A Comparative Study on Efficacy of Decaf Score Verus Serum Magnesium Levels at Admission in Assessing Prognosis of Acute Exacerbation of COPD

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Abstract- Background: Chronic obstructive pulmonary disease (COPD) is a major global health burden with high rates of morbidity and mortality. Acute exacerbations (AECOPD) often necessitate hospitalization and are linked to increased risk of death and recurrent admissions. This study compares the utility of the DECAF score and serum magnesium levels at admission in predicting outcomes in AECOPD patients.

Methods: This observational cross-sectional comparative study included 100 AECOPD patients admitted to a tertiary care hospital. Patients were assessed using the DECAF score and serum magnesium levels. Prognostic outcomes such as 30-day mortality, requirement of ventilation, and readmission rates were analysed.

Results: High DECAF scores (≥3) were significantly associated with higher mortality ($p<0.0001$), increased need for mechanical ventilation, and 30-day readmissions. Similarly, hypomagnesemia (<1.0 mg/dL) was observed in 22% of patients and was significantly associated with increased mortality (38.5%), ventilation requirement, and longer hospital stay. Vaccinated patients had significantly lower mortality (9.1%) compared to unvaccinated (31.3%).

Conclusion: Both DECAF score and serum magnesium levels are independent predictors of prognosis in AECOPD. Their combined use at admission can enhance risk stratification and guide clinical decision-making.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a leading cause of global morbidity and mortality, ranked third among causes of death worldwide. The burden is particularly severe in low- and middle-income countries, including India, where COPD is the second leading cause of death and disability-adjusted life years (DALYs) lost.

COPD is characterized by chronic airflow limitation and persistent respiratory symptoms caused by airway and alveolar abnormalities, commonly due to long-term exposure to harmful particles like cigarette smoke and biomass fuels. Acute exacerbations of COPD (AECOPD), defined as sudden worsening of symptoms requiring medical intervention, significantly deteriorate lung function, quality of life, and survival rates. They account for a substantial portion of healthcare costs and hospitalizations.

Numerous clinical scores have been developed to predict prognosis in AECOPD, including BAP65, APACHE II, CAPS, and the DECAF score. Among these, the DECAF score (Dyspnea, Eosinopenia, Consolidation, Acidemia, Atrial Fibrillation) has shown robust predictive value for in-hospital mortality.

Meanwhile, hypomagnesemia is increasingly recognized as a modifiable risk factor in AECOPD. Magnesium plays a vital role in smooth muscle relaxation, airway tone maintenance, and modulation of inflammatory responses. Hypoxemia during exacerbations often leads to intracellular magnesium depletion, exacerbating muscle fatigue and respiratory failure. Previous studies have indicated a correlation between low serum magnesium levels and increased

severity, longer hospital stays, and higher mortality in COPD patients.

However, comparative studies evaluating the efficacy of DECAF score versus serum magnesium levels in predicting prognosis are lacking, especially in Indian populations. This study addresses this gap by assessing and comparing the prognostic utility of both parameters in hospitalized AECOPD patients.

MATERIALS AND METHODS

This study was conducted at the Department of General Medicine, ASRAM Medical College, Eluru. A total of 100 patients admitted with AECOPD, as per GOLD 2019 criteria, were included using simple random sampling.

Inclusion Criteria:

- Age >30 years
- Confirmed AECOPD diagnosis requiring hospitalization

Exclusion Criteria:

- Coexisting respiratory illnesses (e.g., asthma)
- Significant comorbidities (e.g., CKD, CLD, malignancy)

Each patient underwent detailed clinical evaluation, laboratory investigations (CBC, ABG, serum magnesium), imaging (chest X-ray), and ECG. The DECAF score and serum magnesium levels were recorded at admission. Patients were followed for clinical outcomes including mortality, need for mechanical ventilation, and 30-day readmissions.

