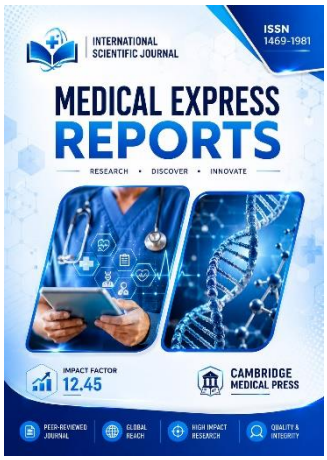
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# CHANGES IN EXTERNAL RESPIRATORY FUNCTION IN PATIENTS WITH BRONCHIAL ASTHMA

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**ABSTRACT**

*This article examines changes in external respiratory function in patients with bronchial asthma, focusing on the physiological mechanisms and clinical significance of airway obstruction. Particular attention is given to the assessment of pulmonary function parameters, including forced expiratory volume in one second ($FEV_1$), forced vital capacity (FVC), the $FEV_1$/FVC ratio, and peak expiratory flow (PEF). The study analyzes the effects of chronic airway inflammation, bronchoconstriction, mucus hypersecretion, and airway remodeling on respiratory function. Based on a review of scientific literature, the article highlights the importance of spirometry and bronchodilator responsiveness testing in identifying variable airflow limitation and evaluating respiratory impairment. The findings emphasize that regular monitoring of pulmonary function contributes to early diagnosis, assessment of disease control, and optimization of individualized treatment strategies for patients with bronchial asthma.*

**Introduction.** Bronchial asthma is one of the most common chronic respiratory diseases worldwide and represents a significant medical and socioeconomic challenge. It is a heterogeneous inflammatory disorder of the airways characterized by variable respiratory symptoms, bronchial hyperresponsiveness, and reversible or persistent expiratory airflow limitation. The disease affects individuals of different ages and may considerably reduce their

quality of life, physical activity, and occupational performance. According to the World Health Organization (WHO), approximately 262 million people worldwide were affected by asthma in 2019, and the disease was responsible for approximately 455,000 deaths [1]. Despite considerable advances in diagnostic technologies and therapeutic approaches, bronchial asthma continues to be an important public health concern because of its increasing clinical complexity, recurrent exacerbations, and potential long-term consequences for pulmonary function. One of the most important aspects of bronchial asthma is the alteration of external respiratory function, which reflects the ability of the respiratory system to provide adequate pulmonary ventilation and support gas exchange. External respiratory function is closely associated with the anatomical and physiological condition of the bronchial tree, respiratory muscles, lung tissue, and pulmonary circulation. In patients with bronchial asthma, inflammatory processes in the airways lead to bronchial smooth muscle contraction, mucosal edema, excessive mucus secretion, and increased airway resistance. These pathological changes impair normal airflow, particularly during expiration, resulting in varying degrees of obstructive ventilatory dysfunction [2]. The functional impairment of the respiratory system in bronchial asthma is characterized by considerable variability depending on disease severity, inflammatory activity, environmental exposure, and individual physiological characteristics. During asthma exacerbations, narrowing of the bronchial lumen may cause a significant reduction in expiratory airflow, increased respiratory effort, and disturbances in pulmonary ventilation. In contrast, patients with well-controlled asthma may demonstrate relatively normal respiratory function between exacerbations. This variability emphasizes the importance of objective functional assessment in addition to clinical examination and symptom evaluation. Spirometry is considered one of the principal diagnostic methods for evaluating external respiratory function in patients with bronchial asthma. It provides quantitative measurements of pulmonary ventilation and enables the identification of airflow obstruction and its variability. Among the most clinically relevant spirometric parameters are forced expiratory volume in one second ($FEV_1$), forced vital capacity (FVC), the $FEV_1$/FVC ratio, and peak expiratory flow (PEF). A reduction in $FEV_1$ and the $FEV_1$/FVC ratio may indicate expiratory airflow limitation, while changes in PEF can reflect fluctuations in bronchial patency. These parameters are particularly valuable for evaluating the functional condition of the respiratory system, assessing bronchodilator responsiveness, and monitoring changes in pulmonary function over time [3]. An essential pathophysiological mechanism underlying respiratory dysfunction in bronchial asthma is chronic airway inflammation. The inflammatory process involves various immune cells, including eosinophils, mast cells, T lymphocytes, and other cellular components that release biologically active mediators. These mediators contribute to bronchial hyperresponsiveness, increased vascular permeability, mucus hypersecretion, and structural alterations in the airway walls. Prolonged inflammation may result in airway remodeling, which includes subepithelial fibrosis, increased bronchial smooth muscle mass, goblet cell hyperplasia, and thickening of the airway wall. Such structural changes may contribute to persistent airflow

