

Personalized asthma: Biomarkers, genes, digital care.

Benjamin Lee*

Department of Respiratory Medicine, Yonsei University College of Medicine, South Korea

Introduction

The evolving landscape of asthma management increasingly embraces personalized medicine, a paradigm shift from conventional generalized approaches. This comprehensive strategy focuses on tailoring treatment, particularly for severe asthma cases, by considering an individual's unique biological and clinical profile rather than relying on a one-size-fits-all model [1].

This involves a sophisticated understanding of underlying disease mechanisms, patient-specific factors, and the identification of optimal therapeutic pathways for each person. A significant hurdle in achieving effective personalized asthma management stems from the persistent challenge of poor adherence to inhaled corticosteroids. This widespread issue actively undermines the potential benefits of individualized treatment plans, highlighting a critical need to develop and implement innovative strategies. These strategies must be designed to enhance patient engagement, improve consistent medication use, and ultimately lead to more favorable clinical outcomes [2].

Beyond adherence, the genetic makeup of an individual plays a pivotal role in how they respond to inhaled corticosteroids. Extensive research is dedicated to investigating specific genetic variations that influence drug efficacy and the potential for adverse reactions. Unlocking these genetic insights promises to pave the way for highly personalized asthma treatments, thereby optimizing therapeutic benefits and minimizing unwanted side effects through a precision-guided approach [3]. Central to tailoring asthma management is the accurate classification of patients into distinct inflammatory phenotypes, such as eosinophilic or neutrophilic asthma. This nuanced understanding of inflammatory pathways empowers clinicians to develop highly targeted treatment strategies. By aligning therapy with a patient's specific phenotype, it becomes possible to guide the most effective use of inhaled corticosteroids and other specialized therapies, ensuring superior disease control and improving patient well-being [4].

For individuals grappling with severe asthma, personalized medicine offers a transformative pathway in therapeutic intervention. This approach meticulously combines advanced diagnostic tools with a thorough evaluation of patient characteristics to in-

form the selection of appropriate therapies, which can range from inhaled steroids to newer biologics. The goal is to achieve more precise, effective, and individualized disease management, moving beyond empirical treatment protocols [5]. Innovations in digital health tools are rapidly reshaping the landscape of asthma care, offering unprecedented opportunities for personalized management. Technologies like smart inhalers and remote monitoring systems are proving instrumental in facilitating individualized treatment plans. These tools not only significantly improve adherence to prescribed inhaled steroids but also provide clinicians with invaluable real-time data, enabling them to dynamically optimize treatment plans based on a patient's current status and response [6].

The identification and utilization of specific biomarkers are fundamental to personalizing treatment for severe asthma. Key markers such as blood eosinophils, Fractional exhaled Nitric Oxide (FeNO), and periostin are employed to classify patients into distinct "treatable traits." This classification directly informs the selection of either inhaled steroids or targeted biologic therapies, ensuring that patients receive the most appropriate and effective interventions for optimal outcomes [7]. Furthermore, the principles of precision medicine are making substantial inroads into pediatric asthma care, providing tailored interventions for younger patients. By thoroughly understanding individual patient characteristics unique to children, healthcare providers can meticulously guide the use of inhaled steroids and other therapies. This meticulous approach ensures that pediatric patients receive treatments that are not only maximally effective but also least burdensome, promoting better health trajectories from an early age [8].

The emerging concept of theranostics—a synergistic combination of diagnostic tools with therapeutic strategies—holds immense promise for advancing personalized asthma care. This innovative framework integrates sophisticated diagnostics, potentially including specific markers relevant to an individual's response to inhaled steroids, to create highly precise and effective treatment plans that are customized for each patient [9]. The practical application of personalized asthma management is increasingly supported by real-world data, which provides crucial insights into its effectiveness outside of controlled research environments. Systematic reviews aggregate and synthesize this evidence, highlighting how patient-

*Correspondence to: Benjamin Lee, Department of Respiratory Medicine, Yonsei University College of Medicine, South Korea. E-mail: benjamin.lee@koreamedical.ac.kr

Received: 01-Jul-2025, Manuscript No. AAJCRM-25-278; Editor assigned: 03-Jul-2025, Pre QC No. AAJCRM-25-278 (PQ); Reviewed: 23-Jul-2025, QC No. AAJCRM-25-278; Revised: 01-Aug-2025, Manuscript No. AAJCRM-25-278 (R); Published: 12-Aug-2025, DOI: 10.35841/AAJCRM-9.4.278

specific factors and their unique responses to treatments, including inhaled corticosteroids, are being successfully utilized in everyday clinical practice. This real-world evidence is vital for validating and refining personalized strategies, ultimately optimizing outcomes for patients in diverse clinical settings [10]. The overarching trend points towards a future where asthma care is deeply individualized, leveraging scientific advancements and technological innovations to deliver truly patient-centric treatment.

