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RESEARCH ARTICLE

A COMPARATIVE STUDY OF DECAF SCORE AND MODIFIED DECAFSCORE IN PREDICTING HOSPITAL MORTALITY RATES IN ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Abstract

Background: Acute exacerbations of chronic obstructive pulmonary disease (AECOPD) are common and lead to catastrophic events. Accurate prognostic tool for patients with exacerbation who required hospital admission is needed to predict the risk of in-hospital mortality and help physicians to select the appropriate level of care. Aim The aim was to compare the ability of conventional DECAF (dyspnea, eosinopenia, consolidation, acidemia, frequency of hospital admission) and modified DECAF scores to expect the in-hospital mortality rate.

Patients and Methods: A prospective, observational study was carried out on 100 patients with AECOPD admitted at the respiratory ICU and chest department. All patients were subjected to complete medical history taking, chest examination, dyspnea assessment by extended modified Medical Research Council Dyspnea, complete blood count, chest radiograph, ECG, and arterial blood gas analysis. Both conventional DECAF score [(D) dyspnea, (E) eosinopenia, (C) consolidation, (A) acidemia, (F) atrial fibrillation] and modified DECAF score [(D) dyspnea, (E) eosinopenia, (C) consolidation, (A) acidemia, (F) frequency of hospital admission] were calculated. In-hospital mortality was recorded.

Results: Nine (9%) patients died during their hospital stay. The modified DECAF score showed a good prediction of in-hospital mortality (area under the receiver operating characteristic curve=0.95) and was higher in accuracy than the original DECAF score (area under the receiver operating characteristic curve=0.92). Both were (sensitive 100%) but the modified DECAF was more specific (specificity=86.81) than the DECAF score (specificity=80.22).

Conclusion: Both the conventional DECAF score and the modified DECAF score are practical and can be calculated easily using simple questions and routine investigations available during the initial admission. Both were good predictors of mortality and the requirement of invasive mechanical ventilation. The modified DECAF was superior in predicting in-hospital mortality in AECOPD than the original score.

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Introduction:-

COPD is considered nowadays the fourth major cause of death all over the world and is expected to become the third cause of death worldwide by 2020 [1,2]. It also represents the second main cause of disability- adjusted life-years lost [3].

COPD is defined as a serious respiratory condition characterized by limitation of the airflow and chronic inflammation of the airway [4]. Acute exacerbations of be catastrophic events leading to poor outcomes and contribute to high and early mortality rate in COPD patients. Early recovery from severe AECOPD is a substantial issue to determine the long-term prognosis of COPD patients [6]. The 1-year mortality rate for patients with AECOPD requiring either noninvasive ventilation (NIV) was reported as 28% or those requiring ICU care was reported as 43% [7]. The chronic obstructive pulmonary disease (AECOPD) are manifested by worsening patient's baseline respiratory symptoms including sputum production, cough, and dyspnea, and increased sputum purulence. It is characterized by exaggerated airway inflammation

 prevention of AECOPD had an important role in managing COPD.

In stable COPD, multiple prognostic tools were applied to predict mortality risk, such as the BODE score [8]. In exacerbations requiring hospital admission, limited prognostic scores were found to identify exacerbators at risk of mortality. Previously, the CURB-65 score [(C) confusion, (U) urea, (R) respiratory rate, (B) blood pressure, age >65 years] community-acquired pneumonia prognostic score was used in patients with AECOPD requiring hospital admission complicated by consolidation to assess risk and to decide the antibiotic therapy [9]. But the use of CURB-65 in exacerbators with concomitant consolidation was shown to be suboptimal [10]. DECAF score [D; dyspnea, E; eosinopenia, C; consolidation, A; acidemia, F; atrial fibrillation (AF)] was developed for exacerbators who required hospital admission and showed good identification of the patient at risk of death [11]. A modified DECAF (dyspnea, eosinopenia, consolidation, acidemia, frequency of hospital admission) score replacing AF with the frequency of hospital admission in the previous year has been developed and found to have an appreciable prediction for in-hospital mortality [12].