limitation and reduced pulmonary function in some patients [4]. The scientific relevance of investigating external respiratory function in patients with bronchial asthma is associated with the need to better understand the relationship between airway inflammation, bronchial obstruction, structural remodeling, and functional respiratory impairment. A detailed analysis of spirometric parameters and other pulmonary function indicators may contribute to more accurate interpretation of disease manifestations and facilitate the development of effective diagnostic and monitoring approaches. The aim of the present study is to analyze changes in external respiratory function in patients with bronchial asthma, characterize the principal physiological mechanisms responsible for airflow limitation, and evaluate the diagnostic and clinical significance of pulmonary function parameters. The study specifically focuses on the relationship between bronchial obstruction and spirometric abnormalities, the role of airway inflammation and remodeling in respiratory dysfunction, and the importance of bronchodilator responsiveness and pulmonary function monitoring in the comprehensive assessment of bronchial asthma.

**Literature review.** Bronchial asthma has been extensively investigated in respiratory medicine because of its complex pathophysiology, heterogeneous clinical manifestations, and significant effects on pulmonary function. Scientific studies have demonstrated that changes in external respiratory function are primarily associated with chronic airway inflammation, bronchial hyperresponsiveness, variable expiratory airflow limitation, and structural remodeling of the bronchial walls. The assessment of these functional abnormalities is essential for understanding disease progression, establishing an accurate diagnosis, and evaluating the effectiveness of therapeutic interventions. Papi et al. (2018) [7] described bronchial asthma as a heterogeneous respiratory disorder characterized by chronic airway inflammation and variable airflow obstruction. The authors emphasized that asthma involves complex interactions among genetic susceptibility, environmental exposures, immunological mechanisms, and airway structural changes. Their analysis demonstrated that respiratory dysfunction may result from both reversible bronchoconstriction and persistent alterations in airway structure. Furthermore, the researchers highlighted the importance of pulmonary function testing in distinguishing asthma from other obstructive respiratory diseases and evaluating the physiological consequences of airway inflammation. Wenzel (2012) [10] investigated the clinical and molecular heterogeneity of bronchial asthma and proposed that different asthma phenotypes are associated with distinct inflammatory mechanisms and functional characteristics. The study emphasized that eosinophilic and non-eosinophilic inflammatory patterns may contribute differently to bronchial hyperresponsiveness, airway obstruction, and treatment responsiveness. This approach provides an important theoretical foundation for understanding why patients with similar respiratory symptoms may demonstrate different spirometric parameters and clinical outcomes. The author also highlighted the importance of integrating physiological measurements with inflammatory biomarkers when investigating asthma phenotypes. Graham et al. (2019) [4] presented updated international standards for spirometry, emphasizing the importance of accurate measurement

