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The Decaf score: prognostication scoring system for Patients Presents with Acute exacerbation of chronic obstructive pulmonary disease to Emergency Medicine department of tertiary Care Hospital

Dr. Prabhu P, Dr. Bharath K and Dr. Brinda B

Abstract
The DECAF Score: Prognostication Scoring System for Patients Presents to ED with Acute Exacerbations of Chronic Obstructive Pulmonary Disease.
Introduction: Chronic obstructive pulmonary disease (COPD) is the fourth most frequent cause of death. In patients presenting to ED with acute exacerbation of COPD (AECOPD), identifying simple, immediately accessible and strong prognostic indicators will aid in management decision.
Aim of The Study: To assess the DECAF score as an optimal clinical tool for accurate prognostication of patients presenting to ED with acute exacerbation of chronic obstructive pulmonary disease.
Materials and Methods: 50 patients with primary diagnosis of AECOPD were included. Patients were scored according to the DECAF scoring system-Dyspnea, Eosinopenia, Consolidation, Acidemia and atrial Fibrillation. The patients were 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 outcome was analysed. Study period: 1 year June 2018-July 2019.
Conclusion: The DECAF score incorporates indices routinely available and helps to stratify patients admitted with AECOPD into clinically relevant risk groups. It aids the emergency physician in taking management decisions and triaging.

Keywords: Acute exacerbation of chronic obstructive pulmonary disease, DECAF score, prognosis

Introduction
COPD is a common cause of morbidity and mortality worldwide. COPD is the fourth most frequent cause of death after Ischemic heart disease, cerebrovascular disease and Malignancy. The disease which is ranked sixth as a cause of death in 1990, will become the third leading cause of death in 2020 [1]. Exacerbations and comorbidities contribute to overall severity in Patients [2]. In patients presenting with hypercapnic exacerbations, the death rate is around 10% [3].

Acute Exacerbation of COPD (AECOPD) is an acute event characterised by worsening of patient's symptoms that is beyond normal day to day variations and leads to a change in medication. Exacerbations accelerate the rate of decline of lung function and are associated with significantly high mortality [4]. Prognostic tools derived for disease have not been studied on patients requiring hospitalization. Prognostic research in exacerbations needing hospitalization has been limited. There seems to be considerable difference in prognostic factors in acute exacerbation and stable COPD. There is need for identifying simple, easy to use, easy to obtain but strong predictors of patients coming with AECOPD. Roche *et al*. [5] studied COPD patients visiting emergency department due to exacerbation. None of these studies provided a simple prediction tool to aid in management decisions.

J Steer *et al*. [6] developed a simple prognostication tool in acute exacerbation of COPD-the DECAF score, which 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 mortality and morbidity.

The strongest five categorical variables selected and relative weights assigned according to regression co-efficient. Thus Dyspnea [7], Eosinopenia [8], Consolidation [9], Acidemia [10]

and Atrial fibrillation [11, 12]. The DECAF score was developed. 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 hospitalization [13].

Aims and objectives

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.

Study design

This prospective study was conducted in an ED of a tertiary care hospital during a period of 1 year.

Materials and methods

50 patients with primary diagnosis of AECOPD were included.

Patients were scored according to the DECAF scoring system-Dyspnea, Eosinopenia, Consolidation, Acidemia and atrial Fibrillation.

The patients were 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 outcome was analysed.

Table 1: The DECAF Score

Variable	Score
Dyspnea	
eMRCD 5a	1
eMRCD 5b	2
Eosinopenia (<50cellsinun3)	1
Consolidation	I
Acidemia (pH <7.3)	1
Atrial fibrillation	1
Total score	6

DECAF: Dyspnea according to eMRCD, extended MRC dyspnea, Eosinopenia, Consolidation, Acidemia and atrial Fibrillation.

Inclusion criteria

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

Exclusion criteria

1. Patients in whom the previously diagnosed as COPD came with AECOPD other than acute exacerbation of COPD were 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 of these exclusion criteria were left to the clinician's discretion in order to ensure that the real life nature of the study was respected.

Results

Age distribution

A total of 50 patients were included in our study as per our patient selection methods, inclusion and exclusion criteria. The age group of our patients in our study ranged from 35 to 80. The mean age of the study population was 53.4 with a standard Deviation of 11.4. The number of patients in the age groups ≤40, 40-50, 50-60, 60-70, 70-80, >80 were 8 (16%), 14 (28%), 13(26%), 13 (26%), 2(4%) respectively.

Table 2: Distribution of cases according to age

Age (YRS)	N	%
31-40	8	16
41-50	14	28
51-60	13	26
61-70	13	26
>70	2	4
Total	50	100

Descriptive Statistics	Minimum	Maximum	Mean	SD
Age (YRS)	35	80	53.4	11.4

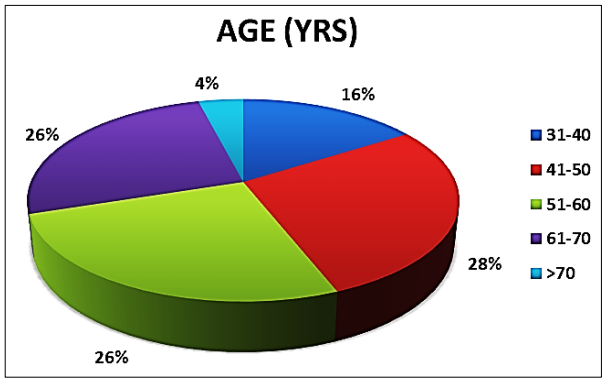

Fig 1: Distribution of cases according to age

Table 3: Distribution of cases according to comorbidity

Comorbidity	N	%
DM	27	54
Hypertension	19	38
CKD	2	4
IHD	2	4

In the study population. The most common comorbidity among the study population is diabetes mellitus. Among 'others' 2 patients had coronary artery disease, 2 patients had CKD, 19 patients had HTN.

