Section: General Medicine

Original Research Article

EVALUATION OF THE DECAF SCORE FOR PROGNOSTIC ASSESSMENT IN PATIENTS WITH ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE AT A TERTIARY CARE HOSPITAL IN NORTHERN KERALA

Hibu Geev Joseph[1], Mahesh Jayadharan[1], Joel Thomas[1], Ranjit Kumar K.C.[2]

[1]Junior Resident, Department of General Medicine, Govt Medical College, Kannur, Kerala, India
[2]Professor, Department of General Medicine, Govt Medical College, Kannur, Kerala, India

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Corresponding Author:
Dr. Hibu Geev Joseph
Junior Resident, Department of General Medicine
Govt Medical College Kannur
Email: hibu.joseph@gmail.com

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is the fourth most frequent cause of death. In patients getting admitted with acute exacerbation of COPD (AECOPD), identifying simple, immediately accessible, and strong prognostic indicators will aid in management decision. The objective is to assess the DECAF score as an optimal clinical tool for accurate In- hospital prognostication of patients admitted with acute exacerbation of chronic obstructive pulmonary disease.

Materials and Methods: A hospital based prospective study was performed on 100 patients admitted with primary diagnosis of AECOPD, in the wards of Government Medical College, Kannur during the period between July 2019 to July 2020. 100 consecutive patients were recruited, no randomization was done. Data was collected as per the well- structured proforma, after obtaining informed consent. Patients were scored according to the DECAF scoring system – Dyspnea, Eosinopenia, Consolidation, Acidemia and atrial Fibrillation. The patients were regularly followed during the entire hospital stay. The clinical outcome was categorized as a) improved b) status quo c) mortality. The role of DECAF score in predicting in-hospital outcome was analysed statistical software package SPSS, version 20.0.

Results: Out of 100 patients studied, 51 patients had DECAF score between 0-1 (low risk), 16 patients had a DECAF score of 2 (Intermediate risk) and 33 patients had a DECAF score between 3-6 (high risk). In the high-risk group (DECAF 3-6) there was significantly higher mortality, longer duration of hospital stay and increased need for use of ventilator.

Conclusion: The DECAF score incorporates indices routinely available at the time of admission and helps to stratify patients admitted with AECOPD into clinically relevant risk groups. This aids the physician in taking management decisions.

Keywords: Acute Exacerbation of Chronic Obstructive Pulmonary Disease; DECAF score; Prognosis.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a preventable and treatable disease that causes breathlessness, chronic sputum production and cough. The World Health Organization report,[1] defines COPD as a lung disease characterized by chronic obstruction of lung airflow that interferes with normal breathing and is not fully reversible. According to the 2017 Global Initiative for Chronic Obstructive Lung Disease (GOLD) executive report,[2] in 2016, there were 251 million cases of COPD in the world and it is estimated that COPD causes 3.15 million deaths worldwide per year,

COPD is also the 3rd leading cause of death globally and is highly prevalent in low-income countries. The report also lists exposure to tobacco smoke and other inhaled toxic particles and gases as the main risk factors for COPD. Recent research has also identified that perinatal factors and suboptimal lung growth before and after birth can also increase the risk of COPD later in life.[3]

The disease has a large economic and social burden which is progressively worsening as the population grows. COPD which was ranked sixth as a cause of death in 1990, has become the third leading cause of death in 2020.[4] This worsening scenario is in a large part due to burgeoning trend of smoking, increasing life expectancy and reduced mortality from Old World diseases.

Acute Exacerbation of COPD (AECOPD) is an acute worsening of the patient's symptoms that is beyond usual day to day variations and requires a change in medication. Exacerbations accelerate the rate of decline of lung function and are associated with significantly high mortality.[5]

AECOPD have a negative influence on the natural progression of the disease. Roughly one to four decompensation episodes occur in a year, these episodes lead to great healthcare and financial burdens. In a COPD patient 10 out of 100 times medical admissions are for an exacerbation episode and around 2% of all emergency department visits are due to exacerbations, almost 60% of the economic burden of the disease is related to exacerbation episodes, especially severe acute exacerbations needing hospitalisation.[6]

Currently, a diagnosis of AECOPD is mainly based on clinical presentation of increasing dyspnoea, increasing cough or alteration of sputum. A panel of biomarkers are yet to be identified for diagnosing an exacerbation. Similarly, sufficient clinical data does not exist to determine the adequate duration of hospitalisation in these patients. Multiple prognostic indices related to higher death rates in COPD like Forced Expiratory Volume in one second,[7] J Steer et al,[8] developed a simple prognostication tool in acute exacerbation of COPD – the DECAF score that will help in deciding location of care early stepping up of care and anticipation of need for ventilatory support. It helps the physician in informing the relatives and patients on prognosis and risks associated with exacerbations. Thus, it will help in directing the most efficient use of resources and thereby reducing health care costs, mortality and morbidity.

