RESEARCH PAPER

Inflammatory Blood Cell Ratios as Biomarkers of Exacerbation Severity in Acute Exacerbation of Chronic Obstructive Pulmonary Disease: A Cross-sectional Study

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ABSTRACT

Introduction: Acute exacerbation of chronic obstructive pulmonary disease (AECOPD) is accompanied by systemic inflammatory activation, but bedside estimation of exacerbation severity remains difficult in many Indian tertiary and semi-urban settings. Blood cell ratios derived from the complete blood count may offer a low-cost adjunct for early risk stratification.

Aim: To assess the prognostic utility of platelet-to-lymphocyte ratio (PLR), neutrophil-to-lymphocyte ratio (NLR), monocyte-to-lymphocyte ratio (MLR), basophil-to-lymphocyte ratio (BLR), and eosinophil-to-lymphocyte ratio (ELR) in relation to AECOPD severity and hospital outcomes.

Materials and Methods: This cross-sectional study was conducted in the Department of Respiratory Medicine, Adichunchanagiri Hospital and Research Centre, B.G. Nagara, Karnataka, India, over 18 months from March 2024 to August 2025. A total of 120 patients aged more than 40 years with AECOPD were analysed. Demographic variables, smoking status, previous exacerbations, GOLD stage, COPD Assessment Test (CAT) score, vital parameters, arterial blood gas values, spirometry, inflammatory markers, length of hospital stay (LHS), admission type, and non-invasive ventilation (NIV) requirement were recorded. Categorical variables were summarised as frequency and percentage, while continuous variables were expressed as mean +/- standard deviation. Chi-square test, Kruskal-Wallis H test, Spearman correlation, and receiver operating characteristic (ROC) analysis were used in SPSS and Microsoft Excel. A p-value <0.05 was considered statistically significant.

Results: The mean age was 67.12+/-9.543 years, and 89 (74.2%) patients were male. GOLD Stage 2 was the most frequent category, observed in 45 (37.5%) patients, followed by Stage 3 in 39 (32.5%). ICU admission was required in 64 (53.3%) patients and NIV support in 69 (57.5%). NLR showed the strongest positive correlation with LHS (rho=0.45), followed by PLR (rho=0.36) and MLR (rho=0.28). Across GOLD stages, PLR increased from 130.4+/-65.27 to 263.3+/-189.78 (p=0.003), NLR from 5.17+/-3.61 to 15.30+/-8.25 (p<0.001), and MLR from 0.33+/-0.25 to 0.93+/-0.94 (p<0.001). NLR was higher in ICU patients than ward patients (8.28+/-6.17 vs 5.66+/-5.04, p=0.013). On ROC analysis, NLR showed the highest AUC (0.709, 95% CI: 0.615-0.802, p<0.001), followed by PLR (AUC=0.685, p<0.001) and MLR (AUC=0.611, p=0.036).

Conclusion: NLR was the most consistent CBC-derived biomarker associated with AECOPD severity, symptom burden, longer hospital stay, and ICU admission. PLR and MLR showed supportive but comparatively weaker associations, whereas ELR and BLR had limited discriminatory value in this cohort.

Keywords: Acute exacerbation; Biomarkers; Chronic obstructive pulmonary disease; Leukocyte count; Prognosis.

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) remains a major cause of preventable morbidity, recurrent hospitalisation, and premature mortality. The World Health Organization reported COPD as the fourth leading cause of death worldwide, with a disproportionate mortality burden in low- and middle-income countries [1]. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) frames COPD as a heterogeneous lung condition marked by chronic respiratory symptoms and persistent, often progressive airflow obstruction [2]. This phrasing is important because it moves clinical attention beyond spirometry alone and toward treatable traits, exacerbation tendency, and systemic consequences.

The Indian burden is substantial. The India State-Level Disease Burden Initiative demonstrated wide interstate heterogeneity in chronic respiratory disease burden, with COPD contributing heavily to deaths and disability-adjusted life years [3]. A systematic review and meta-analysis from India estimated a pooled COPD prevalence of 7.4%, though the figure varied with region, diagnostic approach, and exposure profile [4]. In rural and semi-urban practice, the familiar risk pattern is rarely limited to smoking; biomass exposure, occupational dust, previous pulmonary infection, and delayed diagnosis often coexist. That makes pragmatic risk assessment particularly relevant for hospital-facing respiratory units.