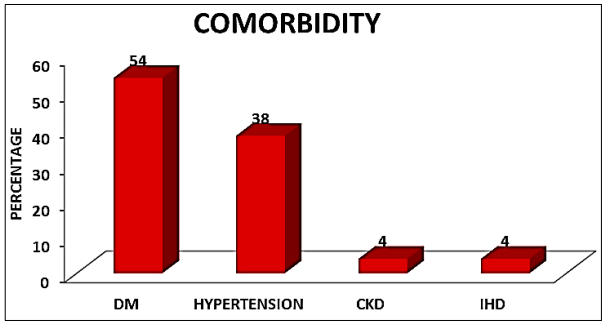

Fig 2: Distribution of cases according to comorbidity

Table 4: Distribution of cases according to dyspnea

DYSPNEA	N	%
4	12	24
5a	21	42
5b	17	34
Total	50	100

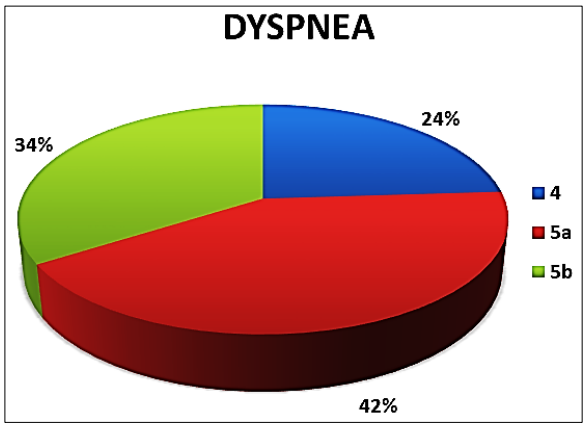

Fig 3: Distribution of cases according to dyspnea

Dyspnea grading

The patients in the study were graded according to the extended Medical Research Council score. Accordingly, 12 patients had eMRC grade 4, 21 patients had eMRC grade 5a and 17 patients had a score of 5b. In terms of percentage, the distribution of patients in grades 4, 5a and 5b was 24, 42 and 34 respectively.

Table 5: Distribution of cases according to eosinopenia

Eosinopenia	N	%
Yes	4	8
No	46	92
Total	50	100

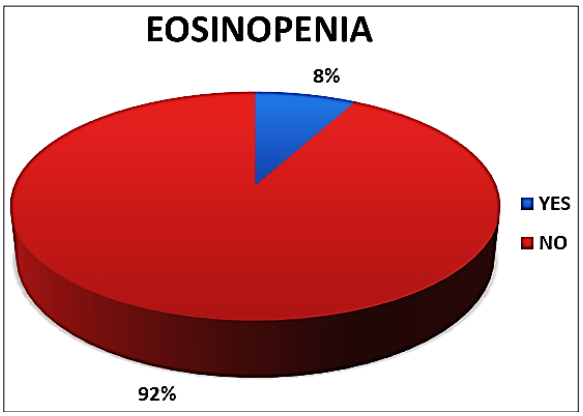

Fig 4: Distribution of cases according to eosinopenia

Presence of Eosinopenia

Eosinopenia was defined as an absolute eosinophil count of less than 50/mm3. 4 out of 50 patients had eosinopenia. Hence 8% of the study population had low eosinophil count.

Table 6: Distribution of cases according to consolidation

Consolidation	N	%
Yes	25	50
No	25	50
Total	50	100

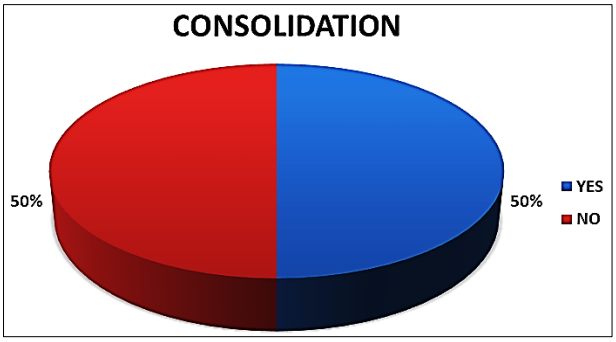

Fig 5: Distribution of cases according to consolidation

Presence of Consolidation

Assessment of chest radiographs of patients at admission to confirm the presence of consolidation was done. Accordingly 25 (50%) patients had consolidation on chest radiograph.