MATERIALS AND METHODS

The study was a non-randomized hospital based prospective study No specific intervention was carried out. No specific method of randomisation was used. No controls were used in the study. The study was conducted at a tertiary care institute – Government Medical College Kannur, Pariyaram, Kerala, India. The study was conducted over a period of one year from July 2019 to July 2020.

Sample Size:

Based on Prevalence

n = 4 p x q Where, p= prevalence of disease

d2 q= 1- prevalence of disease

d= absolute precision = 5% Confidence level = 95%

As per studies by Jindal S.K. et al, Prevalence, p = 6.5,[9] so, n = 4 x 6.5 x 93.5

25

n= 97.24

Sample size was taken as 100.

Consecutive sampling, No randomization

Patients admitted to Government Medical College Kannur with symptoms of acute exacerbation of Chronic Obstructive Pulmonary Disease (COPD) were selected.

A patient was diagnosed,[2] to have AECOPD if

1. Age was above 35 years and
2. History of exposure to risk factors
   - Smoking history of >10 cigarette pack
   - Smoke from home cooking and heating fuels
   - Occupational dusts and chemicals and
3. Spirometric evidence of airflow obstruction PLUS presence of any one of the following
   - Worsening of dyspnea above normal day to day variations
   - Increased quantity of sputum production
   - Increased purulence of sputum

Inclusion Criteria

- Patients admitted with primary diagnosis of acute exacerbation of chronic obstructive pulmonary disease
- Age ≥ 35 years

Exclusion Criteria

1. Patients in whom the primary reason for admission was other than acute exacerbation of COPD was excluded from the study. Hence patients with the following diseases were excluded from our study
   - Bronchial Asthma-acute exacerbation
   - Bronchiectasis-infective exacerbation
   - Interstitial Lung Diseases-exacerbation
   - Lung cancer
   - Pneumothorax
   - Congestive cardiac failure
   - Acute on chronic decompensated liver disease
   - Acute on chronic decompensated renal disease
   - Psychiatric illness

All these exclusion criteria were left to the clinician's discretion in order to ensure that the real-life nature of the study is respected.

2. Readmitted patients who were already previously included in the study.

Data Collection

The following were assessed in our study in patients with Acute Exacerbation Chronic Obstructive Pulmonary Disease (COPD)

- Socio-demographic and clinical data
- Details of comorbidity
- Complete blood count and absolute eosinophil count at admission
- Arterial blood gas results at admission
- Chest radiograph

- Electrocardiogram

Study Procedure: 100 consecutive patients admitted with the diagnosis of acute exacerbation of COPD satisfying our inclusion and exclusion criteria during the study period were included. Socio-demographic and clinical data of the study subjects were collected on admission. Details of comorbidity were obtained from the clinical notes. Complete blood count, absolute eosinophil count and arterial blood gas results performed at the time of admission were recorded. Chest radiograph was assessed by the treating physician to look for new consolidation. The presence of atrial fibrillation was confirmed by ECG at the time of hospital admission. The patients were daily followed up during the entire hospital stay. Treatment was individualised for each patient. The investigator did not interfere with the treatment. Patients were scored according to the DECAF scoring system.

DECAF score

Variable		Score
Dyspnea Grade (eMRCD)	5a	1
	5b	2
Eosinopenia		1
Consolidation		1
Acidemia		1
Atrial Fibrillation		1
Total		6

The clinical outcome was categorised as a) improved b) status quo c) mortality. "Improved" was clinically defined as subjective sense of improvement and objective improvement in dyspnoea scoring. "Status quo" refers to patients who get discharged against medical advice and whose clinical condition at the time of discharge did not fit into the other two groups. Length of hospital stay in days and need for ventilator was also collected.

Statistical Analysis: The data was entered in Excel spread sheet. Categorical and quantitative variables were expressed as frequency (percentage) and mean ± SD respectively. Chi-square test was used to association of score with selected variables. For all statistical interpretations, $p<0.05$ was considered the threshold for statistical significance. Statistical analyses were performed by using a statistical software package SPSS, version 20.0

RESULTS

The age group of our patients in our study ranged from 38 to 82. The mean age of the study population was 61.3 with a Standard Deviation of 9.95. Out of the 90 patients in the study, 90 are male and 10 are female. Thus, males accounted for 90% of our study population while females accounted for 10%. Out of 100 patients included in the study 24 patients had cor pulmonale as evidenced on echocardiography. Out of them 10 patients had mild pulmonary hypertension (PHT), 2 patients had moderate PHT, 12 patients had severe PHT.

Table 1: Age and Gender wise distribution.

