Acta Scientific Pharmaceutical Sciences (ISSN: 2581-5423)

Volume 8 Issue 4 April 2024

Research Article

To Predict the Clinical Significance of Neutrophil to Lymphocyte Ratio (NLR) in Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease

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DOI: 10.31080/ASPS.2024.08.1050

Received: February 23, 2024

Published: March 10, 2024

Abstract

A total of 120 prescriptions were enrolled in the present study that met the inclusion criteria. 96% were males and 04% were females. 33% of the patients were in the age group of 61-70 with a mean average of 24 ± 15.5. Of which 75% were found to be from rural areas and 25% from urban areas. The most common cause of COPD is smoking out of which 86% were males and 60% were female smokers among the studied population. The most common comorbidities with AECOPD which are seen in the study are pure COPD (56%), HTN (24%), DM (7%), and HTN +DM (13%). Maximum patients with a history of COPD from 1-2 years were found to be 50%. Based on mMRC grading, a maximum of 52% patients were found to be on grade 3. 78% of patients were found to be with a maximum percentage on an NLR range of 1-10. The data in the present study is assessed by using chi-square to determine the relationship between the variable NLR and both genders, results were found to be significant at $p < 0.05$, out of which males were shown to have a higher prevalence of NLR value when compared to females. Our study found that patients with acute exacerbated COPD had elevated NLR levels. Our results suggest that worsened COPD patients have a low-grade persistent systemic inflammation that can be utilized to determine inflammation.

Keywords: COPD; NLR; AECOPD; Inflammation; Biomarker

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory disorder characterized by lung parenchyma deterioration and persistent airway flow obstruction, primarily linked to chronic immune responses to irritants like smoking [1,10]. Despite being preventable and treatable, COPD is not entirely curable, with diagnostic criteria based on spirometry, particularly the FEV1/FVC ratio, and is projected to become the third leading cause of global mortality by 2030, disproportionately affecting low and middle-income nations [3,4].

COPD comprises two primary components, emphysema and chronic bronchitis, often coexisting in individuals. COPD is a substantial global health burden, with an estimated three million deaths and 64 million affected individuals worldwide, making it a leading cause of mortality by 2030 [5,7].

Acute exacerbations, marked by intensified symptoms, significantly impact the quality of life and contribute to increased mortality risk [11]. Risk factors, such as smoking and exposure to pollutants, play a crucial role in the prevalence of COPD, which varies globally and is particularly prevalent among the elderly. In India, COPD ranks as the second-leading cause of death, with prevalence varying across states [12,13].

Symptoms of COPD include dyspnea, persistent cough, fatigue, and wheezing, and complications like pulmonary hypertension and infections further amplify the disease's impact [16,20,22]. Di-

agnosis involves an array of tests, including blood analysis, imaging, lung function assessments, and physiological tests. Managing COPD necessitates addressing acute exacerbations, improving airflow, and implementing preventive measures to mitigate the disease's progression and impact on individuals' lives [25].

The treatment of Acute Exacerbation of COPD (AECOPD) involves a multifaceted approach to address the severity of symptoms and enhance overall patient management. Utilizing bronchodilators, such as short-acting muscarinic antagonists and beta-agonists, through inhalation methods like nebulizers or metered dose inhalers, proves effective in managing acute airflow restriction [26]. Corticosteroids play a crucial role in reducing airway inflammation during AECOPD, although their prolonged use is associated with unfavorable side effects. Antibiotics are recommended for patients displaying symptoms indicative of bacterial infection, and oxygen therapy aims to maintain arterial oxygen saturation above 90%. Non-invasive ventilation has emerged as a valuable tool for acute hypercapnic respiratory failure, significantly reducing the effort required for breathing and minimizing the risk of complications [27,28].

Additionally, mechanical ventilation becomes necessary in cases where AECOPD leads to respiratory failure. Pulmonary rehabilitation, focusing on exercise capacity and symptom management, is considered a highly effective non-pharmacological treatment. Smoking cessation remains a pivotal intervention, given the strong association between smoking and COPD, with healthcare providers playing a crucial role in motivating and supporting patients in their cessation efforts [28]. Overall, the comprehensive treatment strategy emphasizes a personalized approach based on the patient's functional level, health condition, and lung function, with a goal to reduce the severity and frequency of exacerbations [28].

Neutrophils to lymphocyte ratio (NLR)

NLR is a clinical diagnostic biomarker that is used to measure inflammation. The NLR is determined by calculating the total number of neutrophils by lymphocytes. Physiologic stress results in an increase in neutrophils and a decrease in lymphocytes. Both of these changes are combined by the NLR [31].

Increased NLR = Increased Neutrophils/Decreased Lymphocytes

The NLR may be significantly influenced by endogenous cortisol and catecholamines. It is also well known that higher cortisol levels raise neutrophil counts while lowering lymphocyte counts. NLR is therefore not just a sign of infection or inflammation [31].

