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PROGNOSTIC VALUE OF SERUM ALBUMIN & SERUM URIC ACID IN PATIENTS OF ACUTE EXACERBATION OF COPD: A CROSS-SECTIONAL STUDY

Respiratory Medicine

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ABSTRACT

Background: Acute exacerbations of chronic obstructive pulmonary disease (AECOPD) significantly impact morbidity and mortality. This study evaluates the prognostic value of serum albumin and serum uric acid in AECOPD. **Materials And Methods:** A cross-sectional study involving 165 AECOPD patients was conducted. Serum levels of albumin and uric acid were measured and correlated with disease severity and clinical outcomes including ICU admission and mortality. **Results:** Serum albumin levels negatively correlated with COPD severity ($r = -0.65$, $p < 0.001$), while serum uric acid positively correlated ($r = 0.6$, $p < 0.001$). Lower albumin and higher uric acid levels were significantly associated with longer hospital stays, ICU admission, and mortality. Multivariate analysis showed serum albumin (OR = 0.7, $p < 0.001$) and serum uric acid (OR = 1.3, $p < 0.001$) as independent predictors of poor outcomes.

KEYWORDS

COPD, Acute exacerbation of COPD, Respiratory failure, Serum albumin, Serum uric acid

INTRODUCTION:

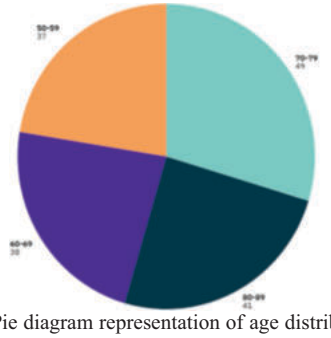
Chronic Obstructive Pulmonary Disease (COPD) is a heterogeneous lung condition characterized by chronic respiratory symptoms (dyspnea, cough, sputum production and/or exacerbations) due to abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent, often progressive, airflow obstruction.[1]. Acute exacerbations of COPD (AECOPD) significantly worsen these symptoms, accelerate pulmonary function decline, increase hospitalization rates, and contribute substantially to mortality [1,4,5]. These exacerbations involve rapid deterioration in respiratory function, often associated with increased local and systemic inflammation from infection or pollution [1,3].

Identifying reliable prognostic markers is crucial for assessing AECOPD severity and outcomes [6,7,8]. Serum albumin, a primary plasma protein, indicates nutritional status and systemic inflammation, with lower levels in AECOPD linked to poorer prognosis, prolonged hospital stays, and increased mortality due to heightened inflammation and oxidative stress [6,7,8]. Similarly, serum uric acid, an antioxidant, often rises during hypoxia and oxidative stress in COPD, correlating with worse clinical outcomes, including higher hospitalization rates, frequent exacerbations, and increased mortality [3,5]. Both biomarkers offer cost-effective insights into disease burden and guide timely interventions [1,6,7]. This study aims to analyze serum albumin and uric acid levels in AECOPD patients to establish their prognostic value and contribute to individualized treatment strategies.

MATERIALS AND METHODS

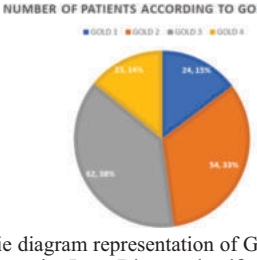
This cross-sectional study was conducted at the Government Medical College, Kota, and included a total of 165 patients admitted with acute exacerbation of chronic obstructive pulmonary disease (AECOPD). Patients were included based on clinical diagnosis of AECOPD, while those with other chronic lung diseases such as bronchiectasis or interstitial lung disease, as well as those with significant cardiac or renal comorbidities, were excluded. Data collection involved recording demographic and clinical details, measuring serum albumin and serum uric acid levels, and performing arterial blood gas (ABG) analysis. Statistical analysis was carried out using SPSS version 20. Correlation analysis was used to explore relationships between variables, the Mann-Whitney U test was applied for comparing groups, and multivariate regression analysis was conducted to identify independent predictors. A p-value of less than 0.05 was considered statistically significant.

RESULTS:



Graph 01: A Pie diagram representation of age distribution of study subjects

Most patients were aged 70–79 years (29.7%). Males represented 55.15%. The majority had GOLD stages 2 and 3 (70.91%).



Graph 02: A pie diagram representation of GOLD: Global Initiative for Chronic Obstructive Lung Disease classification of study subjects.

