

FREQUENCY OF BLOOD EOSINOPHILIA AND ITS ROLE AS A MARKER OF OUTCOME AMONG THE PATIENTS ADMITTED WITH ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Published:- 10 October 2025

ABSTRACT

Background: Chronic obstructive pulmonary disease pathological features are characterized by neutrophilic inflammation, high eosinophil count, productive cough and SOB on exertion.

Objective: To evaluate the association between eosinophil count and clinical outcomes during acute exacerbation of COPD.

Methods: It's a descriptive case study that was conducted at Mayo Hospital, Lahore from May 2025 to September 2025. Both genders between 40-80 years of age with spirometry proven COPD cases (n=123) presenting with acute exacerbation were included. Under aseptic measures, a venous blood sample was drawn for blood eosinophilic count at the time of admission. They were then divided into Eosinophilic and Non-eosinophilic groups. An arterial blood sample were taken daily under aseptic measures for ABGs analysis to look for respiratory failure during admission. All the data was processed by SPSS v28.0. Independent samples t-test was applied for quantitative parameters like age, duration of disease, length of hospital stays between eosinophilic and non-eosinophilic groups. Chi-square test was also applied with p-value of ≤ 0.05 was taken significant.

Results: Patients with eosinophilic acute exacerbation of COPD had a shorter hospital stay in comparison to non-eosinophilic patients ($p < 0.001$). Regarding clinical outcomes, all-cause in-hospital mortality were observed exclusively in the non-eosinophilic group (12.9%). Similarly, the development of respiratory failure was significantly more frequent in non-eosinophilic patients compared to eosinophilic patients ($p = 0.042$). The requirement for mechanical ventilation, either invasive or non-invasive, was also significantly higher in the non-eosinophilic group ($p = 0.020$).

Conclusion: We concluded that better in-hospital outcomes were seen among patients with acute exacerbation of COPD who had peripheral blood eosinophilia.

KEYWORDS: Acute Exacerbation, COPD, Eosinophilia and Clinical Outcomes.

INTRODUCTION:

Chronic obstructive pulmonary disease (COPD) pathological features are characterized by neutrophilic inflammation, high eosinophil count, productive cough and SOB on exertion and is more common among male smokers.^{1,2} Need for additional therapy due to acute worsening of respiratory symptoms defines its exacerbation according to previous studies.^{2,3} However, eosinophilic inflammation among COPD patients during acute attack is an emerging field nowadays. According to literature review, stable as well as its acute exacerbations exhibit eosinophilic inflammation.⁴ According to GOLD criteria, blood eosinophil counts guide ICS therapy in clinical practice which has important therapeutic and prognostic implications.⁵ According to studies, it was estimated that peripheral blood Eosinophilia

among COPD exacerbation cases ranged from 13.2% to 39.3%.^{6,7} Previous studies documented that COPD cases with eosinophilia ($\geq 2\%$) had shorter hospital stays and good clinical outcomes with less death rates.^{8,9} However, role of peripheral eosinophilia during its exacerbation on clinical outcomes remained controversial. It has been reported that longer duration of hospital stay and high frequency of readmissions for AECOPD were associated with eosinophilia among patients of COPD.

This role of eosinophilic count as a therapeutic and prognostic biomarker prompted us to evaluate the association between eosinophil count and clinical outcomes of AECOPD as no such previous study has been done at Mayo Hospital, Lahore-Pakistan. It added to the current pool of supporting evidence towards targeted treatment in the light of GOLD guidelines and helped in establishing the role of eosinophil count as a prognostic marker of AECOPD in local population.

METHODS:

It's a descriptive case study that was held at Department of Medicine and Pulmonology of Mayo Hospital, Lahore, from May 2025 to September 2025, following ethical approval. Total of 123 spirometry proven COPD patients presenting with acute exacerbation including both genders having age (40-80 years) were enrolled in present study. However, patients with prior history of asthma, pneumothorax, congestive cardiac failure or malignancy, taking drugs causing eosinophilia, incomplete medical record and follow-up loss were excluded.¹⁰ Enrolled patients were then divided into two groups (eosinophilic and a non-eosinophilic groups).