techniques, equipment calibration, patient cooperation, and quality control. Their recommendations established standardized procedures for assessing forced expiratory volume in one second ($FEV_1$), forced vital capacity (FVC), and other respiratory parameters. According to the authors, the reliability of spirometric results depends on the acceptability and repeatability of respiratory maneuvers. These methodological principles are particularly important in bronchial asthma because variations in respiratory effort or measurement conditions may influence the interpretation of airflow limitation. Stanojevic et al. (2022) [5] examined modern interpretive strategies for routine pulmonary function testing and emphasized the importance of using appropriate reference equations and lower limits of normal when identifying respiratory abnormalities. The authors demonstrated that spirometric interpretation should consider individual physiological characteristics, including age, height, and sex. Their recommendations also addressed bronchodilator responsiveness and the interpretation of obstructive ventilatory patterns. These findings are relevant to bronchial asthma because a reduced $FEV_1$/FVC ratio provides evidence of airflow obstruction, whereas changes in $FEV_1$ following bronchodilator administration may support the presence of variable expiratory airflow limitation. The literature also indicates that the relationship between asthma severity and pulmonary function is not always linear. Some patients may demonstrate relatively preserved $FEV_1$ values despite frequent symptoms, while others may develop persistent airflow limitation even when respiratory symptoms are relatively mild. This discrepancy highlights the importance of comprehensive clinical evaluation and repeated functional assessment. Overall, the reviewed studies establish that external respiratory dysfunction in bronchial asthma is a multifactorial process involving inflammatory, mechanical, and structural mechanisms. However, differences in patient characteristics, inflammatory phenotypes, disease duration, and treatment exposure complicate the interpretation of pulmonary function abnormalities. Consequently, further investigation is necessary to clarify the relationship between spirometric indicators, airway remodeling, and long-term clinical outcomes.

**Discussion.** The findings of the present literature-based study demonstrate that changes in external respiratory function represent one of the most important physiological manifestations of bronchial asthma. The analysis indicates that respiratory dysfunction is primarily associated with variable expiratory airflow limitation, chronic airway inflammation, bronchial hyperresponsiveness, and structural remodeling of the bronchial walls. These pathological mechanisms contribute to alterations in pulmonary ventilation and affect important spirometric parameters, including forced expiratory volume in one second ($FEV_1$), forced vital capacity (FVC), the $FEV_1$/FVC ratio, and peak expiratory flow (PEF). The observed patterns of respiratory dysfunction are consistent with the findings reported by Papi et al. [7], who emphasized that bronchial asthma is characterized by heterogeneous inflammatory mechanisms and variable airflow obstruction. The authors demonstrated that airway narrowing results from complex interactions between inflammatory mediators, bronchial smooth muscle contraction, and

structural alterations in the respiratory tract. These mechanisms explain why patients with bronchial asthma may experience considerable fluctuations in pulmonary function during different stages of the disease. One of the most clinically significant aspects of asthma-related respiratory dysfunction is the reduction in $FEV_1$. This parameter reflects the ability of the respiratory system to generate expiratory airflow and is particularly sensitive to changes in airway resistance. During asthma exacerbations, bronchoconstriction, mucosal edema, and mucus accumulation may cause a substantial decrease in $FEV_1$. However, the degree of functional impairment varies among patients and does not always correspond directly to the severity of subjective respiratory symptoms. Some individuals may demonstrate significant airflow obstruction despite reporting relatively mild symptoms, while others may experience considerable respiratory discomfort with near-normal spirometric values. The findings of Graham et al. [4] emphasize the importance of standardized spirometric measurements in evaluating these abnormalities. Accurate interpretation requires appropriate testing procedures, acceptable respiratory maneuvers, and reliable reference values. Similarly, Stanojevic et al. [5] highlighted the necessity of considering individual physiological characteristics when interpreting pulmonary function parameters. These recommendations are particularly relevant because the $FEV_1$/FVC ratio changes with age and other physiological factors, making the use of appropriate reference equations essential for identifying obstructive ventilatory impairment. Another important finding concerns the role of bronchodilator responsiveness in assessing variable expiratory airflow limitation. Improvement in $FEV_1$ or FVC following bronchodilator administration provides objective evidence of changes in airway caliber. Nevertheless, the absence of significant bronchodilator responsiveness during a single examination does not exclude bronchial asthma. Patients receiving effective anti-inflammatory treatment or those examined during asymptomatic periods may demonstrate relatively normal pulmonary function. Therefore, bronchodilator testing should be interpreted together with clinical symptoms, medical history, and additional diagnostic findings. The relationship between chronic airway inflammation and pulmonary function impairment is another essential consideration. Inflammatory processes involving eosinophils, mast cells, lymphocytes, and other immune cells contribute to bronchial hyperresponsiveness, airway wall edema, and excessive mucus secretion. These processes increase resistance to expiratory airflow and may lead to reduced pulmonary ventilation. Wenzel [10] emphasized that bronchial asthma consists of different inflammatory phenotypes, which may influence the degree of respiratory dysfunction and response to treatment. This heterogeneity suggests that patients with similar clinical symptoms may demonstrate different functional and inflammatory characteristics.

