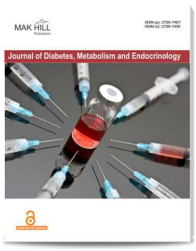

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Research Article

Admission Eosinopenia and Clinical Severity in Patients Hospitalised with Acute Exacerbation of Chronic Obstructive Pulmonary Disease: An Observational Study

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Abstract: Background: Acute exacerbations of chronic obstructive pulmonary disease (AECOPD) are heterogeneous in severity and may require early identification of patients at greater clinical risk. Peripheral blood eosinopenia is an inexpensive and routinely available laboratory finding that has been proposed as a marker of acute systemic stress. However, its relationship with the overall clinical severity of AECOPD remains incompletely characterised. **Objective:** To evaluate the prevalence of admission eosinopenia and the relationship between admission eosinophil count and predefined clinical severity strata among patients hospitalised with AECOPD. **Methods:** A hospital-based observational study included 185 patients aged 18–65 years admitted with AECOPD at a tertiary care teaching hospital. Complete blood count with differential was obtained at admission. Eosinopenia was defined as an absolute eosinophil count <0.05 × 10^9/L. Patients were classified into three predefined ascending clinical severity strata used in the parent study. Admission eosinophil and total leukocyte counts were compared across these strata. **Results:** Among 185 patients, 80 (43.2%) had admission eosinopenia. The three severity strata comprised 70 patients in the lowest-risk group, 90 in the intermediate group and 25 in the highest-risk group. Mean eosinophil counts progressively decreased across increasing severity strata from 0.12 ± 0.05 × 10^9/L to 0.08 ± 0.04 × 10^9/L and 0.04 ± 0.02 × 10^9/L, respectively ($p < 0.001$). Conversely, mean total leukocyte count increased from 8.0 ± 1.5 × 10^9/L to 9.2 ± 2.0 × 10^9/L and 10.0 ± 2.5 × 10^9/L, respectively ($p = 0.01$). **Conclusion:** Admission eosinophil count showed a significant inverse relationship with increasing clinical severity in this cohort of patients hospitalised with AECOPD. Eosinopenia is a readily available laboratory finding that may serve as a marker of overall clinical severity. Because eosinopenia contributed to the composite severity classification used in the parent study, these findings should be interpreted as an association with severity rather than evidence of an independent causal or prognostic effect.

Keywords: COPD, Acute Exacerbation, Eosinopenia, Eosinophil Count, Clinical Severity, Biomarker, Inflammation

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INTRODUCTION

Acute exacerbations of chronic obstructive pulmonary disease are a frequent cause of hospitalisation and are associated with substantial clinical and healthcare burden. The severity of an exacerbation varies considerably between individuals, making early recognition of patients with more severe disease clinically important. Blood eosinophils have received considerable attention in COPD because of their relationship with airway inflammatory phenotypes and corticosteroid responsiveness. In contrast, eosinopenia during acute illness represents a different biological phenomenon and has been described as part of the systemic stress response. Eosinopenia has been investigated as a marker of severity in patients with acute exacerbations of COPD, with previous studies reporting associations with hospital outcomes. The practical appeal of eosinophil count is its immediate availability as part of the routine differential leukocyte count, without requiring additional specialised testing. Nevertheless, evidence regarding its relationship with severity in hospitalised AECOPD remains heterogeneous. The present analysis was undertaken to characterise the prevalence of admission eosinopenia and examine the relationship between eosinophil count and predefined clinical severity categories in a cohort of patients hospitalised with AECOPD [1].

MATERIALS AND METHODS

Study Design and Setting

This was a hospital-based observational study conducted over one year in the Departments of General Medicine and Respiratory Medicine at Hassan Institute of Medical Sciences, Hassan, Karnataka, India [1, 2].

Study Population
A total of 185 patients admitted with AECOPD were included. Patients were eligible if they were aged >18 and <65 years, were willing to provide informed written consent, and had AECOPD diagnosed according to GOLD criteria with spirometric evidence of airflow obstruction. Patients with bronchial asthma, other primary respiratory illnesses including tuberculosis, post-COVID sequelae and interstitial lung disease, and non-pulmonary causes of breathlessness including congestive cardiac failure, chronic kidney disease and chronic liver disease were excluded.

Sample Size
The sample size was calculated using a prevalence-based formula with a 95% confidence level, an anticipated prevalence of 34.4% from a previous study and a precision of 20% of the estimated prevalence. The calculated minimum sample was 183 and was rounded to 185 participants.

Assessment of Eosinophil Count
A complete blood count with differential leukocyte count was obtained at admission as part of routine clinical evaluation. Absolute eosinophil count was recorded. Eosinopenia was defined as an absolute eosinophil count $<0.05 \times 10^9$/L.

Clinical Severity Classification
Patients were classified into three predefined ascending clinical severity strata used in the parent study: lowest-risk, intermediate-risk and highest-risk groups. The present manuscript focuses specifically on the relationship between admission eosinophil count and these overall clinical severity strata and does not evaluate mortality as an outcome.
Because eosinopenia was one of the variables incorporated into the composite severity assessment used in the parent study, the association between eosinophil count and severity is interpreted as a descriptive association with overall clinical severity. It is not interpreted as an independent effect of eosinopenia.