Informed consent was also taken at the time of enrolment, Demographic data like age, gender, duration of disease, medical history and spirometry findings were noted in a special Performa. Under aseptic measures, a venous blood sample were sent to the Central laboratory of the hospital for blood eosinophilic count at the time of admission. On daily basis, arterial blood samples were taken to look for respiratory failure during admission period. Duration of hospital stay and invasive or non-invasive mechanical ventilation were also noted. Data was collected by researcher.

Data Analysis:

SPSS v 27 analyzed the collected data. Quantitative variables were expressed as mean \pm SD. like age and duration of disease. Qualitative variables like gender and eosinophilia were expressed as frequency (n) and percentage (%). Independent samples t-test was used for comparison of quantitative parameters like length of hospital stays between eosinophilic and non-eosinophilic groups. Chi-square test was also applied for comparison of parameters like all-cause in-hospital mortality, development of respiratory failure and requirement of mechanical ventilation in both groups with p-value of ≤ 0.05 was considered as significant.

RESULTS:

Mean duration of COPD among the study participants was 9.53 ± 4.79 years thus indicated wide variability in the chronicity of COPD among patients admitted with acute exacerbation as shown in table-1.

Table-1: Baseline Parameters of Participants (n = 123)		
Parameters	Mean \pm SD	Range
Age (years)	62.2 ± 8.41	40 – 78
Duration of COPD (year)	9.53 ± 4.79	1.0 – 20.6
Gender	Frequency (n)	Percentage (%)
Male	74	60.2
Female	49	39.8

Peripheral blood eosinophilia ($\geq 2\%$) was observed in 30 (24.4%) patients, while 93 (75.6%) patients did not exhibit peripheral blood eosinophilia. This indicated that the majority of patients had a non-eosinophilic phenotype (figure-1).

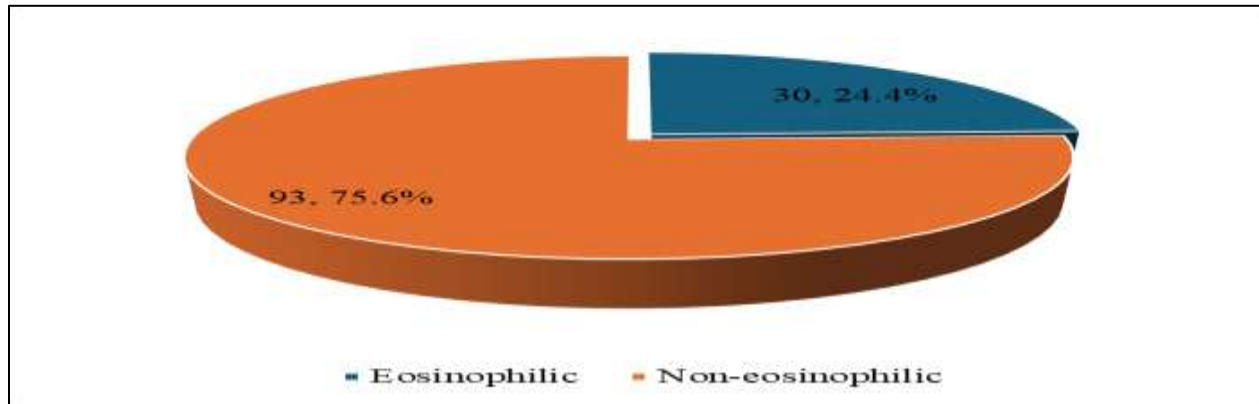


Figure-1: Frequency of eosinophilia among participants

Among the 123 patients, all cause in-hospital mortality occurred in 9.8% of patients. Respiratory failure developed in nearly one-third of the patients (31.7%), while 22.0% required mechanical ventilation, either invasive or non-invasive. Mean duration of hospital stay was 8.97 ± 3.10 days, with hospital stays ranging from 3 to 19 days, indicating moderate variability in disease severity and clinical course during hospitalization (table-2 and figure-2).

