the preschool age.

Keywords: immune status, chronic bronchitis, children

Relevance

Bronchopulmonary pathology occupies a significant place in the structure of childhood morbidity. In the last two decades, there has been an increase in the proportion of recurrent and chronic respiratory diseases.

In children, which often continues into adulthood and causes limited ability to work and disability [1, 10, 12].

Mortality from respiratory diseases ranks third after diseases of the circulatory system and neoplasms. And if we take into account that the vast majority of patients are young and middle-aged people, as well as children and adolescents, then the relevance of the problem of early diagnosis and treatment of these patients becomes obvious; it contributes to the emergence of an infectious process, the activity and recurrence of which largely depend on the local immunity of the bronchi and development of secondary immunological deficiency [3, 6].

Chronic bronchitis (CB) in children can be a manifestation of a number of other bronchopulmonary sufferings (acquired, congenital, hereditary), the differentiation of

which often presents certain difficulties [4, 7].

Among the important factors in the pathogenesis of CB, a certain role belongs to nonspecific and specific immune reactions [9, 13]. In relation to the immune system, the nature, depth, and duration of inflammation and the immune response are regulated through cytokines [14].

General changes in the immunological status of children are apparently due to the fact that the bronchopulmonary system suffers with all this pathology. With a deficiency of immunoregulatory cells, antigen- specific effector reactions of the humoral and cellular type, they are strengthened several times, the level of antigen-specific lymphocytes, directed not only against the antigens of the pathogens, but also against the lung tissue itself, sharply increases. Studies by a number of authors have shown that in patients with bronchiectasis, the functional properties of T-lymphocytes are suppressed [2,11].

A decrease in the function of T-cytotoxic lymphocytes in chronic disease is a key mechanism in the development of immunopathological reactions in various diseases in children [5, 8]. The main changes in the immunoglobulin system in CB are expressed in an increase in their level, especially IgG. The cause of chronicity of the bronchopulmonary process in children may be primary immune deficiency. Analysis of literature data showed that in general there is a significant number of works by domestic and foreign authors devoted to the study and correction of immunological aspects of chronic bronchopulmonary diseases.

Lower respiratory tract infection in children may be one of the main manifestations of immune system deficiency. Features of the course of the inflammatory process and its prognosis depend on the state of specific and nonspecific immunity [15, 16].

Understanding the immunopathological mechanisms underlying CB in children is necessary both to identify the mechanisms of frequent chronicity and high incidence of complications, and to prescribe pathogenetically based therapy.

The results of studying the contents of bronchoalveolar lavage and bronchoalveolar biopsy showed that inflammation in bronchiectasis is characterized by tissue neutrophil infiltration, represented mainly by T cells (CD4+, CD8+) and macrophages, in addition, a significant increase in the level of interleukin-8 (IL-8) and IL-6, tumor necrotic factor α.

Among the factors of the humoral component of local immunity, immunoglobulins (Ig) are of great importance. The main role in the processes of protecting the tracheobronchial tree belongs to secretory Ig A (sIg A). E.V.Klimanskaya (1972) believes that the long course of the inflammatory process in children with bronchiectasis has an adverse effect on the production of local specific and nonspecific protective factors [5]. According to N.N.Rozinova (2007), the basis of

chronic bronchopulmonary pathology is local deficiency of Ig A [11]. At the same time, the authors cannot exclude a secondary disruption of Ig A synthesis as a consequence of actively ongoing purulent endobronchitis. It has been established that a significant decrease in Ig A with Long-term inflammation of the bronchial tube is caused by the absence in the bronchial epithelium of cells capable of synthesizing the secretory component.

Thus, CB in children is characterized by general and local immunological deficiency. 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 talk about a whole group of immunopulmonological diseases.The purpose of the study was to study and evaluate the immune status of children with CB.

Materials and research methods

To achieve this goal, 100 children aged 3 to 15 years with CB who were undergoing inpatient treatment at the clinic were examined No. 1 Samarkand State Medical University. The control group consisted of 22 practically healthy children of the same age. This group included children who did not have chronic foci of infection and did not suffer from chronic bronchopulmonary diseases.

The diagnosis of CB was made on the basis of anamnesis, clinical symptoms, results of bacteriological, radiological, functional, biochemical, immunological and bronchological studies.

The study of immune status is a multicomponent study that consists of several stages: assessment of humoral immunity, cellular immunity, nonspecific resistance of the body. 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+) using a modified method [2]; concentrations of serum Ig A, G, M in peripheral blood according to the method of G. Manchini et al. (1965).

