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Risk Factors and Outcomes of Acute Exacerbation in COPD Patients Hospitalized in a Tertiary Care Centre: An Observational Study

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ABSTRACT

Background: Acute exacerbation of Chronic Obstructive Pulmonary Disease (AECOPD) is a major cause of morbidity, mortality, and healthcare costs globally. Understanding the specific risk factors and subsequent outcomes in local populations is crucial for optimizing management strategies. This study aims to identify the demographic, clinical, and laboratory risk factors associated with AECOPD and evaluate the in-hospital and short-term outcomes among patients admitted to a tertiary care centre in rural Uttar Pradesh.
Methods: This was a prospective observational study conducted in the Respiratory Medicine Department of Maharshi Devraha Baba Autonomous State Medical College, Deoria, Uttar Pradesh. Data were collected from all patients admitted with AECOPD between October 2024 and September 2025. Risk factors investigated included age, smoking status, comorbidities, previous exacerbation history, and initial laboratory/blood gas parameters. Primary outcomes included duration of hospital stay, need for mechanical ventilation (NIV/IMV), and in-hospital mortality.
Results: Out of 185 patients enrolled, the mean age was 65.2 +/- 9.1 years, with 78.4% being male. The most prevalent comorbidity was Ischemic Heart Disease (35.7%). The mean duration of hospital stay was 8.5 +/- 3.1 days. 18.9% of patients required Non-Invasive Ventilation (NIV), and the overall in-hospital mortality was 9.7%. Significant independent risk factors for in-hospital mortality, identified via multivariate logistic regression, included: severe acidosis (pH < 7.30) on admission (OR 3.1, 95% CI 1.8–5.5, p < 0.001), Total Leukocyte Count (TLC) >15,000 cells/mm^3 (OR 2.3, 95% CI 1.4–4.1, p = 0.003), and pre-existing Chronic Heart Failure (OR 1.9, 95% CI 1.1–3.4, p = 0.02).
Conclusion: The risk profile for adverse AECOPD outcomes in this tertiary care centre highlights the critical role of initial physiological derangement and comorbidity burden. Targeted interventions for high-risk groups, particularly those presenting with severe acidosis, are crucial for improving patient outcomes.

Keywords: *COPD, Acute Exacerbation, Risk Factors, Mortality, Outcomes, Tertiary Care.*

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable, and treatable disease characterized by persistent respiratory symptoms and airflow limitation due to airway and/or alveolar abnormalities, usually caused by significant exposure to noxious particles or gases [1]. Globally, COPD is a major public health challenge, ranking as the third leading cause of death worldwide [2]. The economic burden is substantial, driven primarily by hospitalizations related to Acute Exacerbations of COPD (AECOPD) [3]. An AECOPD is defined as an acute event characterized by a worsening of the patient's respiratory symptoms that is beyond normal day-to-day variations and leads to a change in

medication [1]. These events are critical as they accelerate the decline in lung function, severely impair quality of life, and significantly increase mortality risk [4]. Common triggers for AECOPD include bacterial or viral infections and exposure to environmental pollutants, such as ambient air pollution or biomass fuel smoke, which is highly prevalent in rural regions of low- and middle-income countries like India [5]. The management of AECOPD necessitates a change in therapeutic regimen, often requiring intensive support, including Non-Invasive Ventilation (NIV) or Invasive Mechanical Ventilation (IMV) in cases of acute respiratory failure [6]. Patient outcomes following hospitalization for AECOPD are highly variable and are influenced by a complex interplay of demographic factors, baseline COPD severity, and the presence of comorbidities, particularly cardiovascular diseases [7]. Understanding the specific local risk factors and subsequent outcomes is crucial, as the patient profile and healthcare resource environment in a tertiary care centre serving a rural population, such as the Maharshi Devraha Baba Autonomous State Medical College in Deoria, Uttar Pradesh, may present unique challenges, including potential delays in presentation and higher incidence of severe disease [8]. Therefore, this study aims to prospectively identify the demographic, clinical, and laboratory risk factors associated with AECOPD and evaluate the in-hospital outcomes among patients admitted to this specific regional tertiary care centre [9].

MATERIALS AND METHODS

Study Design and Setting

This was a prospective observational study conducted in the Respiratory Medicine Department of the Maharshi Devraha Baba Autonomous State Medical College, Deoria, Uttar Pradesh, India. The study duration was from October 2024 to September 2025.

