ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 11 | November - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

DECAF SCORE IN PREDICTING THE PROGNOSIS OF PATIENTS WITH ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

General Medicine

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KEYWORDS

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a preventable and treatable disease which is characterized by persistent airflow limitation, usually progressive and associated with enhanced chronic inflammatory response in the airways and lung to noxious particles or gases.

Exacerbations and comorbidities contribute to overall severity in patients.[1] More recently American Thoracic society and European respiratory society jointly defined COPD as "a preventable and treatable disease state which is characterized by airflow limitation and is not fully reversible" and is the most common definition being used now.[2]

COPD is the fourth most frequent cause of death after Ischemic heart disease, Cerebrovascular disease and Malignancy. The Global Burden of Disease Study projected that COPD, which is ranked sixth as a cause of death in 1990, likely to become the third leading cause of death by 2020. Exacerbations have a negative impact on patient"s quality of life, affecting symptoms and lung function taking several weeks to recover from. In patients presenting with hypercapnic exacerbations, the in-hospital death rate is around 10% .[3] If a patient is put on mechanical support during hospitalisation the death rate reaches 40% at one year after discharge [4] and reaches 49% three years after discharge.[5] The burden of COPD can be tackled by a comprehensive approach which includes prevention, prompt diagnosis and immediate management of exacerbations.

COPD exacerbations are precipitated by respiratory tract infections [6], air pollution [7], congestive heart failure, pulmonary embolism and interruption of maintenance therapy. The cause for about one third of exacerbations cannot be identified. When the number of exacerbations per year is two or more, then the COPD patient is called a "frequent exacerbator".[8]

Studies assessing prognostic factors in AECOPD patients who are hospitalised have been performed infrequently. Robust clinical tools which aid in management decisions have not been developed. Well established scores like BODE score [10] exist to assess mortality risk in stable COPD. Prognostic tools derived for stable disease have not been studied on patients requiring hospitalisation.

J Steer et al [11] developed a simple prognostication tool in acute exacerbation of COPD – the DECAF score, that will help in deciding early stepping up of care and anticipation of need for ventilatory support. It helps the physician in planning for appropriate escalation/ de-escalation of antibiotics .This score also helps us in informing patients/relatives on the prognosis and risks associated with exacerbations. Thus it will help in directing the most efficient use of resources and thereby reducing mortality and morbidity.

Decaf Score

Table 1 : Various components and scoring of DECAF score

VARIABLE	SCORE
DYSPNEA :	
EMRCD 5a	1
EMRCD 5b	2
EOSINOPENIA (<0.05X10^9/dl)	1
CONSOLIDATION	1
ACIDEMIA (pH<7.3)	1
ATRIAL FIBRILLATION	1
TOTAL DECAF SCORE	6

Aim:

To assess the prognostic value of DECAF score based on duration of ICU stay, duration of hospital stay and mortality.

Objective:

To determine sensitivity and specificity of DECAF score in patients with acute exacerbation of COPD

MATERIALS AND METHODOLOGY

- **Study Design :**

A hospital based prospective observational study.

- **Study Period :**

September 2022 To August 2034

- **Study Subjects :**

Patients undergoing contrast procedures fulfilling the inclusion criteria were enrolled after taking prior informed consent during the study period.

Methods Of Collecting Data:

- Medical history
- Plain chest x-ray
- CBC
- ABG
- ECG
- 2D ECHO
- TSH
- ABSOLUTE EOSINOPHIL COUNT

Inclusion Criteria

- All those who were previously diagnosed COPD by pulmonary function test, now presenting with exacerbation.

Exclusion Criteria:

- Immunocompressive status patients
- Overt malignancy
- Known asthmatic
- Valvular and ischemic heart diseases
- Hyperthyroidism · Hypertension.

