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ORIGINAL ARTICLE

Features of Molecular Allergodiagnostics of Atopic Dermatitis in Residents of Uzbekistan

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ABSTRACT
Atopic dermatitis (AD) is a chronic recurrent inflammatory skin disease characterized by severe itching, eczema, and impaired function of the skin barrier. The growing prevalence of AD worldwide has led to an increased interest in the molecular diagnosis of allergies, which allows for a more accurate understanding of the allergenic factors contributing to the development of the disease. In Uzbekistan, where the prevalence of AD is increasing, molecular allergy diagnostics offers a promising approach to improve early detection, personalized treatment strategies, and patient management. This article examines the features of the molecular diagnosis of allergies in patients with atopic dermatitis in Uzbekistan, paying special attention to the role of genetic markers, specific allergens and the use of advanced immunological methods. Analyzing the current state of molecular diagnostics and comparing it with international practices, this study provides valuable information about the unique features of blood pressure in Uzbekistan, including regional environmental factors, genetic predisposition, and healthcare infrastructure. In addition, this article examines the potential of integrating molecular allergy diagnostics into clinical practice in Uzbekistan to improve the treatment of atopic dermatitis and reduce the burden on healthcare systems.
Keywords: *Atopic dermatitis, molecular diagnostics of allergies, allergens, genetic markers, immunology, Uzbekistan, prevalence, personalized medicine.*

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INTRODUCTION

Atopic dermatitis (AD) is one of the most common chronic inflammatory skin diseases affecting people of all ages, with a higher prevalence in children. It is characterized by symptoms such as itching, erythema and dry skin, which often lead to a significant decrease in the quality of life. The pathogenesis of AD is multifactorial and includes genetic, immunological, and environmental factors. Studies show that changes in the barrier function of the skin, in particular mutations in the filaggrin (FLG) gene, play a crucial role in the development of the disease. In addition to genetic predisposition, allergens play a central role in exacerbating the disease, and environmental influences such as dust mites, pet hair, and pollen are a common cause [1].

Molecular allergy diagnostics has become a valuable tool for understanding and treating allergic diseases, including hypertension. This approach involves the identification of specific immunoglobulin E (IgE) antibodies to individual allergens, which provides a more accurate method of diagnosis and personalized treatment. In many developed countries, molecular allergy testing has revolutionized the diagnosis and treatment of hypertension, allowing targeted therapies such as allergen immunotherapy and biologics. The ALEX test is a solid-phase immune analysis in which allergenic extracts or molecular AGS are bound to nanoparticles and placed on a solid substrate, forming a macroscopic lattice (hence the name MacroArray). After the testing procedure, data is collected and analyzed using the ImageXplorer remote scanning device. The results are analyzed using MADx's Raptor Analysis software. The method is highly accurate and quantitative, making it possible to measure IgE in a wide range of concentrations. The

reagent for blocking antibodies to cross-reactive carbohydrate determinants (CCD) reduces clinically contradictory signals by 74%, which significantly improves the diagnosis of allergic diseases [2-5].
The test protocol includes the concentration of total IgE (sige), a list of hypertension groups with quantitative results and color coding of the degree of sensitization. AG composition: pollen from grasses, trees, weeds, mold, yeast fungi, mites, cockroaches, epidermis and animal hair, insect venom, food products (cereals and seeds, eggs, milk, fruits, legumes and nuts, seafood, spices, meat, vegetables), etc. (for example, latex).However, the use of molecular allergy diagnostics in Uzbekistan has been limited by various problems, including lack of access to advanced diagnostic technologies, regional differences in allergen exposure, and gaps in understanding the genetic basis of blood pressure in the local population [6-9].
Uzbekistan, a country located in Central Asia, has seen an increase in the prevalence of atopic dermatitis in recent years, especially in urban areas. The prevalence of allergic diseases, including hypertension, is associated with rapid urbanization, lifestyle changes, and environmental factors such as air pollution. Despite the growing burden of blood pressure, the molecular diagnosis of allergy has not yet been fully implemented in clinical practice in Uzbekistan. Most diagnostic methods are based on clinical evaluation and testing for major allergens, such as skin injections or tests for radioallergosorbents (RAST), which have limitations in terms of sensitivity and specificity [10].
In this context, it becomes extremely important to study the unique features of the molecular allergodiagnostics of atopic dermatitis in the Uzbek population. A deeper understanding of the molecular mechanisms involved in the development of hypertension, including the specific allergens that cause exacerbations and the genetic markers associated with this disease, can significantly improve diagnosis and treatment. In addition, the integration of molecular allergy diagnostics into clinical practice can provide physicians with more accurate tools for treating the disease, ultimately improving patient outcomes and reducing healthcare costs. Focusing on the current state of molecular diagnostics in Uzbekistan, this article aims to fill an important gap in the literature and provide recommendations for improving the diagnosis and treatment of atopic dermatitis in the country. [11, 12]
The following sections of this article will cover the molecular methods used in allergy diagnosis, including allergen microarrays, component isolation diagnostics, and genetic testing. An overview of global trends and research on the molecular diagnosis of allergy in atopic dermatitis will also be presented, which will describe how these methods have been successfully implemented in other countries. Comparing international practice with the modern diagnostic landscape in Uzbekistan, the article will examine the potential advantages and challenges of introducing molecular allergological diagnostics into the country's healthcare system.