Research 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 CB 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 disease during the period of exacerbation of the disease, a significant decrease in the absolute number of leukocytes in the youngest and oldest age subgroups of the main study group up to (6482 ± 320.0) and (5362 ± 625.0), respectively, $p < 0.001$; $p < 0.001$. Indicators such as the relative and absolute number of lymphocytes significantly decrease compared to

the norm: (32.1 ± 0.2) and (31.8 ± 1.1), respectively, but no significant differences were found between the groups.

Table 1

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

Analyzed Indicators	Practically healthy children, n = 22 (group I)	Patients with CB (n = 100) during exacerbation of the disease		p	p1	p2
		3–6 years (gr. II) (n = 38)	7–15 years (group III) (n = 62)			
Leukocytes, abs.	8540 ± 421,0	6482 ± 320,0	5362 ± 625,0	< 0,05	< 0,001	< 0,001
Lymphocytes, %	34,6 ± 2,3	32,1 ± 0,2	31,8 ± 1,1	< 0,05	< 0,01	< 0,01
Lymphocytes, abs.	2948 ± 234,0	2080 ± 432,0	1705 ± 105,0	< 0,05	< 0,01	< 0,01
$CD3^+$, %	61,5 ± 2,2	49,1 ± 0,3	44,8 ± 0,2	< 0,001	< 0,001	< 0,001
$CD3^+$, abs.	1676 ± 193,0	1021 ± 45,0	763 ± 49,0	< 0,001	< 0,01	< 0,01
$CD4^+$, %	39,2 ± 2,1	24,6 ± 1,9	21,2 ± 3,2	< 0,001	< 0,001	< 0,001
$CD4^+$, abs.	1032 ± 98,0	512 ± 98,0	361 ± 35,0	< 0,05	< 0,001	< 0,001
$CD8^+$, %	19,5 ± 1,8	15,7 ± 0,4	13,0 ± 0,1	< 0,01	< 0,01	< 0,001
$CD8^+$, abs.	595 ± 75,0	493 ± 19,2	473 ± 38,0	< 0,05	< 0,01	< 0,01
IIR (CD4/CD8)	2,0 ± 0,2	1,6 ± 0,3	1,6 ± 0,5	> 0,05	> 0,05	> 0,05
$CD16^+$, %	10,2 ± 1,3	16,8 ± 1,7	19,7 ± 2,1	< 0,001	< 0,001	< 0,01
$CD16^+$, abs.	278 ± 32,0	349 ± 11,0	335 ± 11,0	< 0,05	< 0,05	< 0,01
Phagocytes, %	58,5 ± 2,3	46,4 ± 1,2	43,7 ± 0,8	< 0,001	< 0,001	< 0,01
$CD20^+$, %	16,4 ± 0,5	35,6 ± 1,6	37,3 ± 2,2	< 0,001	< 0,001	< 0,01
$CD20^+$, abs.	774 ± 97,0	623 ± 23,0	587 ± 21,0	< 0,01	< 0,01	< 0,05
Ig G, mg/%	938,3 ± 17,6	1901,1 ± 33,5	2118,2 ± 40,7	< 0,001	< 0,001	< 0,001
Ig A, mg/%	107,9 ± 3,6	168,4 ± 4,0	184,4 ± 3,2	< 0,001	< 0,001	< 0,01
Ig M, mg/%	90,7 ± 2,8	202,4 ± 5,0	212,3 ± 4,2	< 0,001	< 0,001	< 0,05
CEC	1,01 ± 0,1	1,31 ± 0,1	1,42 ± 0,1	< 0,05	< 0,001	< 0,05
ASLO, %	1,1 ± 0,1	3,2 ± 0,8	4,9 ± 0,6	< 0,01	< 0,01	< 0,001

Note: significance of differences between groups I and II; p1 - significance of differences between groups I and III; p2 - significance of differences between groups II and III.