Statistical Analysis:

Data were analysed using SPSS v24. Chi-square and t-tests were used for comparisons. ROC curves assessed sensitivity/specificity of DECAF and magnesium levels. P-values <0.05 were considered statistically significant.

Results:

Demographics and Baseline Characteristics:

Variable	Value
Total patients	100
Mean Age (Survived)	67.7 ± 7.0 years
Mean Age (Deceased)	70.1 ± 9.2 years
Gender (Male)	70%
Gender (Female)	30%
COPD Classification	66% - GOLD D, 34% - GOLD C
Smoking History	53% Ex-smokers, 13% Current smokers

- Mean age: 68.4 years (SD ±8.1)
- Male: 70%; Female: 30%
- Majority (66%) had GOLD stage D COPD
- 53% were ex-smokers; 13% were current smokers

Mortality and DECAF Score:

DECAF Score Category	Number of Patients	Mortality (%)
0–1 (Low Risk)	17	0%
2 (Moderate Risk)	30	3.3%
≥3 (High Risk)	53	46%
P-value		<0.0001

- Overall mortality: 24%
- DECAF high risk group (>3): 53% of patients
- Mortality in DECAF ≥4: 52.4%; DECAF = 5: 100%
- Strong association between DECAF score and mortality (p<0.0001)
- DECAF was also significantly associated with need for mechanical ventilation and 30-day readmissions

Serum Magnesium:

Serum Magnesium Level	Number of Patients	Mortality (%)
>2.0 mg/dL (Normal)	28	~10%
1.0–2.0 mg/dL	50	~25%
<1.0 mg/dL (Low)	22	38.5%
P-value		<0.05

- Normal Mg (>2.0): 28%
- Moderate (1.0–2.0): 50%
- Low (<1.0): 22%
- Mortality in hypomagnesemia (<1.0 mg/dL): 38.5%. Hypomagnessemia correlated with higher mortality and need for invasive ventilation.
- Significant correlation with ventilation requirement and length of stay

Vaccination and Mortality:

Group	Mortality (%)
Vaccinated	9.1%
Unvaccinated	31.3%
P-value	0.014

ROC Analysis:

- DECAF AUC for mortality: 0.86
- Serum magnesium AUC for mortality: 0.78
- Combined use improves prognostic accuracy

Other findings:

Variable	Result
30-day readmission (total)	29.5%
Readmissions in DECAF ≥3 group	57.6%
Mechanical ventilation requirement	21% (mostly DECAF ≥4)
ABG hypoxia (PaO_2 < 60 mmHg) mortality	~45%

DISCUSSION

The findings of this study reinforce the prognostic significance of the DECAF score in AECOPD. As a composite index combining clinical, serological, and radiographic parameters, DECAF enables robust risk stratification. Mortality rates escalated sharply with increasing DECAF scores, affirming its predictive validity.

Parallel to this, serum magnesium levels demonstrated independent prognostic utility. Hypomagnesemia correlated with increased mortality and mechanical ventilation. This is consistent with previous literature, which attributes magnesium's protective role to its bronchodilatory, anti-inflammatory, and membrane-stabilizing effects.

Interestingly, the study underscores the added benefit of vaccination, with a significantly lower mortality in vaccinated patients. This supports existing recommendations for influenza and pneumococcal vaccination in COPD populations.

While DECAF remains a validated scoring tool, serum magnesium offers a simple, inexpensive biomarker that can complement clinical judgment. Together, these parameters can guide early triage decisions, identify patients requiring intensive care, and potentially reduce adverse outcomes.

LIMITATIONS

This single-center study has limited generalizability. Serial monitoring of serum magnesium and long-term outcomes was not performed. Future multicentric trials with larger cohorts are warranted.

CONCLUSION

Both DECAF score and serum magnesium levels at admission are significant, independent predictors of prognosis in AECOPD. DECAF excels in structured clinical risk assessment, while serum magnesium offers metabolic insight into disease severity. Incorporating both into clinical practice could improve patient outcomes through early risk stratification and targeted intervention.

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