Acute exacerbations are decisive events in the clinical course of COPD. They are episodes of worsening dyspnoea, cough, sputum volume, or sputum purulence that usually require treatment escalation and sometimes admission [5]. Exacerbation susceptibility is not explained by airflow limitation alone; the ECLIPSE cohort showed that a past exacerbation history remains a strong predictor of future exacerbations even after accounting for disease severity [6]. In admitted patients, the immediate question is not simply whether COPD is present. It is whether the patient is likely to need closer monitoring, respiratory support, prolonged admission, or intensive care.

AECOPD is not only an airway event. It is associated with heightened airway and systemic inflammation, with neutrophil recruitment, cytokine release, oxidative stress, endothelial activation, and a stress-related shift in circulating leukocyte populations [7]. The COPD Assessment Test (CAT) captures symptom burden in a patient-centred manner and has become useful for routine clinical assessment [8]. However, CAT and spirometry do not fully reflect the inflammatory intensity of an acute admission. Arterial blood gases, C-reactive protein, and imaging may help, but they may not always be rapidly or uniformly available across resource-limited settings.

Ratios derived from routine complete blood counts offer a simple biological window into this inflammatory state. NLR combines neutrophil-mediated innate inflammatory activation with relative lymphopenia, while PLR reflects platelet-linked thromboinflammatory activity against lymphocyte-mediated adaptive response. MLR may represent monocyte-macrophage axis activation, and ELR may indicate eosinophil-skewed inflammatory biology. Recent review evidence has suggested that NLR may predict adverse clinical outcomes in COPD [9]. Similar synthesis focused on AECOPD has also supported the prognostic relevance of NLR and PLR, although study populations and thresholds differ considerably [10]. Evidence comparing PLR, NLR, MLR, BLR, and ELR together in Indian AECOPD admissions is still limited.

The present study was therefore undertaken to evaluate PLR, NLR, MLR, BLR, and ELR as biomarkers of AECOPD severity in a tertiary-care respiratory medicine setting in Karnataka, India. The primary objective was to assess their association with length of hospital stay. Secondary objectives were to examine their relationship with GOLD stage, CAT score, ICU admission, NIV requirement, and ROC-derived discriminatory performance.

MATERIALS AND METHODS

Study design and setting: This cross-sectional study was conducted in the Department of Respiratory Medicine, Adichunchanagiri Hospital and Research Centre, B.G. Nagara, Karnataka, India. The study period was 18 months, from March 2024 to August 2025.

Study population: Patients aged more than 40 years attending the pulmonary medicine outpatient or inpatient services with a primary diagnosis of acute exacerbation of COPD as per GOLD guidelines were considered eligible. All patients included in the analysis had provided informed consent and underwent the required clinical and laboratory assessments.

Inclusion criteria: Patients aged more than 40 years with a primary diagnosis of AECOPD according to GOLD guidelines and willingness to provide informed consent were included.

Exclusion criteria: Patients unwilling to provide consent, patients who denied investigations required for the study, and patients diagnosed with malignancy, acute cardiac pathology, chronic structural lung disease such as bronchiectasis, or other acute infective lung pathology were excluded.

Sample size: The sample size was calculated using the formula n=Z^2pq/d^2. With Z=1.96, anticipated prevalence p=7.4%, q=92.6%, and absolute precision d=5%, the minimum sample size was 105.2, approximated to 105. After allowing for 10% non-response, the required sample size was 115. A total of 120 patients were enrolled and analysed.

Data collection: Demographic details, smoking status, previous exacerbation history, comorbid clinical information, symptoms, length of hospital stay, admission type, and NIV requirement were recorded. Clinical assessment included vital signs, CAT score, GOLD stage, arterial blood gas parameters, spirometry where not contraindicated, C-reactive protein, lactate dehydrogenase, D-dimer, and complete blood count parameters. Blood cell ratios were calculated from the admission haemogram as PLR, NLR, MLR, BLR, and ELR.

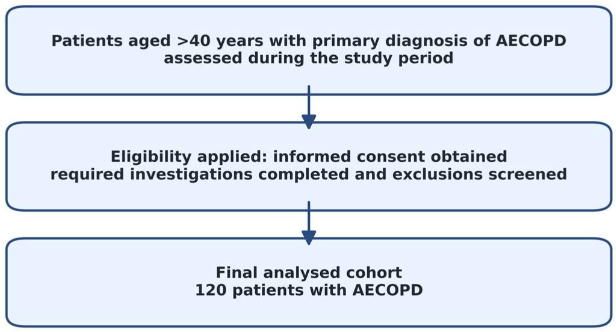
Outcome measures: The principal outcome was length of hospital stay. Additional severity-related outcomes included GOLD stage, CAT score, ICU versus ward admission, NIV requirement, and ROC-based discriminatory performance of inflammatory ratios.