Table 7: Distribution of cases according to acidemia

Academia	N	%
Yes	20	40
No	30	60
Total	50	100

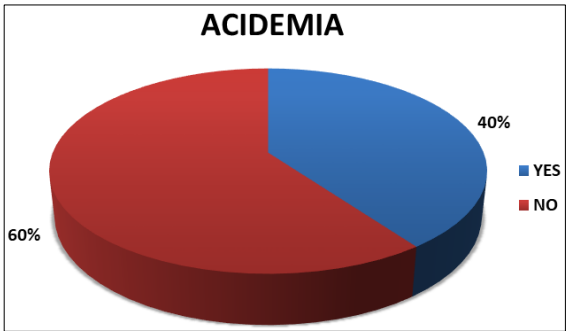

Fig 6: Distribution of cases according to acidemia

Presence of Acidemia

Acidemia is defined as the presence of arterial blood gas pH<7.30. 20 patients (40%) had acidemia.

Table 8: Distribution of cases according to fibrillation

Fibrillation	N	%
Yes	8	16
No	42	84
Total	50	100

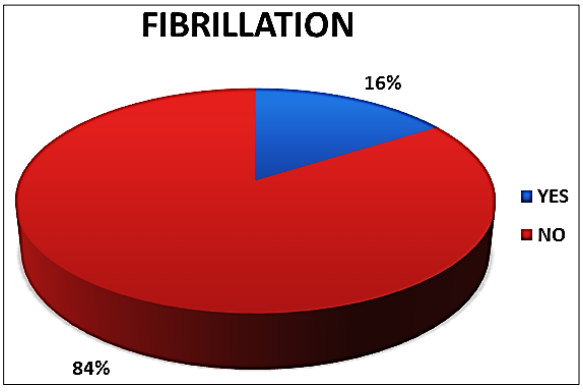

Fig 7: Distribution of cases according to fibrillation

Presence of Fibrillation

Presence of atrial fibrillation was confirmed with the presence of admission electrocardiogram. Accordingly 8 (16%) patients had atrial fibrillation, while the remaining 86 did not have fibrillation.

Table 9: Distribution of cases according to decaf score

Decaf Score	N	%
0-1 (Low Risk)	16	32
2 (Intermediate Risk)	8	16
3-6 (High Risk)	26	52
Total	50	100

Descriptive Statistics	Minimum	Maximum	Mean	SD
Decaf Score	0	5	2.2	1.4

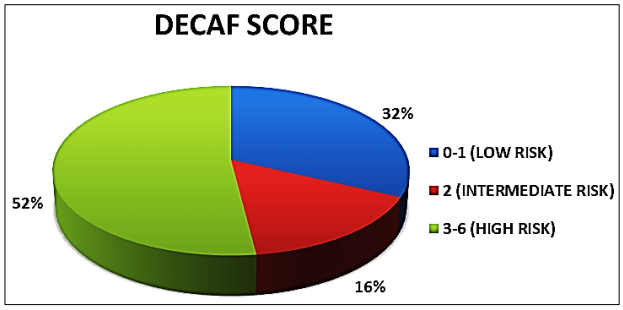

Fig 8: Distribution of cases according to decaf score

The Decaf Score

Each patient was scored using DECAF score-where dyspnea eMRC grade 5a gets 1 point, dyspnea eMRC grade 5b gets 2 points, others parameters, namely Eosinopenia, Consolidation, Acidemia, atrial Fibrillation get 1 point each. We divided the population into three group's namely low risk, intermediate risk and high risk with the groups getting DECAF score of 0-1, 2 and 3-6 respectively.

16 patients had a DECAF score between 0-1, 8 patients had a DECAF score of 2 and 26 patients had a DECAF score between 3-6. In terms of percentage this is 32%, 16% and 52% respectively.

Table 10: Distribution of cases according to outcome

Outcome	N	%
Improved	42	84
Status Quo	5	10
Mortality	3	6
Total	50	100

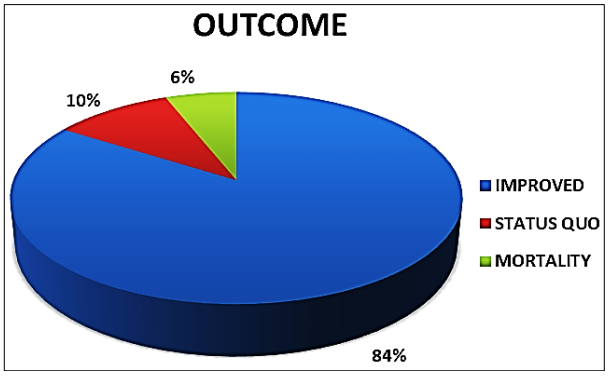

Fig 9: Distribution of cases according to outcome

Outcome

The mortality rate for the study population was 3 out of 50 (6%). 42 patients "improved" at the time of discharge with "improved" being clinically defined as subjective sense of improvement and objective improvement in dyspnea scoring, 3 patients died in the hospital, 5 patients were discharged against medical advice whose clinical condition could not be defined as 'improved' or deteriorated at the time of leaving the hospital.