Calculation of NLR

NLR can be estimated using either absolute cell counts or percentages, as

NLR = Absolute # Neutrophils/Absolute # Lymphocytes

= Relative % Neutrophils/Relative % Lymphocytes

Interpetation of NLR

- An average normal NLR is about 1-3.
- An NLR of 6 to 9 denotes mild stress
- Patients in critical condition frequently have an NLR of 9 or greater (occasionally reaching values close to 100) [31].

Significance

In a few recent studies, the Neutrophil-to-lymphocyte ratio (NLR) has been assessed for its potential significance in the inflammatory phases of chronic illnesses and was reported that elevated NLR could be employed as a predictive marker for COPD patients that could be used to measure inflammation and predict early-stage exacerbations, and potentially serves as a solitary biomarker for all-cause death.

The purpose of the study is to evaluate the clinical significance of NLR in the identification of chronic inflammation and detect early exacerbations for their early management and treatment in acute exacerbated COPD patients.

Aims

To Study the clinical significance of Neutrophil to Lymphocyte Ratio (NLR) in patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease.

Objectives

- To identify the patients with AECOPD
- To predict the Neutrophil to Lymphocyte Ratio (NLR) values as an indicator in patients with AECOPD.

Methodology

- **Study design:** A Cross-sectional study was conducted.
- **Study site:** The study will be conducted on patients with acute Exacerbation of COPD in the Department of Respiratory Medicine admitted to Mamata Academy of Medical Sciences Hospital, Bachupally.
- **Study duration:** This study was conducted for a duration of six months.
- **Sample size:** The study included a total sample of 120 patients.

Study criteria

Inclusion criteria

All patients more than 40 years of age with a prior diagnosis of COPD based on spirometry who presents to ER with exacerbation.

Exclusion criteria

All COPD patients of less than 40 years of age who have any condition that affected the Neutrophil or Lymphocyte count in the peripheral blood such as Pneumonia, Bronchiectasis, Tuberculosis, Malignancy, or other inflammatory diseases.

Source of data

The demographics and clinical characteristics will be collected, and Blood Cell Count and other inflammatory indicators will be obtained. Furthermore, The NLR value of each subject will be calculated and analyzed. Even The Arterial Blood Gas values will be taken into consideration.

Statistical analysis

The data collected from the patients were first written in data collection form and then entered a Microsoft Excel sheet. Statistical analysis was done by calculating the mean and standard deviation.

Results and Discussion

Categorization of patients according to their gender

A total of 120 patients were enrolled in the study, 96% were males and 04% were females. The pictorial representation of the categorization of patients according to their gender is given in figure 1.

Gender	No. of patients	Percentage
Male	115	96%
Female	05	04%
Total	120	

Table 1: Categorization of patients according to their gender.

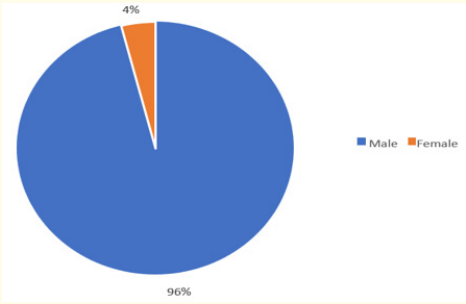

Figure 1: Pictorial representation of categorization of patients according to their gender

Categorization of patients according to their age

Among all 120 patients enrolled in the study, they were grouped into different age groupsbased on their age with a class interval of 10. A maximum number of patients were found to be between the age group 61-70 with 33%, and a minimum number of patients were found to be between the age group 81-90 with 1%. The mean average was found to be 24 ± 15.5. The categorization of patients according to their age is given in table 2.

Age group	Frequency	Percentage
41-50	16	13%
51-60	38	32%
61-70	39	33%
71-80	25	21%
81-90	02	1%

Table 2: Categorization of patients according to their age.

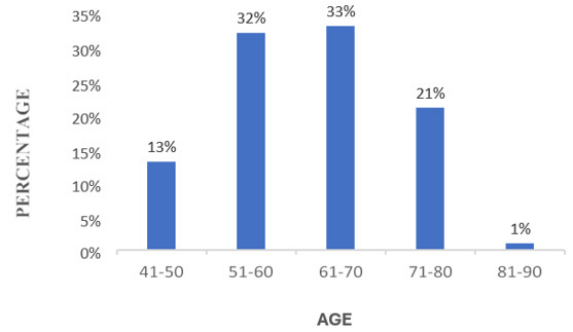

Figure 2: Graphical representation of categorization of patients according to their age.