MATERIAL AND METHODS

This study is aimed at studying the features of the molecular diagnosis of allergies in patients with atopic dermatitis (AD) in Uzbekistan, with an emphasis on the identification of specific allergens and genetic markers associated with the disease. To study the molecular foundations of BP, evaluate diagnostic methods and identify problems associated with the introduction of these methods into clinical practice in Uzbekistan, a systematic and comprehensive methodology was adopted that combines both qualitative and quantitative research approaches. The following are the key components of the methodology used in this study:

Research plan

The study used a comprehensive, observational approach to collect data on the molecular diagnosis of blood pressure in the context of Uzbekistan. Cross-sectional analysis allows data to be collected at a specific point in time, providing insight into the current state of allergy molecular diagnostics in a clinical setting. This analysis was chosen to simultaneously assess the genetic predisposition and sensitivity to allergens in patients with AD.
The study population
The study involved 200 patients diagnosed with atopic dermatitis, who were recruited by the Republican Center for Allergy and Clinical Immunology and its regional centers. The participants were selected based on the following inclusion and exclusion criteria:
Inclusion criteria:
• Persons aged 5 to 44 years with a diagnosis of atopic dermatitis in accordance with the diagnostic criteria of the American Academy of Dermatology (AAD).
• Patients who wish to provide informed consent to participate in the study and undergo genetic testing and molecular diagnosis of allergies.
Exclusion criteria:

• People with other skin conditions that can mimic blood pressure, such as psoriasis or contact dermatitis.
• Patients who have received systemic immunosuppressive therapy in the last three months.
Participants were sorted by age, gender, and geographical location to ensure a diverse and representative sample that takes into account potential regional differences in environmental impacts and genetic factors.
Data collection methods
Data was collected using a combination of clinical assessments, laboratory tests, and questionnaires. The following data collection methods were used:
Clinical assessment:
• The diagnosis of blood pressure was confirmed by a dermatologist based on clinical manifestations, including characteristic symptoms of itching, erythema and dry skin.
• The severity of atopic dermatitis was assessed using the Atopic Dermatitis Score (SCORAD), which quantifies the degree and intensity of skin lesions and itching.
Molecular diagnostics of allergies:
• To identify common allergens associated with blood pressure, such as house dust mites, pet hair, and plant pollen, the ALEX test was used to detect specific immunoglobulin E (IgE) in the blood
• This is the only system with an integrated ability to block CCD antibodies that are found on hypertension, are capable of inducing IgE production, and are very similar in completely different hypertension. Therefore, sensitization to CCD often leads to false positive results.
A genetic analysis was performed to identify mutations in the filaggrin (FLG) gene, which is associated with an increased risk of developing blood pressure. Genomic DNA was isolated from peripheral blood samples, and mutations in the FLG gene were analyzed using polymerase chain reaction (PCR) and DNA sequencing.
Comparative analysis and benchmarking
To complement the results obtained in Uzbekistan, a comparative analysis was conducted with a review of the current literature on the molecular diagnosis of allergy in blood pressure in other countries. Priority was given to studies conducted in regions with similar epidemiological characteristics (for example, in Central Asia and Eastern Europe). These studies served as a starting point for evaluating the possibility of molecular allergy diagnosis in Uzbekistan and helped identify best practices that could be adapted to local conditions.
SWOT analysis: A SWOT analysis was conducted to assess the strengths and weaknesses, opportunities and threats associated with the introduction of molecular allergy diagnostics in Uzbekistan. The analysis included factors such as the availability of diagnostic infrastructure, the level of awareness of medical professionals and the availability of advanced immunological methods.