Table 11: Distribution of cases according to use of ventilator

Use of Ventilator	N	%
Yes	11	22
No	39	78
Total	50	100

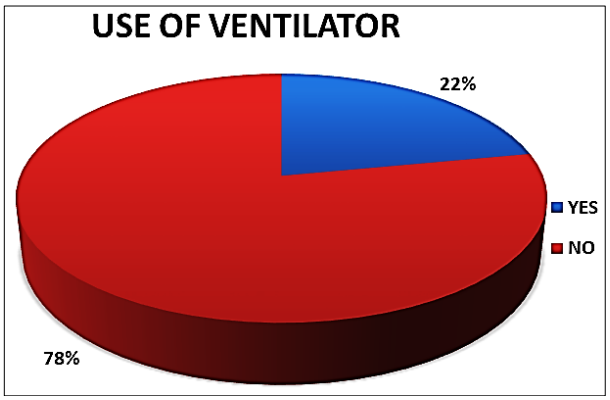

Fig 10: Distribution of cases according to use of ventilator

Use of ventilator

Out of the 50 patients 11(22%) were put on ventilator, 3 were put on Noninvasive ventilation and 8 were put on Invasive ventilation.

Table 12: Distribution of decaf score according to age

Age (Yrs)	Decaf Score						p value
	0-1 (Low Risk)		2 (Intermediate Risk)		3-6 (High Risk)		
	N	%	N	%	N	%	
31-40	4	25.0%	2	25.0%	2	7.7%	0.22
41-50	7	43.8%	2	25.0%	5	19.2%	
51-60	4	25.0%	1	12.5%	8	30.8%	
61-70	1	6.3%	3	37.5%	9	34.6%	
>70	0	0.0%	0	0.0%	2	7.7%	
Total	16	100.0%	8	100.0%	26	100.0%	

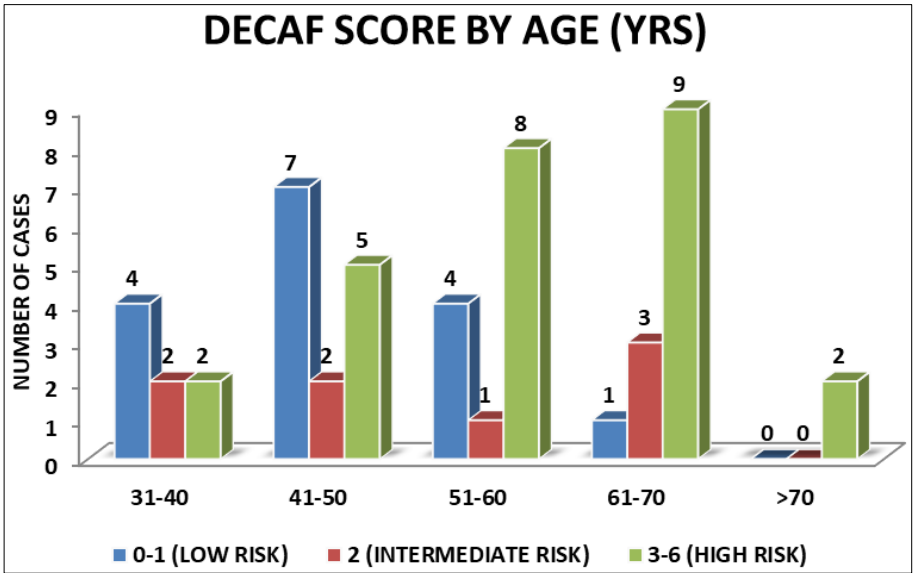

Fig 11: Distribution of decaf score according to age

Table 13: Distribution of decaf score according to comorbidity

Comorbidity	Decaf Score						P Value
	0-1 (Low Risk)		2 (Intermediate Risk)		3-6 (High Risk)		
	N	%	N	%	N	%	
CKD & Hypertension	0	0.0%	0	0.0%	2	7.7%	0.278
DM	2	12.5%	3	37.5%	9	34.6%	
DM & Hypertension	3	18.8%	1	12.5%	6	23.1%	
DM & IHD	2	12.5%	0	0.0%	0	0.0%	
DM, IHD & Hypertension	0	0.0%	0	0.0%	1	3.8%	
Hypertension	1	6.3%	0	0.0%	5	19.2%	
Nil	8	50.0%	4	50.0%	3	11.5%	