Sample Size:

- In the present study sample size is calculated considering studies done by Nafae et al and Echevarria et al where the specificity of predicting mortality of DECAF was 88 %. In the present study,expecting similar results with DECAF score and to get precision of 95% confidence interval with 2 % absolute precision ,this study requires minimum of 84 subjects.

$$\text{sample size } (n) \text{ based on specificity} = \frac{Z^2_{1-\alpha/2} \times Sp \times (1-Sp)}{L^2 \times (1-\text{Prevalence})}$$

Z^2 1- α/2 = standard normal deviate corresponding to the specified site of critical region (α)
Sp: Anticipated specificity
1-α :confidence interval

L :Absolute precision desired on either half (half-width of confidence interval) of sensitivity or specificity

RESULTS

Disturbution Of Cases According To Age:

The study revealed maximum age disturbution of 35.7% between 61-70 years followed by 27.4% between 71-80 years.

Table 6: Age distribution of patients studied

Age in years	%
<40	1.2
40-50	7.1
51-60	14.3
61-70	35.7
71-80	27.4
81-90	11.9
>90	2.4
Total	100

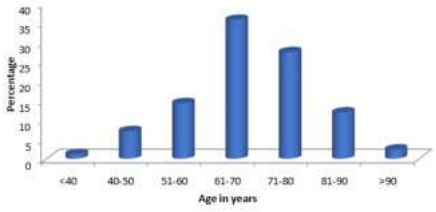


Figure 1 : Age description in the present study

Gender :

Among the 84 patients , majority i.e 57 (68 %) were males.

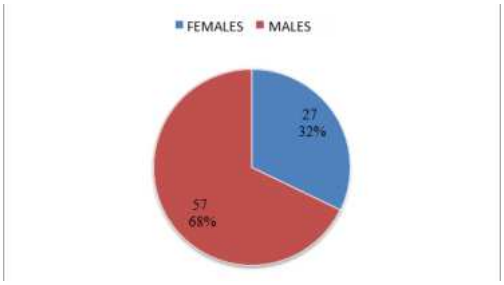


Figure 2: Gender distribution

Outcome Of The Study :

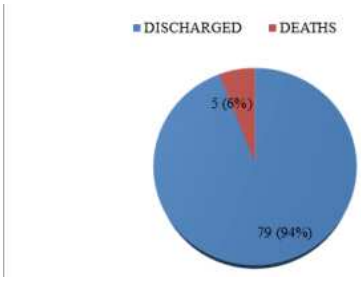


Figure 3: Survivors vs non survivors

Duration Of Hospital Stay :

Table 7: Hospital stay in days/ICU stay (in days) distribution of patients studied

	No. of patients (n=84)	%
Total Hospital Stay		
1-6	48	57.1
7-14	34	40.5
>14	1	1.2
D	1	1.2
ICU Stay		
1-6	70	81.0
7-14	14	13.1
>14	0	0.0
D	5	6.0

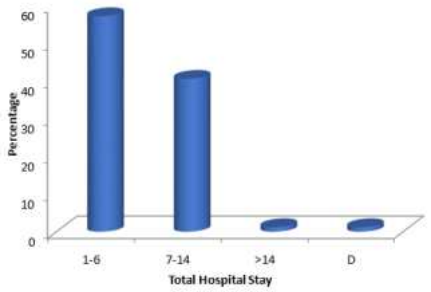


Figure 4: Length of hospital stay (in days) comparison with percentage of individuals

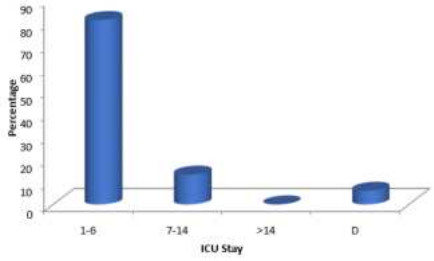


Figure 5: Percentage of cases and hospital stay duration (in days)

Dyspnea :

Majority of the patients (70.2%) had e MRC 5 A score of 1 .