Age	50 and below	18
	51 - 60	29
	61 - 70	34
	Above 70	19

Table 2: DECAF score.

DECAF Score	0	37	37.0%
	1	14	14.0%
	2	16	16.0%
	3	13	13.0%
	4	14	14.0%
	5	6	6.0%

DECAF Score Groups	Count	Percentage %
0 – 1 (low)	51	51.0%
2 (intermediate)	16	16.0%
3 – 5 (high)	33	33.0%

Each patient was scored using DECAF score – where dyspneae MRC grade 5a gets 1 point, dyspneae MRC grade 5b gets 2 points, other parameters, namely Eosinopenia, Consolidation, Acidemia, Atrial Fibrillation get 1 point each. We divided the population into three groups namely low risk, intermediate risk and high risk with the groups getting DECAF score of 0-1, 2 and 3-6 respectively.

Table 3: Age vs Mortality and Improved Outcomes

Age Groups	Outcome				p value
	Mortality		Improved		
	Count	Percent	Count	Percent	.012 (Significant)
50 and below	1	5.6%	17	94. %	
51 - 60	7	25.9%	20	74. %	
61 - 70	1	3.1%	31	96. %	
Above 70	6	31.6%	13	68. %	

Outcomes in various age groups were analysed. Age showed a statistically significant association with mortality, $p < 0.05$ ($p = 0.012$).

Table 4: Gender vs Use of Ventilator

Gender	Use of ventilator				p-value
	No		Yes		
	Count	Percent	Count	Percent	0.405 (NS*)
Female	9	90.0%	1	10.0%	
Male	71	78.9%	19	21.1%	

Gender did not have a statistically significant association with use of ventilator in the study population.

Table 5: Cor-pulmonale vs Mortality and Improved Outcomes

Cor- pulmonale	Outcome				p-value
	Mortality		Improved		
	Count	Percent	Count	Percent	0.000 (HS*)
Absent	6	8.1%	68	91.9%	
Present	9	40.9%	13	59.1%	

The mortality among patients with cor-pulmonale is 40.9% (9/22). The mortality among patients without corpulmonale is 8.1% (6/74). Hence, patients having cor- pulmonale and pulmonary hypertension had higher mortality, this association is statistically significant at p=0.000.

Table 6: DECAF Score vs Outcome

Outcomes	DECAF Scores						p-value
	0 - 1		2		3 - 5		
	Count	Percent	Count	Percent	Count	Percent	0.000 (HS*)
Improved	51	63.0%	15	18.5%	15	18.5%	
Mortality	0	0.0%	0	0.0%	15	100.0%	
Status quo	0	0.0%	1	25.0%	3	75.0%	

The DECAF score is strongly associated with outcome. There is no mortality in the in patients with Low or intermediate DECAF score (between 0-2). The mortality rate for patients getting score of 3-5 is 15 out of 33 (45%). The higher is the DECAF score, the higher is the mortality. This relation is statistically highly significant at p=0.000.

Table 7: DECAF Score vs Hospital Stay

Duration of hospital stay	DECAF Scores						p-value
	0 - 1		2		3 - 5		
	Count	Percent	Count	Percent	Count	Percent	0.000 (HS*)
< 5	29	87.9%	0	0.0%	4	12.1%	
> 10	1	4.3%	6	26.1%	16	69.6%	
5 - 10	21	47.7%	10	22.7%	13	29.5%	

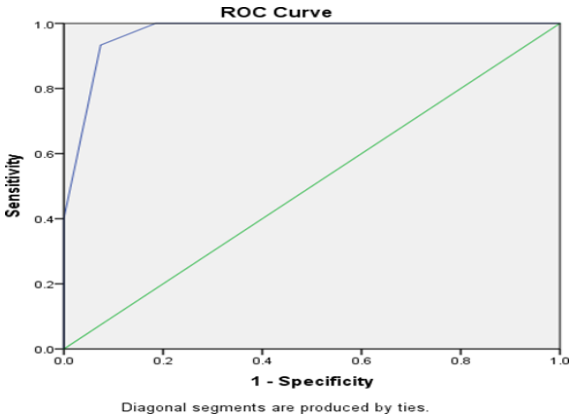

Figure 1- ROC Curve

The average duration of hospital stays for the low to intermediate risk group (DECAF 0-2) was 6.2. Whereas the average duration of hospital stays for the high risk group (DECAF 3-6) is 9.8. The higher is the DECAF score, the longer is the hospital stay. This association between the DECAF score and in-hospital stay is statistically significant at p=0.000

The area under the curve was calculated to be 0.972 (95% confidence interval is 0.943 to 1.0). The value can be considered to be having agood level of discrimination. From the above ROC curve, a cut-off value for DECAF Score of more than 3 has a sensitivity of 93.3% and a specificity of 92.6%. Hence, the DECAF Score can be used as a highly

accurate prognostic tool for accessing in-hospital mortality in our population.