Ethical considerations: The study was approved by the Institutional Ethics Committee of Adichunchanagiri Institute of Medical Sciences, B.G. Nagara, Karnataka, India, under approval No. AIMS/IEC/059/2024 dated 02-04-2024. The Institutional Ethics Committee registration number was EC/NEW/INST/2023/KA/0382. Written informed consent was obtained before enrolment.

Statistical analysis: Data were entered in Microsoft Excel and analysed using SPSS software. The SPSS version was not specified. Categorical variables were expressed as frequencies and percentages. Continuous variables were expressed as mean +/- standard deviation. Normality was assessed before selecting comparative tests. Chi-square test was used for categorical comparisons. Kruskal-Wallis H test was used to evaluate differences in inflammatory ratios across multiple groups, including GOLD stages and length-of-stay groups. Spearman rank correlation was used to assess relationships between blood cell ratios and clinical parameters such as CAT score and length of hospital stay. ROC curve analysis was used to evaluate discriminatory performance, and optimal cut-off values were determined using the Youden Index. A p-value <0.05 was considered statistically significant, with p<0.001 regarded as highly significant.

RESULTS

A total of 120 patients admitted with AECOPD were included in the final analysis. The participant flow is shown in Table/Fig 1.



Table/Fig 1: Participant flow of the analysed cohort.

AECOPD: acute exacerbation of chronic obstructive pulmonary disease.

The mean age of the study population was 67.12+/-9.543 years. The largest age group was 70-79 years, comprising 47 (39.2%) patients, followed by 60-69 years in 38 (31.7%) patients. Male predominance was observed, with 89 (74.2%) males and 31 (25.8%) females. Smoking exposure was common: 51 (42.5%) patients were active smokers and 38 (31.7%) were former smokers (Table/Fig 2).

Variable	Category / summary	Frequency / value
Age	Mean +/- SD	67.12 +/- 9.543 years
Age group	40-49 years	7 (5.8%)
Age group	50-59 years	14 (11.7%)
Age group	60-69 years	38 (31.7%)
Age group	70-79 years	47 (39.2%)
Age group	80-89 years	11 (9.2%)
Age group	>=90 years	1 (0.8%)
Gender	Male	89 (74.2%)
Gender	Female	31 (25.8%)
Smoking status	Active smoker	51 (42.5%)
Smoking status	Former smoker	38 (31.7%)
Smoking status	Never smoker	31 (25.8%)
Previous exacerbations	Mean +/- SD	1.68 +/- 1.523
Previous exacerbations	0 / 1 / 2 / 3 / 4 / 5	33 / 29 / 27 / 14 / 8 / 9

Table/Fig 2: Baseline demographic and exposure profile of the study population (n=120).

SD: standard deviation.

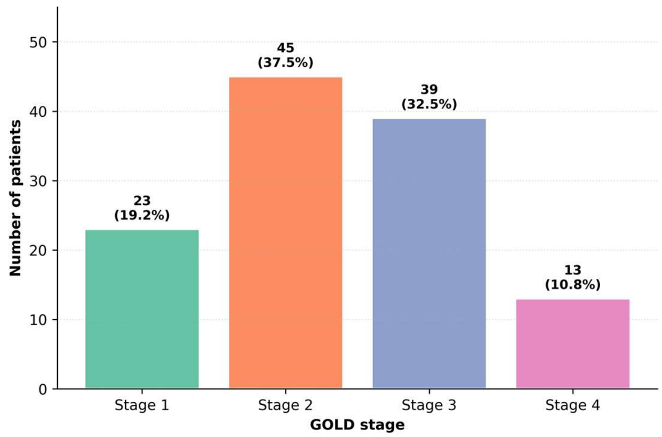
Clinical severity was distributed across GOLD stages, with Stage 2 being most frequent in 45 (37.5%) patients and Stage 3 in 39 (32.5%) patients. The mean length of hospital stay was 6.34+/-3.132 days. ICU admission was required in 64 (53.3%) patients, while 69 (57.5%) received NIV support. CAT score distribution showed medium impact in 66 (55.0%) patients and high or very high impact in 38 (31.7%) patients (Table/Fig 3). GOLD stage distribution, smoking status, and admission-support profile are shown graphically in Table/Fig 4, Table/Fig 5, and Table/Fig 6, respectively.