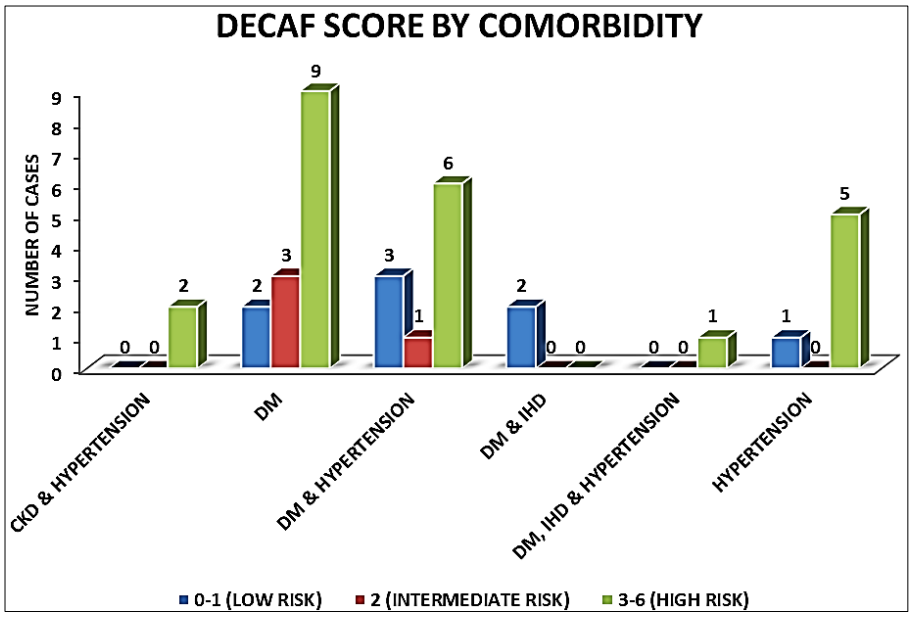

Fig 12: Distribution of decaf score according to comorbidity

Table 14: Distribution of decaf score according to dyspnea

Dyspnea	Decaf Score						p value
	0-1 (Low Risk)		2 (Intermediate Risk)		3-6 (High Risk)		
	N	%	N	%	N	%	
4	12	75.0%	0	0.0%	0	0.0%	<0.001*
5a	4	25.0%	6	75.0%	11	42.3%	
5b	0	0.0%	2	25.0%	15	57.7%	
Total	16	100.0%	8	100.0%	26	100.0%	

Note: *significant at 5% level of significance ($p<0.05$)

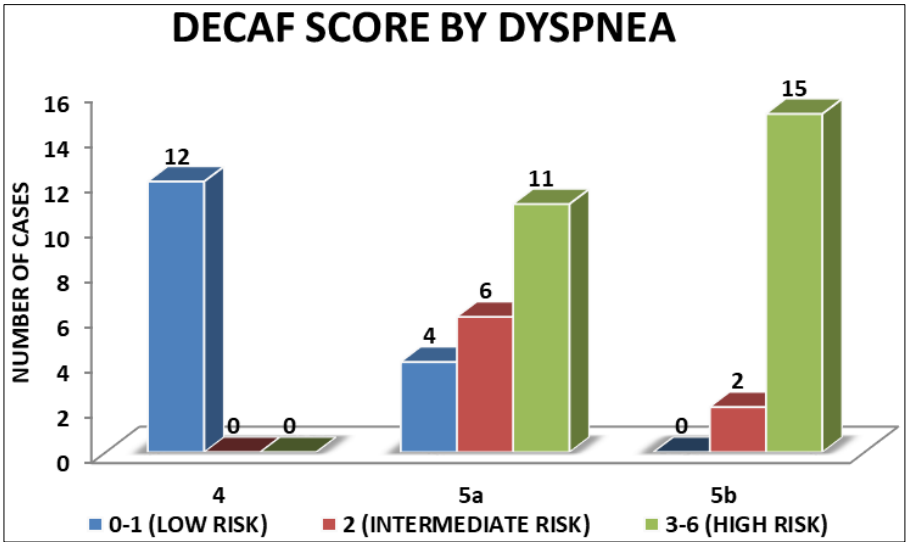

Fig 13: Distribution of decaf score according to dyspnea

Table 15: Distribution of decaf score according to eosinopenia

Eosinopenia	Decaf Score						p value
	0-1 (Low Risk)		2 (Intermediate Risk)		3-6 (High Risk)		
	N	%	N	%	N	%	
Yes	0	0.0%	0	0.0%	4	15.4%	0.134
No	16	100.0%	8	100.0%	22	84.6%	
Total	16	100.0%	8	100.0%	26	100.0%	

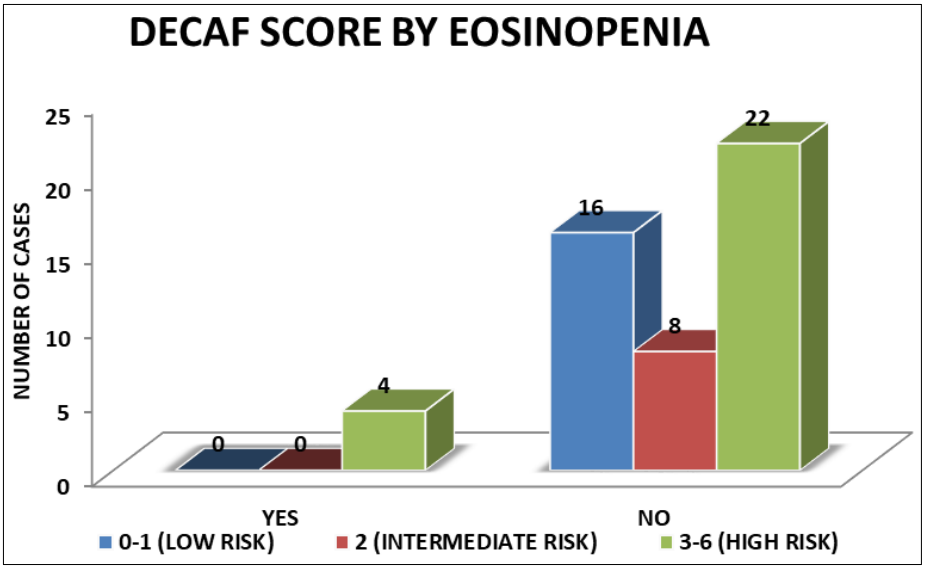

Fig 14: Distribution of decaf score according to eosinopenia

Table 16: Distribution of decaf score according to consolidation

Consolidation	Decaf Score						p value
	0-1 (Low Risk)		2 (Intermediate Risk)		3-6 (High Risk)		
	N	%	N	%	N	%	
YES	3	18.8%	5	62.5%	17	65.4%	0.010*
NO	13	81.3%	3	37.5%	9	34.6%	
Total	16	100.0%	8	100.0%	26	100.0%	