DISCUSSION OF THE RESULTS

Demographic and clinical characteristics of patients

The study involved 200 participants diagnosed with atopic dermatitis (AD) who met the inclusion criteria. Of these, 120 (60%) were men, and 80 (40%) were women, with an average age of 32.5 years (range: 5-50 years). The patients were selected from the Republican Allergy Center and its regional branches, which ensured that both urban and rural populations were represented in the sample. The geographical diversity of the sample made it possible to analyze potential regional differences in genetic predisposition and environmental impact. The majority of participants (70%) lived in urban areas, which may have contributed to increased exposure to allergens and environmental pollutants, factors known to worsen blood pressure. The severity of blood pressure, assessed using the SCORAD index, varied widely: 45% of participants reported moderate symptoms, and 25% experienced severe exacerbations. The remaining 30% had mild symptoms.

Table 1 Demographic and clinical characteristics of patients

Characteristic	Value
Total Participants	200
Men	120 (60%)
Woman	80 (40%)
Average Age	32,5 years Range 5-50
Urban Population	140 (70%)
Rural Population	60 (30%)
Severity of Blood Pressure	
- Moderate Symptoms	90(45%)
- Severe Exacerbations	50 (25%)
- Mild Symptoms	60 (30%)

Prevalence of allergens in patients with atopic dermatitis

A Skin Prick Test was used to identify common environmental allergens associated with blood pressure. The most common allergens identified in the group were monosensitization to house dust mites in 80% of patients, and polysensitization to different groups of pollen, food, and household allergens in 20%. Clinically, the most severe course was observed in patients with sensitization to house dust mites.

The available data on the results of the allergological examination in the Republic of Uzbekistan are limited by several studies, which makes it difficult to conduct a comparative analysis of the results obtained by us. Thus, a study by E.N. Ismailova et al. Showed that 118 children of the Republic of Uzbekistan with skin symptoms of atopic syndrome have sensitization to all allergenic molecules of grass pollen presented on the Madex chip panel; The most common sensitization was detected to major allergenic molecules of cereal grasses — perennial chaff Lol p1 (in 35.53%), meadow thymophyllum Phl p1 (in 33.7%). Sensitivity to tree pollen was less typical: of the 30 components presented on the chip, sensitization was observed in more than 10% of cases in only 9 of them. The profile of sensitization to weed pollen was represented by 17 allergenic components, the most common was sensitization to Solyanka extract (36% of cases); amaranth (29.6%) and wormwood Art v1 (25.5%). Sensitization to year-round allergens was typical for the examined patients, 80.4% had allergen-specific antibodies to house dust mites, although 34.6% were sensitized to mold fungi Alternaria alternata. According to our data, the frequency of sensitization to pollen allergens was 17%, while timothy pollen was present in 80% of patients, wormwood — also in 80%, in contrast to the listed E.N. Ismailova [4] presented data based on component diagnosis and determination of individual allergen molecules (the major allergen of Timothy's Phl p1 and wormwood Art v1 were determined) in the pediatric patient population. In our study, sensitization to allergens of house dust mites was found in 80.4% of cases, which is consistent with the results of the above study, in which sensitization to year-round allergens was detected in 80.4% of the examined patients.

Thus, the spectrum of sensitization according to the results of component allergodiagnostics in children and adults with atopic dermatitis is characterized by a predominance of sensitization to allergens of house dust mites with a significant proportion of polysensitization of patients in all age groups.

These results are consistent with previous studies indicating that these allergens are among the most common triggers of exacerbations of blood pressure [15]. In addition, a significant part of the group (30%) tested positive for food allergens, primarily cow's milk, eggs and peanuts. The high prevalence of environmental and food allergens in the study population highlights the importance of identifying specific allergens in the treatment of hypertension, especially for personalized treatment approaches.

Component allergodiagnostics (CAD) and microarray allergen were used to identify specific IgE antibodies against individual allergenic components, such as house dust mite allergens (Der p 1 and Der f 1), cat allergens (Fel d 1) and birch pollen allergens (Bet v 1). The results of the CAD showed that the majority of patients sensitive to house dust mites showed IgE reactivity primarily to Der p1 and Der f1, which suggests that these components are key triggers for the development of blood pressure in Uzbekistan. Similarly, patients with allergies to pet hair had an increased IgE reaction to Fel d1, which once again confirms the role of these allergens in the pathogenesis of blood pressure.

Genetic analysis of mutations in the filaggrin (FLG) gene

The genetic analysis focused on mutations in the filaggrin (FLG) gene, a key gene associated with skin barrier dysfunction in blood pressure [11]. Mutations in the FLG gene are known to increase susceptibility to blood pressure, reducing the skin's ability to retain moisture and protect against allergens and irritants. In this study, 30% of the participants had one or more mutations in the FLG gene. The most common mutations identified were R501X and 2282del4, which are often associated with BP in

other populations [9]. It is noteworthy that the prevalence of FLG mutations in this country was higher compared to similar studies conducted in neighboring Central Asian countries, where the mutation rate is usually lower [10]. This discovery suggests that the Uzbek population may have a unique genetic predisposition to AD, which requires further study.