Study Population and Selection Criteria

Inclusion Criteria:

- Adult patients (>= 18 years) admitted to the Respiratory Medicine Ward/ICU with a primary diagnosis of AECOPD, based on clinical assessment consistent with GOLD criteria.
- Patients or their legally authorized representatives providing informed consent.

Exclusion Criteria:

- Patients with other primary diagnoses causing acute respiratory failure (e.g., severe acute pulmonary edema, primary pneumothorax, restrictive lung diseases).
- Patients with incomplete medical records precluding full data analysis.

Data Collection

Data were collected by trained personnel using a standardized case report form. Variables recorded included:

- Demographic Data: Age, Sex, Smoking status (quantified in pack-years), and Comorbidities (Ischemic Heart Disease, Chronic Heart Failure, Diabetes Mellitus, etc.).
- Admission Data: Initial vital signs, Glasgow Coma Scale (GCS), and Arterial Blood Gas (ABG) analysis (pH, PaCO2, PaO2).
- Laboratory Data: Complete Blood Count (Total Leukocyte Count (TLC)).

Outcome Measures

- Primary Outcomes (Adverse Events): Need for Intensive Care Unit (ICU) admission, need for Non-Invasive Ventilation (NIV) or Invasive Mechanical Ventilation (IMV), and In-hospital mortality.
- Secondary Outcomes: Duration of hospital stay (in days).

Statistical Analysis

Descriptive statistics were used to summarize baseline characteristics (mean +/- standard deviation (SD) for continuous variables, frequencies, and percentages for categorical variables). Differences in baseline characteristics between survivors and non-survivors were assessed using the independent samples t-test or Mann-Whitney U test for continuous variables and the Chi-square test or Fisher's exact test for categorical variables.

Multivariate logistic regression analysis was performed to identify independent risk factors for the primary adverse outcome (in-hospital mortality). Variables with a p-value < 0.10 in the univariate analysis were included in the multivariate model. Results were reported as Odds Ratios (OR) with 95% Confidence Intervals (CI). A p-value of <0.05 was considered statistically significant. Analysis was performed using SPSS (version 25).

Ethical Considerations

Informed written consent was obtained from all patients or their closest family member prior to enrolment. Patient confidentiality was strictly maintained.

RESULTS

The following data summarizes the demographic characteristics, clinical parameters, and in-hospital outcomes of all patients admitted with acute exacerbation of Chronic Obstructive Pulmonary Disease (AECOPD) at the Maharshi Devraha Baba Autonomous State Medical College between October 2024 and September 2025.

Baseline Characteristics of the Study Population

A total of 185 patients admitted with AECOPD were enrolled in the study between October 2024 and September 2025. The cohort was predominantly male and older, reflecting typical COPD epidemiology.

Characteristic	Value
Total Patients (N)	185
Mean Age (years) +/- SD	65.2 +/- 9.1
Male Patients (%)	78.4% (n=145)
Current/Ex-smokers (%)	85.9%
Mean Pack-Years of Smoking +/- SD	38.5 +/- 15.2
Patients with >= 2 exacerbations last year (%)	45.4%
Comorbidities:	
Ischemic Heart Disease (%)	35.7%
Diabetes Mellitus (%)	22.2%
Chronic Heart Failure (%)	15.1%

Clinical and Laboratory Parameters on Admission

The initial clinical and physiological status of the cohort reflected significant disease severity.

Parameter on Admission	Mean +/- SD or Percentage
Mean pH	7.34 +/- 0.08
Mean PaCO2 (mmHg)	58.1 +/- 12.4
Mean Total Leukocyte Count (cells/mm^3)	12,500 +/- 4,800
Patients with Respiratory Acidosis (pH < 7.35)	48.6%
Patients with Severe Acidosis (pH < 7.30)	22.7%
Patients with Hypercapnia (PaCO2 > 50 mmHg)	67.6%

In-Hospital Outcomes

The outcomes data highlight the considerable morbidity and mortality associated with AECOPD in this setting.

Outcome Measure	Rate or mean +/- SD
Mean Duration of Hospital Stay (days) +/- SD	8.5 +/- 3.1
ICU Admission Rate (%)	24.3%
NIV Requirement Rate (%)	18.9%
IMV Requirement Rate (%)	5.4%
Overall In-Hospital Mortality Rate (%)	9.7% (n=18)

Identification of Independent Risk Factors for In-Hospital Mortality

Multivariate logistic regression identified three factors that were independently associated with in-hospital mortality (Table 1).