DISCUSSION

This hospital based cross- sectional and observational study for assessing the prognostic value of DECAF score was performed on a total of 100 patients admitted in GMC Kannur, with a primary diagnosis of Acute Exacerbation of Chronic Obstructive Pulmonary Disease (AECOPD).

In the present study, the age of the sample patients ranged from 39 years to 82 years, with a median age of 61.5 and a standard deviation of 9.78. This kind of distribution is consistent with the well-established fact that age is an important risk factor for COPD.[10] However, on the other hand, the number of patients above the age of 80 was only 1, which could be explained by the fact that elderly patients were more likely to have multiple co-morbidities and patients with breathlessness of multiple aetiology were excluded from the study.

Large majority (90%) of the study population was male, this is consistent with studies done by Indian researchers,[11] this has been hypothesized to be due to the fact that smoking is relatively rare among Indian females when compared to the West. Another postulation is that there is a gender-bias when making a diagnosis of COPD, and women are less likely to be offered spirometry evaluation and are also more likely to be diagnosed as asthma.[12] The main reason for females developing COPD in our country is attributed to passive smoking, fuel smoke exposure and post tuberculosis.

Cor pulmonale is defined as "altered structure and/or function of the right ventricle in the context of chronic lung disease and is triggered by the presence of pulmonary hypertension".[13] Out of 100 patients included in the study 24 patients had cor pulmonale as evidenced on echocardiography. Out of them 10 patients had mild pulmonary hypertension (PHT), 2 patients had moderate PHT, 12 patients had severe PHT. This is consistent with recent studies,[14] that have reported similar prevalence, they also report that pulmonary hypertension in COPD is the result of hypoxic pulmonary vasoconstriction, polycythemia, destruction of the pulmonary vascular bed by hyperinflation and endothelial dysfunction.

Out of 100 patients studied, 51 patients had a DECAF score between 0-1 (low risk), 16 patients had a DECAF score of 2 (intermediate risk) and 33 patients had a DECAF score between 3-6(high risk). In terms of percentage this is 51%, 16% and 33% respectively. This is consistent with the study by J.Steer et al,[8] in which the low risk group comprised 53.5% of the study population, intermediate risk group comprised 24.5%of the study population, high risk group comprised 22% of the study population. This shows that in each population getting admitted with AECOPD, low risk group outnumber the high risk patients. This may be because these patients approach health care facilities early during the course of exacerbation. The DECAF score comprising the five variables – Dyspnea, Eosinopenia, Consolidation, Acidemia, atrial Fibrillation is strongly associated with outcome. There is no mortality in the in patients with DECAF score between 0-2. The mortality rate for patients getting score of 3 and above is 15 out of 33. In terms of percentage this is 45.3%. The higher is the DECAF score, the higher is the mortality. This relation is statistically significant at p=0.000. Our study agrees with the findings by J Steer et al.[8] In their study involving 920 AECOPD patients, the strongest five categorical variables strongly associated with in-hospital mortality were selected and the DECAF score devised. They reported that in DECAF 0-1 the in hospital mortality was 1.4%, in DECAF 2 mortality was 8.4%. and in DECAF 3-6 the mortality was 34.6%.

The area under DECAF score ROC curve for predicting in hospital mortality was 0.972 (95% confidence interval is 0.943 to 1.0). The value can be considered to be having a good level of discrimination. A cut-off value for DECAF Score of more than 3 has a sensitivity of 93.3% and a specificity of 92.6%. Hence patients with DECAF Score of 3-6 can be considered to be having a high risk of in-hospital mortality. These findings are consistent with those of J Steer et al,[8] which reported AUROC of 0.83 (95% CI 0.78 to 0.87), and 73% sensitivity and 78% specificity with cut-off score of 3.

The major limitations of our study are:

1. Lack of post hospital follow up data, which would be necessary for validation of predictive factors found in the present study.
2. The number of female patients enrolled in the study was quite small, lesser than that expected. However, since consecutive patients were recruited, this has to be considered as corresponding to what occurs in the real-life setting.

CONCLUSION

The DECAF score is a simple clinical tool for assessing in-hospital prognosis in patients admitted with acute exacerbation of Chronic Obstructive Pulmonary Disease. This scoring system incorporates indices routinely available and can stratify patients admitted with AECOPD into clinically relevant risk groups.

Hence assessing the DECAF score at the time of admission in AECOPD helps in decision regarding:

1. Early escalation of care
2. Deciding the location of treatment – Intensive care or ward
3. Determining the need for use of ventilator
4. Deciding on end-of-life care
5. Helps the physician in informing the patient and relatives regarding the prognosis and exacerbation related short term risks.

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