Note: *significant at 5% level of significance (p<0.05)

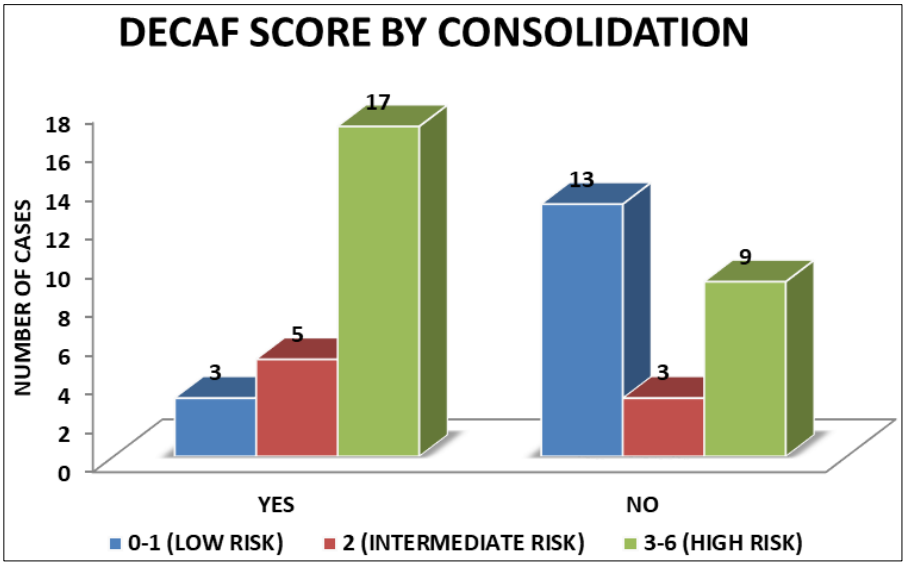

Fig 15: Distribution of decaf score according to consolidation

Table 17: Distribution of decaf score according to fibrillation

Fibrillation	Decaf Score						p value
	0-1 (Low Risk)		2 (Intermediate Risk)		3-6 (High Risk)		
	N	%	N	%	N	%	
YES	0	0.0%	0	0.0%	8	30.8%	0.012*
NO	16	100.0%	8	100.0%	18	69.2%	
Total	16	100.0%	8	100.0%	26	100.0%	

Note: *significant at 5% level of significance (p<0.05)

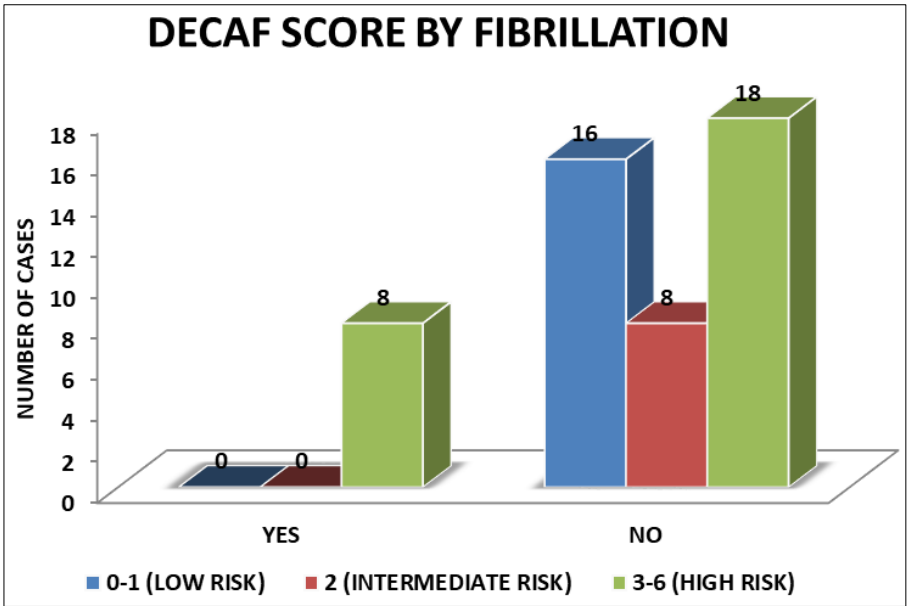

Fig 16: Distribution of decaf score according to fibrillation

Table 18: Distribution of decaf score according to use of ventilator

Use of Ventilator	Decaf Score						p value
	0-1 (Low Risk)		2 (Intermediate Risk)		3-6 (High Risk)		
	N	%	N	%	N	%	
YES	1	6.3%	3	37.5%	7	26.9%	0.15
NO	15	93.8%	5	62.5%	19	73.1%	
Total	16	100.0%	8	100.0%	26	100.0%	