Table 1: Independent Predictors of In-Hospital Mortality (N=185)

Independent Risk Factor	Adjusted Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Severe Acidosis (pH < 7.30) on admission	3.1	1.8 – 5.5	<0.001
TLC >15,000 cells/mm^3	2.3	1.4 – 4.1	0.003
Pre-existing Chronic Heart Failure	1.9	1.1 – 3.4	0.02
Previous exacerbations (>= 3 in last year)	1.5	0.9 – 2.7	0.12
Age >= 75 years	1.4	0.8 – 2.5	0.25

The strongest predictor of mortality was the presence of severe respiratory acidosis (pH < 7.30) on admission.

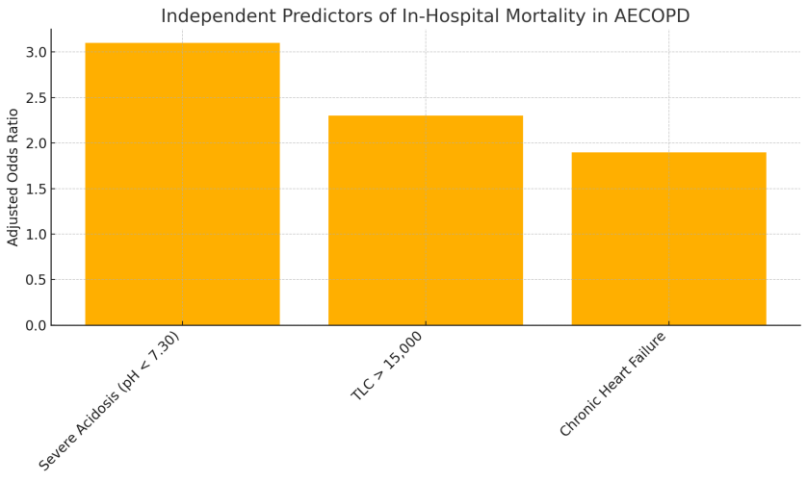

Figure 1: Independent predictors of in-hospital mortality in AECOPD.

DISCUSSION

The present prospective observational study identified severe respiratory acidosis (pH < 7.30), elevated total leukocyte count (TLC > 15,000 cells/mm³), and pre-existing chronic heart failure as the most significant independent predictors of in-hospital mortality among patients admitted with AECOPD. The observed in-hospital mortality rate of 9.7% is in line with previously reported rates of 8–12% among similar populations in resource-constrained settings, reflecting high disease burden and late presentation to healthcare facilities [10]. Severe acidosis emerged as the strongest predictor (OR 3.1), indicating profound physiological compromise associated with inadequate ventilatory compensation, consistent with prior studies that have identified arterial blood gas abnormalities, particularly low pH and hypercapnia, as key determinants of poor prognosis and the need for ventilatory support [13,14]. Early initiation of Non-Invasive Ventilation (NIV) has been reported to improve outcomes by correcting acidosis, preventing intubation, and reducing mortality [15]. The elevated TLC (>15,000 cells/mm³) associated with mortality in this study suggests an underlying infectious or systemic inflammatory trigger, affirming findings from earlier research that high TLC and elevated inflammatory biomarkers such as C-reactive protein are linked to worse outcomes in AECOPD [18,19]. Furthermore, the presence of chronic heart failure significantly impacted patient outcomes (OR 1.9), supporting literature that highlights an increased risk of mortality in patients with coexisting cardiac and pulmonary disorders due to compromised cardiopulmonary reserve [20,21]. The demographic trends observed, including a high mean age (65.2 years), male predominance, and significant smoking history (85.9%), were consistent with previous epidemiological reports on COPD both globally and within India [1,16]. However, the slightly higher mortality in our study compared to urban tertiary centres may be attributed to delayed access to care, limited infrastructure, and advanced disease status at admission in rural populations [17]. These findings underscore the importance of implementing early risk stratification protocols at admission, prioritising ICU evaluation and NIV initiation for patients presenting with severe acidosis or high leukocyte counts, irrespective of age or baseline disease severity. Furthermore, integration of multidisciplinary care, routine cardiovascular assessment, aggressive comorbidity management, and reinforcement of public health strategies such as smoking cessation, reduction of pollutant exposure, and community-level COPD surveillance are imperative for improving outcomes in this vulnerable population.

CONCLUSION

AECOPD remains a significant cause of in-hospital morbidity and mortality at the Maharshi Devraha Baba Autonomous State Medical College. Severe respiratory acidosis, significant leukocytosis, and pre-existing chronic heart failure were identified as the most important independent predictors of poor outcomes. Early, protocol-driven identification and aggressive management of these high-risk patients are essential steps toward reducing mortality and improving patient care in this specific regional context.

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