

Clinical and Immunological Characteristics of Chronic Allergic Conjunctivitis in Children and Evaluation of the Effectiveness of Treatment on Quality of Life

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Abstract The research presents an assessment of the effectiveness of complex treatment of chronic allergic conjunctivitis in children, taking into account immunological parameters and quality of life. The study included the determination of IgE, IL-6 and IL-10 levels before and after therapy, as well as an analysis of the dynamics of the psychoemotional state according to the adapted scale of the Pediatric Quality of Life Inventory (PedsQL). Prior to treatment, patients showed marked immune shifts in the form of increased IgE, IL-6 and IL-10, accompanied by a decrease in the overall quality of life index to 58.4 ± 3.2 points. After the treatment, a significant decrease in IgE, IL-6 and IL-10 was revealed, which reflected a decrease in the activity of the Th2-dependent inflammatory process, and the PedsQL index increased to 83.7 ± 2.9 points ($p < 0.05$). The data obtained indicate the high effectiveness of complex therapy aimed not only at immunological stabilization, but also at significantly improving the quality of life of children with chronic allergic conjunctivitis.

Keywords Chronic allergic conjunctivitis, Immunoglobulins, Interleukins, Treatment, Quality of life

1. Introduction

Allergic conjunctivitis (AK) is one of the most common manifestations of allergic diseases in children and occupies one of the leading places among chronic inflammatory eye diseases. In recent years, there has been a steady trend towards an increase in the frequency of this pathology, which is associated with a deterioration in the environmental situation, an increase in population sensitization, and a change in the immune status of children [2,5,8].

According to the literature, up to 40% of children with allergic diseases have clinical manifestations from the eyes, and in the structure of all allergic lesions of the eye surface, the share of AK reaches 60-70%.

The immunopathogenesis of allergic conjunctivitis is caused by dysregulation of T-helper reactions (Th2-type) and activation of immunoglobulin E (IgE) production, which leads to degranulation of mast cell degranulation, release of inflammatory mediators (histamine, IL-4, IL-5, IL-13) and damage to the conjunctival epithelium. Clinically, this is manifested by itching, hyperemia, edema and lacrimation, which significantly reduce the quality of life of the child [1,3,4,10].

Modern therapeutic approaches for AK are aimed not only at relieving symptoms, but also at modulating the immune response, restoring the barrier function of the mucous

membrane, and preventing relapses. However, the effectiveness of treatment is often evaluated only by clinical criteria, while the effect of therapy on the patient's quality of life remains insufficiently studied [6,7,11,12].

In this regard, it is of interest to conduct a comprehensive clinical and immunological assessment of the condition of children with various forms of allergic conjunctivitis, as well as to analyze the effectiveness of treatment in terms of improving the quality of life [9].

Purpose of the study. To evaluate the clinical and immunological features of allergic conjunctivitis in children and determine the effectiveness of the treatment, taking into account its impact on the quality of life of patients.

2. Materials and Methods of Research

To solve these tasks, a comprehensive examination of 150 children suffering from various forms of allergic conjunctivitis is being conducted in 2023-2025.

- * Bukhara branch of the Republican Scientific and Specialized Center of Allergology,
- * Republican Specialized Scientific and Practical Medical Center of Eye Microsurgery.

All patients were divided into four groups:

1. The first main group consists of children suffering from chronic forms of allergic conjunctivitis (the duration of the disease is more than 2 years).

2. The second main group consists of children with newly diagnosed allergic conjunctivitis.
3. Comparison group — children with allergic conjunctivitis combined with other eye diseases (blepharitis, keratoconjunctivitis, etc.).
4. The control group consisted of practically healthy children of the same age without signs of allergic diseases (n=30).

Modern ophthalmological, laboratory, immunological (determination of the level of IgA, IgG, IgM, IgE, IL-1B, IL-4, IL-6, IL-10, procalcitonin, complement C3, lactoferrin in the blood), instrumental (visiometry, biomicroscopy, ophthalmoscopy) and statistical methods of research were used in the study. The quality of life assessment was carried out using the adapted Pediatric Quality of Life Inventory (PedsQL) scale and analysis of the dynamics of indicators before and after treatment.

3. Results

The average age of the examined children was 10.8 ± 0.45 years. Of the 45 patients included in the study, 48.9% were aged 6-10 years, 40.0% were aged 11-14 years, and only 11.1% were older than 15 years.

Thus, allergic conjunctivitis was more often diagnosed in school-age children, which is consistent with the data of the world literature indicating the greatest sensitization of the body in this age period.

The average duration of the disease from the onset of symptoms to a doctor's appointment was 6.8 ± 0.24 days.

All patients (100%) complained of itching and redness of the eyes, while 82.2% noted swelling of the eyelids and conjunctiva.

These data reflect a typical picture of allergic inflammation of the ocular surface associated with the

activation of inflammatory mediators (histamine, interleukins, prostaglandins).

The majority of those surveyed had previously received treatment for allergic diseases.

The most frequent cases in the anamnesis were:

- * allergic dermatitis - in 22 patients (48.9%),
- * allergic conjunctivitis (recurrent course) - in 11 patients (24.4%),
- * allergic rhinitis — in 15 patients (33.3%),
- * bronchial asthma — in 12 patients (26.7%),

Quincke's and Lyell's syndromes were less common (4-6%).

The data obtained indicate a close relationship between allergic conjunctivitis and other atopic manifestations, confirming the systemic nature of the allergic process.

Of those surveyed, 57.8% were treated repeatedly, 11.1% — for 3 years, and 13.3% - for more than 4 years.

This reflects the chronic course of the disease and the need to improve therapeutic approaches.