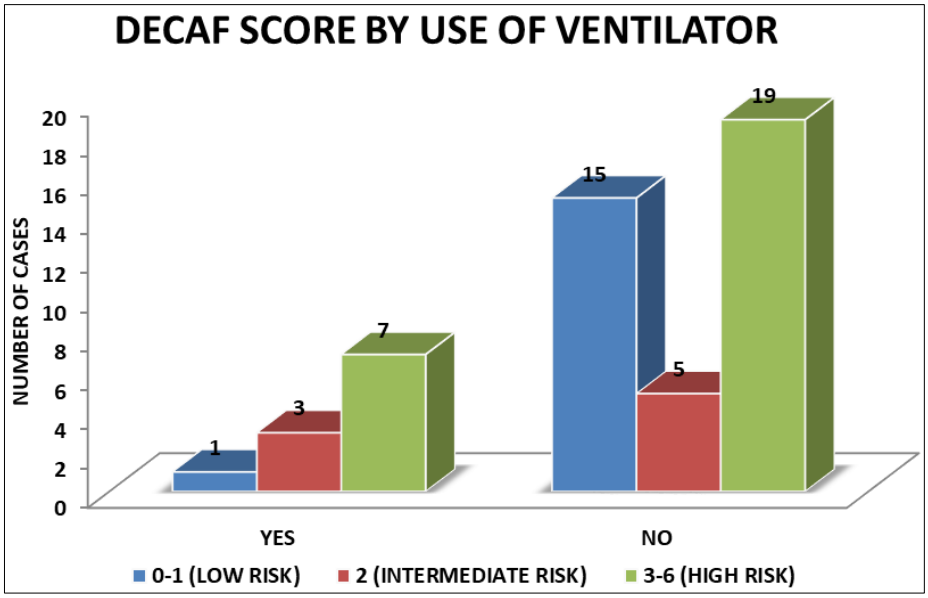

Fig 17: Distribution of decaf score according to use of ventilator

Table 19: Distribution of decaf score according to outcome

Outcome	Decaf Score						p value
	0-1 (Low Risk)		2 (Intermediate Risk)		3-6 (High Risk)		
	N	%	N	%	N	%	
Improved	16	100.0%	8	100.0%	18	69.2%	0.067
Status Quo	0	0.0%	0	0.0%	5	19.2%	
Mortality	0	0.0%	0	0.0%	3	11.5%	
Total	16	100.0%	8	100.0%	26	100.0%	

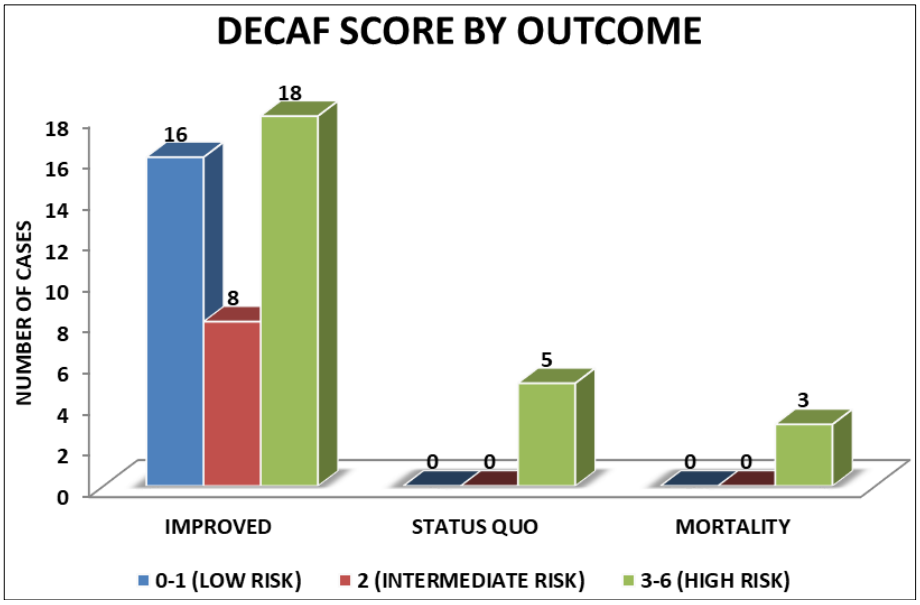

Fig 18: Distribution of decaf score according to outcome

Table 20: Mean decaf score according to outcome

Outcome	Decaf Score		p value
	Mean	SD	
Improved	1.9	1.2	<0.001*
Status Quo	4.0	0.7	
Mortality	4.3	0.6	
Total	2.2	1.4	

Note: *significant at 5% level of significance (p<0.05)