	N	Min. age	Max. age	Mean	SD	SE	Range
AGE	120	41	90	24	15.5	6.96	37

Table 3: Descriptive statistics of age.

Categorization of patients according to their living status

All 120 patients in the study were divided according to their place of living. Of which 75% were found to be from rural areas and 25 % from urban areas. The pictorial representation ofthe categorization of patients according to their living status is shown in figure 3.

Living status	N	%
Rural	90	75%
Urban	30	25%

Table 4: Categorization of patients according to their living status.

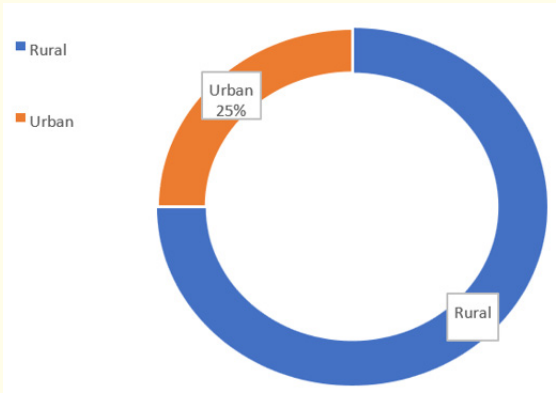

Figure 3: Pictorial representation of categorization of patients according to their living status.

Categorization of patients based on smoking status

Out of all the 120 patients involved in the study, a maximum number of patients i.e., 85%were smokers, where as 15% were non-smokers. The pictorial representation of categorization of patients based on smoking status is shown in figure 4.

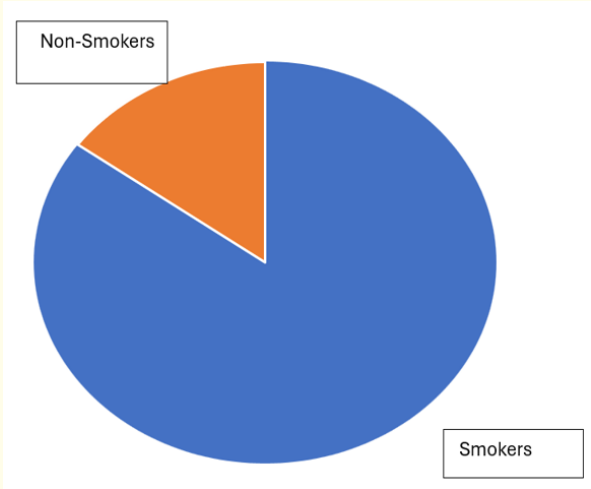

Figure 4: Pictorial representation of categorization of patients based on smoking status.

Smoking status	N	%
Smokers	102	85%
Non-Smokers	18	15%

Table 5: Categorization of patients based on smoking status.

Gender-wise categorization of patients based on smoking status

The maximum number of males and females among the studied population were Smokersi.e., 86% and 60% respectively. A graphical representation of gender-wise categorization of patients based on smoking status is shown in figure 5.

Smoking status	Male (n)	%	Female (n)	%
Smokers	99	86%	3	60%
Non-Smokers	16	14%	2	40%

Table 6: Gender-wise categorization of patients based on smoking status.

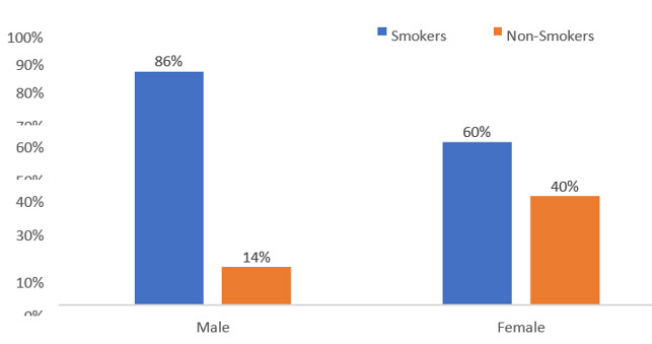

Figure 5: Graphical representation of Gender-wise categorization of patients based on smoking status.

Categorization of patients based on their common comorbidities

Out of all 120 patients involved in the study, a maximum number of patients i.e. 56% were pure COPD followed by 24% were HTN, 09% were DM and a minimum number of patientsfound to be 13% were HTN+DM The pictorial representation of categorization of patients based on their comorbidities are shown in figure 6.