Table 8 : Grading of dyspnea and distribution of patients studied

Dyspnea (e MRC)	No. of patients	%
1 TO 4	14	16.7
5A	59	70.2
5B	11	13.1
Total	84	100.0

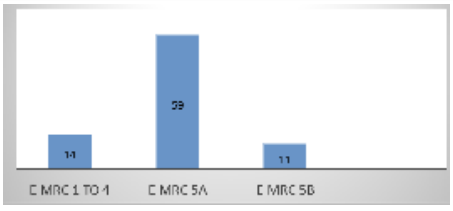


Figure 6 : Grading of dyspnea and distribution of patients studied

Table 9 : Dyspnea and average duration of ICU stay (days)

Dyspnea (e MRC)	Total ICU stay duration (days)
1-4	2.28± 1.06
5A	3.8± 2.19
5B	4.71± 2.13

p value(using paired t test) comparing e MRC1 to 4 with 5a: 0.049
p value (using paired t test) comparing 5a and 5b : 0.2

Table 10 : Dyspnea and average duration of hospital stay (days)

Dyspnea (e MRC)	Total hospital stay duration (days)
1 – 4	4.71 ± 2.09
5 A	6.6 ± 3.28
5 B	8.1 ± 3.9

p value(using paired t test) comparing e MRC 1-4 and 5a :0.04
p value(using paired t test) comparing 5a and 5b: 0.18

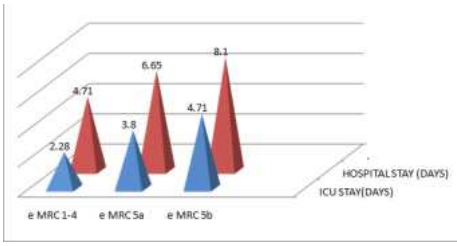


Figure 7 : Grading of dyspnea and mean duration of ICU and hospital stay

Statistical significance was seen with Dyspnea of e MRC grade 0-4 with 5A and the duration of stay in ICU(0.049) and total hospital stay(0.04) .However , no such significance was seen with e MRC 5A and 5 B .

Eosinopenia :

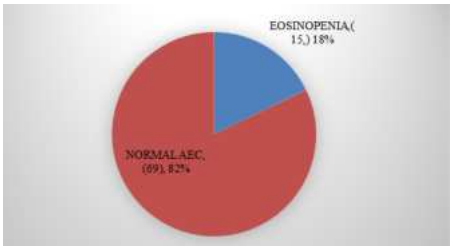


Figure 8 : Eosinopenia and distribution of patients studied

Table11 : Eosinopenia and average duration of hospital stay (days)

Absolute Eosinophil count	<40 cells/mm3	>40 cells/mm3	P VALUE
Total ICU stay (days)	4.58±2.7	3.4±1.96	0.05
Total hospital stay (days)	7.42±2.71	6.25±2.09	0.0665

Statistical significance with eosinopenia could be seen with the duration of ICU stay, rather than the total duration of hospital stay.

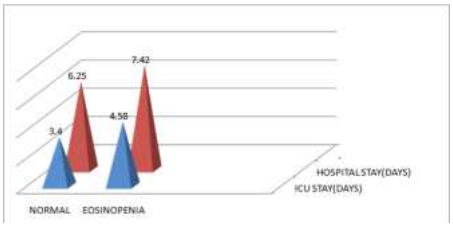


Figure 9 : Grading of eosinopenia and mean duration of ICU and hospital stay

Consolidation :
Of the total number of COPD cases (84) ,60 % of them i.e 50 subjects had consolidation on Chest X-ray.

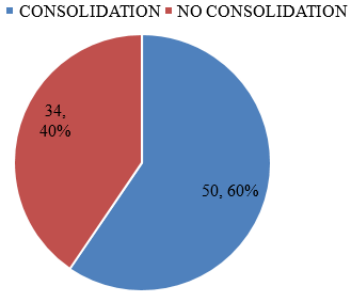


Figure 10 : Consolidation and distribution of patients studied

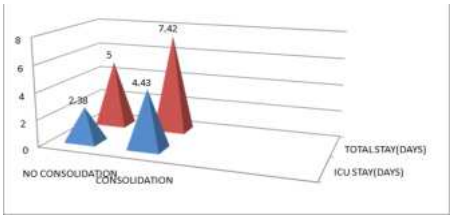


Figure 11 : Consolidation and average duration of hospital stay (days)

Table 12 : Consolidation and average duration of hospital stay (days)

	CONSOLIDATION	NO CONSOLIDATION	P VALUE
Total ICU stay (days)	4.43±2.23	2.38±1.19	<0.001
Total hospital stay (days)	7.42±3.53	5±2.30	0.01

Statistical significance with consolidation on Chest X-ray could be seen with the duration of ICU stay and total duration of hospital stay.

