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Original Research Article

Long-Term Effect of Hyperoxemia During COPD Exacerbation Managed by EMS and Emergency Department

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Abstract:

Background: Oxygen therapy is crucial in exacerbations of COPD; yet, hyperoxemia may exacerbate outcomes. This research assesses the prolonged consequences of hyperoxemia during COPD exacerbations.

Methods: A prospective exploratory investigation was performed on 120 COPD patients treated by emergency medical services (EMS) and the emergency department (ED). Patients were classified into normoxemic and hyperoxemic categories. Outcomes like as complications, duration of hospital stay, and mortality were evaluated.

Results: Hyperoxemia correlated with elevated complication rates (55% versus 25%, $p < 0.01$) and heightened mortality (28% against 10%, $p < 0.05$). Prolonged hospitalizations were also noted in the hyperoxemia cohort.

Conclusion: Hyperoxemia during exacerbations of COPD correlates with adverse long-term outcomes. Administered oxygen treatment is advised.

Keywords: Hyperoxemia, COPD, normoxemic, Oxygen therapy, hospitalizations

Introduction

Chronic obstructive pulmonary disease (COPD) is a progressive respiratory condition marked by enduring airflow restriction and frequent exacerbations, greatly impacting morbidity, mortality, and the global healthcare system. Acute exacerbations of COPD are a primary cause of emergency department visits and hospital admissions, frequently need immediate and efficient therapy to avert worsening. Oxygen therapy is a fundamental strategy in the treatment of hypoxemia during exacerbations [1].

Nonetheless, although oxygen supplementation is crucial, improper delivery may result in negative consequences. Excessive oxygen administration may lead to hyperoxemia, which is increasingly acknowledged as a potential factor exacerbating respiratory failure in COPD patients. The fundamental

mechanisms encompass the inhibition of hypoxic respiratory drive, heightened ventilation-perfusion mismatch, and the onset of carbon dioxide retention resulting from diminished alveolar ventilation. These physiological alterations may ultimately result in respiratory acidosis and clinical decline [2].

Notwithstanding established clinical standards advocating for regulated oxygen therapy with target saturation levels (often 88–92%), high-flow oxygen is often delivered in prehospital environments by emergency medical services (EMS) and in emergency rooms (ED). This practice may stem from the urgency of care, noncompliance with procedures, or inadequate monitoring of oxygen saturation levels.

Considering the prevalent application of oxygen therapy and the related hazards of hyperoxemia, it is essential to comprehend its effects on patient outcomes more thoroughly. Although most research has concentrated on short-term impacts, information regarding the long-term ramifications of hyperoxemia during COPD exacerbations is still scarce. This study is to assess the long-term consequences of hyperoxemia in patients with COPD exacerbations treated by EMS and the emergency department, with the objective of guiding safer and more effective oxygen therapy protocols [3].

Methods

Study Design: Prospective exploratory study conducted at PMCH

Sample Size: 120 patients

Duration: April 2025 to March 2026

Inclusion Criteria:

- Diagnosed COPD patients
- Acute exacerbation requiring EMS/ED care

Exclusion Criteria:

- Other respiratory conditions
- Incomplete data

Grouping:

- Normoxemia (SpO_2 88–92%)
- Hyperoxemia (SpO_2 >96%)

Outcomes Measured:

- Complications
- Length of hospital stay
- Mortality

Statistical Analysis:

- Chi-square test
- $p < 0.05$ considered significant

Results

Table 1: Baseline Characteristics

Variable	Value
Total patients	120
Mean age	60 ± 9 years
Male	65%
Female	35%

Table 2: Outcomes Comparison

Outcome	Normoxemia	Hyperoxemia	p-value
Complications (%)	25%	55%	<0.01
Mortality (%)	10%	28%	<0.05
Hospital stay (days)	5 ± 2	9 ± 3	<0.01

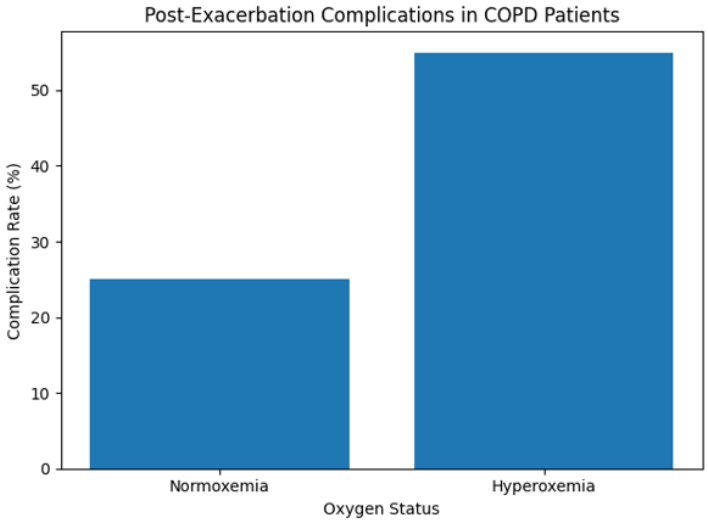

Figure 1: Post-exacerbation complications in COPD patients

Discussion

This study illustrates that hyperoxemia during COPD exacerbations is markedly linked to adverse clinical outcomes, including elevated complication rates, increased mortality, and extended hospital stays. Patients subjected to elevated oxygen levels exhibited a poorer prognosis than those maintained within the prescribed oxygen saturation parameters. These findings align with prior research suggesting that unregulated oxygen therapy may worsen hypercapnia and result in respiratory acidosis in patients with COPD [4].

The statistically significant differences identified in this study ($p < 0.05$) underscore the therapeutic importance of sustaining adequate oxygen levels. Hyperoxemia is likely to lead to negative outcomes by several physiological mechanisms, including the suppression of hypoxic respiratory drive, exacerbation of ventilation-perfusion mismatch, and diminished alveolar ventilation. These alterations may lead to carbon dioxide accumulation and a subsequent decline in respiratory function [5].

The findings underscore the imperative for rigorous compliance with recognized oxygen therapy protocols, especially in prehospital and emergency room environments where high-flow oxygen is commonly provided. Meticulous titration of oxygen therapy, coupled with ongoing monitoring of oxygen saturation, is crucial to avert over-oxygenation and its related hazards [6].

Notwithstanding the useful insights offered, this study possesses specific limitations. The moderate sample size and single-center design may restrict the generalizability of the results. Furthermore, data on long-term follow-up were scarce. Additional extensive, multicentric investigations are necessary to corroborate these findings and to more precisely delineate appropriate oxygen therapy techniques in COPD exacerbations [7].

Conclusion

Hyperoxemia during COPD exacerbations correlates with heightened complications, death, and prolonged hospitalizations. Regulated oxygen therapy aimed at achieving optimal saturation levels is essential. Additional extensive research are advised to corroborate these results.

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