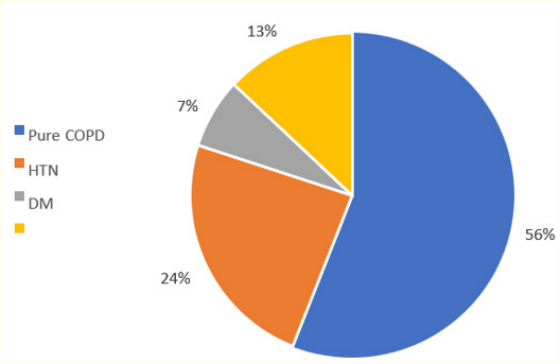

Figure 6: Pictorial Representation of categorization of patients based on their common comorbidities

Comorbidities	No. of patients	Percentage
Pure COPD	67	56%
HTN	29	24%
DM	09	7%
HTN+DM	15	13%

Table 7: Categorization of patients based on common comorbidities.

Categorization of patients based on the duration of COPD

Patients were divided based on the duration of COPD. Maximum patients were found to behaving a history of COPD from 1-2 years (50%) and minimum patients had a history of COPD >5 years (13%). The graphical representation of categorization of patients based onthe duration of COPD is shown in figure 7.

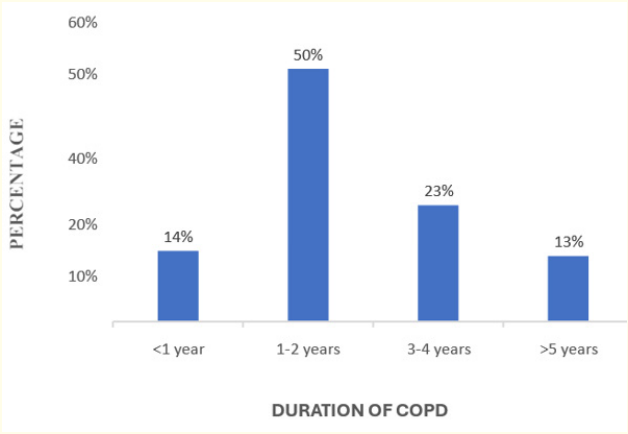

Figure 7: Graphical representation of categorization of patients based on the duration of COPD.

Duration of COPD	No. of patients	Percentage
<1 year	17	14%
1-2 years	60	50%
3-4 years	28	23%
>5 years	15	13%

Table 8: Categorization of patients based on the duration of COPD.

Categorization of patients based on neutrophil to lymphocyte ratio (NLR)

A graphical representation of categorization of patients based on the Neutrophil to Lymphocyte Ratio (NLR) is shown in figure 8.

NLR range	No. of patients	Percentage
1-10	94	78%
11-20	19	16%
21-30	03	3%
31-40	02	1.5%
41-50	02	1.5%

Table 9: Categorization of patients based on Neutrophil to Lymphocyte Ratio (NLR).

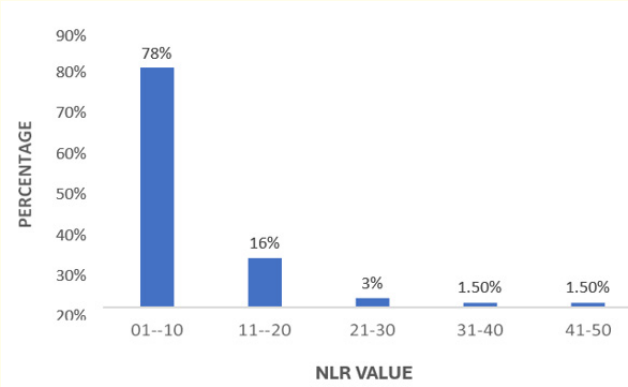

Figure 8: Graphical representation of categorization of patients based on Neutrophil to Lymphocyte Ratio (NLR).

Prevalence of neutrophil to lymphocyte ratio (NLR) among males and females

The data in this study is assessed by using chi-square to determine the relationship between the variable NLR and both gender, results were found to be significant at $p < 0.05$. Males wereshown to have higher prevalence of NLR value when compared to females. The prevalence among male and females is given in the table 10.

NLR range	Male	Female	No. of patients	Percentage
1-10	92	02	94	78%
11-20	16	03	19	16%
21-30	03	01	03	3%
31-40	02	01	02	1.5%
41-50	02	01	02	1.5%

Table 10: Prevalence of Neutrophil to Lymphocyte Ratio (NLR) among males and females.

NLR value and Gender chi-square = 19.48,

p-value is 0.0006*($p < 0.05$) – SIGNIFICANT.

Conclusion

Our study found that patients with acute exacerbated COPD had elevated NLR levels. Our results suggest that worsened COPD patients have a low-grade persistent systemic inflammation that can be utilized to determine inflammation. To prevent serious problems associated with COPD exacerbation, the presence of a marker for early diagnosis and management of acute exacerbations is crucial. This ratio of NLR can be regarded as a measure of inflammation because we observed that the number of neutrophils was higher and the number of lymphocytes was lower. As a result, NLR is an easily accessible and basic measure that could be employed as a low-cost inflammatory biomarker to predict exacerbations in individuals with acutely exacerbated COPD.

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