Acidosis : A total of 43 patients had severe respiratory acidosis (pH<7.3 with hypercapnia).

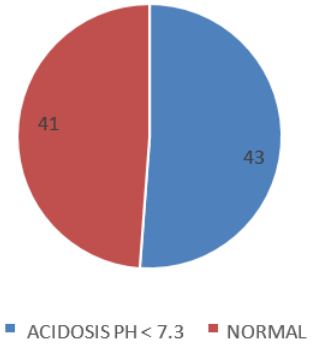


Figure 12 : Consolidation and distribution of patients studied

Table 13 : Acidosis and average duration of hospital stay (days)

	ACIDOSIS (pH <7.3)	NORMAL	P VALUE
Total ICU stay (days)	4.3±2.06	2.91±1.95	0.0021
Total hospital stay (days)	7.33±3.28	5.6±3.10	0.016

Statistical significance with Respiratory acidosis was seen with the duration of ICU stay and total duration of hospital stay.

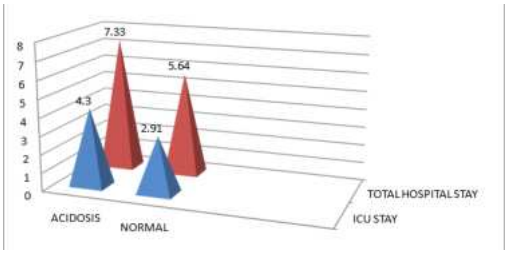


Figure 13 : Acidosis and average duration of hospital stay (days)

Atrial Fibrillation :
Only 5 out 84 had atrial fibrillation, during the hospital stay. All of them were non survivors, hence significance of atrial fibrillation with duration of hospital/ICU stay could not be established.

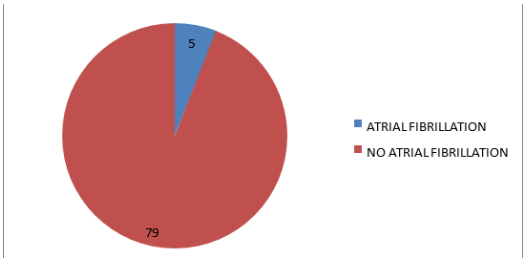


Figure 14 : Atrial fibrillation and its significance in DECAF score

Table 14: Comparision of DECAF score with mean duration of ICU and hospital stay (in days)

DECAF SCORE	NUMBER OF PATIENTS	MEAN DURATION IN ICU (DAYS)	MEAN DURATION IN HOSPITAL (DAYS)	DEATHS
0	3	1.66 ± 0.57	3.3 ± 1.15	O
1	23	2.24 ± 1.04	4.82 ± 2.46	0
2	20	2.97 ± 1.58	5.45 ± 2.78	0
3	28	4.92 ± 2.1	8.34 ± 2.54	0
4	6	6.2 ± 1.64	11.5 ± 1.64	1
5	3			3
6	1			1
OVERALL	84	3.65±2.21	6.45±3.28	

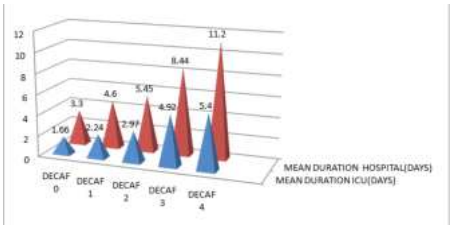


Figure 15: DECAF score comparision with mean duration of ICU and hospital stay (in days)