As can be seen from the presented data, the following deviations were identified in children with CB during the height of the disease: a significant decrease in T-lymphocytes CD3+ - (44.8 ± 0.2)% in children aged 7 to 15 years and (49.1 ± 0.3)% at the age of 3 to 6 years with (61.5 ± 2.2) % in practically healthy children, $p1 < 0.001$; $p2 < 0.001$; their subpopulations: CD4+ T helper cells - (21.2 ± 3.2)% in children aged 7 to 15 years and (24.6 ± 1.9)% in children aged 3 to 6 years, (39, 2 ± 2.1)% in practically healthy children, $p < 0.001$; $p1 < 0.001$; $p2 < 0.001$; T-cytotoxic lymphocytes CD8+ - (15.7 ± 0.4)% in preschool children, (13.0 ± 0.1)% in school-age children with (19.5 ± 1.8) in practically healthy children, $p < 0.01$; $p1 < 0.01$. Changes in CD3+-, CD4+-, CD8+-lymphocytes were more pronounced in the age group of 7–15 years compared to children from 3 to 6 years old ($p < 0.01$; $p1 < 0.001$). 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 up to 1.3 times, mainly due to CD4+ lymphocytes.

There was a significant increase in natural killer CD16+ lymphocytes compared with practically healthy children: (16.8 ± 1.7)% in children aged 3 to 6 years and (19.7 ± 2.1)% in children aged from 7 to 15 years, respectively, (10.2 ± 1.3) in practically healthy children; $p < 0.001$.

There was a tendency towards an increase in B-lymphocytes (CD20+) in the peripheral blood, in absolute numbers up to (623 ± 23.0) and (587 ± 21.0), $p < 0.01$; $p2 < 0.05$. This was especially noted in the group of older children.

When studying the level of phagocytosis, we noted that phagocytosis in the majority of children with CB was significantly reduced: to (46.4 ± 1.2)% in children aged 3 to 6 years, compared with the norm (58.5 ± 2.3), $p < 0.001$.

One of the main indicators of humoral immunity, as is known, is blood serum immunoglobulins. By being involved in the chain of immunological reactions, immunoglobulins play a certain role in the pathogenesis of CB. On the part of humoral immunity in children with CB, there was pronounced hypoimmunoglobulinemia, a sharp increase in the level of Ig M: (202.4 ± 5.0) mg/% and (212.3 ± 4.2) mg/% versus (90.7 ± 2.8) mg/% in apparently healthy children, $p < 0.001$; the levels of Ig A and Ig G increased more in the group of preschool children ($p < 0.001$). The concentration of CEC in sick children with CB was also significantly higher than in practically healthy children: (1.31 ± 0.1) and (1.4 ± 0.1), $p1 < 0.001$; $p2 < 0.05$, which indicates the activity of the inflammatory process.

In children with CB, antistreptolysin O (ASLO) is detected in the blood during the period of exacerbation of the disease, which indicated the presence of an autoimmune reaction. At the same time, ASLO increased 4–5 times in the group of school-age children and amounted to (4.9 ± 0.6)% and (3.2 ± 0.8)% compared to practically healthy children - (1.1 ± 0 ,1) %, $p2 < 0.001$; $p1 < 0.01$

Conclusion

In children with CB 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 during the period of exacerbation of the disease was established. Indicators such as the relative and absolute number of lymphocytes are significantly reduced compared to the norm.

One of the main indicators of humoral immunity is serum immunoglobulins. By being involved in the chain of immunological reactions, immunoglobulins play a certain role in the pathogenesis of CB. In terms of humoral immunity, children with CB had pronounced hypoimmunoglobulinemia, a sharp increase in the level of Ig M

compared with a group of practically healthy children, the levels of Ig A and Ig G increased more in the group of preschool children.

The main disorder in the functioning of the immune system is the autoimmune process, which, in combination with inflammatory reactions, destroys organs and tissues. Therefore, disorders of the immune status in chronic bronchitis should not be considered in isolation, but in conjunction with other important systems of the body's vital functions. 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 makes it possible to identify profound changes in the T-cell component 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, which were higher in the group of school-age patients.

References

1) Sh.A. Yusupov Assessment of the effectiveness of ultrasound sonography among children with appendicular peritonitis // journal: European science review // publisher: Premier Publishing sro // - 2017.— N° 1-2. - P 161-163.

2) Sh.A. Yusupov The influence of ozone on the morphological structure of the peritoneum in experimental peritonitis//journal: Ural Medical Journal//publisher: M.: Medicine, 2009. - N° 7. - P. 86-90.

3) A.M. Shamsiev., R.Kh. Sharipov., D.O. Atakulov., Sh.A. Yusupov., Zh.A. Shamsiev., U.T. Suvankulov Age-related dynamics of lipid peroxidation in children // Journal: Bulletin of the General Practitioner. Samarkand // - 2001.