Parameter	Category / summary	Frequency / value
GOLD stage	Stage 1 / Stage 2 / Stage 3 / Stage 4	23 (19.2%) / 45 (37.5%) / 39 (32.5%) / 13 (10.8%)
Length of hospital stay	Mean +/- SD	6.34 +/- 3.132 days
Length of hospital stay	2-4 / 5-7 / 8-10 / >=12 days	28 (23.3%) / 68 (56.6%) / 16 (13.3%) / 8 (6.7%)

Admission type	ICU / Ward	64 (53.3%) / 56 (46.7%)
NIV support	Yes / No	69 (57.5%) / 51 (42.5%)
CAT score	Mean +/- SD	19.02 +/- 7.64
CAT score category	Low / Medium / High / Very high	16 (13.3%) / 66 (55.0%) / 26 (21.7%) / 12 (10.0%)
SpO2	Mean +/- SD	90.22 +/- 6.031%
Respiratory rate	Mean +/- SD	24.69 +/- 4.276/min
Spirometry	FEV1 / FVC / FEV1-FVC ratio	54.68+/-19.06% / 73.26+/-17.82% / 60.48+/-8.2%

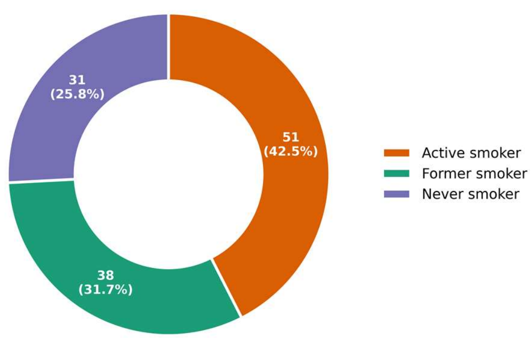
Table/Fig 3: Clinical, symptom, respiratory support, and spirometric profile.

CAT: COPD Assessment Test; FEV1: forced expiratory volume in 1 second; FVC: forced vital capacity; GOLD: Global Initiative for Chronic Obstructive Lung Disease; ICU: intensive care unit; NIV: non-invasive ventilation; SD: standard deviation; SpO2: oxygen saturation.



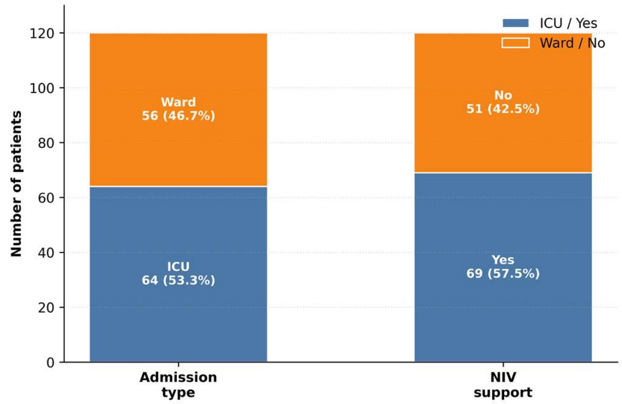
Table/Fig 4: Distribution of patients according to GOLD stage.

GOLD: Global Initiative for Chronic Obstructive Lung Disease.



Table/Fig 5: Distribution of smoking status in the study cohort.

Values represent number of patients and percentage of the total cohort.



Table/Fig 6: Admission type and NIV support profile.

ICU: intensive care unit; NIV: non-invasive ventilation.

The mean NLR was 7.06+/-5.8, mean PLR was 182.1+/-120.59, and mean MLR was 0.44+/-0.44. NLR, PLR, MLR, and BLR showed statistically significant variation across GOLD stages, whereas ELR did not show a significant stage-wise difference (Table/Fig 7). NLR increased from 5.17+/-3.61 in Stage 1 to 15.30+/-8.25 in Stage 4. PLR also increased from 130.4+/-65.27 to 263.3+/-189.78 across the same severity gradient.

GOLD stage	PLR	NLR	MLR	BLR	ELR
Stage 1	130.4 +/- 65.27	5.17 +/- 3.61	0.33 +/- 0.25	0.006 +/- 0.016	0.11 +/- 0.14
Stage 2	161.1 +/- 68.72	4.97 +/- 3.08	0.33 +/- 0.19	0.016 +/- 0.026	0.14 +/- 0.14
Stage 3	209.7 +/- 145.09	7.83 +/- 5.83	0.46 +/- 0.37	0.019 +/- 0.043	0.17 +/- 0.25
Stage 4	263.3 +/- 189.78	15.30 +/- 8.25	0.93 +/- 0.94	0.060 +/- 0.117	0.10 +/- 0.11
p-value	0.003	<0.001	<0.001	0.012	0.432

Table/Fig 7: Inflammatory blood cell ratios according to GOLD stage.

