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*Original Research Article*

# MORPHOMETRIC AND CLINICOPATHOLOGICAL FEATURES OF ATOPIC DERMATITIS IN CHILDREN IN COMBINATION WITH CHRONIC OBSTRUCTIVE BRONCHITIS (ON THE EXAMPLE OF SAMARKAND REGION)


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***Abstract***: Atopic dermatitis (AD) is a common chronic inflammatory skin disease in children, often associated with respiratory comorbidities. Objective. To evaluate morphometric and clinical features of AD in children with and without chronic obstructive bronchitis (COB). Methods. A prospective study included 142 children. AD severity was assessed using SCORAD; skin morphometry and serum IgE levels were analysed. Programmes (View2, QuPath) were used to evaluate skin morphology. The results showed that in AD, especially the severe form, there was significant marked hyperplasia of the stroma, vacuolated degeneration of basal keratinocytes and marked inflammatory infiltration consisting mainly of eosinophils and lymphocytes, associated with clinical severity according to the SCORAD index. Boys predominated (63.5%), and the onset was most often observed before the age of 1 year. Patients with atopic dermatitis and COB had reduced skin filtration with preserved structural remodelling of the epidermis. A positive correlation was found between the level of total serum Ige and the severity of the skin process. The results reveal local features of AD progression and suggest an individualised approach to diagnosis and treatment, especially in the context of concomitant respiratory pathology.



*Keywords*: Atopic dermatitis, chronic obstructive bronchitis, skin morphometry, children, Samarkand region, epidermal barrier, Ige, pathogenesis.


## INTRODUCTION

Atopic dermatitis (AD) is a widespread chronic inflammatory disease affecting a significant proportion of the population [1]. The prevalence of AD, especially among children, is increasing, according to some epidemiological studies, with a trend of 15 to 30% and 1 to 3% in children and adults, respectively [2, 3]. According to recent data, the prevalence in Russia (RF) ranges from 5.2% to 15.5% [4]. Global studies, including ISAAC (International Study of Asthma and Allergy in Children), have shown significant geographical differences in the prevalence of AD, indicating a multifactorial role of climatic and environmental conditions, socioeconomic situation and genetic background in the onset and development of the disease [5, 6]. The pathogenesis of AD is multifactorial; there is an interaction between genetics, epidermal barrier defects, immune dysregulation and changes in the skin microbiome [7, 8]. Important discoveries that have changed the understanding of the aetiology of AD, include the demonstration of "loss-of-function" mutations in the filaggrin gene (FLG) [9]. The maintenance of a dense stratum corneum and skin hydration depend on the presence of filaggrin, an important structural protein [10]. Reduced functionality of filaggrin leads to high levels of transepidermal water loss (TEWL) and increased

permeability of the skin barrier to various exogenous substances such as allergens and microbes [11]. Disruption of the skin barrier is thought to allow allergens and irritants to penetrate the skin, leading to complex immune mechanisms. Traditionally, AD is characterised by Th2-type inflammation with hyperproduction of interleukins IL-4, IL-5 and IL-13, overproduction of IgE and activation of eosinophils, and direct involvement in suppression of filaggrin synthesis in keratinocytes, thus completing the vicious circle of inflammation [12, 13].

However, in the chronic phase of the disease, several types of T-helper cells are involved: Th1 (IFN-γ), Th2, and Th22 (IL-22), indicating the diversity of the immune response [14]. In addition, microbial dysbiosis, particularly skin colonisation by S. aureus, further enhances inflammation through superantigens that directly activate T lymphocytes [15]. AD is generally considered the first stage of the "atopic march" in which patients gradually develop other allergic diseases including food allergy, allergic rhinitis and bronchial asthma [16]. This emphasises the systemic characteristics of atopy and the importance of a comprehensive approach to diagnosis and therapy. Of particular clinical importance is the combination of AD with chronic respiratory diseases such as chronic obstructive bronchitis (COPD) in children. The relationship between skin and lung manifestations in atopy and the peculiarities of morphological changes of the skin against the background of concomitant bronchobstructive pathology are not sufficiently studied, especially in some regions.

