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Evidence-Based Management of Pediatric Atopic Dermatitis: A Comprehensive Review Incorporating Recent Guideline and Therapeutic Advances

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ABSTRACT

Background: Atopic dermatitis (AD) is a common chronic inflammatory skin disorder affecting children worldwide and significantly impacting quality of life, sleep, psychosocial well-being, and family functioning.

Objective: To provide a comprehensive evidence-based review of pediatric atopic dermatitis management incorporating recent guideline recommendations and advances in targeted therapies.

Methods: A structured literature review was conducted using PubMed, Google Scholar, NICE, WHO, AAP, and international dermatology guideline publications from 2018 to 2025. Search terms included "pediatric atopic dermatitis," "eczema," "dupilumab," "JAK inhibitors", "biologics" and "guidelines." Relevant systematic reviews, randomized controlled trials, cohort studies, and guideline documents focusing on pediatric populations were included.

Results: Management strategies include optimized skin care, topical anti-inflammatory therapies, phototherapy, systemic immunomodulators, biologics, and Janus kinase (JAK) inhibitors. Recent advances in biologic and targeted therapies have significantly improved disease control and quality of life in moderate-to-severe disease.

Conclusion: Pediatric atopic dermatitis requires a stepwise, individualized, and multidisciplinary approach. Integration of evidence-based skin care, topical therapy, and emerging targeted treatments improves disease outcomes and may influence long-term progression of atopic disease.

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Introduction

Atopic dermatitis (AD) is a chronic inflammatory skin disease affecting a significant proportion of children worldwide, with increasing prevalence in both developed and developing countries [1,2]. It is characterized by pruritus, xerosis, recurrent eczematous lesions, and relapsing disease activity that may significantly impair sleep, psychosocial well-being, school performance, and quality of life.

AD is associated with immune dysregulation, particularly involving type 2 inflammatory pathways mediated by interleukin (IL)-4 and IL-13. Skin barrier dysfunction, genetic susceptibility, and environmental triggers contribute to disease development and progression [1].

Recent advances in understanding the immunopathogenesis of AD have led to the development of targeted therapies including biologics and Janus kinase (JAK) inhibitors. Contemporary management now focuses not only on symptom control but also on long-term disease modification, restoration of skin barrier function, prevention of flares, and improvement in patient quality of life [3-5].

Methods

A structured literature review was conducted using PubMed, Google Scholar, NICE, WHO, AAP, and international dermatology guideline publications from 2018 to 2025. Search terms included "pediatric atopic dermatitis," "eczema," "dupilumab," "JAK inhibitors," "biologics,"

and "guidelines." Relevant systematic reviews, randomized controlled trials, cohort studies, and guideline documents focusing on pediatric populations were included.

Pathophysiology

Atopic dermatitis is characterized by epidermal barrier dysfunction and immune dysregulation involving predominantly type 2 inflammatory pathways. Filaggrin (FLG) mutations, altered ceramide composition, and increased transepidermal water

loss contribute to impaired skin barrier integrity and increased susceptibility to allergens, irritants, and microbial colonization [1,6].

Recent studies have also highlighted the role of the skin microbiome in immune priming and disease progression. Alterations in early-life skin bacterial communities may influence later development of atopic dermatitis and impaired skin barrier maturation [7].

Children with AD are also at increased risk of developing other atopic conditions including asthma, allergic rhinitis, and food allergies, a phenomenon commonly described as the "atopic march" [8].

Clinical Features and Burden of Disease

Pediatric atopic dermatitis commonly presents with pruritic, xerotic, and relapsing eczematous lesions with age-dependent distribution patterns. Infants often present with facial and extensor involvement, while older children more commonly develop flexural disease.

The disease burden extends beyond skin manifestations. Sleep disturbance, anxiety, depression, impaired school performance, social stigmatization, and caregiver stress are increasingly recognized consequences of chronic disease activity [9].

The 2025 American Academy of Pediatrics (AAP) update emphasized the substantial psychosocial burden of AD and highlighted the importance of proactive long-term disease control and family-centered care [10].

Skin Care and Basic Management

Regular use of emollients remains the cornerstone of AD management and plays a key role in restoring skin barrier function, reducing xerosis, and preventing disease flares [3,11]. Fragrance-free moisturizers with low water content are generally preferred.

The AAP 2025 update emphasized frequent use of thick moisturizers, gentle skin care, and short lukewarm bathing practices followed immediately by moisturization [10]. Ointments such as petrolatum may be preferred in children experiencing stinging with creams.

Avoidance of irritants and implementation of gentle skin care practices are essential components of long-term management. Common triggers include harsh soaps, detergents, fragrances, overheating, sweating, and low humidity environments [10].

Overemphasis on food allergy as the primary cause of eczema should be avoided. Unnecessary elimination diets may increase nutritional risks and potentially lead to loss of tolerance to previously tolerated foods [10].

Topical Therapies

Topical Corticosteroids

Topical corticosteroids remain first-line anti-inflammatory therapy for acute flares and maintenance treatment when appropriately used [4]. Selection of potency should be based on patient age, anatomical site, and disease severity.

