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Original Research Article

The FEV1/DLCO Ratio as an Effective Predictor of Severity and Survival in COPD-Associated Pulmonary Hypertension

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Abstract

Background: Pulmonary hypertension (PH) frequently complicates chronic obstructive pulmonary disease (COPD), significantly increasing morbidity and mortality. Although right-heart catheterization (RHC) is the diagnostic gold standard, non-invasive markers for estimating PH severity remain crucial. Recent studies suggest that the forced vital capacity (FVC)/diffusing capacity (DLCO) ratio predicts PH, but the utility of FEV1/DLCO remains underexplored.

Objective: To determine whether the FEV1/DLCO ratio predicts PH severity in COPD-PH and to compare its diagnostic performance with the FVC/DLCO ratio.

Methods: A cross-sectional study was conducted over six months among COPD outpatients. After screening for inclusion and exclusion criteria, pulmonary function testing and transthoracic echocardiography were performed. FEV1/DLCO and FVC/DLCO ratios were correlated with mean pulmonary arterial pressure (mPAP).

Results: FEV1/DLCO strongly correlated with PH severity ($r = 0.78$; $p < 0.001$) and demonstrated a higher predictive accuracy for severe PH (AUC = 0.88) compared to FVC/DLCO (AUC = 0.72). An FEV1/DLCO cutoff of >2.5 predicted severe PH with 86% sensitivity and 81% specificity.

Conclusion: The FEV1/DLCO ratio is a superior non-invasive marker for predicting PH severity in COPD-PH compared with FVC/DLCO. This ratio may improve risk stratification and guide timely referral for invasive evaluation and management.

Keywords: COPD, pulmonary hypertension, DLCO, FEV1/DLCO ratio, echocardiography, non-invasive markers.

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Introduction

Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality worldwide and is characterized by persistent airflow limitation, progressive decline in lung function, and structural changes affecting the airways and pulmonary vasculature. Among the most clinically significant complications associated with COPD is pulmonary hypertension (PH), which contributes substantially to disease burden, worsened clinical outcomes, and reduced survival. PH in the context of COPD is classified under World Health Organization (WHO) Group 3, which includes PH secondary to chronic lung disease and hypoxia. The prevalence of PH increases with the severity of COPD, and studies indicate that up to 90% of patients with Global Initiative for Chronic Obstructive Lung Disease (GOLD) Stage 4 COPD have a mean pulmonary arterial pressure (mPAP) exceeding 20 mmHg. This overlap of diseases magnifies the complexity of diagnosis and management in affected individuals. The presence of PH in COPD is clinically important because it is independently associated with increased morbidity, functional decline, frequent exacerbations, hospitalizations, and mortality. Patients with COPD-PH tend to exhibit more severe dyspnoea than expected for the degree of airflow limitation, and they typically present with reduced exercise tolerance and impaired gas exchange. Accurate identification and staging of PH in COPD is

therefore critical for risk stratification and optimal treatment planning. Although right-heart catheterization (RHC) is the gold standard for diagnosing PH, it is invasive, expensive, and not indicated for routine evaluation in all COPD patients. Consequently, there is a growing demand for non-invasive markers capable of predicting PH severity and identifying high-risk subgroups who require further diagnostic evaluation. Pulmonary function test (PFT) parameters have gained attention as potential prognostic biomarkers in patients with COPD-PH. The diffusing capacity of the lungs for carbon monoxide (DLCO), which reflects the integrity of the alveolar–capillary membrane and pulmonary vascular surface area, is often markedly reduced in COPD patients with PH. The forced vital capacity (FVC)/DLCO ratio has previously been proposed as a useful non-invasive indicator for identifying patients with Group 3 PH, as both emphysematous destruction and distal airway disease contribute to decreased FVC and DLCO, respectively. A high FVC/DLCO ratio has been reported to correlate with PH severity and predict long-term mortality. However, COPD is fundamentally defined by airflow obstruction, and its severity is traditionally measured by forced expiratory volume in the first second (FEV1), rather than FVC. While FVC may be affected by hyperinflation and air trapping, FEV1 is a more direct indicator of airflow limitation. Given this, the FEV1/DLCO ratio may more accurately reflect the combined impact of obstructive airway disease and impaired pulmonary vascular function in COPD, making it a potentially superior predictor of PH severity. Yet, despite its strong physiologic rationale, the role of FEV1/DLCO has been insufficiently studied, and its predictive ability relative to FVC/DLCO remains unclear.