Currently, little is known about the morphometric characteristics of skin lesions in children with AD in a regional context and concomitant chronic respiratory disease. A better understanding of these characteristics may help clinicians to accurately diagnose, assess severity and tailor individualised treatment.

In this paper, morphometric and clinical and pathogenetic characteristics of atopic dermatitis in children of Samarkand region in combination with chronic obstructive bronchitis were investigated.

## Materials and Methods of the Study.

This was a prospective observational study conducted at the Samarkand region, at the Samarkand branch of the Specialised Scientific and Practical Medical Centre of Dermatovenerology and the Pulmonology and Allergology Department of the Multidisciplinary Children's Medical Centre. This research was approved by the Local Ethics Committee and was conducted according to the regulations of the country. The parents of the children gave informed consent for the children to participate in the research.

### 2.1 Study population

In total, 142 children aged between 6 months and 18 years were included. The main group consisted of 82 children with atopic dermatitis. The comparison group consisted of 40 children with atopic dermatitis and chronic obstructive bronchitis. The control group consisted of 20 healthy children, aged and sex-matched with the main group, without atopic, skin, and chronic respiratory diseases.

The diagnosis of atopic dermatitis was made according to the Hanifin and Rajka criteria. Chronic obstructive bronchitis was diagnosed in the comparison group. The exclusion criteria were concomitant skin and systemic diseases, immunodeficiency, malignancy, congenital abnormalities, and recent immunosuppressive and systemic steroid therapy.

Clinical evaluation of patients included demographic data, onset and duration of the disease, and the frequency and severity of exacerbations. Allergic conditions were also assessed. The severity of AD was determined using the SCORAD index, and the disease was classified as mild (<25), moderate (25-50), or severe (>50).

2.2 Skin biopsy and histology. Punch biopsies of 3-4 mm diameter were performed in the affected skin of patients in the study and control groups, as well as in the intact skin of the control group. Tissue specimens were fixed in 10% buffered formaldehyde and embedded in paraffin. Histological examination of the specimens was performed. Sections of 4-5 μm thickness were stained with haematoxylin and eosin. Morphometry of the specimens included the thickness of the epidermis and the number of inflammatory cells, indicated as cells per 1 mm².

2.3 Laboratory analysis. Venous blood sampling for analysis of the level of total IgE in the blood of patients and healthy individuals using the ELISA method (Vector-Best) was performed.

2.4 Statistical analysis. Statistica 10.0 software was used for statistical analysis. Quantitative data were presented as M ± SD or Me [Q1; Q3], and qualitative data as n (%). Comparisons of groups were carried out using the chi-square or Fisher's exact tests. Correlation analysis was performed using the Pearson or Spearman correlation coefficient. $p < 0.05$ was considered statistically significant.

## RESULTS

**. Overall epidemiological data.** In 2024, the total number of referrals for skin diseases in the Samarkand branch of the specialised medical centre was 42,917 cases. The diagnosis of atopic dermatitis (AD) was established in 1330 children, which was **3.**1% of the total number of patients. Among them, boys accounted for **63.5 per cent and** girls for 36**.5 per cent, with the** highest number of cases in children under one year of age. The highest incidence was observed in Tayliak, Urgut and urban districts of Samarkand.

**Clinical characteristics and form of AD.** Of 82 children with AD without comorbid pathology, the form of the disease was distributed as follows: Erythemosquamous form - 42 patients (51.2%). Eczematous form - 19 patients (23.2%). Lichenoid form - 12 patients (14.6%).
Prurigo form - 9 patients (11.0%). The *general* blood *analysis of* children with atopic dermatitis revealed few changes (Table 1).