Variable	Mean \pm SD	Range
Duration of hospital stay (days)	8.97 ± 3.10	3 – 19
Clinical Outcome	Frequency (n)	Percentage
All cause in-hospital mortality	12	9.8%
Development of respiratory failure	39	31.7%
Requirement of mechanical ventilation (invasive or non-invasive)	27	22.0%

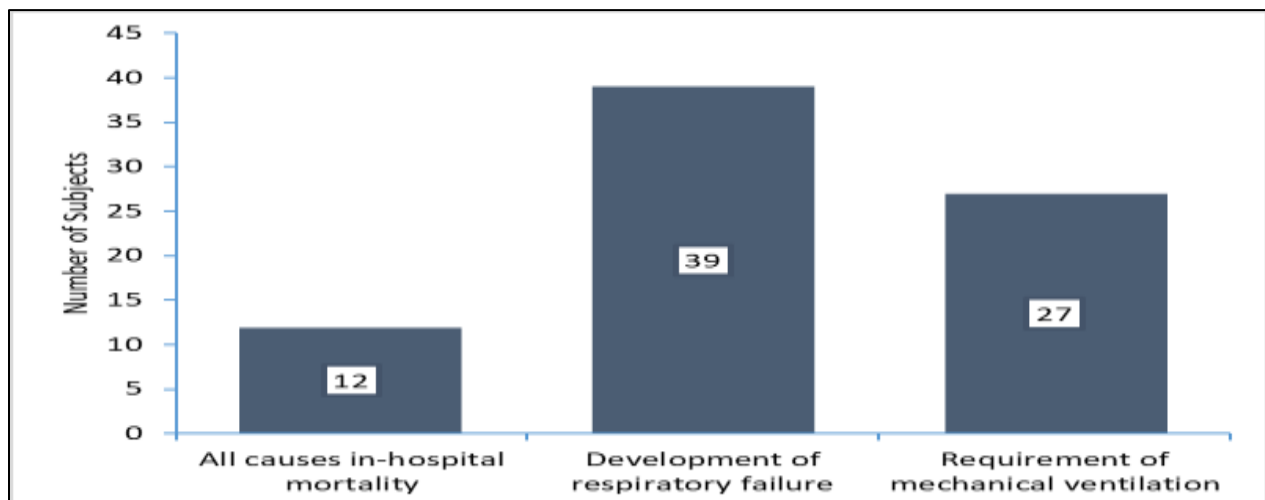


Figure-2: Clinical Outcomes among Patients with AECOPD (n = 123)

Patients with eosinophilic acute exacerbation of COPD had short duration of hospital stay in comparison to non-eosinophilic patients (6.27 ± 1.89 days vs 9.84 ± 2.91 days; $p < 0.001$). Regarding clinical outcomes, all-cause in-hospital mortality was observed exclusively in the non-eosinophilic group (12.9%), whereas no deaths occurred among eosinophilic patients with p -value = 0.038. Similarly, the development of respiratory failure was significantly more frequent in non-eosinophilic patients (36.6%) compared to eosinophilic patients (16.7%, $p = 0.042$). The requirement for mechanical ventilation, either invasive or non-invasive, was increased in the non-eosinophilic group. Overall, these findings indicated that peripheral blood eosinophilia exhibited better in-hospital outcomes among patients with acute exacerbation of COPD (table-3).

Table-3: Clinical Outcomes and Length of Hospital Stay between Both Groups			
Variable	Non-eosinophilic (n=93)	Eosinophilic (n=30)	p-value
Duration of hospital stay (days)	9.84 ± 2.91	6.27 ± 1.89	$< 0.001^*$
Clinical Outcomes			
All cause in-hospital mortality	12 (12.9%)	0 (0.0%)	0.038*
Development of respiratory failure	34 (36.6%)	5 (16.7%)	0.042*
Requirement of mechanical ventilation (invasive or non-invasive)	25 (26.9%)	2 (6.7%)	0.020*

*Statistically significant

When stratified by gender, eosinophilic patients of both sexes showed lower frequencies of in-hospital mortality, respiratory failure, and need for mechanical ventilation compared to non-eosinophilic patients; however, these differences were statistically insignificant in both genders. A borderline association was observed among female patients for reduced requirement of mechanical ventilation as shown in table-4.