4) Sh.A. Yusupov., Zh.O. Atakulov., A.A. Muhammadiev Meckel's Diverticulum: Diagnostic and surgical criteria // journal: Russian Bulletin of Pediatric Surgery, Anesthesiology and Reanimatology // publisher: All-Russian public organization "Russian Association of Pediatric Surgeons" //—2020.—T.1,N°S.—208.

5) Sh.A. Yusupov Diagnostic significance of ultrasound sonography for appendiceal peritonitis in children // journal: Baikal Medical Journal // publisher: State budgetary educational institution of higher professional education "Irkutsk State Medical University" of the Ministry of Health of the Russian Federation // - 2009. -T. 86, N° 3. -S. 138-141.

6) Sh.A. Yusupov Diagnosis of intra-abdominal abscesses in the early postoperative period with appendiceal peritonitis in children//journal: Bulletin of the Ural Medical Academic Science//publisher: Limited Liability Company Editorial Board of the journal Bulletin of the Ural Medical Academic Science// - 2009. - N°3.- P. 36-39.

7) A.M. Shamsiev., Sh.A. Yusupov., D.O. Atakulov., U.T. Suvankulov., A.K. Shakhriev., Zh.A. Shamsiev Diagnosis and prognosis of postoperative complications in cases of raped appendiceal peritonitis in children//journal: Annals of Surgery//publisher: M. Medicine// - 2000/12. - T.6, N°6. - P.65-68.

8) A.M. Shamsiev., Sh.A. Yusupov., A.K. Shahriev Efficiency of an ultrasound sonography in case of appendicular peritonitis among children//journal: Benefits of clinical and experimental medicine//publisher: Ternopil State Medical Academy named after IYa Gorbachevsky//—2016. —N°2.—P.84-87.

9) A.M. Shamsiev., Sh.A. Yusupov., A.K. Shahriev The effectiveness of ultrasound sonography in appendicular peritonitis in children // journal: Clinical and Experimental Medicine // - 2016. —N°2.

10) Sh.A. Yusupov., A.M. Shamsiev., A.K. Shakhriev., Sh.Sh. Yusupov., V.U. Sataev Clinical rationale for decompression of the small intestine in widespread appendiceal peritonitis in children//journal: Experimental and Clinical Gastroenterology//publisher: Society with limited liability "Global Media Technologies"//—2022. — N°1(197).—P.62-68.

11) Sh.A. Yusupov., A.M. Shamsiev., Zh.O. Atakulov., D.A. Jalolov Assessment of the intensity of endogenous intoxication syndrome in children with widespread appendiceal peritonitis//journal: Medical Almanac//publisher: Federal State Budgetary Educational Institution of Higher Education "Privolzhsky Research Medical University" of the Ministry of Health of the Russian Federation//—2019.— N°5-6 (61). —P.57-61.

12) A. M. Shamsiev., Sh.A. Yusupov., V.A. Ryazantsev., K.R. Boboyorov., Yu.A. Turaev Features of preoperative preparation of children with common forms of appendiceal peritonitis//journal: Russian Bulletin of Pediatric Surgery, Anesthesiology and Reanimatology//publisher: All-Russian public organization “Russian Association of Pediatric Surgeons” //—2013. —T.3, N°1. — P.88-92.

13) 13) Sh.A. Yusupov., U.T. Suvonkulov., Sh.Sh. Yusupov., V.U. Sataev Prediction and prevention of postoperative intra-abdominal adhesive complications in children//journal: Experimental and Clinical Gastroenterology//publisher: Limited Liability Company “Global Media Technologies//—2021. —N°1 (185).—S. 127-132.

14) A. M. Shamsiev., Sh. A. Yusupov., M. P. Razin, Zh. A. Shamsiev Common appendicular peritonitis in children // publisher: Limited Liability Company Publishing Group GEOTAR-Media //— 2020. —P.208.

15) A.M. Shamsiev., Sh.A. Yusupov Reproductive function of women who suffered widespread appendiceal peritonitis in childhood//journal: Avicenna Bulletin//publisher: Tajik State Medical University named after. Abuali ibni Sino //— 2019.—T.21, N°3.—P.374-379.

16) A.M. Shamsiev., Sh.A. Yusupov., Yu.M. Akhmedov., I.Yu. Akhmedov., Sh.Zh. Shamsiev Spectrum of microflora in widespread appendicular peritonitis in children//journal: Pediatric Surgery//publisher: Open Joint Stock Company Publishing House Medicine//—2020.—T.24, N° S1. —P.94-95.