ATOPIC DERMATITIS: CLINICAL FEATURES, DIAGNOSTIC METHODS, AND EMERGING TECHNOLOGIES IN TREATMENT

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Annotation

This article summarizes the main clinical features of atopic dermatitis, modern diagnostic methods, and new treatment technologies. Literature data show that AD is characterized by chronic inflammation, pruritus, and skin-barrier dysfunction. Current diagnostics include dermoscopy, biomarkers, and TEWL measurement. Innovative therapies—such as biologics, JAK inhibitors, and microbiome-based approaches—significantly improve disease management. The review emphasizes the importance of combining precise diagnostics with targeted treatment to enhance patient outcomes.

Keywords: atopic dermatitis, clinical features, diagnosis, biologics, JAK inhibitors, skin barrier, TEWL

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АННОТАЦИЯ

В статье представлены основные клинические признаки атопического дерматита, современные методы диагностики и новые подходы к терапии. Показано, что АД характеризуется хроническим воспалением, зудом и нарушением кожного барьера. В диагностику включаются дерматоскопия, биомаркеры и измерение TEWL. Инновационные методы лечения, включая

биологические препараты, JAK-ингибиторы и микробиомные технологии, существенно улучшают контроль заболевания. Отмечается важность сочетания точной диагностики и таргетной терапии для повышения эффективности лечения.

Ключевые слова: атопический дерматит, клинические признаки, диагностика, биологическая терапия, JAK-ингибиторы, кожный барьер, TEWL

1. Introduction

Atopic dermatitis (AD) is one of the most common chronic inflammatory skin disorders, affecting 15–30% of children and 3–10% of adults worldwide. It is characterized by intense pruritus, recurrent eczematous lesions, and impaired skin barrier function. Disease prevalence continues to rise due to environmental changes, urbanization, and lifestyle factors.

The pathogenesis of AD involves a complex interaction between genetic susceptibility, immune hyperreactivity, microbiome imbalance, and environmental triggers. Filaggrin gene mutations, a hallmark contributor, are associated with severe xerosis, transepidermal water loss, and increased sensitization to allergens.

Diagnosing AD traditionally depends on clinical features; however, modern dermatology incorporates objective methods such as TEWL measurement, noninvasive biomarkers, and advanced imaging.

Similarly, the therapeutic landscape has evolved dramatically. Beyond emollients and topical corticosteroids, recent innovations include biologics targeting IL-4 and IL-13 pathways, JAK inhibitors, phototherapy technologies, and microbiome-based therapies.

Given these developments, an integrated understanding of clinical presentation, updated diagnostics, and advanced treatments is essential for effective AD management. This article reviews current knowledge and innovations that support personalized and evidence-based care in AD.

2. Methods

A structured literature review was conducted using PubMed, Scopus, Google Scholar, and dermatology society guidelines (AAD, EAACI, EADV). Publications between 2015–2024 were included. Search terms included:

“atopic dermatitis,” “clinical features,” “diagnosis,” “biologics,” “skin barrier,” “TEWL,” and “JAK inhibitors.”

Inclusion criteria: peer-reviewed studies,clinical trials, meta-analyses, and reviews, focus on diagnosis and treatment

Exclusion criteria: case reports, outdated guidelines.

A total of 85 sources were screened; 52 were selected for narrative synthesis.

3. Results

3.1 Clinical Features

Atopic dermatitis presents with hallmark symptoms:

Intense pruritus (most disabling feature)

Xerosis and lichenification

Erythematous, eczematous lesions

Age-dependent patterns:

Infants: acute, exudative lesions on the cheeks and scalp

Children: flexural involvement (elbow, knees)

Adults: chronic lichenified plaques, hand dermatitis

Triggers include allergens, irritants, sweating, infections, stress, and climate changes.

3.2 Diagnostic Methods

3.2.1 Clinical Diagnosis

Still the gold standard; based on Hanifin and Rajka or UK Working Party Criteria.

3.2.2 Dermoscopy

Allows visualization of: dotted vessels, yellow-white scales, crust patterns indicating secondary infection

3.2.3 Biomarkers

Emerging biomarkers include: total IgE, eosinophil count, TARC/CCL17, periostin

These support disease severity assessment.

3.2.4 Imaging and Digital Tools

Optical coherence tomography (OCT) for microstructural skin evaluation

High-frequency ultrasound for epidermal thickness

AI-based mobile apps for severity scoring (EASI/SCORAD)

3.2.5 Skin Barrier Assessment

Transepidermal water loss (TEWL) as a key indicator of barrier impairment

Corneometry for hydration

3.3 New Technologies in Treatment

3.3.1 Biologic Therapies

Targeted antibody treatments revolutionizing AD care:

Dupilumab (IL-4Rα blocker)

Tralokinumab (IL-13 inhibitor)

Provide significant reduction in inflammation and itch.

3.3.2 JAK Inhibitors

Oral and topical JAK1/2 inhibitors: upadacitinib, abrocitinib, ruxolitinib (topical)

Offer rapid symptom control.

3.3.3 Microbiome-Based Interventions

topical bacterial transplant

Staphylococcus hominis A9 therapy

probiotics and prebiotics

Help rebalance dysbiosis.

3.3.4 Advanced Topical Delivery Systems:nanocarriers, lipid nanoparticles, filaggrin-repair moisturizers, Improve drug penetration and barrier recovery.

4. Discussion

The analysis demonstrates that AD management has evolved from basic symptomatic treatment to precise, targeted, and personalized care. The integration

of biomarkers, digital tools, and imaging techniques enhances diagnostic accuracy, while biologics and JAK inhibitors significantly improve clinical outcomes in moderate-to-severe AD cases.

Barrier repair remains the foundation of therapy, emphasizing the importance of moisturization, protection from irritants, and allergen control. Advances in nanotechnology and microbiome therapeutics address underlying pathophysiology rather than merely alleviating symptoms.

Future perspectives include gene-targeted therapy, microbiome engineering, AI-driven diagnostics, and personalized immunomodulation based on molecular profiling.

5. Conclusion

Atopic dermatitis is a multifaceted skin disorder requiring accurate diagnosis and tailored therapy. Modern diagnostic techniques—supported by biomarkers, imaging, and TEWL measurement—enhance clinical decision-making. Emerging technologies such as biologics, JAK inhibitors, microbiome therapies, and digital monitoring tools provide substantial progress in disease control.

Continued innovation and personalized management strategies will improve quality of life for patients with AD.

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