Statistical Analysis
Continuous variables were expressed as mean ± standard deviation and categorical variables as frequency and percentage. Eosinopenia prevalence was calculated as a proportion of the study population. Mean eosinophil and total leukocyte counts were compared across the three ordered severity strata. Statistical significance of trends across the ordered groups was assessed in the parent analysis. A two-sided p-value <0.05 was considered statistically significant. The present secondary analysis was restricted to severity-related variables and did not perform mortality modelling.

Ethical Considerations
All participants provided informed written consent for participation and use of the collected clinical information for academic and publication purposes. The institutional ethical approval identifier should be inserted from the original institutional ethics committee documentation before journal submission

RESULTS

Study Population
The study included 185 patients hospitalised with AECOPD. The mean age was 58 ± 6 years and 64.9% of participants were male.

Prevalence of Admission Eosinopenia
Admission eosinopenia, defined as an absolute eosinophil count $<0.05 \times 10^9$/L, was present in 80 of 185 participants (43.2%).

Eosinophil Count Across Clinical Severity Strata
There was a progressive reduction in mean admission eosinophil count with increasing clinical severity. Mean eosinophil count was $0.12 \pm 0.05 \times 10^9$/L in the lowest-risk group, $0.08 \pm 0.04 \times 10^9$/L in the intermediate-risk group and $0.04 \pm 0.02 \times 10^9$/L in the highest-risk group. The trend across severity strata was statistically significant ($p < 0.001$) (Table 1).

Total Leukocyte Count Across Severity Strata
In contrast to eosinophils, mean total leukocyte count increased progressively with clinical severity, from $8.0 \pm 1.5 \times 10^9$/L in the lowest-risk group to $9.2 \pm 2.0 \times 10^9$/L in the intermediate-risk group and $10.0 \pm 2.5 \times 10^9$/L in the highest-risk group ($p = 0.01$) (Table 2).

Table 1: Baseline Characteristics of the Study Population

Characteristic	Value
Total participants	185
Age, mean ± SD (years)	58 ± 6
Male sex, n (%)	120 (64.9%)
Admission eosinopenia, n (%)	80 (43.2%)

Table 2: Eosinophil and Total Leukocyte Counts Across Clinical Severity Strata

Severity stratum	n	Eosinophil count ($\times 10^9$/L), mean ± SD	WBC count ($\times 10^9$/L), mean ± SD
Lowest risk	70	0.12 ± 0.05	8.0 ± 1.5
Intermediate risk	90	0.08 ± 0.04	9.2 ± 2.0
Highest risk	25	0.04 ± 0.02	10.0 ± 2.5
Trend p-value	185	<0.001	0.01

DISCUSSION

In this cohort of 185 patients hospitalised with AECOPD, admission eosinopenia was observed in 43.2% of participants. The principal finding was a clear inverse gradient between admission eosinophil count and overall clinical severity. Mean eosinophil count declined progressively across the three severity strata, while total leukocyte counts increased [3].

The observed eosinophil gradient is biologically plausible. Acute systemic stress is associated with neuroendocrine responses that can alter circulating eosinophil distribution, producing a reduction in peripheral eosinophil counts. The accompanying rise in total leukocyte count observed in the present cohort may reflect the broader inflammatory response accompanying more severe exacerbations.

Our findings are consistent with earlier work examining eosinopenia as a marker of severity in AECOPD. Holland *et al.* [4] reported longer hospital stay and higher mortality among eosinopenic patients in a hospitalised AECOPD cohort, suggesting that eosinopenia may identify more severe exacerbations. A later prospective study similarly reported associations between eosinopenia and adverse hospital outcomes. However, subsequent studies have reported heterogeneous findings, and a recent systematic review concluded that blood eosinophil counts have limited and inconsistent prognostic performance for mortality and readmission across AECOPD populations.

The present study adds data from an Indian tertiary-care cohort and demonstrates a marked quantitative reduction in admission eosinophil count across increasing severity categories. The finding is clinically attractive because eosinophil count is already available as part of the routine complete blood count.

An important methodological consideration is that eosinopenia contributed to the composite severity assessment used to classify participants in the parent study. Therefore, the observed gradient cannot be interpreted as independent validation of eosinopenia as a severity score or as evidence of a causal relationship. The present manuscript deliberately treats the finding as an association between admission eosinophil count and overall clinical severity.

Strengths

The study included a relatively large cohort of 185 hospitalised AECOPD patients, included both sexes, used a predefined eosinopenia threshold and assessed eosinophil count at admission, when a clinically useful severity marker would be most valuable. The differential leukocyte count is inexpensive and routinely available.

Limitations

This was a single-centre observational study and therefore may have limited external generalisability. The study population was restricted to patients younger than 65 years. Corticosteroid exposure before the admission blood sample was not separately analysed and could influence circulating eosinophil counts. Most importantly, the clinical severity strata used in the parent study incorporated eosinopenia as one of their components; consequently, the observed association may involve circularity and should not be interpreted as independent validation. Finally, the analysis used grouped severity data, limiting more granular assessment of the continuous relationship between eosinophil count and severity.

CONCLUSION

Admission eosinopenia was common among patients hospitalised with AECOPD and admission eosinophil count demonstrated a significant inverse relationship with increasing clinical severity. Eosinophil count may therefore represent a simple, inexpensive marker of overall severity at hospital admission. However, because eosinopenia contributed to the composite severity classification in the parent study, prospective studies using independent severity outcomes and appropriately adjusted analyses are required before eosinopenia can be considered an independent severity biomarker.

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