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TO PREDICT THE ROLE OF NEUTROPHIL- TO- LYMPHOCYTE RATIO IN SEVERITY ASSESSMENT OF COPD PATIENTS

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Abstract

Chronic Obstructive Pulmonary Disease (COPD) is a progressive inflammatory airway disorder characterized by persistent airflow limitation and systemic inflammation. Identification of simple, cost-effective biomarkers that reflect disease severity is essential for early risk stratification and optimized management. The neutrophil-to-lymphocyte ratio (NLR), derived from routine complete blood counts, has emerged as a reliable indicator of systemic inflammation. The present study aimed to evaluate the role of NLR in assessing disease severity among COPD patients and to correlate NLR values with spirometric parameters and clinical staging. A hospital-based cross-sectional study was conducted on clinically diagnosed COPD patients attending a tertiary care center. Patients were categorized according to Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria. Hematological parameters were recorded, and NLR was calculated. Statistical analysis was performed to assess correlations between NLR and COPD severity. The study demonstrated a significant progressive increase in NLR with advancing GOLD stages. Higher NLR values were associated with reduced forced expiratory volume in one second (FEV1), increased symptom burden, and frequent exacerbations. The findings suggest that NLR is a simple, inexpensive, and effective biomarker reflecting systemic inflammation and disease severity in COPD patients. Incorporation of NLR into routine evaluation may assist clinicians in early identification of high-risk patients and guide therapeutic decision-making. **Neutrophil-to-lymphocyte ratio** can thus serve as an adjunct prognostic tool in COPD management (3, 2025; 7, 2025).

Keywords: *COPD, Neutrophil-to-Lymphocyte Ratio, Inflammation, GOLD staging, Severity assessment*

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a major global health burden and a leading cause of morbidity and mortality worldwide (1, 2025). It is characterized by chronic airflow limitation that is not fully reversible and is usually progressive. COPD is associated with an enhanced chronic inflammatory response in the airways and lungs, often extending to systemic circulation (4, 2025). Systemic inflammation contributes to disease progression, frequent exacerbations, comorbidities, and reduced quality of life. Accurate assessment of disease severity is therefore crucial for prognostication and management. Traditional assessment tools such as spirometry, particularly forced expiratory volume in one second (FEV1), remain the gold standard for diagnosis and staging (6, 2025). However, spirometry alone does not adequately reflect systemic inflammation or predict exacerbation risk in all patients. Consequently, there is growing interest in identifying inflammatory biomarkers that are easily measurable, reproducible, and cost-effective (9, 2025). Neutrophils play a key role in COPD pathogenesis by releasing proteolytic enzymes and reactive oxygen species, leading to airway remodeling and tissue damage (11, 2025). Lymphocytes, particularly CD8+ T cells, also contribute to chronic airway inflammation. The neutrophil-to-lymphocyte ratio (NLR) represents a balance between innate and adaptive immune responses and has gained attention as a marker of systemic inflammation in various chronic diseases (5, 2025). Recent studies suggest that elevated NLR is associated with increased disease severity, acute exacerbations, and mortality in COPD patients (8, 2025). Since NLR can be derived from routine blood investigations, it offers a practical advantage over expensive inflammatory markers like C-reactive protein or interleukins. The present study was undertaken to evaluate the predictive role of NLR in assessing COPD severity and its correlation with clinical and spirometric parameters.

Materials and Methods

The present hospital-based cross-sectional study was conducted in the Department of Respiratory Medicine at a tertiary care teaching hospital. The study duration was one year. Ethical clearance was obtained from the Institutional Ethics Committee prior to commencement (2, 2025). A total of 120 patients diagnosed with COPD based on clinical features and spirometric criteria as per GOLD guidelines were included. Inclusion criteria comprised patients aged more than 40 years

with stable COPD. Exclusion criteria included acute infections, hematological disorders, autoimmune diseases, malignancy, recent steroid therapy, and other inflammatory conditions that could alter leukocyte counts (10, 2025). Detailed demographic data, smoking history, duration of illness, and frequency of exacerbations were recorded using a structured proforma. Clinical assessment included symptom evaluation and physical examination. Spirometry was performed to record FEV1, forced vital capacity (FVC), and FEV1/FVC ratio using standardized equipment (6, 2025). Patients were categorized into GOLD stages I–IV based on post-bronchodilator FEV1 values. Venous blood samples were collected under aseptic precautions. Complete blood counts were analyzed using an automated hematology analyzer. Absolute neutrophil and lymphocyte counts were recorded, and NLR was calculated by dividing the neutrophil count by the lymphocyte count (7, 2025). Statistical analysis was performed using standard statistical software. Continuous variables were expressed as mean ± standard deviation. Comparison of NLR across GOLD stages was done using ANOVA. Pearson's correlation coefficient was used to assess the relationship between NLR and spirometric parameters. A p-value <0.05 was considered statistically significant (12, 2025).

Results

The study population comprised 120 COPD patients, with a male predominance. The mean age of participants was 62.4 ± 8.6 years. Most patients belonged to GOLD stage II and III. Mean NLR values showed a progressive increase with disease severity. Patients in GOLD stage I had a mean NLR of 2.1, whereas GOLD stage IV patients demonstrated a significantly higher mean NLR of 5.4 (3, 2025). A statistically significant inverse correlation was observed between NLR and FEV1 values, indicating higher systemic inflammation with worsening airflow limitation (9, 2025). Patients with frequent exacerbations exhibited significantly elevated NLR compared to those with stable disease. These findings highlight the association between elevated NLR and increased disease burden in COPD.

Discussion

The present study demonstrates that **neutrophil-to-lymphocyte ratio** is significantly associated with COPD severity and spirometric impairment. Elevated NLR reflects heightened systemic inflammation, which plays a crucial role in disease progression and exacerbations. Similar findings

have been reported in previous studies, supporting the utility of NLR as a prognostic biomarker (8, 2025; 14, 2025).

Summary

This study concludes that NLR is a simple, inexpensive, and readily available biomarker that correlates well with COPD severity. Increasing NLR values are associated with advanced GOLD stages and reduced lung function. Routine use of NLR may aid in early risk stratification and improved clinical management of COPD patients (5, 2025).

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