Patients And Methods:-

The present prospective, observational study was carried out on 100 consecutive patients of COPD with acute exacerbation with a mean age of 57.46 ±13.12 years admitted in the Chest Department at Alexandria Main University Hospital. All patients or next of kin were asked to freely volunteer to the study and informed written consent was gathered before their inclusion in the study, according to the guidelines of the Local Ethics Committee, Alexandria Faculty of Medicine (available from http://www.med.alexu.edu. eg/ethics-committee/).

The sample size was calculated and post-hoc power analysis was conducted using IBM SPSS PAAA version 20 (USA) at the Medical Statistics Department in the Medical Research Institute taking into consideration a 5% level of significance and 85% power.

Criteria of inclusion were:

1. Primary diagnosis of AECOPD.
2. Age more than 25 years.
3. Pack-year of index more than 10.

Criteria of exclusion were:

1. Domiciliary ventilation.
2. Comorbidity expected to limit survival to less than 12 months (principally metastatic malignancy).
3. Patients with current cancer or chemotherapy intake.
4. Patients with multisystem failure.
5. The primary reason for admission other than AECOPD.

Sociodemographic data

Sociodemographic data were collected and recorded initially at admission:

Age, sex, BMI, clinical data [smoking history (never, former, current smoker)] pack-years of cigarette smoking, alcohol use (g/day), The presence of comorbid diseases, compliance to medications, history of present illness, and the use of long-term oxygen therapy.

Diagnosis of COPD

COPD was diagnosed by previous obstructive spirometry performed before the admission, or, in absence of interpretable spirometry, by a physician- based clinical history, physical examination, and radiologic data. The diagnosis of COPD using spirometry in this study was defined by the Global Initiative for Chronic Obstructive Lung Disease definition: forced expiratory volume in 1 s/forced vital capacity less than 0.7 [13]. When the diagnosisof asthma or COPD was overlapping, patients were also excluded [14].

Assessment of exacerbation risk

Patients were specifically asked for history of exacerbations (number of exacerbations, the severity of symptoms, and medications were taken and the need for assisted ventilation) and previous hospitalizationsfor a respiratory disorder.

We recorded the number of exacerbations that occurred the last year whether treated at home or required hospitalization. We focused on exacerbationthat required hospitalization in the last years as it is a cornerstone parameter of the new modified DECAF score [12].

All patients were subjected to complete chest examination, routine laboratory investigations, and assessment using the DECAF score [11].

The DECAF score required information available on the initial hospital presentation [11].

(D) Dyspnea assessment by extended modified Medical Research Council Dyspnea score (eMRCD score), CBC: (E) Eosinopenia (<0.05×109/l), chest radiograph:(C) consolidation, arterial blood gas: (A) acidemia (pH <7.3) and ECG: (F) AF.

The difference between eMRCD and traditional MRCD is given in the following: Patients who are too breathless to leave the house unaided (traditional MRCD 5) were subdivided into:

(1) Those able to manage independently washing and/or dressing (eMRCD 5a).
(2) Those requiring assistance with both (eMRCD5b).
(3) The eMRCD score is more strongly associatedwith in-hospital mortality than the traditional score.

The eMRCD score	Degree of breathlessness related to activities	Grade
	'I only get breathless with strenuous exercise'	0
	'I get short of breath when hurrying on the level or walking up a slight hill'	1
	'I walk slower than people of the same age on the level because of breathlessness or have to stop for breathwhen walking at my own pace on the level'	2
	'I stop for breath after walking about 100 yards or after a few minutes on the level'	3
	'I am too breathless to leave the house' or 'I am breathless when dressing'	4
Too breathless to leave the house and independent in		5a

Endpoints of the study

In-hospital mortality is the primary endpoint.