Table 15 : DECAF score and average duration of ICU and hospital stay (days)

	DECAF					Total (n=84)	P value
	0 (n=3)	1 (n=23)	2 (n=20)	3 (n=28)	4 or more (n=10)		
Total Hospital Stay							
1-6	2(66.7%)	18(78.3%)	16(80%)	9(32.1%)	3(30%)	48(57.1%)	<0.001**
7-14	1(33.3%)	5(21.7%)	3(15%)	19(67.9%)	6(60%)	34(40.5%)	
>14	0(0%)	0(0%)	1(5%)	0(0%)	0(0%)	1(1.2%)	
D	0(0%)	0(0%)	0(0%)	0(0%)	1(10%)	1(1.2%)	
ICU Stay							
1-6	3(100%)	23(100%)	19(95%)	21(75%)	2(20%)	68(81%)	<0.001**
7-14	0(0%)	0(0%)	1(5%)	7(25%)	3(30%)	11(13.1%)	
>14	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	
D	0(0%)	0(0%)	0(0%)	0(0%)	5(50%)	5(6%)	

Chi-Square/Fisher Exact Test

Table 16 :Prognostication of DECAF score and classification based on the mortality risk

DECAF SCORE VS OUTCOME	IMPROVED	DEATH	TOTAL
0 – 1 (LOW RISK)	26	0	26
2 (INTERMEDIATE RISK)	20	0	20
3-6 (HIGH RISK)	33	5	38
TOTAL	79	5	84

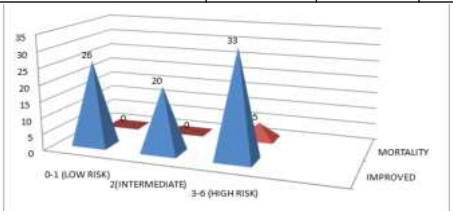
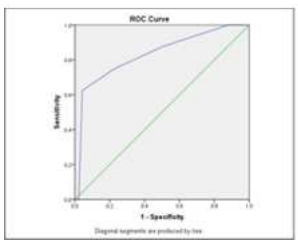
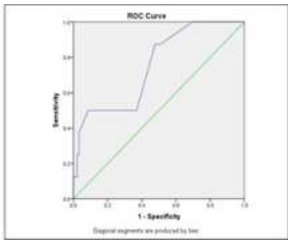


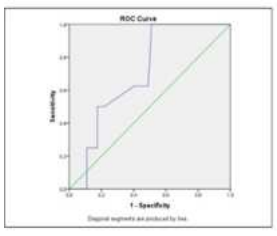
Figure 16 : Stratification of DECAF score vs outcome



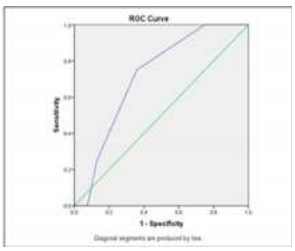
ROC DECAF SCORE : 0.812



ROC APACHE II: 0.72



ROC BAP65 : 0.69



ROC CURB 65: 0.71

Figure 17 : Different ROCs for various COPD scoring systems

Table 17 : Sensitivity and specificity of various scoring systems

SCORE	CUT OFF	SENSITIVITY	SPECIFICITY
DECAF	2.5	76 %	77.2%
APACHE II	9	81 %	53.2 %
BAP 65	2	74.2%	74.8%
CURB 65	2	75.1 %	64.2 %

Table 18 : p value comparison with DECAF

TEST	CUT OFF	AUC	p value comparision with DECAF
APACHE II	9	0.72	0.07
BAP 65	2	0.69	0.056
CURB 65	2	0.71	0.043

DISCUSSION

Acute exacerbations of COPD (AECOPD) account for one in eight hospital admissions. A robust prediction tool, which stratifies patients according to mortality risk, may help in the form of management, including Hospital stay or early supported discharge for low-risk groups, and early escalation for highrisk groups.(92).The DECAF Score shows promise for the risk stratification of patients hospitalised with AECOPD.