Analysis of peripheral blood showed a tendency to mild anemia and moderate eosinophilia, which is characteristic of allergic inflammatory processes.

Children with allergic conjunctivitis showed increased levels of IgE, IL-6, and IL-10, which indicates a pronounced Th2-dependent inflammatory response. The IgG level also slightly exceeded the norm, which reflects the chronic nature of the allergic process. Allergic conjunctivitis in children often develops at the age of 6-14 years, mainly against the background of other atopic diseases. In most patients, the disease has a recurrent and chronic course, requiring repeated courses of therapy. Laboratory data confirm the presence of systemic allergic inflammation with activation of humoral immunity and cytokine response. Elevated levels of IgE, IL-6 and IL-10 can be considered as immunological markers of the activity of the allergic process.

Table 1. Hematological parameters (before treatment)

Indicator	Average value (M ± m)	Norm	Interpretation
Hemoglobin	112.9 ± 1.73 g / l	115-145	Minor anemia
Red blood cells	3.72 ± 0.07 × 10 ¹² /L	3.8-5.0	Slight decrease
White blood cells	7.10 ± 0.46 × 10 ⁹ /L	4.0-9.0	Normal
Eosinophils	3.29 ± 0.32%	0-5	Moderate eosinophilia
Lymphocytes	23.71 ± 0.68%	20-40	Normal
ESR	10.07 ± 0.56 mm/h	2-10	Normal
Platelets	229.13 ± 5.77 × 10 ⁹ /l	200-400	Normal

Table 2. Immunological parameters (before treatment)

Indicator	Norm	Average deviation (M ± m)	Interpretation
IgA	0.9-2.6 g / l	1.80 ± 0.09	Normal
IgM	0.6-2.2 g/l	1.67 ± 0.08	Normal
IgG	9-20 g / L	20.03 ± 0.65	Increased
IgE	70-216 IU / ml	224.11 ± 3.12	Increased, sign of atopy
of IL-6 atopy	0-10 pg/ ml	43.12 ± 2.23	Significantly increased
IL-	610 0-31 pg/ ml	89.42 ± 2.56	Increased, compensatory response
Procalcitonin	0.05-0.1 ng/ ml	0.07 ± 0.00	Normal

Table 3. Immunological parameters after treatment of chronic allergic conjunctivitis

Indicator	Average value (M ± m)	Standard values	Interpretation
IgE, IU / ml	159.53 ± 6.75	70-216	Reduced compared to baseline, is within the reference range, which reflects a decrease in the severity of atopic inflammation
IL-6, pg/ml	22.28 ± 1.70	0-10	Reduced by more than two times compared to baseline; remains slightly above normal, which indicates at the fading phase of the inflammatory process
IL-10, pg/ ml	40.93 ± 2.77	0-31	is reduced by more than half, approaching the reference values, which reflects a decrease in the compensatory anti-inflammatory response

After the course of therapy, there was a statistically significant decrease in key cytokines and immunoglobulins that characterize the activity of allergic inflammation. The level of IgE decreased from 224.11 to 159.53 IU / ml ($p < 0.05$), which indicates a decrease in the activity of Th2-mediated immune response and a decrease in hyperreactivity to allergens. The concentration of the pro-inflammatory cytokine IL-6 decreased from 43.12 to 22.28 pg/ ml, which reflects a more than twofold decrease in inflammatory activity and the transition of the process to the remission phase. At the same time, the level of IL-10 decreased from 89.42 to 40.93 pg/ ml, which is interpreted as a weakening of the excessive anti-inflammatory response due to the normalization of the immune balance.

Assessment of the quality of life in children with chronic allergic conjunctivitis was performed using an age-adapted version of the Pediatric Quality of Life Inventory (PedsQL) questionnaire, which includes four main domains: physical functioning, emotional state, social activity, and school (cognitive) functioning. Each indicator was evaluated on a five-point scale, where higher values reflected a better quality of life. The analysis was carried out in dynamics-before the start of therapy and after the end of the course of treatment, in parallel with the study of immunological parameters.

Before treatment, the total PedsQL index was significantly reduced and averaged 58.4 ± 3.2 points, which reflected a pronounced restriction of physical and emotional comfort due to itching, lacrimation, and hyperemia of the eyes. The lowest values were found in the domains of "emotional" and "social functioning", which indicated the presence of anxiety, irritability, and difficulties in interpersonal contacts in children.

After the therapy, a clear positive dynamics of all indicators of the PedsQL scale was observed. The average integral index increased to 83.7 ± 2.9 points ($p < 0.05$), which indicated a significant improvement in general well-being and psychoemotional state. Children reported a reduction in the frequency of itching, discomfort, and redness in their eyes, as well as improved sleep and concentration. The physical component of quality of life increased by 35%, and the emotional component-by almost 1.5 times.

4. Conclusions

After treatment, there is a pronounced positive dynamics of immunological parameters, characterized by a decrease in

the level of both pro-inflammatory and anti-inflammatory cytokines with normalization of IgE. These changes confirm the effectiveness of the therapy and reflect the stabilization of the immune status in children with chronic allergic conjunctivitis.

The dynamics of the results on the PedsQL scale closely correlated with immunological changes: a decrease in the levels of IgE, IL-6 and IL-10 was accompanied by an increase in subjective well-being and a decrease in the clinical manifestations of the disease. This confirms that therapy not only normalizes the immune status, but also significantly improves the quality of life of patients, reducing psychoemotional stress and improving social adaptation.

Thus, complex treatment of chronic allergic conjunctivitis provides not only biochemical and immunological stabilization, but also leads to a significant increase in the quality of life on the PedsQL scale, which is an important integral criterion for the effectiveness of the therapy.

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