**Table 1.**

**General blood counts of children with atopic dermatitis**

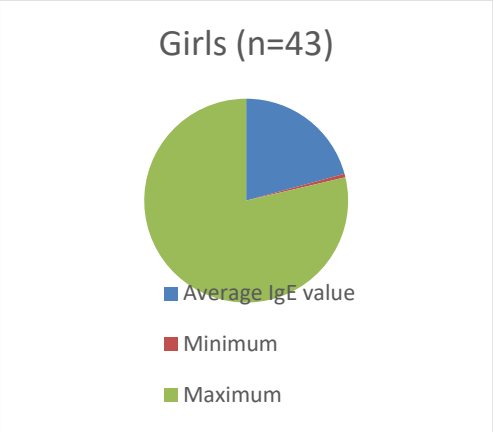
| Indicator | Boys (Mean ± Standard deviation) | Girls (Mean ± Standard deviation) | 95% CI (Boys) | 95% CI (Girls) |
|---|---|---|---|---|
| **MCH (pg)** | 25,92 ± 2,26 | 25,99 ± 1,98 | 25,33 - 26,50 | 25,41 - 26,57 |
| **HCT (%)** | 35,96 ± 3,13 | 36,51 ± 2,56 | 35,14 - 36,78 | 35,68 - 37,33 |
| **Haemoglobin (g/l)** | 119,25 ± 11,42 | 120,33 ± 8,72 | 116,06 - 122,44 | 118,01 - 122,64 |
| **Leucocytes ($10^9$/litre)** | 10,05 ± 6,04 | 9,49 ± 2,94 | 8,49 - 11,61 | 8,61 - 10,37 |
| **Lymphocytes (%)** | 47,42 ± 15,42 | 44,87 ± 13,76 | 43,14 - 51,70 | 40,94 - 48,80 |
| **Monocytes (%)** | 6,46 ± 1,69 | 5,70 ± 1,51 | 5,96 - 6,97 | 5,28 - 6,13 |
| **Segmented neutrophils (%)** | 41,64 ± 14,74 | 45,30 ± 15,47 | 37,61 - 45,67 | 41,04 - 49,57 |
| **Platelets ($10^9$/l)** | 353,02 ± 78,05 | 353,63 ± 126,83 | 331,32 - 374,72 | 314,57 - 392,70 |
| **Eosinophils (%)** | 3,42 ± 2,85 | 3,63 ± 4,83 | 2,57 - 4,27 | 2,04 - 5,23 |
| **Erythrocytes ($10^{12}$/litre)** | 4,62 ± 0,39 | 4,64 ± 0,39 | 4,51 - 4,73 | 4,52 - 4,76 |
| **Colour value** | 0,78 ± 0,07 | 0,78 ± 0,06 | 0,76 - 0,80 | 0,76 - 0,80 |

The general blood counts of children with atopic dermatitis show some similarities between boys and girls, but girls have slightly higher levels of platelets and segmented neutrophils, while boys tend to have higher levels of leucocytes and lymphocytes. **Comparative analysis of the level of total IgE in girls and boys by IHLA method showed that the mean IgE level in girls** is **65.95**, whereas in **boys it is 80.42.** This indicates a slightly higher level of IgE in boys.

**Table 2.**

**Comparison of basic statistical parameters of IgE levels in boys and girls.**

| Parameter | Girls (n=43) | Boys (n=60) |
|---|---|---|
| **Average IgE value** | 65,95 | 80,42 |
| **Minimum** | 1,8 | 3 |
| **Maximum** | 250 | 678,8 |




The lower limit of IgE is 1.8 in girls and 3 in boys. The upper limit is 250 in girls and 678.8 in boys, which also indicates a greater difference in boys. The serum IgE level in boys was 80.42 ±3.6 IU/ml and in girls was 65.95 ±2.9 IU/ml. Elevated IgE levels were observed in 76.8% of patients and were more common in moderate and severe forms of the disease. Blood cell markers: the level of leukocytes and lymphocytes was higher in men. Neutrophils and platelets are higher in girls.