The length of in-hospital stay and the need for MV (invasive or noninvasive) at any point during the hospitalization wereconsideredasco-primary endpoints.

Statistical analysis of data

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (IBM Corp., Armonk, New York, USA). Qualitative data weredescribed using number and percentage. The Kolmogorov–Smirnov test was used

to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, SD, and median. The significance of the obtained results was judged at the 5% level.

The used tests were:

1. χ^2-test: for categorical variables, to comparebetween different groups.
2. Fisher's exact or Monte Carlo correction: correction for $\chi 2$ when more than 20% of thecells have an expected count of less than 5.
3. Student's t-test: for normally distributedquantitative variables, to compare between two studied groups.

Table 2:- Parameters of modified DECAF score [12].

Modified DECAF score	Points
Dyspnea limiting the patient to home (MRCD 5)	12
Independent in bathing and/or dressing (eMRCD 5a) washing and/or dressing	1
Too breathless to leave the house and dependent in Requires assistance with bathing and dressing (eMRCD 5b washing and dressing	2

Both DECAF score (Table 1) and modified DECAF (Table 2) score were calculated and statistically correlated to the length of hospital stay, need for ventilatory support (NIV or invasive ventilation), and in-hospital mortality.

Eosinopenia ($<0.05\times10^9$/l)	1
Consolidation (on chest radiograph)	1
Acidemia (pH<7.30)	1
Frequency of hospital admission in the last year	1
Total score	6

DECAF, dyspnea, eosinopenia, consolidation, acidemia, frequency of hospital admission; eMARD, extended modified Medical Research Council Dyspnea.

Table 1:- Parameters of conventional DECAF score [11].

Conventional DECAF score	Points
Dyspnea limiting the patient to home (MRCD 5)	
Independent in bathing and/or dressing (eMRCD 5a)	1
Requires assistance with bathing and dressing (eMRCD 5b)	2
Eosinopenia ($<0.05\times10^9$/l)	1
Consolidation (on chest radiograph)	1
Acidemia (pH<7.30)	1
Atrial fibrillation (on admission ECG)	1
Total score	6

eMRCD, extended modified Medical Research Council Dyspnea.

1. Mann–Whitney test: for abnormally distributed quantitative variables, to compare between two studied groups.
2. Kruskal–Wallis test: for abnormally distributed quantitative variables, to compare between more than two studied groups, and post hoc (Dunn's multiple comparisons test) for pairwise comparisons.
3. Wilcoxon signed-rank test: for abnormally distributed quantitative variables, to compare between two periods.
4. Friedman test: for abnormally distributed quantitative variables, to compare between morethan two periods or stages and post-hoc test (Dunn's) for pairwise comparisons.
5. Regression: to detect the most affecting factor formortality.

A receiver operating characteristic (ROC) analysis was calculated to determine the optimal cutoff value for total conventional DECAF score and modified DECAF score. The area under the curve, sensitivity,and specificity were also calculated to analyze thediagnostic value of both scores.

Increasing pack-year index of cigarette smoke statistically affected the mortality rate (P=01.010).

The initial place of admission
In this study, 14 patients were admitted to the ICU because of their poor general condition and acidemia. They required either invasive or NIV. On the other hand, 86 patients were admitted to the ward.

Invasive mechanical ventilation statistically affected the mortality rate (P=0.031*), while noninvasive MV did not statistically affect the mortality rate.

COPD and comorbidities
In this study, the most frequent morbidities associated with COPD patients were; hypertension (32%), diabetes (17%), ischemic heart disease (12%), heart failure (6%), and arrhythmia (5%).

Other less frequent morbidities are − described in Table 3. They ranged from 4 to 1%.

Hypertension (P=0.040), diabetes (P=0.043), and ischemic heart diseases (P=0.011*) were the most significant comorbidities linked to in-hospital mortality in patients with AECOPD.

