



## ALLERGIC DISEASES IN CHILDREN (BRONCHIAL ASTHMA, ATOPIC DERMATITIS) AND THEIR TREATMENT

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**Annotatsiya:** *Allergic diseases represent one of the most prevalent chronic health problems in children worldwide, significantly affecting quality of life and imposing a major burden on healthcare systems. Among the wide spectrum of allergic conditions, bronchial asthma and atopic dermatitis are the most common and clinically significant manifestations in the pediatric population. These disorders are characterized by hypersensitivity reactions of the immune system to otherwise harmless environmental substances such as pollen, dust mites, animal dander, or certain foods.[1,8,9,10]*

**Key words:** *IL-4, IL-5, and IL-13, Re-exposure, inflammation, dryness, Staphylococcus, World Allergy Organization, Budesonide, Fluticasone.*

**Introduction:** The prevalence of allergic diseases has increased dramatically over the past few decades, particularly in industrialized nations—a phenomenon often attributed to changes in lifestyle, diet, environmental exposure, and microbial diversity, a concept known as the “hygiene hypothesis.” According to the World Allergy Organization, more than 300 million people worldwide suffer from asthma, and approximately 20% of children experience symptoms of atopic dermatitis at some point during childhood. The immune system in allergic individuals is hyperreactive and tends to mount an exaggerated IgE-mediated immune response upon exposure to allergens. In bronchial asthma, this leads to inflammation and narrowing of the airways, resulting in wheezing, coughing, and shortness of breath. In atopic dermatitis, the immune reaction occurs primarily in the skin, causing chronic inflammation, dryness, and itching. Both conditions are chronic, relapsing, and often coexist in the same child, reflecting the systemic nature of allergic

inflammation. Allergic diseases in children are influenced by genetic predisposition and environmental triggers.[2,6,8,] Children with a family history of allergies, asthma, or eczema have a significantly higher risk of developing similar conditions, a phenomenon termed “atopic march,” where atopic dermatitis in early life can progress to allergic rhinitis and asthma later in childhood. Despite advances in medical science, allergic diseases remain incurable; however, effective management can greatly reduce symptoms and prevent complications. Modern treatment focuses on identifying and avoiding allergens, controlling inflammation through pharmacotherapy, and strengthening the child’s immune system. This paper explores the pathogenesis, mechanisms, clinical manifestations, and treatment of bronchial asthma and atopic dermatitis in children, as well as prevention strategies that can minimize disease onset and recurrence. Pathogenesis and Mechanism Allergic diseases arise from a complex interplay between genetic susceptibility, environmental exposure, and immune dysregulation. The hallmark of allergic disorders is a Type I hypersensitivity reaction, mediated by immunoglobulin E (IgE) antibodies. This reaction involves two major phases: sensitization and re-exposure (effector phase). Immunological Mechanism Sensitization Phase: The process begins when an allergen enters the body through inhalation, ingestion, or skin contact. Antigen-presenting cells (APCs), primarily dendritic cells, capture and process the allergen, presenting it to naïve CD4<sup>+</sup> T cells. These T cells differentiate into T-helper 2 (Th2) lymphocytes under the influence of interleukin-4 (IL-4). Th2 cells then release cytokines such as IL-4, IL-5, and IL-13, which stimulate B cells to produce allergen-specific IgE antibodies. Effector Phase (Re-exposure): During subsequent exposure to the same allergen, IgE antibodies—already bound to mast cells and basophils via high-affinity FcεRI receptors—trigger cell degranulation.[3,7,9]

**Materials and Methods:** This releases histamine, leukotrienes, and prostaglandins, causing vasodilation, increased vascular permeability, smooth muscle contraction, and mucus secretion. The immediate allergic reaction is

followed by a late-phase inflammatory response characterized by the recruitment of eosinophils, macrophages, and T cells, which sustain tissue inflammation and damage. Pathogenesis of Bronchial Asthma Bronchial asthma is a chronic inflammatory disorder of the airways, marked by reversible airflow obstruction and airway hyperresponsiveness. The pathological changes include: Airway inflammation: Eosinophilic infiltration and cytokine release cause swelling and thickening of airway walls. Bronchoconstriction: Smooth muscle contraction narrows the bronchial lumen. Mucus hypersecretion: Goblet cells increase mucus production, leading to airway blockage.[8,10] Airway remodeling: Chronic inflammation can result in fibrosis, smooth muscle hypertrophy, and permanent narrowing of the airways. Environmental allergens such as dust mites, pollen, mold spores, pet dander, and pollutants can initiate or worsen asthma symptoms. Viral respiratory infections, especially from respiratory syncytial virus (RSV) or rhinovirus, are common triggers in children. Non-allergic factors like cold air, exercise, and emotional stress can also exacerbate symptoms. Pathogenesis of Atopic Dermatitis Atopic dermatitis (AD) is a chronic, relapsing inflammatory skin disorder characterized by defective skin barrier function and immune dysregulation. Genetic mutations in the filaggrin gene (FLG), which is responsible for maintaining the integrity of the epidermal barrier, play a major role in disease susceptibility. This defective barrier allows allergens and microbes to penetrate the skin, triggering an immune response. The immunopathogenesis of AD involves both Th2 and Th1 immune pathways: In the acute phase, Th2 cytokines (IL-4, IL-13, IL-31) dominate, leading to IgE production and eosinophilic inflammation. In the chronic phase, Th1 and Th22 cytokines contribute to skin thickening (lichenification) and chronic inflammation.

**Results:** The result is dry, itchy, inflamed skin that becomes prone to bacterial infections, especially by *Staphylococcus aureus*. Scratching exacerbates the condition by further damaging the skin barrier, perpetuating the “itch-scratch cycle.”