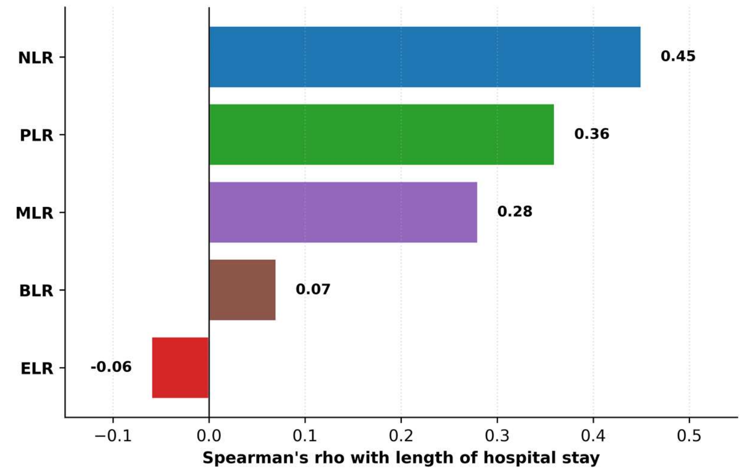
BLR: basophil-to-lymphocyte ratio; ELR: eosinophil-to-lymphocyte ratio; GOLD: Global Initiative for Chronic Obstructive Lung Disease; MLR: monocyte-to-lymphocyte ratio; NLR: neutrophil-to-lymphocyte ratio; PLR: platelet-to-lymphocyte ratio.

The Kruskal-Wallis analysis for length of hospital stay showed statistically significant differences for NLR (p=0.0015), PLR (p=0.0022), and MLR (p=0.0191), while ELR and BLR were not significant. Spearman correlation showed the strongest positive association between NLR and length of hospital stay (rho=0.45), followed by PLR (rho=0.36) and MLR (rho=0.28). NLR also correlated most strongly with CAT score (r=0.453, p<0.001) and was the only ratio significantly associated with D-dimer (r=0.206, p=0.024) (Table/Fig 8 and Table/Fig 9).

Marker	Kruskal-Wallis p-value for LHS	Spearman rho with LHS	Correlation with CAT score	Correlation with D-dimer
NLR	0.0015	0.45	0.453 (p<0.001)	0.206 (p=0.024)
PLR	0.0022	0.36	0.361 (p<0.001)	0.163 (p=0.075)
MLR	0.0191	0.28	0.330 (p<0.001)	0.049 (p=0.593)
ELR	0.1934	-0.06	0.007 (p=0.939)	-0.033 (p=0.717)
BLR	0.7598	0.07	0.255 (p=0.005)	-0.061 (p=0.509)

Table/Fig 8: Association of inflammatory ratios with length of stay, symptom burden, and D-dimer.

BLR: basophil-to-lymphocyte ratio; CAT: COPD Assessment Test; ELR: eosinophil-to-lymphocyte ratio; LHS: length of hospital stay; MLR: monocyte-to-lymphocyte ratio; NLR: neutrophil-to-lymphocyte ratio; PLR: platelet-to-lymphocyte ratio.



Table/Fig 9: Spearman correlation of inflammatory ratios with length of hospital stay.

Positive values indicate longer stay with higher biomarker ratio.

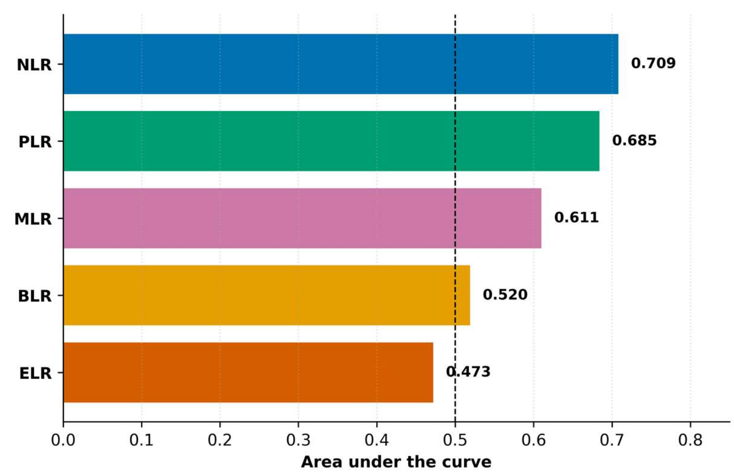
When inflammatory ratios were compared by admission type, NLR was significantly higher in ICU patients than in ward patients (8.28+/-6.17 vs 5.66+/-5.04, p=0.013). PLR, MLR, BLR, and ELR did not show significant differences by admission type. None of the inflammatory ratios differed significantly according to NIV support, although NLR approached significance (7.94+/-6.07 in NIV patients vs 5.87+/-5.23 in non-NIV patients, p=0.053) (Table/Fig 10).