Results:-

The study was carried out at the Respiratory ICU and Chest Department, Alexandria University Hospitals during the period from June 2018 to July 2019. It included 100 COPD patients with acute exacerbation.

The age of the studied patients ranged from 30 to 90 years with a mean of 57.46±13.12 years. There were 87 men and 13 women.

In-hospital mortality rates:
In total, nine (9%) patients died during their hospitalization.

Sociodemographic data
Increasing the age statistically affected the mortality rates (P=0.001). While there were no statistically significant differences between the two studied groups (survived/died) as regards gender difference.

Smoking status
Twenty-four patients were ex-smokers and 76 patients were current smokers including 65 patients who smoked cigarette, one patient smoked waterpipe, four patients were exposed to biomass fuel (burning wood/home cooking/heated fuel), and four patients were passive smokers.

Patients with multiple comorbidities were higher in mortality rate compared with patients with one comorbidity and this difference was statistically significant (^{MC}P=0.002*).

Causes of exacerbation
The most frequent causes of exacerbation were: infectious causes in 34%, noncompliance to medication in 21%, and in 21% of patients due to unknown defined etiology.

Less frequent causes were: AF, pleural effusion, and pneumothorax.

The original DECAF score and mortality
Sixteen patients presented by dyspnea grade (eMRCD 0–4) with a score 0; 59 patients presented by dyspnea grade (eMRCD 5a) with score 1. And 25 patients presented by dyspnea grade (eMRCD 5b) with score 2.

Eosinopenia was detected in 14% of patients, 25% of patients had consolidation, 24% of patients in their initial arterial blood gas showed acidemia, and 5% had AF

Increasing the severity of dyspnea, the presence of consolidation and acidemia statistically affected the

Table 3:- Comparison between the 2 studied groups regarding demographic and clinical data.

Outcome [n (%)]

	Total (n=100) [n (%)]	Survived (n=91)	Died (n=9)	P
Sex Male	87 (87.0)	78 (85.7)	9 (100.0)	FEP=0.601
Female Age (years) (mean±SD)	13 (13.0) 57.46±13.12	13 (14.3) 56.38±13.17	0 (0.0) 68.33±5.66	<0.001*
Smoking: Ex-smoker	24 (24.0)	22 (24.2)	2 (22.2)	FEP=1.000
Smoker	76 (76.0)	69 (75.8)	7 (77.8)	
Type of smoke Cigarette smoker	n=76 65 (85.5)	n=69 58 (84.1)	n=7 7 (100.0)	MCP=1.000
Water pipe	1 (1.3)	1 (1.4)	0	
Passive smoker	4 (5.3)	4 (5.8)	0	
Passive smoker+biomass	2 (2.6)	2 (2.9)	0	
Biomass fuel	4 (5.3)	4 (5.8)	0	
Index Minimum–maximum	n=65 10.0–100.0	n=58 10.0–90.0	n=7 10.0–100.0	0.010*
Mean±SD	46.67±21.17	44.20±19.01	67.14±28.26	
Median	45.0	45.0	75.0	
nitial space of admissionWard only	68	68.0	68	<0.001*
Ward then noninvasive ventilation	11	11.0	10	1.000
Ward then invasive ventilation	7	7.0	4	0.015*
Shift from noninvasive to invasive	2	2.0	1	0.173
Comorbidities Hypertension	32 (32.0)	25 (27.5)	7 (77.8)	0.004*
Diabetes	17 (17.0)	13 (14.3)	4 (44.4)	0.043*
Ischemic heart disease	12 (12.0)	8 (8.8)	4 (44.4)	0.011*
Heart failure	6 (6.0)	6 (6.6)	0	1.000
Arrhythmia	5 (5.0)	5 (5.5)	0	1.000
Viral hepatitis C	4 (4.0)	4 (4.4)	0	1.000
Obstructive sleep apnea	4 (4.0)	4 (4.4)	0	1.000
Cerebrovascular disease	3 (3.0	2 (2.2	1 (11.1)	0.249
Chronic kidney disease	3 (3.0)	2 (2.2)	1 (11.1)	0.249
Pulmonary hypertension	3 (3.0)	3 (3.3)	0	1.000
Tuberculosis	2 (2.0)	2 (2.2)	0	1.000
Gastroesophageal reflux	2 (2.0)	2 (2.2)	0	1.000
Depression	1 (1.0)	1 (1.1)	0	1.000
Peptic ulcer	1 (1.0)	1 (1.1)	0	1.000
Bronchoscopic lung volume reduction	1 (1.0)	1 (1.1)	0	1.000
Valvular HD	1 (1.0)	1 (1.1)	0	1.000
Number of comorbidities Median (minimum–maximum)	1.0 (0.0–4.0)	1.0 (0.0–4.0)	2.0 (1.0–3.0)	0.001*
Cause of exacerbation				
Noncompliant to medication	21 (21.0)	20 (22.0)	1 (11.1)	0.680
Unknown	21 (21.0)	19 (20.9)	2 (22.2)	1.000
Viral infection	18 (18.0)	18 (19.8)	0	0.357
Bacterial infection	16 (16.0)	13 (14.3)	3 (33.3)	0.154
Heart failure	4 (4.0)	4 (4.4)	0	1.000
Arrythmia	4 (4.0)	4 (4.4)	0	1.000
Pleural effusion	3 (3.0)	3 (3.3)	0	1.000
Pneumothorax	2 (2.0)	2 (2.2)	0	1.000