Low-potency corticosteroids are generally preferred for the face, neck, and intertriginous areas, while moderate-to-high potency preparations may be required for thicker plaques on the trunk or extremities.

Intermittent proactive therapy using topical corticosteroids on previously affected areas may reduce flare frequency in recurrent disease [10].

Topical Calcineurin Inhibitors

Topical calcineurin inhibitors such as tacrolimus and pimecrolimus provide effective steroid-sparing options, particularly for sensitive areas including the face and flexures [5]. These agents are useful in long-term maintenance therapy and may reduce corticosteroid exposure.

Phosphodiesterase-4 Inhibitors

Crisaborole provides an additional nonsteroidal topical option for mild-to-moderate atopic dermatitis and has demonstrated favorable safety in pediatric populations [12].

Topical JAK Inhibitors

Ruxolitinib cream has emerged as an effective treatment for mild-to-moderate atopic dermatitis. Clinical studies demonstrated significant anti-inflammatory and antipruritic effects with favorable safety profiles in children and adolescents [13,14].

Infection Control and Adjunctive Therapies

Secondary bacterial infection, particularly with Staphylococcus aureus, may exacerbate disease severity. Appropriate infection control measures including targeted antimicrobial therapy when clinically indicated are important components of management.

Wet-wrap therapy may provide short-term benefit in severe flares by improving hydration and enhancing topical medication penetration.

Phototherapy represents an effective treatment option for refractory disease and may reduce disease severity when used appropriately [5]. Narrowband ultraviolet B therapy is most commonly utilized in selected pediatric patients.

Systemic and Targeted Therapies

In moderate-to-severe disease unresponsive to topical therapy, systemic treatment may be required.

Conventional Systemic Therapies

Traditional systemic agents including cyclosporine, methotrexate, azathioprine, and mycophenolate mofetil may be considered in moderate-to-severe disease unresponsive to optimized topical management [15].

These therapies require careful monitoring because of potential toxicities including nephrotoxicity, hepatotoxicity, bone marrow suppression, and increased infection risk.

Dupilumab

Dupilumab, a monoclonal antibody targeting IL-4 and IL-13 signaling pathways, has significantly transformed the management of moderate-to-severe pediatric atopic dermatitis [16,17].

Clinical trials demonstrated substantial improvements in Eczema Area and Severity Index (EASI) scores, pruritus, sleep quality, and overall quality of life in children as young as six months of age [17].

Recent evidence also suggests that dupilumab may provide additional benefits beyond skin improvement, including reduction in psychiatric and sleep disorders and possible mitigation of atopic march progression in pediatric patients [18,19].

Furthermore, dupilumab has demonstrated positive effects on skin barrier restoration and normalization of ceramide composition [20].

Janus Kinase Inhibitors

Janus kinase inhibitors represent an important emerging therapeutic class offering rapid symptom relief through modulation of inflammatory signaling pathways.

Upadacitinib demonstrated significant improvement in refractory pediatric atopic dermatitis, including in dupilumab nonresponders, although monitoring for infection, anemia, and laboratory abnormalities remains important [21].

Although effective, systemic JAK inhibitors require careful consideration because of potential risks including infection, thromboembolic events, lipid abnormalities, and laboratory derangements.

Emerging Biologic Therapies

Emerging biologic therapies such as nemolizumab have demonstrated promising efficacy in improving both pruritus and disease severity in moderate-to-severe atopic dermatitis [22].

These therapies may further expand future treatment options and contribute to more individualized precision-based management strategies.

Psychosocial Impact and Quality of Life

Atopic dermatitis has substantial psychosocial effects on both patients and caregivers. Chronic pruritus, sleep disturbance, social embarrassment, anxiety, and depression contribute significantly to disease burden.

Recent studies demonstrated that effective biologic therapy may improve psychiatric symptoms and sleep-related disorders in patients with AD [18].

Recognition of mental health impact and incorporation of psychological support into management plans are increasingly emphasized in recent guidelines [10].

Future Directions

Emerging biologics and targeted therapies are transforming pediatric atopic dermatitis management. Ongoing research into immune modulation, microbiome-based therapies, skin barrier restoration, and precision medicine may further improve long-term outcomes and potentially reduce progression of the atopic march.

Future studies focusing on early intervention, biomarker-guided therapy, and long-term safety of biologic and JAK inhibitor therapies are likely to further refine pediatric AD management.

Conclusion

Pediatric atopic dermatitis requires a comprehensive, individualized, and evidence-based approach. Optimized skin care, topical anti-inflammatory therapies, patient education, and trigger avoidance remain foundational components of management.

Recent advances in biologic and targeted therapies have significantly improved outcomes in moderate-to-severe disease and expanded therapeutic possibilities for children with refractory disease.

Continued integration of evidence-based guideline recommendations and emerging therapies is essential for improving long-term outcomes, reducing disease burden, and enhancing quality of life in pediatric patients with atopic dermatitis.

Author Contributions

Dr Asim: Concept development, literature review, manuscript writing, final drafting

Dr Mazher Iqbal: Critical review, clinical supervision, manuscript revision

Conflicts of Interest

The authors declare that they have no competing interests.

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Ethical Approval

Not applicable, as this is a review article and does not involve human or animal subjects.

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