Ratio	ICU	Ward	p-value	NIV yes	NIV no	p-value
PLR	187.2 +/- 120.03	176.3 +/- 122.04	0.622	183.8 +/- 116.90	179.8 +/- 126.54	0.856
NLR	8.28 +/- 6.17	5.66 +/- 5.04	0.013	7.94 +/- 6.07	5.87 +/- 5.23	0.053
MLR	0.46 +/- 0.37	0.42 +/- 0.50	0.654	0.44 +/- 0.36	0.43 +/- 0.52	0.917
BLR	0.018 +/- 0.045	0.021 +/- 0.055	0.776	0.017 +/- 0.04	0.023 +/- 0.06	0.518
ELR	0.12 +/- 0.15	0.17 +/- 0.21	0.113	0.12 +/- 0.16	0.16 +/- 0.21	0.244

Table/Fig 10: Inflammatory ratios according to admission type and NIV support.

BLR: basophil-to-lymphocyte ratio; ELR: eosinophil-to-lymphocyte ratio; ICU: intensive care unit; MLR: monocyte-to-lymphocyte ratio; NIV: non-invasive ventilation; NLR: neutrophil-to-lymphocyte ratio; PLR: platelet-to-lymphocyte ratio.

ROC analysis showed the highest AUC for NLR (0.709, 95% CI: 0.615-0.802, p<0.001), followed by PLR (0.685, 95% CI: 0.589-0.780, p<0.001) and MLR (0.611, 95% CI: 0.510-0.712, p=0.036). BLR and ELR had poor, non-significant discriminatory performance. The optimal NLR cut-off was >=6.28, while the optimal PLR cut-off was >=115.95 (Table/Fig 11 and Table/Fig 12).



Table/Fig 11: ROC-derived AUC values for inflammatory ratios.

AUC: area under the curve; ROC: receiver operating characteristic.

Marker	AUC	Standard error	95% confidence interval	p-value	Optimal cut-off	Sensitivity	Specificity	Youden Index

NLR	0.709	0.048	0.615-0.802	<0.001	>=6.28	0.552	0.758	0.310
PLR	0.685	0.048	0.589-0.780	<0.001	>=115.95	0.845	0.419	0.264
MLR	0.611	0.051	0.510-0.712	0.036	>=0.285	0.707	0.452	0.159
BLR	0.520	0.053	0.415-0.624	0.709	>=0.015	0.241	0.758	0.000
ELR	0.473	0.053	0.369-0.577	0.612	>=0.01	0.724	0.210	-0.066

Table/Fig 12: ROC performance and optimal cut-off values of inflammatory ratios.

AUC: area under the curve; BLR: basophil-to-lymphocyte ratio; ELR: eosinophil-to-lymphocyte ratio; MLR: monocyte-to-lymphocyte ratio; NLR: neutrophil-to-lymphocyte ratio; PLR: platelet-to-lymphocyte ratio; ROC: receiver operating characteristic.

DISCUSSION

This cross-sectional study evaluated five CBC-derived inflammatory ratios in hospitalised AECOPD patients and found a consistent severity signal for NLR. The cohort was predominantly elderly and male, with most patients falling within GOLD Stage 2 or Stage 3. More than half required ICU care and NIV support, suggesting that the admitted population represented clinically meaningful exacerbations rather than mild outpatient worsening.

The central finding was the graded association of NLR with several severity-linked outcomes. NLR had the strongest correlation with length of hospital stay, the strongest correlation with CAT score, a significant association with ICU admission, and the highest ROC-derived AUC. This pattern is biologically plausible. AECOPD often produces neutrophil-dominant inflammation, while physiological stress and corticosteroid exposure may contribute to relative lymphopenia. The ratio therefore captures more than a single leukocyte count. Liao et al. reported that NLR, PLR, and MLR correlated positively with hospital stay and CRP in AECOPD, which closely parallels the present findings [11].