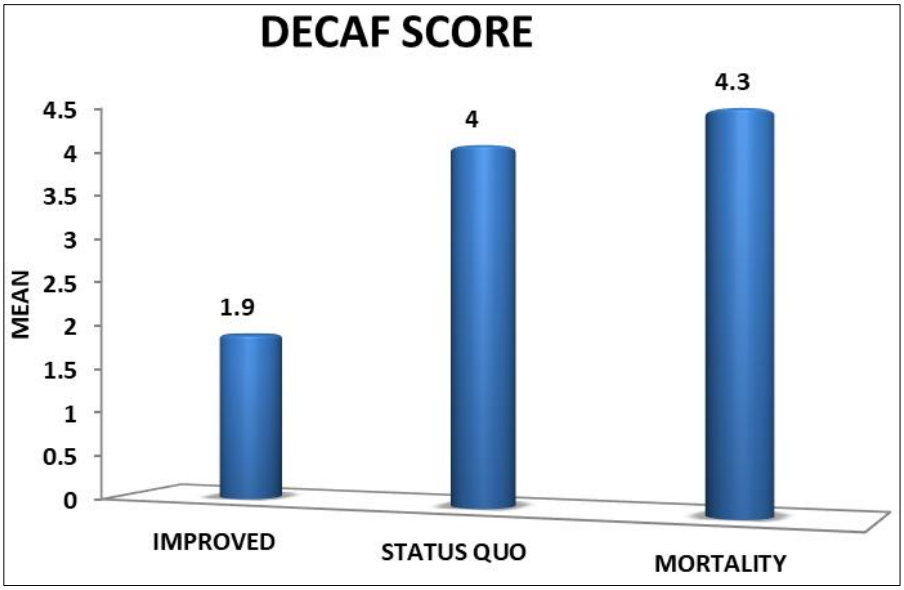

Fig 19: Mean decaf score according to outcome

Discussion

Clinical Profile of the study population

A total of 50 patients were included in our study as per our patient selection methods, inclusion and exclusion criteria. The age group of our patients in our study ranged from 35 to 80. The mean age of the study population was 53.4 with a standard Deviation of 11.4. The number of patients in the age groups ≤40, 40-50, 50-60, 60-70, 70-80, >80 were 8(16%), 14 (28%), 13(26 %), 13 (26%), 2(4%) respectively.

This distribution shows that we had more patients in older age groups than younger age groups. This is consistent with the fact that age is often listed as a risk factor for COPD49. It is unclear if healthy aging as such leads to COPD or if age reflects the sum of cumulative exposures throughout life. Beyond 70 years of age there are fewer study subjects. This situation may have arisen because of exclusion of patients with other co-morbidities. Since co-morbid illnesses are common with aged population we had this sort of age distribution of patients.

Out of the 50 patients in the study, 40 are male and 10 are female. Thus males accounted for 90% of our study population while females accounted for 10%. This could be attributed to low prevalence of smoking among ladies. This shows that smoking habit may not have entered into our female population as much as in the western literature.

Another reason could be that many female patients with COPD are usually branded as having asthma in our country. The primary reason for females developing COPD in our country could be attributed to passive smoking, biomass exposure and post tuberculosis.

In the study population. The most common comorbidity among the study population is diabetes mellitus. Among 'others' 2 patients had coronary artery disease, 2 patients had CKD, 19 patients had HTN.

The risk from occupational exposures in less regulated areas like India is likely to be much higher than reported in Western literature.

The patients in the study were graded according to the extended Medical Research Council score. Accordingly, 12 patients had eMRC grade 4, 21 patients had eMRC grade 5a and 17 patients had a score of 5b. In terms of percentage, the distribution of patients in grades 4, 5a and 5b was 24, 42 and 34 respectively.

Eosinopenia was defined as an absolute eosinophil count of less than 50/mm3. 4 out of 50 patients had eosinopenia. Hence 8% of the study population had low eosinophil count.

Assessment of chest radiographs of patients at admission to confirm the presence of consolidation was done. Accordingly 25 (50%) patients had consolidation on chest radiograph Acidemia is defined as the presence of arterial blood gas pH<7.30. 20 patients (40%) had academia Presence of atrial fibrillation was confirmed with the presence of admission electrocardiogram. Accordingly 8 (16%) patients had atrial fibrillation, while the remaining 86 did not have fibrillation.

Each patient was scored using DECAF score-where dyspnea eMRC grade 5a gets 1 point, dyspnea eMRC grade 5b gets 2 points, others parameters, namely Eosinopenia, Consolidation, Acidemia, atrial Fibrillation get 1 point each. We divided the population into three group's namely low risk, intermediate risk and high risk with the groups getting DECAF score of 0-1, 2 and 3-6 respectively.

16 patients had a DECAF score between 0-1, 8 patients had a DECAF score of 2 and 26 patients had a DECAF score between 3-6. In terms of percentage this is 32%, 16% and 52% respectively.

The mortality rate for the study population was 3 out of 50 (6%). 42 patients "improved" at the time of discharge with "improved" being clinically defined as subjective sense of improvement and objective improvement in dyspnea scoring, 3 patients died in the hospital, 5 patients were discharged against medical advice whose clinical condition could not be defined as 'improved' or deteriorated at the time of leaving the hospital.

Out of the 50 patients 11(22%) were put on ventilator, 3 were put on Noninvasive ventilation and 8 were put on Invasive ventilation.

Conclusion

The present study shows that in patients admitted with acute exacerbation of COPD the DECAF score comprising the five variables-Dyspnea, Eosinopenia, Consolidation, Acidemia, atrial Fibrillation is strongly associated with outcome.

- Based on DECAF score these patients are divided into low risk (DECAF 0-1), intermediate risk (DECAF-2) and high risk (DECAF 3-6).
- The higher the DECAF score, the higher is the mortality, the longer is the hospital stay and the higher is the need for use of ventilator.

The DECAF score is a simple clinical tool for assessing prognosis 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.

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