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DECAF score at admission as a tool to predict clinical outcome in acute exacerbation of COPD

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ABSTRACT

Background: The Dyspnea, Eosinopenia, Consolidation, Acidemia, and Atrial Fibrillation (DECAF) score at presentation is designed to predict the risk of death in patients with chronic obstructive pulmonary disease (COPD). **Aims and Objectives:** To study the DECAF score at admission to predict the clinical outcome of the patients during hospitalization for acute exacerbation of COPD (AE-COPD). **Materials and Methods:** The study was conducted using a prospective cross-sectional observational study design in a tertiary care center in South India from April 2022 to March 2023. Patients were recruited based on specific inclusion and exclusion criteria. The data corresponding to the five variables of the DECAF score was obtained, and the relation to outcome measures such as survival, ventilation, and duration of stay was measured. **Results:** Two hundred consecutive patients were assessed. Based on the DECAF score, 102 patients (51%) were classified as low-risk, and this group had no mortalities. In the intermediate-risk group, the mortality rate was 7.4%; in the high-risk group, the observed mortality rate was 38.6%. The differences noted were significant statistically. Higher dyspnea grade as measured by extended Modified Research Council criteria was related to DECAF score was significant and with the outcome. **Conclusion:** Our study shows that the DECAF score at the initial presentation can be used as a reliable tool to predict the outcome of AE-COPD. Dyspnea grading can be used to predict mortality indirectly.

Key words: Chronic obstructive pulmonary disease; Dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation; Acute exacerbation; Survival

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a common, preventable, and treatable disease characterized by persistent respiratory symptoms and airflow limitation due to airway or alveolar abnormalities.[1] COPD is the fourth-most leading cause of death, next to ischemic heart disease, cerebrovascular disease, and malignancy, with about three million deaths worldwide (5.1%).[2] COPD was the second leading cause of disease burden in India,[3] contributing 8.7% (7.8–9.5) of the total death and 4.8% (4.3–5.3) of the total DALY. The number of COPD cases in India increased to 55.3 million (53.1–57.6) in 2016 from 28.1 million (95% UI 27.0–29.2) in 1990.[4]

Acute exacerbation of COPD (AE-COPD) is an acute event characterized by worsening of the patient's respiratory symptoms that is beyond normal day-to-day variation and leads to changes in medication.[5,6] The various triggering factors for AE-COPD are infections (75%), environmental pollution (10%), and unknown (15%).[7] The in-hospital mortality during acute exacerbation ranges from 11% to 24%.[8] The mortality rate at the end of 1 year following the AE-COPD ranges from 23% to 43%.[9]

There is no specific biological marker to predict prognosis, and the outcome after clinical measures predicts AE-COPD. One measure that is used is the Dyspnea, Eosinopenia, Consolidation, Acidemia, and Atrial Fibrillation (DECAF)

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score.[10] The current study aims to validate the DECAF score at admission as a tool to predict the clinical outcome of the patients during hospitalization for AE-COPD.

Aim and objectives

To study the role of DECAF score in the prediction of clinical outcome of patients hospitalised for AE-COPD. To study the association between DECAF score and outcome variables like mechanical ventilation and duration of hospital stay.

MATERIALS AND METHODS

This prospective cross-sectional observational study was conducted in the Department of General Medicine and Thoracic Medicine in a tertiary care center from April 2022 to March 2023. Two hundred patients were included in the study after getting informed written consent.

The criteria for COPD were age >30 years, history of smoking >10 pack years or history of exposure to smoke, air pollution, occupational exposure to allergens, and definite evidence of airflow obstruction (irreversible with bronchodilators) on spirometry characterized by reduced forced expiratory volume at 1st s/forced vital capacity <0.70.

The criteria for AE-COPD were patients who fulfilled the above-mentioned primary criteria for COPD and were admitted with an AE-COPD characterized by the limitation of activity, worsening of dyspnea, and other respiratory symptoms beyond the normal day-to-day variations.