The stage-wise rise in NLR, PLR, and MLR across GOLD categories also deserves attention. It indicates that inflammatory burden increased as airflow limitation became more severe, although GOLD stage alone cannot explain admission outcomes. Cai et al. found significantly higher NLR, PLR, and MLR in AECOPD than stable COPD, with NLR and MLR behaving as risk markers for acute exacerbation progression [12]. In the present cohort, NLR again stood apart: it was the only ratio that significantly distinguished ICU from ward admission.

PLR showed a supportive but less specific role. It correlated with length of hospital stay and increased across GOLD stage, and its ROC AUC remained statistically significant. Yet PLR did not differentiate ICU from ward admission or NIV requirement. This agrees with the mixed literature. Yao et al. found NLR to be a stronger prognostic marker for hospital mortality in AECOPD, while PLR had weaker independent value [13]. The platelet component may reflect thromboinflammation and systemic stress, but in AECOPD it may be influenced by comorbid vascular disease, infection, hydration, and medication exposure.

MLR showed significant associations with length of hospital stay and GOLD stage, but its discriminatory performance was modest. It may still have clinical value when interpreted as part of a broader inflammatory profile rather than as a standalone triage tool. Monocyte-driven inflammation is relevant in COPD pathobiology, but in routine admission practice the narrower numerical range of MLR can make interpretation less intuitive than NLR. The finding is consistent with Liao et al., in whom monocyte-linked ratios contributed to inflammatory differentiation but did not consistently outperform NLR [11]. A similar pattern was also described by Cai et al. during diagnostic evaluation of AECOPD [12].

ELR and BLR were not useful severity markers in this cohort. ELR did not vary significantly across GOLD stages and showed negligible association with length of stay, CAT score, D-dimer, ICU admission, or NIV requirement. This does not mean eosinophils are clinically irrelevant in COPD. Rather, the ratio may not be a dependable marker of admission severity in this specific cohort. Taylan et al. showed that NLR rises during acute exacerbation compared with stable COPD and healthy controls, reinforcing the prominence of neutrophil-linked biology during acute events [14].

The ROC analysis supports the practical reading of these findings. NLR had the highest AUC at 0.709, with an optimal cut-off of >=6.28. This threshold was close to the cut-off reported by Yao et al., who found NLR useful for predicting hospital mortality [13]. Kumar et al. demonstrated that PLR was associated with 90-day mortality after AECOPD, but the present findings suggest that PLR is better regarded as a secondary marker rather than the leading indicator of severity [15]. Emami Ardestani and Alavi-Naeini also reported that NLR was more useful than PLR for in-hospital mortality prediction in AECOPD [16].

In Indian practice, the clinical implication is straightforward. CBC-derived ratios are inexpensive, rapidly available, and feasible in district-level and tertiary-care hospitals alike. NLR should not replace clinical examination, arterial blood gas interpretation, spirometry, or physician judgement. But when an elderly patient with AECOPD presents with high symptom burden and a raised NLR, closer observation, early review of ventilatory requirement, and more cautious discharge planning may be warranted. Such a low-cost marker becomes particularly useful where bed pressure and delayed presentation are everyday realities.

The study has limitations. It was conducted at a single centre with a sample size of 120 patients, which restricts generalisability. The cross-sectional design limits causal inference and does not capture serial changes in biomarkers during recovery. Medication history, corticosteroid exposure, microbiological phenotype, and comorbid inflammatory conditions could have influenced cell ratios. The SPSS version and IEC approval number were not extractable from the available manuscript text. Despite these limitations, the consistency of the NLR signal across hospital stay, CAT score, GOLD stage, ICU admission, and ROC analysis supports its relevance as a pragmatic admission-time biomarker.

CONCLUSION

NLR emerged as the most reliable CBC-derived inflammatory ratio for assessing AECOPD severity in this cohort. It was associated with longer hospital stay, higher CAT score, worsening GOLD stage, ICU admission, and the best ROC performance. PLR and MLR showed supportive but weaker associations, while ELR and BLR had limited clinical utility. In resource-constrained Indian respiratory care settings, NLR may serve as a simple adjunct to clinical assessment for early risk stratification, provided it is interpreted alongside symptoms, gas exchange, comorbidities, and treatment response.

SOURCE OF FUNDING

Nil.

CONFLICT OF INTEREST

None declared.