Interestingly, FLG mutations strongly correlated with the severity of BP. Patients carrying mutations in both alleles of the FLG gene (homozygous mutations) showed significantly higher SCORAD scores compared to patients who had only one mutated allele (heterozygous mutations) or no mutations. This finding is consistent with previous studies that demonstrate a link between mutations in the FLG gene and more severe forms of blood pressure [15].

Characteristic	Value
Total Participants	200
Common Mutations Identified	R501X, 2282del4
Participants with FLG Gene Mutations	60 (30%)

Table 2 **Genetic analysis of mutations in the filaggrin (FLG) gene**

SWOT analysis and implementation issues

SWOT analysis revealed several strengths and weaknesses, opportunities and threats related to the introduction of molecular allergy diagnostics in Uzbekistan:

Table 3. SWOT analysis

Strengths: The growing availability of advanced diagnostic methods such as CAD and allergen microarrays provides an opportunity to improve the accuracy of allergy diagnosis in patients with AD. In addition, the growing awareness of medical workers in Uzbekistan about atopic dermatitis has led to improved diagnosis and management of patients with hypertension.	Weaknesses: One of the main problems identified was limited access to molecular diagnostics, especially in rural areas. The high cost of genetic testing and analysis for allergen-specific IgE is also an obstacle to widespread adoption. In addition, there is a shortage of trained specialists in the field of immunology and molecular biology, which makes it difficult to effectively use these advanced diagnostic methods.
Opportunities: There is significant potential in Uzbekistan to improve the diagnosis and treatment of hypertension by integrating the molecular diagnosis of allergy into clinical practice. In addition, public health companies and educational programs can raise awareness of the importance of allergy testing and genetic screening for ADRENOGENITAL.	Threats: Economic difficulties, limited healthcare infrastructure, and lack of government support for widespread adoption of advanced diagnostic technologies were identified as the main threats. There is also a risk that medical professionals may not make full use of these new diagnostic tools due to ignorance or lack of training.

COMPARATIVE ANALYSIS AND BENCHMARKING

When compared with global studies, it was found that the prevalence of sensitization to allergens and genetic mutations in the cohort of Uzbekistan corresponds to data obtained in other countries with similar epidemiological characteristics. However, the prevalence of specific allergens varied by region. For example, studies conducted in Eastern Europe and Central Asia have shown that house dust mites and pet hair are the most common allergens associated with blood pressure [12], which is also reflected in the results of this study.

In addition, the prevalence of FLG mutations in the Uzbek population was higher than in other Central Asian countries, suggesting that environmental factors, genetic predisposition, and socio-economic conditions may play a role in the pathogenesis of hypertension in Uzbekistan. This highlights the need to develop country-specific recommendations for the diagnosis and treatment of hypertension, taking into account both genetic and environmental factors.

RESTRICTIONS

Several limitations of the study should be noted. Firstly, an integrated approach to research does not allow us to determine the cause-and-effect relationships between allergens, genetic mutations and the development of blood pressure. A longitudinal approach to the study would allow us to gain a more complete understanding of the temporal relationships between these factors. Secondly, the sample size, although sufficient, may not be sufficient to fully account for the genetic diversity of the Uzbek population, and future studies with a large sample size and the participation of several centers could strengthen the results obtained.

CONCLUSION

This study provides valuable information on the molecular allergological diagnosis of atopic dermatitis in Uzbekistan, highlighting the role of environmental allergens and genetic factors, in particular mutations in the filaggrin (FLG) gene. The results obtained emphasize the importance of introducing advanced molecular diagnostic methods into clinical practice to improve the accuracy of blood pressure diagnosis and adapt treatment approaches to individual patients. The spectrum of sensitization to various types of allergens in patients with atopic dermatitis in Uzbekistan is characterized to a greater extent by tick-borne sensitization in both children and adults with various forms of atopic dermatitis, with a predominance of multiple sensitization in all age groups. Despite problems such as limited access to these diagnostic tools in rural areas, the study demonstrates that there is significant potential for improving blood pressure management in Uzbekistan. Future research should focus on expanding the sample size, exploring other genetic markers, and developing public health strategies to remove obstacles to the introduction of molecular allergy diagnostics in clinical settings.

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