Inclusion criteria

Patients admitted with a diagnosis of acute COPD exacerbation and age >30 years were included.

Exclusion criteria

Age <30 years, primary diagnosis of asthma, acute asthma, patients with other respiratory illnesses, tuberculosis sequelae, bronchiectasis, lung abscess, interstitial lung disease, pneumothorax, congestive cardiac failure, COPD with other significant associated illnesses such as malignancy, chronic liver disease, chronic kidney disease and those patients not willing to participate in the study were excluded.

The data corresponding to the five variables of the DECAF score were dyspnea scoring by extended Modified Research Council (eMRCD) grade, absolute eosinophil count for eosinopenia, chest radiograph for consolidation, arterial blood gas for acidemia, and electrocardiogram for atrial fibrillation which was assessed at admission. Grade 5 dyspnea was further divided into groups 5a and 5b. Patients with DECAF scores of 0–1 are categorized as low risk, 2 as intermediate risk, and 3–6 as high risk. The patients were followed up during the treatment course in the hospital. The clinical outcome was categorized as improved, death, or status quo, where patients left the hospital prematurely and could not be assessed.

Statistical analysis

Statistical analysis was done using SPSS Statistical Analysis software version 23.

RESULTS

Among 200 patients, the age ranged from 31 to 82 years, with a mean age of 59 years, and the study population consisted of 162 males (81%) and 38 females (19%). In the DECAF score distribution, 102 were classified as low risk, 54 as moderate risk, and 44 as high risk (Table 1).

The in-hospital mortality was 10.5%. 172 (86%) of patients improved throughout treatment (Table 2).

Mortality was higher among older individuals. Cross-tabulation was found to be statistically significant, with a P=0.01. Though the mortality rate was slightly higher in males, it was statistically insignificant, with a P=0.233.

In our study, dyspnea severity was assessed with the eMRCD dyspnea scale. Among the 91 patients who were

Table 1: Demographic and clinical data

Label	Category	Frequency (%)
Gender	Male	162 (81)
	Female	38 (19)
Age group (years)	30–40	7 (3.5)
	41–50	45 (22.5)
	51–60	59 (29.5)
	61–70	53 (26.5)
	71–80	32 (16)
	>81	4 (2)
eMRCD grade	<4	91 (45.5)
	5a	69 (34.5)
	5b	40 (20)
Eosinopenia	No	185 (92.5)
	Yes	15 (7.5)
Consolidation	No	141 (70.5)
	Yes	59 (29.5)
Acidemia	No	148 (74)
	Yes	52 (26)
Fibrillation	No	192 (96)
	Yes	8 (4)
DECAF score	0–1	102 (51)
	2	54 (27)
	3–6	44 (22)
Need for ventilation	No	160 (80)
	Yes	40 (20)
Duration of hospital stay (days)	<5	93 (46.5)
	6–10	58 (29)
	11–15	43 (21.5)
	>16	6 (3)

DECAF: Dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation, eMRCD: Extended modified research council

classified as grade 1–4, there was no mortality. Among the 69 patients belonging to grade 5a, six patients (8.7%) died despite care. Among the 40 patients belonging to grade 5b, 15 patients (37.5%) died in the hospital (Table 3). More severe dyspnea grade was associated with a significantly higher risk of in-hospital mortality. The requirement of mechanical ventilation in a group of patients with dyspnea grades 1–4 was 0, whereas the requirement in groups 5a and 5b was 24.6% and 57.5%, respectively. Further, the correlation between the dyspnea severity, hospital stay duration, and need for mechanical ventilation was also statistically significant.