REFERENCES

1. World Health Organization. Chronic obstructive pulmonary disease (COPD) [Internet]. Geneva: World Health Organization; 2024 Nov 6 [cited 2026 Apr 27]. Available from: https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-(copd)
2. Global Initiative for Chronic Obstructive Lung Disease. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: 2024 report [Internet]. Fontana: GOLD; 2024 [cited 2026 Apr 27]. Available from: https://goldcopd.org/2024-gold-report/
3. India State-Level Disease Burden Initiative CRD Collaborators. The burden of chronic respiratory diseases and their heterogeneity across the states of India: The Global Burden of Disease Study 1990-2016. Lancet Glob Health. 2018;6(12):e1363-1374. doi:10.1016/S2214-109X(18)30409-1.
4. Daniel RA, Aggarwal P, Kalaivani M, Gupta SK. Prevalence of chronic obstructive pulmonary disease in India: A systematic review and meta-analysis. Lung India. 2021;38(6):506-513. doi:10.4103/lungindia.lungindia_159_21.
5. Wedzicha JA, Seemungal TA. COPD exacerbations: defining their cause and prevention. Lancet. 2007;370(9589):786-796. doi:10.1016/S0140-6736(07)61382-8.
6. Hurst JR, Vestbo J, Anzueto A, Locantore N, Mullerova H, Tal-Singer R, et al. Susceptibility to exacerbation in chronic obstructive pulmonary disease. N Engl J Med. 2010;363(12):1128-1138. doi:10.1056/NEJMoa0909883.
7. Wouters EF. Local and systemic inflammation in chronic obstructive pulmonary disease. Proc Am Thorac Soc. 2005;2(1):26-33. doi:10.1513/pats.200408-039MS.
8. Jones PW, Harding G, Berry P, Wiklund I, Chen WH, Kline Leidy N. Development and first validation of the COPD Assessment Test. Eur Respir J. 2009;34(3):648-654. doi:10.1183/09031936.00102509.
9. Paliogiannis P, Fois AG, Sotgia S, Mangoni AA, Zinellu E, Pirina P, et al. Neutrophil to lymphocyte ratio and clinical outcomes in COPD: Recent evidence and future perspectives. Eur Respir Rev. 2018;27(147):170113. doi:10.1183/16000617.0113-2017.
10. Zinellu A, Zinellu E, Pau MC, Carru C, Pirina P, Fois AG, et al. Clinical significance of the neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio in acute exacerbations of COPD: Present and future. Eur Respir Rev. 2022;31(166):220095. doi:10.1183/16000617.0095-2022.
11. Liao QQ, Mo YJ, Zhu KW, Gao F, Huang B, Chen P, et al. Platelet-to-lymphocyte ratio (PLR), neutrophil-to-lymphocyte ratio (NLR), monocyte-to-lymphocyte ratio (MLR), and eosinophil-to-lymphocyte ratio (ELR) as biomarkers in patients with acute exacerbation of chronic obstructive pulmonary disease (AECOPD). Int J Chron Obstruct Pulmon Dis. 2024;19:501-518. doi:10.2147/COPD.S447519.
12. Cai C, Zeng W, Wang H, Ren S. Neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR) and monocyte-to-lymphocyte ratio (MLR) as biomarkers in diagnosis evaluation of acute exacerbation of chronic obstructive pulmonary disease: A retrospective, observational study. Int J Chron Obstruct Pulmon Dis. 2024;19:933-943. doi:10.2147/COPD.S452444.
13. Yao C, Liu X, Tang Z. Prognostic role of neutrophil-lymphocyte ratio and platelet-lymphocyte ratio for hospital mortality in patients with AECOPD. Int J Chron Obstruct Pulmon Dis. 2017;12:2285-2290. doi:10.2147/COPD.S141760.
14. Taylan M, Demir M, Kaya H, Selimoglu Sen H, Abakay O, Carkanat AI, et al. Alterations of the neutrophil-lymphocyte ratio during the period of stable and acute exacerbation of chronic obstructive pulmonary disease patients. Clin Respir J. 2017;11(3):311-317. doi:10.1111/crj.12336.
15. Kumar P, Law S, Sriram KB. Evaluation of platelet lymphocyte ratio and 90-day mortality in patients with acute exacerbation of chronic obstructive pulmonary disease. J Thorac Dis. 2017;9(6):1509-1516. doi:10.21037/jtd.2017.05.77.
16. Emami Ardestani M, Alavi-Naeini N. Evaluation of the relationship of neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio with in-hospital mortality in patients with acute exacerbation of chronic obstructive pulmonary disease. Clin Respir J. 2021;15(4):382-388. doi:10.1111/crj.13312.