

The Role of Allergen-Specific Immunotherapy in Asthma Management

Michael Jen*

Department of Immunology, Macau University of Science and Technology, Macao, China

DESCRIPTION

Asthma is a chronic respiratory condition that affects millions of people worldwide. Characterized by airway inflammation, bronchoconstriction and increased mucus production, asthma leads to symptoms such as shortness of breath, wheezing, coughing and chest tightness. Among the many factors contributing to asthma exacerbations, exposure to allergens is one of the most significant. For individuals with allergic asthma, which is triggered by specific environmental allergens, managing the allergic component of their condition is important for long-term control. One of the most potential treatments for allergic asthma is Allergen-Specific Immunotherapy (AIT), a treatment modality that seeks to modify the immune system's response to allergens. AIT has been shown to reduce asthma symptoms, improve lung function and decrease the need for medication in people with allergic asthma. This article analyzes the role of AIT in asthma management, its mechanisms, benefits and challenges.

Immune response in allergic asthma

Allergic asthma, the most common form of asthma, occurs when exposure to certain allergens triggers the immune system to react inappropriately, causing inflammation in the airways. Common allergens that can provoke asthma symptoms include pollen (from trees, grasses, and weeds), dust mites, pet dander, mold spores and cockroach allergens. When an individual with allergic asthma is shown to these allergens, their immune system produces Immunoglobulin E (IgE) antibodies, which attach to mast cells and other immune cells. Upon re-exposure to the allergen, these cells release inflammatory mediators like histamine, leading to airway inflammation and the characteristic symptoms of asthma.

Management in traditional asthma

Asthma management typically involves the controller medications, such as Inhaled Corticosteroids (ICS) or Long-Acting Beta-Agonists (LABAs), which reduce inflammation and prevent symptoms. Reliever medications, such as Short-Acting Beta-Agonists (SABAs), which provide quick relief during

asthma attacks by relaxing the airway muscles. While these medications are effective in managing symptoms and preventing exacerbations, they do not tackle the underlying allergic mechanisms that trigger asthma in many patients. This is where AIT comes in as a potential innovation.

Mechanisms of AIT

The immune system's response to allergens is complex, but in allergic individuals, there is an altered immune response favouring Th₂-type helper T cells, which produce inflammatory cytokines and promote the production of IgE antibodies. These IgE antibodies bind to mast cells and basophils, priming the immune system for an allergic response. AIT works by shifting this Th₂-dominated response toward a more balanced immune reaction. Specifically, AIT helps to:

Induce regulatory T cells: These cells suppress allergic responses by promoting tolerance to the allergen. Over time, this leads to a reduction in the production of IgE antibodies.

Increase IgG4 levels: IgG4 antibodies block allergens from binding to IgE on mast cells, preventing the release of histamine and other inflammatory mediators.

Reduce mast cell: AIT reduces the sensitivity of mast cells and eosinophils (another type of immune cell involved in allergic inflammation), leading to less inflammation and fewer asthma symptoms.

Considerations in AIT

While AIT offers numerous benefits for asthma management, there are several considerations that both patients and healthcare providers should be aware of:

Patient selection: Not all individuals with asthma are candidates for AIT. AIT is most effective in patients whose asthma is clearly linked to specific allergens, such as pollen, dust mites or pet dander.

Safety concerns: AIT is generally safe, but it carries a risk of allergic reactions, including local reactions at the injection site or systemic reactions, such as anaphylaxis.

Correspondence to: Michael Jen, Department of Immunology, Macau University of Science and Technology, Macao, China, E-mail: jenmichael@lt.com

Received: 20-Aug-2024, Manuscript No. IDIT-24-34501; **Editor assigned:** 22-Aug-2024, PreQC No. IDIT-24-34501 (PQ); **Reviewed:** 05-Sep-2024, QC No. IDIT-24-34501; **Revised:** 12-Sep-2024, Manuscript No. IDIT-24-34501 (R); **Published:** 20-Sep-2024, DOI: 10.35248/2593-8509.24.9.194

Citation: Jen M (2024). The Role of Allergen-Specific Immunotherapy in Asthma Management. *Immunol Disord Immunother.* 9:194.

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Time commitment: AIT is a long-term treatment that requires a significant time commitment. Ongoing research continues to improve the understanding of how AIT can be optimized for asthma management. Modern developments, such as improved allergen extracts, shorter treatment protocols and combination therapies, offer the potential to enhance the efficacy and accessibility of AIT. Additionally, precision medicine approaches that customize treatment to the individual's unique immune profile and allergic triggers are being analyzed. As research advances, AIT is likely to become an even more integral part of asthma management, particularly for individuals with moderate

to severe allergic asthma. AIT represents a potential treatment option for individuals with allergic asthma. By targeting the underlying allergic triggers, AIT can reduce asthma symptoms, improve lung function, decrease medication use and prevent exacerbations. Although AIT requires a long-term commitment and carries some risks, its potential for providing lasting benefits makes it an important consideration in the comprehensive management of allergic asthma. As awareness of the benefits of AIT grows, healthcare providers can help more patients achieve better asthma control, improving their quality of life and reducing the burden of this chronic condition.