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Allergies. Types of Allergic Reactions. Anaphylaxis, Urticariaand Angioedema (Quincke's Edema) in Children

Osmonova Gulnaz Zhenishbaevna, Anjali Mishra, Mohd Arman Khan, Aakif
OSH State University, Kyrgyzstan

Abstract: *Allergic diseases represent one of the most common chronic health problems affecting children globally, with prevalence rates steadily increasing over the past few decades. This article provides an in-depth examination of IgE-mediated hypersensitivity reactions in the pediatric population, specifically focusing on three significant clinical manifestations: urticaria, angioedema, and anaphylaxis. We review the underlying immunopathology involving mast cell degranulation and histamine release. The clinical presentation, triggers, and management strategies for these conditions are detailed. Furthermore, the article analyzes global epidemiological trends, highlighting the rising burden of food allergies and anaphylaxis. It also briefly discusses the specific context of allergic disease management in developing regions, using Kyrgyzstan as a case study for the challenges in diagnostics and emergency preparedness in Central Asia. The review concludes by emphasizing the critical need for caregiver education and prompt access to epinephrine.*

Keywords: Pediatrics, Allergy, Anaphylaxis, Urticaria, Angioedema, IgE-mediated reaction, Mast Cells, Epidemiology, Kyrgyzstan

I. INTRODUCTION

Allergies are hypersensitivity reactions initiated by immunological mechanisms to otherwise harmless environmental substances known as allergens. In the pediatric population, these reactions can range from mild allergic rhinitis and eczema to severe, lifethreatening systemic reactions. The burden of allergic disease in childhood extends beyond physical symptoms, significantly impacting quality of life, school attendance, and family dynamics due to anxiety surrounding potential exposures.

While allergic rhinitis and asthma are chronic manifestations, acute allergic reactions often present dermatologically or systemically. This article focuses on three critical, often interlinked, acute presentations: urticaria (hives), angioedema (deeper tissue swelling), and anaphylaxis (a severe, systemic reaction). Understanding the pathophysiology, prompt recognition of symptoms, and immediate management of these conditions are paramount for pediatric healthcare providers, parents, and caregivers to prevent morbidity and mortality.

Pathology:

The Mechanism of Reaction The majority of acute allergic reactions, including anaphylaxis, acute urticaria, and angioedema, are classified as Type I (immediate) hypersensitivity reactions. The central mechanism involves the immune system misidentifying a benign substance (e.g., peanut protein, penicillin, bee venom) as a threat.The process occurs in two phases:

1. Sensitization: Upon initial exposure to an allergen, susceptible individuals produce specific Immunoglobulin E (IgE) antibodies against that allergen. These IgE antibodies bind to high-affinity receptors on the surface of mast cells

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(abundant in skin, respiratory, and gastrointestinal tracts) and basophils in the blood. At this stage, there are usually no symptoms.

2. Elicitation (The Reaction): Upon subsequent re-exposure, the allergen specifically binds to and cross-links the IgE antibodies already attached to the mast cells. This cross-linking triggers rapid cellular activation and degranulation.Degranulation results in the explosive release of pre-formed inflammatory mediators, most notably histamine, tryptase, and heparin. Subsequently, newly synthesized lipid mediators (leukotrienes, prostaglandins) and cytokines are released.These mediators cause the classic symptoms of allergy:

• Vasodilation: Increased blood flow (causing redness/erythema).
• Increased Vascular Permeability: Fluid leaks from vessels into tissues (causing swelling/edema and hives).
• Smooth Muscle Contraction:
Bronchoconstriction (wheezing) and gastrointestinal cramping.
• Sensory Nerve Stimulation: Intense itching (pruritus).

3. Explanation of Types

A. Urticaria (Hives) :Urticaria is characterized by the rapid appearance of wheals—circumscribed, raised, erythematous (red), and intensely pruritic (itchy) plaques on the skin. The hallmark of urticaria is its transient nature; individual lesions typically resolve within 24 hours without scarring, even while new ones may appear elsewhere.In children, acute urticaria (lasting less than six weeks) is very common. While often feared to be an allergy, the most common trigger for acute urticaria in young children is actually viral infection. However, IgE-mediated reactions to foods (milk, eggs, nuts) and medications (antibiotics like amoxicillin) are significant causes.