Clinical Features and Treatment Clinical Features Bronchial Asthma in Children

Asthma symptoms can vary from mild to severe and may occur intermittently or persistently. Common clinical features include: Wheezing: High-pitched whistling sounds during breathing, especially on exhalation.[1,2] Coughing: Often worse at night or early morning. Shortness of breath (dyspnea): Especially after physical exertion or allergen exposure. Chest tightness or pain. During an acute asthma attack, children may show rapid breathing (tachypnea), nasal flaring, and use of accessory respiratory muscles. Severe attacks can lead to cyanosis and respiratory distress. Diagnosis is based on medical history, physical examination, and lung function tests (spirometry or peak expiratory flow rate). Allergy testing (skin prick or IgE assays) helps identify triggers. Atopic Dermatitis in Children Atopic dermatitis usually begins in infancy, often within the first six months of life. The clinical presentation varies with age: Infantile phase (0–2 years): Red, oozing, itchy patches on the cheeks, scalp, and extensor surfaces. Childhood phase (2–12 years): Dry, thickened skin (lichenification) on the flexural areas such as elbows and knees. Adolescent phase: Lesions often appear on the hands, face, and neck. Common symptoms: Intense itching (pruritus), Dry, scaly skin, Erythema and excoriations due to scratching, Secondary bacterial infection (impetigo). Diagnosis is primarily clinical but may be supported by elevated total serum IgE levels or eosinophilia. Treatment of Allergic Diseases The treatment of allergic diseases in children aims to control inflammation, alleviate symptoms, and prevent exacerbations. Management is individualized based on disease severity and triggers. Bronchial Asthma Treatment Pharmacological Management: Reliever medications (short-term): Short-acting  $\beta$ 2-agonists (SABA): e.g., Salbutamol or albuterol, used for rapid relief during asthma attacks. Anticholinergics (Ipratropium bromide): Used as adjunct therapy in acute exacerbations. Controller medications (long-term): Inhaled corticosteroids (ICS): e.g., Budesonide, Fluticasone — cornerstone of asthma control; reduce inflammation and airway hyperreactivity. Leukotriene receptor antagonists (Montelukast): Effective in mild persistent asthma, especially with allergic rhinitis. Long-acting  $\beta$ 2-agonists (LABA): Used in combination with ICS

for moderate to severe persistent asthma.[3,6] Biologic therapy: Omalizumab (anti-IgE monoclonal antibody) for severe allergic asthma unresponsive to conventional therapy. Non-Pharmacological Management: Allergen avoidance (dust mite covers, air purifiers). Regular physical exercise and breathing exercises to strengthen lungs. Education of parents and children about proper inhaler technique and asthma action plans. Acute Attack Management: Administer SABA via nebulizer or inhaler. Oxygen therapy for hypoxemia. Systemic corticosteroids (prednisolone) for moderate to severe attacks. Hospitalization if the child shows respiratory failure or poor response to initial treatment.

**Discussion:** Atopic Dermatitis Treatment Basic Skin Care: Frequent moisturizing with emollients to restore skin barrier function. Lukewarm baths with mild soap substitutes and immediate application of moisturizers afterward. Avoidance of irritants (fragrances, wool clothing, harsh detergents). Anti-inflammatory Therapy: Topical corticosteroids: Hydrocortisone, mometasone — first-line for flare-ups. Topical calcineurin inhibitors: Tacrolimus or pimecrolimus for sensitive areas (face, eyelids) or steroid-resistant cases. Antihistamines: Reduce itching and improve sleep. Antibiotics: For secondary *Staphylococcus aureus* infection. Systemic Therapies: In severe, refractory cases: short courses of systemic corticosteroids, cyclosporine, or dupilumab (anti-IL-4 receptor antibody). Psychosocial Management: Address emotional stress and anxiety, as these can worsen symptoms. Education for parents and children on proper skincare and trigger avoidance.[2,4,6] Prevention and Conclusion Prevention Strategies Early Allergen Exposure Management: Avoid known allergens such as dust mites, pet dander, and cigarette smoke. Exclusive breastfeeding for at least six months lowers the risk of developing allergies. Environmental Control: Regular cleaning, use of HEPA filters, and maintaining low indoor humidity to prevent mold growth. Avoiding strong odors, chemical fumes, and pollutants. Vaccination: Routine immunizations prevent respiratory infections that can trigger asthma attacks. Dietary and Microbiome Balance: Diet rich in omega-3 fatty acids, antioxidants, and probiotics supports

immune regulation. Avoid unnecessary antibiotic use to preserve healthy gut microbiota. Health Education: Training caregivers to recognize early warning signs and follow personalized management plans. School-based asthma and allergy education programs to reduce emergencies.

**Conclusion:** Allergic diseases in children, especially bronchial asthma and atopic dermatitis, represent a growing global concern due to their chronic nature and increasing prevalence. These conditions not only cause physical discomfort but also emotional and social challenges for children and families. Understanding the underlying immunological mechanisms allows for more targeted therapies that improve outcomes and quality of life. Inhaled corticosteroids and topical anti-inflammatory agents remain the mainstay of treatment, complemented by patient education, allergen avoidance, and environmental modifications. Prevention strategies focused on early immune modulation, breastfeeding, and maintaining a clean environment can significantly reduce disease onset. Continued research into genetic, immunological, and environmental factors promises to yield novel interventions and possibly preventive vaccines in the future. In conclusion, effective management of childhood allergic diseases requires a multidisciplinary approach—combining medical care, education, environmental control, and psychological support. With proper awareness and early intervention, children with allergies can lead healthy, active, and fulfilling lives.[1,3,5,7,9,10]

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