Twenty-four skin samples (n=24) from children with AD and AD+COB were analysed. The changes in the findings were as follows: Epidermis: acanthosis, vacuolar degeneration of basal cells, focal parakeratosis, intercellular oedema of the malpighian layer, hyperkeratosis. The following changes prevailed in the dermis: superficial and middle blood vessels of the skin were dilated, there was an increase in the number of collagen fibres, infiltration with lymphocytes, eosinophils and macrophages. Morphometric study showed that the mean thickness of the stratum corneum was 11.3 ± 2.1 μm (in normal skin usually up to 7 μm), while the mean thickness of the scaly layer was 55.6 ± 3.9 μm (normal 40-45 μm).

In AD+COB, a more subtle infiltration was observed, which was particularly prominent in the remission phase; there was a direct correlation between the area of skin lesions and the degree of cellular infiltration.

Table3

**Comparative analysis of AD and AD+COB groups**

| Indicator | BP (n=82) | BP + COB (n=40) |
|---|---|---|
| IgE level (IU/ml) | 74,2 ± 3,2 | 78,1 ± 3,7 |
| Number of eosinophils (%) | 7,3 ± 1,1 | 5,6 ± 1,4 |
| Thickness of the studded layer (μm) | 56,1 ± 4,2 | 51,3 ± 3,7 |
| Frequency of severe AD | 14,3% | 10,5% |
| Density of cellular infiltration (in foci) | high | moderate |

Macroscopic examination of the skin of children with atopic dermatitis revealed sharp, extensive and asymmetrical inflammatory changes. The lesions mainly concerned the skin of the face and trunk. Spots, papules, scales and pustules of various types and sizes appeared on the skin. The pruritic papules ranged in size from 0.2 mm to 0.5 cm and stood out prominently against an erythematous and scaly background. There were dry, slightly flaky and haemorrhagic pustules on the affected skin areas. Itching was pronounced or with severe symptoms. They were mostly vesicular-papular. Areas of skin desquamation with localised hyperkeratosis and minor fissures were observed. There were small pinpoint haemorrhages around them. Some children had a rash on the background of erythema. The epidermis had a brownish-yellow colour and preserved architectural structures. Invagination of the granular layer of the epidermis, hyperkeratosis, focal parakeratosis and loss of the granular layer were noted. Skin biopsy revealed minor orthokeratosis and invagination of the corneal layer. In some places this layer had detached. No significant changes in the granular layer were noted. In the epidermis, irregular acanthosis, swelling of the intercellular mass in the stellate layer and coagulative degeneration of basal cells in some areas were noted. Microscopically, the

epidermis was covered by multilayered squamous epithelium with a horny layer on the surface. Massive fragmentation and destruction of the stratum corneum of the skin was observed. Differentiated keratinocytes were barely distinguishable and cell adhesion was impaired due to loss of corneal cells (Fig.1).

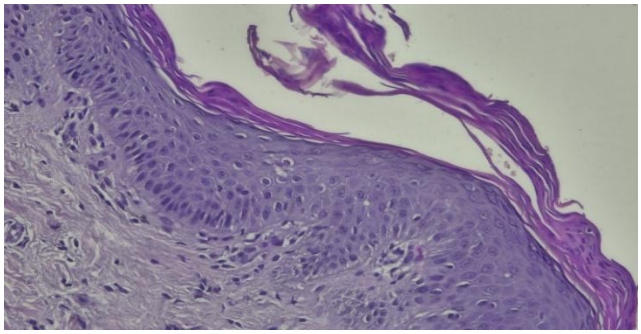


**Fig.1**. Hyperkeratosis and desquamation of the multilayer squamous epithelium of the skin of a 3.5-year-old child with atopic dermatitis. Haematoxylin and eosin staining. MagnificationX200.

The dermis contains unformed connective tissue, which is fibrous, swollen in some places, and it reveals accumulation of tissue fluid. In the sebaceous layer of the dermis, tissues - sebaceous glands located in the epithelium consisting of connective tissue - are visible by colour. In our observations, infiltration with lymphocytes, histiocytes, eosinophils and mast cells was noted in this layer. Haemostasis was observed in capillaries of small blood vessels (Fig. 2).