Among the 200 patients, eosinopenia was found in 15 patients. Out of the 15 patients, 10 (66.7%) improved, 3 (20%) died, and 2 (13.3%) were status quo. Among the 185 patients without eosinopenia, 18 (9.7%) died. The association between eosinopenia and mortality was statistically significant, with a P=0.037 (<0.05). Further, the mortality rate among the 148 patients without consolidation was 5 (3.4%). Among the 52 patients with consolidation, 31 (59.6%) improved, 16 (30.8%) died, and 5 (9.6%) could not be followed up. This association between consolidation and clinical outcome was statistically significant.

Furthermore, among 200 patients, 52 (26%) had respiratory acidosis at admission. Out of 52, 16 were dead (30.8%), 31 improved (59.6%), and 5 patients (9.6%) outcomes could not be followed up. The association between academia and the clinical outcome was statistically significant.

The mortality rate among the 192 patients without atrial fibrillation was 18 (9.4%). Among the eight patients with atrial fibrillation, 5 (62.5%) improved, and 3 (37.5%) died. Atrial fibrillation was clinically correlated with the outcome with a P=0.037 (<0.05), which was statistically significant (Table 3).

Of 200 patients, 102 fall under the low-risk category, 54 as intermediate (DECAF score 2), and 44 as high risk (DECAF score 3–6). The mortality rate in the low-risk category was 0%. In the intermediate risk group with a DECAF score of 2, the mortality rate was 7.4%. In the high-risk category with DECAF scores of 3–6, the mortality rate was 38.6%. The association between the DECAF score and outcome was significant (Table 4).

The need for mechanical ventilation in the low-risk category was 2 (2%), among the 54 patients in the intermediate category was 12 (22.2%), and among the 44 patients in the high-risk category was 26 (59.1%). The association between the DECAF score and the need for mechanical ventilation was statistically significant (Table 5).

Table 2: Age and treatment outcome

Outcome	Frequency (%)	Number of patients	Mean age	SD	P-value
Improved	172 (86)	172	57.88	11.31	0.012
Status quo	7 (3.5)	7	64.57	10.39	
Died	21 (10.5)	21	64.81	10.71	
Total	200 (100)	200	58.84	11.42	

SD: Standard deviation

Table 3: Association of DECAF variables and outcome

DECAF Variable	Outcome				P-value
	Improved (%)	Status quo (%)	Died (%)	Total (%)	
eMRCD grade					
<4	91 (100)	0	0	91 (100)	<0.0001
5a	63 (91.3)	0	6 (8.7)	69 (100)	
5b	18 (45)	7 (17.5)	15 (37.5)	40 (100)	
Eosinopenia					
0.00	162 (87.6)	5 (2.7)	18 (9.7)	185 (100)	0.037
1.00	10 (66.7)	2 (13.3)	3 (20)	15 (100)	
Consolidation					
0.00	137 (97.2)	1 (0.7)	3 (2.1)	141 (100)	<0.0001
1.00	35 (59.3)	6 (10.2)	18 (30.5)	59 (100)	
Acidemia					
0.00	141 (95.3)	2 (1.4)	5 (3.4)	148 (100)	<0.0001
1.00	31 (59.6)	5 (9.6)	16 (30.8)	52 (100)	
Fibrillation					
0.00	167 (87)	7 (3.6)	18 (9.4)	192 (100)	0.037
1.00	5 (62.5)	0	3 (37.5)	8 (100)	

eMRCD: Extended modified research council

On cross-tabulation between the DECAF score and the duration of hospital stay, the severe category with DECAF score 3–6 was found to have a longer duration of hospitalization. This clinical correlation was statistically significant, P<0.0001 (Table 6).

DISCUSSION

In our study, out of 200 patients, 19% were female, and the percentage of female patients in the studies involving the Western population ranges from 42% to 53%. This discrepancy is due to the decreased prevalence of smoking among Indian women. In a study, Steer et al.[10] found a significant difference in the outcome and prognosis between groups 5a and 5b. This difference is brought out in our study also.