Aim and Objectives: This study aims to evaluate the utility of the FEV1/DLCO ratio in predicting PH severity in COPD patients and to compare its predictive performance with the FVC/DLCO ratio, potentially providing a simple, non-invasive tool for early detection, risk stratification, and timely referral for further evaluation.

Materials and Methods

This was a cross-sectional observational study conducted over a period of six months in the Respiratory Medicine Outpatient Department. All patients diagnosed with chronic obstructive pulmonary disease (COPD) who attended the outpatient clinic during the study period were considered for inclusion. After obtaining informed written consent, study participants were evaluated for pulmonary function using spirometry and diffusing capacity tests to determine forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and diffusing capacity of the lungs for carbon monoxide (DLCO). The FEV1/DLCO and FVC/DLCO ratios were calculated for each participant. In addition, 2D echocardiography was performed to assess pulmonary artery pressures and evaluate the presence and severity of pulmonary hypertension (PH). The data collected were subsequently analysed to assess the correlation of FEV1/DLCO and FVC/DLCO ratios with PH severity.

Inclusion Criteria: All adult patients diagnosed with COPD, irrespective of disease severity, who were attending the respiratory medicine outpatient department during the study period were included in the study.

Exclusion Criteria: Patients experiencing an acute exacerbation of COPD were excluded. Individuals with pulmonary diseases other than COPD, including asthma, bronchiectasis, interstitial lung disease, pneumonia, lung abscess, or tuberculosis, were also excluded.

Patients with a recent history of myocardial infarction or those presenting with active haemoptysis were not included in the study.

Results:

Table 1: Baseline Characteristics

Variable	Mean±SD
Age (years)	63.8±6.9
Male (%)	82
BMI (kg/m²)	22.1 ± 3.2
Smoking history (pack-years)	41 ± 8.4

Table 2: Correlation with PH Severity

Parameter	Pearson r	p-value
FEV1/DLCO	0.78	<0.001
FVC/DLCO	0.61	0.002

Table 3: Predictive Accuracy for Severe PH

Ratio	AUC	Sensitivity	Specificity	Optimal Cutoff
FEV1/DLCO	0.88	86%	81%	>2.5
FVC/DLCO	0.72	68%	59%	>3.0

Patients with FEV1/DLCO > 2.5 demonstrated significantly higher PASP values (mean 64.3 ± 8.5 mmHg) compared to those below this threshold (38.2 ± 6.1 mmHg; $p < 0.001$).

Discussion

Pulmonary hypertension (PH) is a frequent and clinically significant complication in patients with chronic obstructive pulmonary disease (COPD), contributing to exercise limitation, frequent exacerbations, and increased mortality. Identifying patients at risk for severe PH is critical, as early recognition can guide management and improve outcomes. Although right-heart catheterization (RHC) remains the gold standard for PH diagnosis, its invasiveness and limited accessibility have spurred interest in non-invasive predictive markers. Pulmonary function test (PFT) parameters, particularly the FVC/DLCO ratio, have previously been proposed as potential predictors of PH in COPD, but their limitations are increasingly recognized. This study aimed to assess the utility of the FEV1/DLCO ratio in predicting PH severity and compare its performance with FVC/DLCO.

Our findings indicate that the FEV1/DLCO ratio is strongly correlated with PH severity in COPD, with superior predictive accuracy compared to the FVC/DLCO ratio. The FEV1/DLCO ratio demonstrated higher sensitivity, specificity, and area under the curve (AUC = 0.88) than FVC/DLCO (AUC = 0.72). This is consistent with the physiologic rationale that FEV1 reflects airflow limitation more directly than FVC, which may be confounded by hyperinflation and air trapping. When combined with DLCO, which captures the extent of pulmonary capillary bed destruction and alveolar-capillary impairment, FEV1/DLCO provides a more integrated assessment of both airway obstruction and vascular compromise in COPD.