The findings also highlight the complex relationship between pulmonary function abnormalities and asthma control. Although reduced $FEV_1$ may indicate clinically important airflow limitation, asthma control cannot be evaluated exclusively through spirometric parameters. Symptom frequency, nocturnal awakenings, physical activity limitations, exacerbation history,

and medication requirements must also be considered. This comprehensive approach is consistent with international recommendations emphasizing individualized asthma assessment and management [2, 9]. From a clinical perspective, regular evaluation of external respiratory function contributes to the identification of persistent airflow limitation, assessment of treatment response, and monitoring of long-term pulmonary health. Early recognition of functional abnormalities may support timely therapeutic adjustments and reduce the risk of severe exacerbations. Nevertheless, treatment decisions should be based on an integrated assessment of respiratory function, clinical manifestations, risk factors, and individual patient characteristics. The present analysis has certain limitations. As a narrative review, it does not include original clinical observations, patient recruitment, or statistical comparisons between different asthma severity groups. Therefore, the discussion is based on previously published scientific evidence rather than newly obtained experimental findings. Furthermore, variations in study populations, diagnostic criteria, treatment exposure, and pulmonary function measurement methods may limit direct comparisons among the reviewed investigations. Future research should focus on prospective evaluation of pulmonary function in patients with different asthma phenotypes and levels of disease control. Particular attention should be given to the relationship between inflammatory biomarkers, airway remodeling, bronchodilator responsiveness, and longitudinal changes in $FEV_1$. The integration of spirometry with advanced pulmonary function testing and clinical monitoring may improve the identification of patients at increased risk of persistent airflow limitation.

**Conclusion.** The present study demonstrates that changes in external respiratory function are among the most important physiological manifestations of bronchial asthma. The analysis of scientific literature indicates that chronic airway inflammation, bronchial hyperresponsiveness, bronchoconstriction, mucus hypersecretion, and structural airway remodeling contribute to the development of variable expiratory airflow limitation and impaired pulmonary ventilation. The most characteristic functional abnormalities in patients with bronchial asthma include a reduction in forced expiratory volume in one second ($FEV_1$), a decreased $FEV_1$/FVC ratio during bronchial obstruction, increased variability in peak expiratory flow (PEF), and, in some cases, air trapping and pulmonary hyperinflation. The severity and reversibility of these abnormalities depend on disease activity, inflammatory characteristics, airway structure, and individual patient factors. Spirometry remains an essential diagnostic method for evaluating respiratory function in patients with bronchial asthma. Bronchodilator responsiveness testing provides additional evidence of variable expiratory airflow limitation, while repeated pulmonary function measurements help identify persistent obstruction and monitor changes in respiratory function over time. The reviewed evidence also indicates that pulmonary function abnormalities do not always directly correspond to the severity of clinical symptoms. Therefore, comprehensive assessment should combine spirometric parameters with clinical manifestations, exacerbation history, and relevant inflammatory markers. In conclusion, regular evaluation of external respiratory function plays a fundamental role in the diagnosis, monitoring, and individualized management of bronchial

asthma. Early identification of respiratory abnormalities, appropriate anti-inflammatory treatment, and systematic clinical follow-up may contribute to improved disease control, prevention of exacerbations, and preservation of long-term pulmonary function. Further prospective clinical studies are required to clarify the relationship between airway remodeling, inflammatory phenotypes, and progressive respiratory impairment in patients with bronchial asthma.