The present study includes 84 patients admitted in ICU with Acute exacerbation of COPD and the usefulness of DECAF score were analysed based on duration of stay in ICU and hospital. We have compared DECAF score with other prognostic scores(APACHE II , CURB 65 and BAP 65) .

In the present study , most of the patients were in the age group of 61-70 years(35.7%).Mean age of population was 68.29±11.80. The mortality rate was 6% (out of 84 ,5 deaths) ,which is consistent with the published figures of mortality of 4.4-7.7 % (92)

Out of 84 cases in our study, 14 of them had dyspnea of grade eMRCD 0–4, 59 cases presented with dyspnea grade eMRCD 5a and 11 cases presented with dyspnea grade of eMRCD 5b.

Statistical significance was seen comparing Dyspnea of e MRC grade 0-4 with 5A and the duration of stay in ICU(0.049) and total hospital stay(0.04) .

In our study, eMRCD 5a and 5b were compared based on the hospital stay, which could not attain statistical significance.

The length of stay in stay in hospital in patients with and without eosinopenia are 7.42±2.71 days and 6.25±2.09 days. It showed suggestive significance(p value :0.05 in ICU duration ,0.06 in hospital stay) ,these findings are consistent with finding of Holland et al ,who assessed the total duration of hospital stay and eosinopenia . (8 vs 5 days, P = 0.005). (65)

Out of 84 cases admitted to ICU , 4 out of 5 non survivors had eosinopenia (80%),compared to 11 out of 78 in survivors (14.1%).The mortality rate was higher when compared to Rahimi Rad et al,wherein the mortality rate was 5 fold higher in eosinopenic group compared to non eosinopenic group .

Their study showed 37.5% (12/44) mortality in patients with eosinopenia compared to 7.6%(4/56) mortality in patients without eosinopenia.(93)

In our study , 60% of the patients with AECOPD had consolidation on Chest Xray , required longer hospital stay compared to patients of AECOPD without consolidation (i.e 4.43±2.23 vs 2.38±1.19 days in ICU and 7.42±3.53 vs 5±2.3 days was the total length of hospital stay),which was statistically significant.

Steer et al had similar results in subset of patients with consolidation comparing total length of hospital stay(7 vs 6 days, p<0.001).(62)

In the subset of patients with consolidation , when statistically analysed it is seen that CURB-65 has ROC = 0.71, DECAF with ROC = 0.759. Similar results were obtained by Steer et al and Nafae et al (94)

Table 19: Comparision of ROC between DECAF and CURB 65 in various studies

	DECAF	CURB 65
Steer et al	0.77	0.66
Nafae et al	0.87	0.65
Present study	0.759	0.71

In the present study, 43 out of 84 patients had respiratory acidosis. These 43 patients required longer hospital stay compared to patients without respiratory acidosis. The duration of ICU stay (2.91±1.95 vs 4.3±2.06 days) and hospital stay(5.6±3.1 vs 7.33±3.28 days) was statistically significant in individuals with respiratory acidosis. Mean pH was 7.14 in non survivors compared to 7.29 in survivors . A study by John Steer, John Gibson et al showed that arterial pH was lower and statistically significant in patients who died in hospital compared to those who survived till discharge (pH <7.3 odds ratio (95% CI) 2.68(1.41 – 5.09) p=0.003). (11)

In our study, Out of 84 patients, 5 had Atrial fibrillation and mortality was 100% . Hence we could not calculate relation between atrial fibrillation and duration of ICU and hospital stay. In a study in UK, on patients of Acute exacerbation of COPD 12.5 % had atrial fibrillation and mortality was seen in 26% of patients having atrial fibrillation compared to 10.9% in survivors, indicating atrial fibrillation as an independent predictor of mortality.(11)

In the study by Ying et al in Oslo involving 590 patients admitted with AECOPD, the mean length of hospital stay was 6 days. Various studies have illustrated wide range of hospital stay between 3-12 days, which is consistent with our study of 6.45±3.28 days.(96) The mean duration of ICU stay was3.65±2.21 days.