Thromboembolism	1 (1.0)	1 (1.1)	0	1.000
Frequency of admission 0	52 (52.0)	51 (56.0)	1 (11.1)	0.013*
1 (>2 times of admission in the last year)	48 (48.0)	40 (44.0)	8 (88.9)	
Original DECAF score				

Dyspnea
(Continued)

Table 3 (Continued)

Outcome [n (%)]

	Total (n=100) [n (%)]	Survived (n=91)	Died (n=9)	P
0 (no)	16 (16.0)	16 (17.6)	0	MCP<0.001
1 (eMRCD 5a)	59 (59.0)	58 (63.7)	1 (11.1)	
2 (eMRCD 5b)	25 (25.0)	17 (18.7)	8 (88.9)	
Eosinopenia 0 (no)	86 (86.0)	78 (85.7)	8 (88.9)	FEP=1.000
1 (yes)	14 (14.0)	13 (14.3)	1 (11.1)	
Consolidation 0 (no)	75 (75.0)	72 (79.1)	3 (33.3)	FEP=0.007*
1 (yes)	25 (25.0)	19 (20.9)	6 (66.7)	
Acidemia 0 (no)	76 (76.0)	75 (82.4)	1 (11.1)	FEP=<0.001*
1 (yes)	24 (24.0)	16 (17.6)	8 (88.9)	
Atrial fibrillation0 (no)	94 (94.0)	86 (94.5)	8 (88.9)	FEP=0.441
1 (yes)	6 (6.0)	5 (5.5)	1 (11.1)	
Total DECAF Median (minimum–maximum)	2.0 (0.0–5.0)	1.0 (0.0–5.0)	4.0 (3.0–5.0)	<0.001*
Total modified DECAF Median (minimum–maximum)	2.0 (0.0–6.0)	2.0 (1.95±1.37)	5.0 (4.67±0.71)	<0.001*
Duration of admission Median (minimum–maximum)	7.0 (7.88±2.98)	7.0 (7.58±2.85)	10.0 (10.89±2.71)	0.003*
Duration of mechanical ventilation Mean±SD	4.50±1.57	3.40±1.14	5.29±1.38	0.032*

DECAF, dyspnea, eosinopenia, consolidation, acidemia, frequency of hospital admission; e MRCD, extended Medical Research Council Dyspnea Scale; FE, Fisher exact test; HD, heart disease; MC, Monte-Carlo test. mortality rate, while the presence of AF andeosinopenia did not statistically affect the mortality rate.