## References

1. World Health Organization. (2024). Asthma. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/asthma

2. Global Initiative for Asthma. (2024). Global Strategy for Asthma Management and Prevention. Global Initiative for Asthma. https://ginasthma.org/

3. Hough, K. P., Curtiss, M. L., Blain, T. J., Liu, R. M., Trevor, J., Deshane, J. S., & Thannickal, V. J. (2020). Airway remodeling in asthma. Frontiers in Medicine, 7, Article 191. https://doi.org/10.3389/fmed.2020.00191

4. Graham, B. L., Steenbruggen, I., Miller, M. R., et al. (2019). Standardization of spirometry 2019 update: An official American Thoracic Society and European Respiratory Society technical statement. American Journal of Respiratory and Critical Care Medicine, 200(8), e70–e88. https://doi.org/10.1164/rccm.201908-1590ST

5. Stanojevic, S., Kaminsky, D. A., Miller, M. R., et al. (2022). ERS/ATS technical standard on interpretive strategies for routine lung function tests. European Respiratory Journal, 60(1), Article 2101499. https://doi.org/10.1183/13993003.01499-2021

6. Fehrenbach, H., Wagner, C., & Wegmann, M. (2017). Airway remodeling in asthma: What really matters. Cell and Tissue Research, 367, 551–569. https://doi.org/10.1007/s00441-016-2566-8

7. Papi, A., Brightling, C., Pedersen, S. E., & Reddel, H. K. (2018). Asthma. The Lancet, 391(10122), 783–800. https://doi.org/10.1016/S0140-6736(17)33311-1

8. Miller, M. R., Hankinson, J., Brusasco, V., et al. (2005). Standardisation of spirometry. European Respiratory Journal, 26(2), 319–338. https://doi.org/10.1183/09031936.05.00034805

9. Reddel, H. K., Bacharier, L. B., Bateman, E. D., et al. (2022). Global Initiative for Asthma Strategy 2021: Executive summary and rationale for key changes. European Respiratory Journal, 59(1), Article 2102730. https://doi.org/10.1183/13993003.02730-2021

10. Wenzel, S. E. (2012). Asthma phenotypes: The evolution from clinical to molecular approaches. Nature Medicine, 18(5), 716–725. https://doi.org/10.1038/nm.2678

11. Global Initiative for Asthma. (2025). Global Strategy for Asthma Management and Prevention. Global Initiative for Asthma. https://ginasthma.org/

12. Pellegrino, R., Viegi, G., Brusasco, V., et al. (2005). Interpretative strategies for lung function tests. European Respiratory Journal, 26(5), 948–968. https://doi.org/10.1183/09031936.05.00035205

13. Holgate, S. T. (2012). Innate and adaptive immune responses in asthma. Nature Medicine, 18(5), 673–683. https://doi.org/10.1038/nm.2731

14. Fahy, J. V. (2015). Type 2 inflammation in asthma—Present in most, absent in many. Nature Reviews Immunology, 15(1), 57–65. https://doi.org/10.1038/nri3786

15. Haldar, P., Pavord, I. D., Shaw, D. E., et al. (2008). Cluster analysis and clinical asthma phenotypes. American Journal of Respiratory and Critical Care Medicine, 178(3), 218–224. https://doi.org/10.1164/rccm.200711-1754OC