Table-4: Gender-wise Association of Peripheral Blood Eosinophilia with Clinical Outcomes						
Clinical Outcome	Male			Female		
	Non-eosinophilic (n=93)	Eosinophilic (n=30)	p-value	Non-eosinophilic (n=93)	Eosinophilic (n=30)	p-value
All cause in-hospital mortality	8 (14.3%)	0 (0.0%)	0.090	4 (10.8%)	0 (0.0%)	0.235
Development of respiratory failure	22 (39.3%)	3 (16.7%)	0.078	12 (32.4%)	2 (16.7%)	0.293
Requirement of mechanical ventilation (invasive or non-invasive)	11 (19.6%)	1 (5.6%)	0.158	14 (37.8%)	1 (8.3%)	0.054*

*Statistically significant

DISCUSSION:

Both inflammation and causative agents cause variation during its exacerbations among COPD patients. Blood eosinophil counts guide steroid therapy in clinical practice which has important therapeutic and prognostic implications.^{6,10} According to various previous studies, several factors that contributed towards exacerbations of COPD include like bacterial infection, sputum eosinophilia and bacterial infection with sputum eosinophilia.^{4,11} In present study, mean duration of COPD among the study participants was 9.53 ± 4.79 years thus indicated wide variability in the chronicity of COPD among patients admitted with acute exacerbation as shown in table-1. Our findings were in line with one study that showed mean age in their participants was 72 years with males being the major sufferers from acute exacerbation of COPD having more than 10 years of disease duration. This can be contributed by various factors like smoking, infections and co-morbidities.¹²

According to our results, patients with eosinophilic acute exacerbation of COPD had a shorter duration of hospital stay in comparison to non-eosinophilic patients (6.27 ± 1.89 days vs 9.84 ± 2.91 days; $p < 0.001$). Regarding clinical outcomes, all-cause in-hospital mortality was observed exclusively in the non-eosinophilic group (12.9%), whereas no deaths occurred among eosinophilic patients having p -value=0.038. Our findings were well supported by previous studies that explained various theories regarding poor outcomes among COPD patients with low eosinophil counts. Low eosinophilic COPD patients had higher neutrophil counts and this high neutrophil count is a marker of bacterial infection thus causing its exacerbation and long duration of hospital stay according to studies.^{4,13} Similarly, the development of respiratory failure was significantly more frequent in non-eosinophilic patients (36.6%) compared to eosinophilic patients (16.7%, $p = 0.042$) in present study. The requirement for mechanical ventilation, either invasive or non-invasive, was also higher in the non-eosinophilic group with p -value = 0.020. Overall, these findings indicated that patients with peripheral blood eosinophilia had better in-hospital outcomes during its acute exacerbation (table-3). Paradoxical to our findings, one previous study documented that patients with severe COPD having peripheral eosinophilia exhibited increased frequency of acute exacerbation of COPD.^{7,14} One study reported that majority of COPD patients with low eosinophil counts had poor clinical outcomes like a long duration of hospital stay, required NIMV and developed more complications.¹ Similarly, another study showed that patients with non-eosinophilic COPD developed poor clinical outcomes and more complications like increased mechanical ventilation requirement, mortality, cardiac arrhythmias and long hospital stay in comparison to eosinophilic COPD patients.^{1,15} Thus our findings and method of classification of patients in present study were in line with above mentioned study. Our study combined clinical and para-clinical data with clinical outcomes thus ensured a complete follow-up of enrolled participants for readmissions and mortality.

Limitations:

Our study had a number of limitations. This was a single Centre study and lack of human resources, financial constraints and genetic workup added to its limitations.

CONCLUSION:

Identification of biomarkers for acute exacerbation of COPD played a critical role in knowing its phenotypes. However, lower-eosinophilic COPD patients were more critically ill and had poor clinical outcomes like long duration of hospital stays and more complications. Thus we concluded that better in-hospital outcomes were seen among patients with acute exacerbation of COPD who had peripheral blood eosinophilia.

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