Table 1: Outcome-based Group Analysis

Outcome	Serum Albumin (g/dL)	Serum Uric Acid (mg/dL)
Short Stay (<7 days)	3.2	5.8
Long Stay (≥7 days)	2.6	6.8
ICU Admission	2.5	7.2
Non-ICU Admission	3.3	5.7
Survivors	3.1	6
Non-survivors	2.4	7.1

Serum albumin decreased and uric acid increased with COPD severity. Strong correlations existed between GOLD stage and both biomarkers.Longer hospital stays, ICU admission, and mortality were associated with lower albuminand higher uric acid levels.

Table 2: Biomarker Levels By GOLD Stage

GOLD Stage	Serum Albumin (g/dL)	Serum Uric Acid (mg/dL)	Ph	pO_2 (mmHg)	pCO_2 (mmHg)	HCO_3 (mmol/L)
1	3.5 (±0.3)	5.5 (±1.0)	7.4 (±0.02)	75 (±3)	40 (±5)	24 (±2)
2	3.2 (±0.4)	6.0 (±1.2)	7.38 (±0.03)	70 (±4)	43 (±6)	25 (±2)
3	2.8 (±0.5)	6.5 (±1.3)	7.36 (±0.04)	65 (±5)	47 (±7)	26 (±3)
4	2.5 (±0.6)	7.0 (±1.5)	7.33 (±0.05)	60 (±6)	50 (±8)	28 (±4)

Serum albumin (OR=0.7), uric acid (OR=1.3), pO_2 (OR=0.8), and pCO_2 (OR=1.2) were significant predictors of outcomes.

DISCUSSION

Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory disorder with significant global health implications. Acute exacerbations of COPD (AECOPD) contribute notably to increased hospitalizations, rapid decline in lung function, and higher mortality rates [1,2]. These episodes, often triggered by infections or environmental factors, are marked by heightened inflammation and oxidative stress.

Serum albumin, a hepatic protein with antioxidant and anti-inflammatory properties, is a valuable biomarker reflecting nutritional status and systemic inflammation. This study showed a strong inverse correlation between serum albumin levels and disease severity ($r = -0.65$, $p < 0.001$), consistent with previous studies conducted by Khilnani et al and Zhao et al [3,4]. Lower albumin levels were also associated with prolonged hospitalization, ICU admissions, and increased mortality, emphasizing its prognostic significance.

Serum uric acid, a purine metabolism byproduct, typically acts as an antioxidant. However, its levels rise in hypoxia and oxidative stress—conditions common in AECOPD. A positive correlation between uric acid levels and GOLD stage ($r = 0.6$, $p < 0.001$) was observed in our study, aligning with prior findings conducted by Bartziokas et al and Sarangi et al [5,6]. Elevated levels were also linked to poorer clinical outcomes, including longer hospital stays and higher mortality.

The **uric acid-to-albumin ratio (UAR)** has emerged as a composite biomarker with improved predictive value in AECOPD [7]. Combining these markers may enhance risk stratification and clinical decision-making.

In our cohort, the majority of patients were in the 70–79 age group, and most fell into GOLD stages 2 and 3, consistent with earlier research studies by Zaho et al and Abdelhalim et al[4,8]. Deteriorating blood gas parameters - decreased pO_2 and increased pCO_2 further confirmed the progression of respiratory compromise with disease severity similar to findings of study conducted by Bartziokas et al [5].

Multivariate regression analysis showed that serum albumin (OR = 0.7, 95% CI: 0.58–0.84, $p < 0.001$) and serum uric acid (OR = 1.3, 95% CI: 1.10–1.50, $p < 0.001$) were independent predictors of ICU admission and mortality, alongside blood gas parameters (pO_2 and pCO_2), reinforcing previous findings from studies by Huang et,Bartziokas and Qin et al [2,5,9].

Serum albumin and uric acid are reliable, cost-effective prognostic biomarkers in AECOPD. Their routine measurement can facilitate early risk assessment, guide management, and improve patient outcomes.

CONCLUSION

This study highlights the prognostic significance of serum albumin and serum uric acid in patients with acute exacerbation of COPD (AECOPD). Lower serum albumin levels were associated with advancing disease severity, reflecting systemic inflammation and malnutrition, while elevated serum uric acid indicated increased oxidative stress and was linked to more severe exacerbations and poorer outcomes.The combined use of these biomarkers, particularly the uric acid-to-albumin ratio (UAR), offered improved predictive accuracy for identifying high-risk patients. Additionally, blood gas abnormalities (reduced pO_2 and elevated pCO_2) further supported disease severity assessments.Routine evaluation of these cost-effective biomarkers can aid in early risk stratification, guide clinical decision-making, reduce ICU admissions, and improve overall patient outcomes. Incorporating albumin and uric acid into COPD management protocols may enhance treatment strategies and optimize resource use.

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