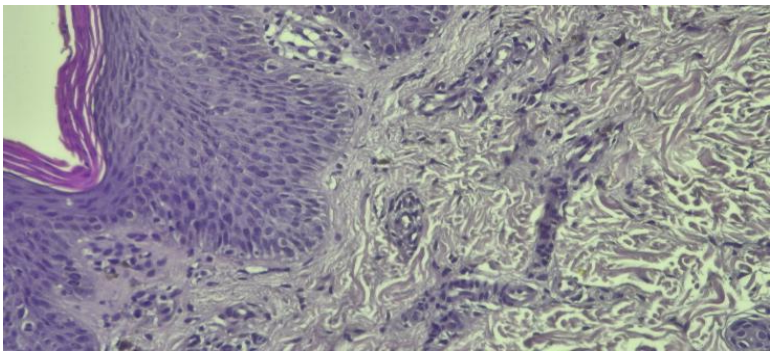


**Fig 2.** Lymphocytic cell infiltration of the epidermis of a 4-year-old child with atopic dermatitis. Haematoxylin and eosin staining. Magnification X200.

The intensity of cellular infiltration and epidermal thickening directly correlate with the severity of the clinical picture. In combination of AD and COPD, weakened infiltration is observed, which is probably due to immune adaptation and peculiarities of COPD therapy. More pronounced morphological changes and clinically severe forms are more frequent in boys.

## DISCUSSION

Discussion of the study results. The present study extends the clinical, epidemiological, morphometric, and immunological description of atopic dermatitis in children from the Samarkand region and identifies the distinctive features of the disease in the presence of chronic obstructive bronchitis.

The epidemiological data show that AD is more common in infancy, especially in boys, which is in accordance with the global and national trends and reflects the immaturity of the skin barrier function. The majority of the patients had mild or moderate AD according to the SCORAD index, and increased levels of total IgE were found in more than three-quarters of the AD patients, which is in agreement with the global data and reflects the activation of the Th2 immune response and its correlation with the severity of AD.

Histological and morphometric examination revealed pronounced changes in the epidermal barrier function, including acanthosis, hyperkeratosis, parakeratosis, and dermal inflammatory cell infiltration. These changes correlated with the severity of the AD, which confirms the potential of morphometric parameters as objective markers of AD activity.

Children with AD and COB had decreased dermal inflammatory cell infiltration despite persistent epidermal remodelling, which reflects the distinctive feature of the AD endotype in the presence of COB.

The limitations of the present study are the small sample size and the single-center design, the limited number of histological samples, and the lack of genetic analysis of the mutations in the filaggrin gene. However, the data obtained confirm the importance of the morphometric parameters in the diagnosis and prognosis of AD and support the idea that the use of immunological and genetic markers could help in the better understanding of the AD endotypes in the region.

## Conclusion.

All characteristic morphometric and clinicopathological features of atopic dermatitis were expressed in children living in Samarkand region. Characteristic features of skin and epidermis (hyperplasia of spiny cells, vacuum dystrophy of basal keratinocytes) and dermis (layering of eosinophils and lymphocytes) were found to correlate with the disease. Characteristic morphological risks were found in association with chronic obstructive bronchitis, characterised by less inflammatory infiltration of the skin and closed structural damage to the epidermis. You are in different regions, where there are problems with clothing, and you know about diagnostic diagnostics, morphometrics, about diagnosis and choice of individualised medical services. strategies, common themes, the most serious pathologies. Towards explaining the immunological mechanism. of the genetic factor of importance to this patient's skupin I suppress further development.

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30. Khamidova F. M. - ideological concept of the work, writing the text; editing articles;
31. Tolibov M.M. - concept and design, acquisition, analysis, or interpretation of data, manuscript drafting, manuscript revision. collection and analysis of literature sources, compilation of text.
32. Aminova N. A. - concept and design, acquisition, analysis, or interpretation of data, manuscript drafting, manuscript revision.

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