

Breathing insights: Biomarkers as tools for chronic obstructive pulmonary disease assessment – A systematic review

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Abstract:

Chronic obstructive pulmonary disease (COPD) remains a major global health burden, posing ongoing challenges in diagnosis and management. This systematic review examines current evidence on biomarkers relevant to COPD, emphasizing their diagnostic, prognostic, and therapeutic potential. A comprehensive search of PubMed and Scopus identified studies published from January 2019 to April 2025 involving adult COPD patients. Two independent reviewers screened observational and randomized studies, with duplicates ($n = 24$) removed using Mendeley and verified manually. Due to heterogeneity in methodology and outcomes, data were synthesized narratively. Risk of bias was assessed using RoB 2.0 for randomized trials and the Newcastle–Ottawa Scale for observational studies. Traditional biomarkers such as C-reactive protein and fibrinogen were consistently associated with exacerbation risk and disease severity. Interleukins-6 and -8 were elevated in frequent exacerbators, while surfactant proteins showed potential in distinguishing COPD from other chronic lung diseases. Emerging genetic and multiomics markers – such as matrix metalloproteinase-9, chitinase-3-like protein 1, and various microRNAs – demonstrated associations with disease phenotypes and treatment response. The findings highlight that while individual biomarkers offer valuable insights, a combined multimarker approach integrated with clinical parameters may enhance the precision of COPD management. This review provides clinicians and researchers with an updated perspective on the utility and limitations of current biomarkers, supporting the move toward more personalized and effective strategies in COPD care.

Keywords:

Biomarkers, chronic obstructive pulmonary disease, genetics, systematic review