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Understanding asthma phenotypes: Towards targeted therapy and better outcomes.

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Introduction

Asthma, once regarded as a single, homogeneous disease, is now recognized as a complex and heterogeneous condition characterized by varying clinical presentations, underlying mechanisms, and treatment responses. The concept of asthma phenotypes—distinct observable characteristics such as age of onset, triggers, inflammatory profiles, and severity—has emerged as a critical framework in understanding the disease more deeply and personalizing its management. Recognizing these phenotypes is key to developing targeted therapies and improving patient outcomes [1].

Traditionally, asthma was treated using a "one-size-fits-all" approach, focusing primarily on symptom control through bronchodilators and inhaled corticosteroids (ICS). While effective for many, this strategy often failed in patients with severe or atypical asthma, resulting in frequent exacerbations, poor quality of life, and increased healthcare utilization. This gap in treatment success prompted a shift towards identifying distinct asthma subtypes to enable more individualized care [2].

Asthma phenotypes can be broadly classified into clinical and inflammatory categories. Clinical phenotypes are based on characteristics such as age at onset (childhood vs. adult), allergic vs. non-allergic asthma, exercise-induced asthma, and obesity-related asthma. Inflammatory phenotypes, on the other hand, are based on the type of airway inflammation, such as eosinophilic, neutrophilic, mixed granulocytic, or paucigranulocytic asthma. These inflammatory patterns are often determined through analysis of sputum, blood eosinophils, and exhaled nitric oxide (FeNO) levels [3].

One of the most studied phenotypes is eosinophilic asthma, characterized by high levels of eosinophils in the airways and blood. This phenotype is typically responsive to corticosteroids and is associated with type 2 (T2) inflammation, driven by cytokines like IL-4, IL-5, and IL-13. Patients with eosinophilic asthma often benefit from biologic therapies targeting these cytokines, such as mepolizumab (anti-IL-5) and dupilumab (anti-IL-4/IL-13), resulting in reduced exacerbations and steroid use [4].

Conversely, neutrophilic asthma, more common in older adults and individuals exposed to environmental pollutants or occupational irritants, is often less responsive to corticosteroids. This phenotype is associated with T1 and T17 immune responses and presents a significant challenge in treatment. Research into macrolide antibiotics and other anti-inflammatory agents for this phenotype is ongoing but still limited in terms of effectiveness [5].

Conclusion

In conclusion, understanding asthma phenotypes represents a major step forward in achieving targeted, effective, and patient-centered asthma care. By moving beyond generic treatment protocols and embracing precision medicine, clinicians can significantly improve disease control, reduce exacerbations, and enhance the quality of life for people with asthma. Continued research and improved access to diagnostic and therapeutic tools will be essential in translating this knowledge into everyday clinical practice.

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