ALLERGY IN PRETERM INFANTS: PATHOPHYSIOLOGY, CLINICAL MANIFESTATIONS, AND MANAGEMENT STRATEGIES

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https://doi.org/10.5281/zenodo.14879648

Abstract. *Preterm infants, due to their immature immune systems and increased exposure to environmental allergens, are at a heightened risk of developing allergies. This article explores the unique pathophysiology of allergy development in preterm infants, outlines the diverse clinical manifestations, and discusses current management strategies aimed at preventing sensitization and minimizing allergic reactions. We also address the challenges in diagnosis and the need for ongoing research in this vulnerable population.*

Keywords: *Preterm infants, allergy, immune immaturity, food allergy, atopic dermatitis, gut microbiota, anaphylaxis, diagnosis, management strategies, sensitization, immune system, respiratory allergy, management, prevention.*

АЛЛЕРГИЯ У НЕДОНОШЕННЫХ ДЕТЕЙ: ПАТОФИЗИОЛОГИЯ, КЛИНИЧЕСКИЕ ПРОЯВЛЕНИЯ И СТРАТЕГИИ ЛЕЧЕНИЯ

Аннотация. *Недоношенные дети из-за незрелой иммунной системы и повышенного воздействия аллергенов окружающей среды подвергаются повышенному риску развития аллергии. В этой статье рассматривается уникальная патофизиология развития аллергии у недоношенных детей, описываются разнообразные клинические проявления и обсуждаются современные стратегии лечения, направленные на предотвращение сенсибилизации и минимизацию аллергических реакций. Мы также рассматриваем проблемы диагностики и необходимость постоянных исследований в этой уязвимой группе населения.*

Ключевые слова: *Недоношенные дети, аллергия, незрелость иммунитета, пищевая аллергия, атопический дерматит, микробиота кишечника, анафилаксия, диагностика, стратегии лечения, сенсибилизация, иммунная система, респираторная аллергия, лечение, профилактика.*

Introduction

Preterm infants are predisposed to allergic reactions due to the immaturity of their immune systems. Their underdeveloped immunological response increases the risk of allergic diseases.

This article discusses the course of allergies in preterm infants, the pathophysiological mechanisms, clinical manifestations, and management strategies.

1. Pathophysiology of Allergies in Preterm Infants

Pathophysiology of Allergy in Preterm Infants

Several factors contribute to the increased risk of allergies in preterm infants:

- **Immature Immune System:** Preterm infants have a diminished number of circulating T cells and impaired T-helper type 1 (Th1) cytokine production, which normally suppresses allergic (Th2) responses. This imbalance favors Th2 polarization, predisposing them to allergic sensitization.
- **Barrier Dysfunction:** The skin and gut of preterm infants are more permeable, allowing greater allergen penetration and increasing the likelihood of sensitization. This is further exacerbated by reduced production of secretory IgA, which normally provides mucosal immunity.
- **Altered Gut Microbiota:** The gut microbiota plays a crucial role in immune development and tolerance. Preterm infants often have a disrupted gut microbiome, characterized by reduced diversity and colonization with commensal bacteria. This dysbiosis can contribute to immune dysregulation and increased allergic responses.
- **Environmental Exposure:** While early exposure to diverse microbes can be protective, preterm infants may encounter a skewed environment with increased exposure to certain allergens (e.g., dust mites in the NICU) before their immune system is ready.
- **Genetic Predisposition:** Genetic factors play a significant role in allergy development. Preterm infants with a family history of allergies are at even greater risk.

2. Clinical Manifestations

Allergic diseases in preterm infants present with various clinical features:

- **Atopic dermatitis** – Characterized by dry, erythematous, and pruritic skin.
- **Food allergies** – Manifested as lactose or protein intolerance, leading to gastrointestinal issues, vomiting, diarrhea, and colic.
- **Respiratory allergies** – Early-life asthma and rhinitis symptoms may emerge.
- **Risk of anaphylaxis** – Increased sensitivity to food or medications may lead to severe reactions.

3. Diagnostic Approaches

- **Skin prick tests** – Less commonly used due to reduced skin reactivity in preterm infants.
- **Serum IgE levels** – Assessing total or specific IgE levels in blood aids in diagnosis.
- **Elimination diets** – Removing potential allergens from the diet and monitoring symptom improvement.
- **Gut microbiota assessment** – Evaluating gut bacterial composition to detect immune tolerance disruptions.

4. Management Strategies

- **Optimizing nutrition** – Breastfeeding supports immune development.
- **Hypoallergenic formula milk** – Specially formulated hypoallergenic diets are recommended for severe allergic reactions.
- **Probiotics and prebiotics** – Improving gut microbiota reduces allergy risk.
- **Skin care** – Emollients and moisturizers help restore the skin barrier.
- **Pharmacological treatment** – Antihistamines, corticosteroids, and immunomodulators are prescribed in specific cases.

Challenges and Future Directions

Several challenges remain in the management of allergies in preterm infants:

- **Difficulty in diagnosis:** Overlapping symptoms with other conditions of prematurity can make diagnosis challenging.
- **Limited data on safety and efficacy of treatments:** More research is needed to evaluate the safety and efficacy of allergy treatments in this vulnerable population.
- **Need for long-term follow-up:** Long-term follow-up is essential to assess the natural history of allergies in preterm infants and evaluate the effectiveness of preventive strategies.

Future research should focus on:

- **Understanding the mechanisms of allergy development in preterm infants:** Further research is needed to elucidate the complex interplay of genetic, environmental, and immune factors.
- **Developing effective preventive strategies:** Strategies to promote immune maturation and prevent sensitization are crucial.
- **Evaluating the safety and efficacy of allergy treatments:** Well-designed clinical trials are needed to assess the safety and efficacy of allergy treatments in preterm infants.

Conclusion

The course of allergic diseases in preterm infants is linked to immune immaturity, necessitating individualized diagnostic and management approaches. Early detection and appropriate interventions positively impact healthy infant development.

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