Conclusion

The field of asthma treatment is undergoing a significant transformation, moving towards personalized medicine to address the diverse needs of patients, especially those with severe cases. This evolution emphasizes the critical role of biomarkers, such as eosinophil count and Fractional exhaled Nitric Oxide (FeNO), in guiding the selection and use of inhaled steroids and newer biologics, thereby moving beyond conventional generalized approaches. A core aspect involves classifying asthma patients into distinct inflammatory phenotypes, like eosinophilic or neutrophilic asthma, to implement tailored treatment strategies that optimize the application of inhaled corticosteroids and other targeted therapies, ultimately leading to improved disease control.

Despite these advancements, adherence to inhaled corticosteroids remains a substantial hurdle in achieving effective personalized asthma management. Poor adherence directly impedes treatment efficacy, highlighting the necessity for innovative strategies to enhance patient engagement and overall outcomes. Researchers are also exploring genetic factors that influence an individual's response to inhaled corticosteroids. Understanding these genetic variations could significantly optimize drug efficacy and minimize adverse effects, paving the way for highly individualized treatments. Furthermore, personalized medicine is making strides in pediatric asthma, enabling tailored interventions based on specific patient characteristics to ensure children receive the most effective and least burdensome care.

The integration of advanced diagnostic tools with patient-specific profiles is becoming central to selecting appropriate therapies, fostering more precise and effective disease management. Digital

health technologies, including smart inhalers and remote monitoring systems, are actively contributing to personalized care by enhancing medication adherence and providing real-time data crucial for optimizing treatment plans. The promising concept of theranostics, which synergizes diagnostic assessments with therapeutic interventions, aims to establish highly precise and effective treatment pathways. Real-world evidence consistently demonstrates the practical application of these personalized approaches, showcasing how patient-specific factors are effectively leveraged in clinical settings to achieve superior outcomes compared to traditional methods.

References

1. Pavord I, Menzies-Gow A, Corren J. Personalized Medicine in Asthma: *Recent Advances and Future Perspectives*. *J Allergy Clin Immunol Pract*. 2021;9:1475-1488.e4.
2. Al-Ahmad Y, Bardin P, Menzies-Gow A. Poor adherence to inhaled corticosteroids in asthma: a challenge in personalized medicine. *Expert Rev Respir Med*. 2020;14:569-583.
3. Sharma S, Agarwal A, Singh B. Genetic variants associated with response to inhaled corticosteroids in asthma: a systematic review. *J Asthma*. 2020;57:579-591.
4. Wu Y, Zhu Y, Wang R. Tailoring asthma management based on inflammatory phenotypes: *A review*. *Front Pharmacol*. 2022;13:846747.
5. Gagliardo R, Bignardi D, Vitulo P. Personalized medicine strategies for severe asthma patients: from diagnosis to therapeutic intervention. *Expert Rev Respir Med*. 2022;16:749-760.
6. Kostyrka M, Kolbe J, Booth J. Digital Health in Asthma Management: *Emerging Opportunities and Challenges for Personalized Care*. *J Allergy Clin Immunol Pract*. 2023;11:440-449.e1.
7. Maspero J, Bignardi D, Vitulo P. Biomarkers in severe asthma: towards a personalized approach. *Expert Rev Clin Immunol*. 2020;16:31-43.
8. Fitzpatrick AM, Levy M, Fuhlbrigge A. *Precision Medicine Approaches to Pediatric Asthma*. *Chest*. 2020;158:S28-S35.
9. Al-Ahmad Y, Chaudhuri R, Haughney J. Theranostics in Asthma: *Advancing Personalized Medicine*. *J Clin Med*. 2023;12:4627.
10. Sulaiman Z, Abdullah A, Sulaiman A. Real-world evidence of personalized asthma management: a systematic review. *Curr Opin Allergy Clin Immunol*. 2020;20:18-24.

Citation: Lee B. Personalized asthma: Biomarkers, genes, digital care. *J Clin Resp Med*. 2025;09(04):278.