B. Angioedema: Angioedema involves the same pathological process as urticaria—vascular leakage—but it occurs in the deeper dermis and subcutaneous or submucosal tissues. It results in dramatic, often asymmetric swelling.Common sites in children include the eyelids, lips, tongue, genitals, and extremities. Unlike the intense itching of urticaria, angioedema is often described as painful, burning, or tingling due to tissue distension. While it often co-occurs with urticaria, isolated angioedema can occur. Swelling of the tongue or larynx constitutes a medical emergency as it threatens airway patency.

C. Anaphylaxis:Anaphylaxis is a severe, potentially life-threatening, systemic hypersensitivity reaction. It is characterized by rapid onset (minutes to hours) after exposure to a likely allergen.It is a multisystem event. Diagnosis generally requires acute onset of illness involving skin/mucosal tissue (e.g., hives, swollen lips) PLUS at least one of the following:

• Respiratory compromise: Wheezing, stridor, shortness of breath, persistent cough.
• Reduced blood pressure or associated symptoms:hypotonia (collapse), syncope, incontinence.
• Severe gastrointestinal symptoms: Persistent cramping, repetitive vomiting (especially after exposure to a non-food allergen like insect sting).In children, food items are the most common triggers for anaphylaxis, followed by insect stings and medications. The cornerstone of treatment is immediate intramuscular
administration of epinephrine.

Epidemiology:

The prevalence of allergic diseases has risen dramatically globally over the last 30-40 years, particularly in industrialized nations, a phenomenon often linked to the "hygiene hypothesis" and environmental changes.

• General Allergy: Estimates suggest that 30-40% of the world's population is affected by one or more allergic conditions.
• Pediatric Food Allergy: Affects approximately 6-8% of children globally, with rates appearing higher in Western countries.

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• Urticaria: Approximately 15-20% of the general population will experience at least one episode of acute urticaria during their lifetime.
• Anaphylaxis: The lifetime prevalence of anaphylaxis is estimated at 0.05–2% globally. Crucially, hospital admissions for food-induced anaphylaxis in children have increase
significantly (some studies showing a
several-fold increase) in the past two decades, although fatal outcomes remain rare.
In Kyrgyzstan: Specific, comprehensive national epidemiological data on pediatric allergies, particularly acute manifestations like anaphylaxis, is limited for the Kyrgyz Republic in easily accessible international medical literature.However, regional trends in Central Asia suggest that Kyrgyzstan is not immune to the global rise in allergies. Factors influencing the landscape in Kyrgyzstan include:
• Environmental Triggers: High levels of dust, seasonal pollens, and increasing urban air pollution in cities like Bishkek contribute to respiratory allergies which often co-exist with other atopic conditions.
• Dietary Shifts: As the country transitions and incorporates more processed "Western" diets, changes in gut microbiome may influence allergy development in children.
• Healthcare Challenges: Similar to many developing nations, Kyrgyzstan faces challenges in allergy management. These include limited availability of specialized pediatric allergists in rural areas, lack of access to advanced diagnostic testing (like component-resolved diagnostics), and inconsistent availability or affordability of epinephrine auto-injectors (EpiPens). Reliance
is often on ampules and syringes, which can cause delays in emergency administration by laypeople.Improving data collection on hospital admissions for acute allergic reactions in Bishkek and Osh is necessary to understand the true local burden.

Discussion

The interrelationship between urticaria, angioedema, and anaphylaxis is crucial. Urticaria and angioedema are cutaneous manifestations of the same process; when this process becomes systemic and involves vital organs (heart and lungs), it becomes anaphylaxis.A critical challenge in pediatrics is the under-recognition of anaphylaxis, especially in infants who cannot verbalize symptoms like "throat tightness" or "feeling of impending doom." In young children, sudden behavioral changes, irritability, drooling (indicating swallowing difficulty), or sleepiness after exposure to a trigger should raise suspicion.The management of these conditions rests on two pillars: avoidance of known triggers and emergency preparedness. For anaphylaxis, delayed administration of epinephrine is the single greatest risk factor for fatalities.Therefore, education of parents, teachers, and caregivers on recognizing symptoms and using epinephrine devices is a life-saving intervention.

II. CONCLUSION

Allergic reactions in children, ranging from the discomfort of urticaria to the life threat of anaphylaxis, are a growing global health concern. The underlying pathology is a swift, IgEmediated release of histamine and other inflammatory mediators. While global statistics show a clear upward trend, specific data for regions like Kyrgyzstan remains a gap that needs addressing. Regardless of geography, the cornerstone of managing severe pediatric allergies is widespread education on early recognition and the immediate availability and administration of intramuscular epinephrine.

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