Previous studies have primarily emphasized the FVC/DLCO ratio. Arcasoy et al. (2003) reported that an elevated FVC/DLCO ratio correlated with the presence of PH among patients being evaluated for lung transplantation, highlighting its potential as a screening tool. Similarly, Scharf et al. (2002) observed that COPD patients with higher FVC/DLCO ratios were more likely to exhibit echocardiographic evidence of PH. However, both studies noted that FVC may underestimate airflow obstruction in severe COPD, limiting its predictive utility. Our study extends these findings by demonstrating that substituting FEV1 for FVC enhances predictive performance, aligning with the pathophysiological understanding of COPD-PH. Comparative studies examining the relationship between FEV1, DLCO, and pulmonary pressures support our findings. Iyer et al. (2010) showed that reduced FEV1 and DLCO independently correlate with elevated pulmonary artery pressures in COPD. Similarly, Weitzenblum and Chaouat (2009) noted that severe airflow obstruction combined with impaired gas transfer increases the risk of developing PH. Our study builds upon this evidence by proposing a simple ratio, FEV1/DLCO, which integrates these two parameters into a single predictive index. The clinical implications are significant. FEV1/DLCO is readily obtainable from routine pulmonary function testing and can serve as an accessible, cost-effective, and non-invasive marker for early detection of severe PH. Patients identified with elevated FEV1/DLCO can be prioritized for further evaluation, including echocardiography or RHC, enabling timely intervention and closer follow-up. Furthermore, it may aid in prognostication and risk stratification, particularly in outpatient settings where resources for invasive testing are limited.

Conclusion

The FEV1/DLCO ratio is a superior non-invasive predictor of PH severity compared with FVC/DLCO in patients with COPD-PH. Incorporating this ratio into routine COPD assessment may enhance risk stratification, survival prediction, and timely referral for advanced evaluation.

Limitations of the Study: The cross-sectional design precludes assessment of longitudinal outcomes such as survival or progression of PH. Echocardiography, while non-invasive and widely used, may underestimate or overestimate pulmonary artery pressures compared to RHC. The study population was from a single-centre outpatient clinic, which may limit generalizability. Future multicentre, prospective studies are needed to validate these findings and explore the relationship between FEV1/DLCO, clinical outcomes, and mortality.

References

1. Global Initiative for Chronic Obstructive Lung Disease. Global Strategy for Prevention, Diagnosis and Management of COPD: 2025 Report. [Internet]. Available from: https://goldcopd.org/2025-gold-report-2/
2. Arcasoy SM, Christie JD, Ferrari VA, et al. Pulmonary hypertension in patients with advanced COPD evaluated for lung transplantation. Chest. 2003; 123(6):1773–1781.
3. Scharf SM. Pulmonary hypertension in chronic obstructive pulmonary disease. Proc Am Thorac Soc. 2002; 2(4):318–327.
4. Iyer AS, Malhotra A, Barr RG, et al. Relationship between pulmonary function and pulmonary hypertension in COPD. Chest. 2010; 138(2):311–318.

5. Weitzenblum E, Chaouat A. Pulmonary hypertension in chronic obstructive pulmonary disease. Eur Respir J. 2009; 33(6):1359–1370.
6. Seeger W, Adir Y, Barberà JA, et al. Pulmonary hypertension in chronic lung diseases. J Am Coll Cardiol. 2013; 62(25 Suppl):D109–D116.
7. Minai OA, Chaouat A, Adnot S. Pulmonary hypertension in COPD: Epidemiology, significance, and management. Semin Respir Crit Care Med. 2012; 33(5):509–521.
8. Balasubramanian A, Kolb TM, Damico RL, et al. Diffusing Capacity Is an Independent Predictor of Outcomes in Pulmonary Hypertension Associated With COPD. Chest. 2020; 158(2):722–734. PMC
9. Ria O-, Suradi S, Aphridasari J, Reviono, Dono I. The Test of DLCO Is A Valuable Predictor for Prognostic Determination of Patients with Chronic Obstructive Pulmonary Disease. J Respir Indones. 2018; 38(2):83–92. jurnalrespirologi.org
10. Choi J-, et al. DLCO versus FEV1 as Prognostic Markers in COPD Patients. BMC Pulm Med. 2021; 21:152. Biomed Central.