Eosinopenia was present in 15 patients (7.5% of the study population). Among the 15 patients with eosinopenia, 20% died in the hospital. The association was statistically significant, with a P=0.037 (<0.05). Similarly, in a Biradar et al. study, eosinopenia patients showed poor outcomes of long-duration hospital stays, increased need for mechanical ventilation, and higher mortality risk.[11] Consolidation was found to be present in 29.5% of the study population. Acidemia is slightly higher than in other studies, ranging from 19% to 20%.[11,12] The prevalence of atrial fibrillation in our population was 4.0%, and this was lower than that presented in the study by Steer et al.[10]

Table 4: Association of DECAF score and outcome

DECAF score	Outcome			P-value
	Improved (%)	Status quo (%)	Died (%)	
<1	102 (100)	0	0	<0.0001
2	50 (92.6)	0	4 (7.4)	
3–6	20 (45.5)	7 (15.9)	17 (38.6)	

DECAF: Dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation

Table 5: Association of DECAF score and ventilation

DECAF score	Ventilation			P-value
	Not required	Required	Total	
<1	100 (98)	2 (2)	102	<0.0001
2	42 (72.8)	12 (22.2)	54	
3–6	18 (10.9)	26 (59.1)	44	

DECAF: Dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation

The overall mortality in each group by DECAF score was 0%, 7.4%, and 38.6%. This is similar to previous studies that reported that mortality was 1.4% in low-risk patients, 8.4% in the intermediate-risk group, and 34.6 % in high-risk patients.[10]

The differences in mortality between the dyspnea grades were statistically significant. This finding is consistent with previous studies in which the in-hospital mortality of the patients in grade 5b was 33.1%.[10] Dyspnea score was also associated with a greater need for ventilation and longer hospital stays. Dyspnea score correlated with DECAF score also. Thus, the severity of the dyspnea grade may be taken as the indirect measure of a higher DECAF score and outcome. Dyspnea leads to worse outcomes through a higher risk of complications such as consolidation, respiratory failure, and pulmonary hypertension.

Ventilation is associated with decreased survival and longer stays. The need for ventilation was associated with higher scores for dyspnea, eosinopenia, and higher DECAF scores at admission. This is similar to the findings of previous studies.[12]

In our study, the distribution frequency of DECAF scores among our study population as low, intermediate, and high risk was 51%, 27%, and 22%. The frequency of ventilator requirement was 20%. Out of 200 patients, the total in-hospital mortality is 10.5% in our study population. The in-hospital mortality in the study conducted by Steer et al. is 10.43%, [11] which is similar to our study. In a study reported by Huang et al., the DECAF score is an effective and possible predictor for short-term mortality.[13] These reports were similar to our study. The DECAF score was also associated with the need for ventilation and longer stay, as previously reported.

Limitations of the study

The study's major limitation is the small sample size, and a study in a large population is required. There is no specific randomization in the patients.

Table 6: Association of DECAF score and hospital stay

DECAF score	Hospital stay				P-value
	<5	6–10	11–15	>16	
<1	83 (81.4)	18 (17.6)	1 (1)	0	<0.0001
2	10 (18.5)	19 (35.2)	24 (44.4)	1 (1.9)	
3–6	0	21 (47.7)	18 (40.9)	5 (11.4)	

DECAF: Dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation

CONCLUSION

Our study was conducted to validate the DECAF score at presentation as a tool to predict the clinical outcome in AE-COPD. On statistical analysis, the higher the DECAF score, the higher the mortality, the longer the hospital stay, and the higher the need for mechanical ventilation. Dyspnea grade can be considered an indirect marker of higher DECAF scores. The DECAF score is a simple bedside tool that can be applied to patients admitted with AE-COPD to assess the in-hospital prognosis. It contains easily available parameters and, therefore, can be universally adopted. Measuring the DECAF score in patients with AE-COPD at initial presentation helps us stratify the low-risk and high-risk patients, provide intensive care for high-risk patients, determine the need for mechanical ventilation, and predict the patient's prognosis.

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