In the present study,out of 84 patients, 5 deaths occurred. For the remaining 79 cases the mean stay in ICU (from DECAF score of 0 to 4 were 1.66±0.57 vs 2.21±1.04 vs 2.97±1.58 vs 4.92±2.1 vs 6.2±1.64 days and hospital stay (from DECAF score of 0 to 4 were 3.3±1.15 vs 4.82±2.46 vs 5.45±2.78 vs 8.34±2.54 vs 11.5±1.64 days).For a DECAF score of 5 and 6 mean duration of stay could not be calculated as the mortality rate was 100 %.

C Echevarria etal, studied 1725 patients of acute exacerbation of Chronic obstructive pulmonary disease ,the mean duration of hospital stay in the hospital was almost similar with our study.(92)

In a South Indian study ,individuals with DECAF score of 1 had a mean duration of hospital stay of 3 days and DECAF score of 4 had mean duration of stay as 15 days.These results were consistent with the present study which had a mean duration of 4.6 days and 11.2 days respectively.(56)

R.K. Yadavilli et al reported that length of hospital stay was more in patients with DECAF score of more than 3. Study included total 78 patients and the average Length of Stay in hospital was 15.1 days. Length of stay was lowest with scores of 0-1 (12 days) and highest with DECAF scores of 3-5 (16.7 days) . The findings in the present study for DECAF 0-1 vs 3-4 was 4.7 days vs 8.7 days.(57)

Table 20 : Mean duration of hospital stay (days) in various studies

DECAF SCORE	0	1	2	3	4
ECHEVVARIA ET AL	3 DAYS	4 DAYS	5 DAYS	7 DAYS	7.5 DAYS
KUMAR ET AL		3 DAYS	6 DAYS	10 DAYS	15 DAYS
PRESENT STUDY	3.3 DAYS	4.8 DAYS	5.45 DAYS	8.34 DAYS	11.5 DAYS

ROC of DECAF score was compared with other established scoring systems in Acute exacerbation of COPD. It was superior to ROC of APACHE II (0.72) , BAP 65 (0.69) ,CURB 65 (0.71).

A multicentric study done by Echeverria et al showed similar results and established DECAF score to have a better ROC in the prediction of in-hospital mortality than the Acute Physiology and Chronic Health Evaluation (APACHE) II prognostic index (ROC = 0.78, DECAF vs. APACHE II, p =0.003) and a stronger predictor of in-hospital mortality than CURB-65 for a subgroup of patients with radiological consolidation (ROC = 0.87 vs. 0.65, p= 0.02).(92)

Nafae et al carried out a study on 200 AECOPD patients, they illustrated that the DECAF score showed an excellent discrimination for in-hospital mortality (ROC=0.83), which was superior to APACHE II and CURB 65 (ROC :0.68 and 0.65) (94)

Table 21: ROC of various scoring systems in various studies

SCORING SYSTEMS	D DECAF ROC	APACHE II ROC	BAP 65 ROC	URB 65 ROC
CHEVVARIA ET AL	0.82	0.78	0. 77	0.76
NAFAE ET AL	0.83	0.68	-	.65
PRESENT STUDY	0.81	0.72	0.69	0.71

All the non survivors in our study belonged to high-risk DECAF group (DECAF score of 3 to 6), these findings are similar to study conducted by Kumar et al, where in all the non survivors (6 out of 80) belonged to DECAF score of 36. (56)

Findings from present study can suggest patients hospitalized with AECOPD can be classified as low risk (DECAF 0–1) of in hospital mortality and might therefore potentially be suitable for early supported discharge. On the other hand, a high risk (DECAF Score ≥3) might be used as a guide to early escalation of care.

CONCLUSION

DECAF scoring in acute exacerbation of COPD is an effective scoring system to risk stratify the hospitalized patients and helps in management.

The DECAF Score is a stronger predictor for predicting the in-hospital mortality. Higher the DECAF score, higher the in-hospital mortality.

The DECAF score also helps in predicting the duration of ICU stay and hospital stay.