The statistically significant higher death rate was found among patients with higher total DECAF.

Frequency of hospital admission: the modified DECAFscore

The increase in mortality rates were associated with frequent exacerbation leading to hospital admission at least two times in the last year. Frequency of admission showed a statistically significant effect on mortality rate than AF (P=0.013* vs 0.441).

The higher total modified DECAF had been associated with high in-hospital mortality. Patients who died showed statistically significant differences compared with those who survived as regards theincreasing total modified DECAF.

Mechanical ventilation and duration of hospital stay

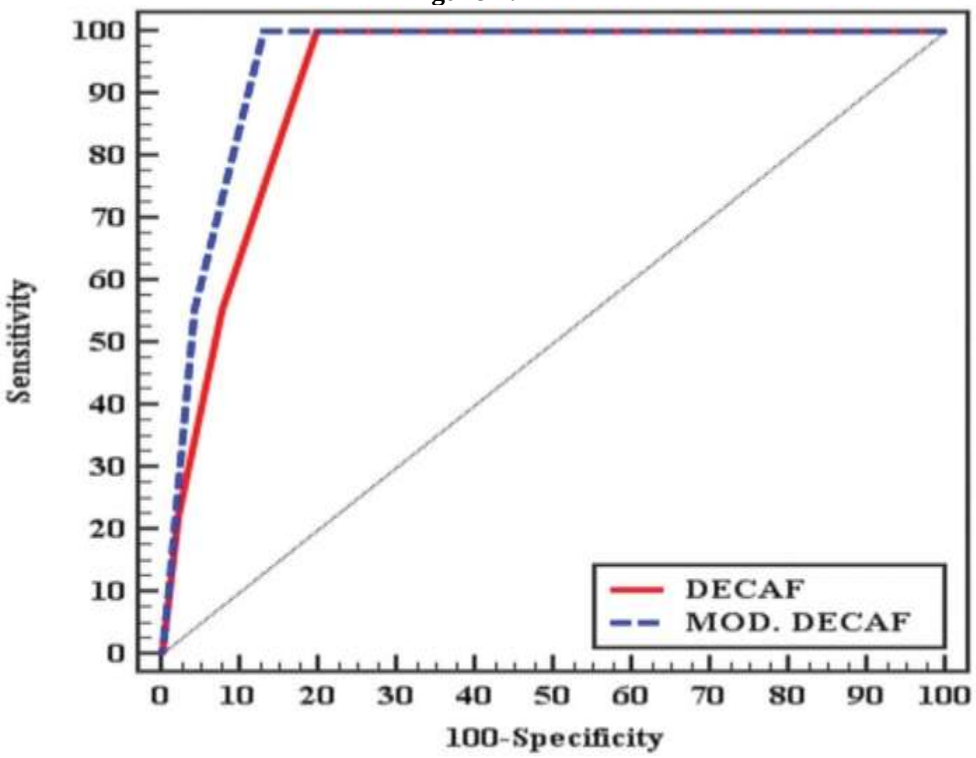
In the current study, 15 patients required invasive mechanical ventilation. The duration of mechanical ventilation ranged from 2 to 7 days,while 17 patients received noninvasive mechanicalventilation.

Increasing the duration of invasive mechanical ventilation was associated with an increase in mortality rates.

Increasing the duration of hospital admission statistically affected mortality rates (P=0.032). The majority of patients (67%) were admitted to the hospital from 5 to 10 days. In 13 patients, their hospital stay was less than 5 days while 20 patients were admitted for more than 10 days. Patients who died (9%) showed a prolonged hospital stay. In five ofthem their hospital stay was between 5 and 10 days and others were admitted for more than 10 days.

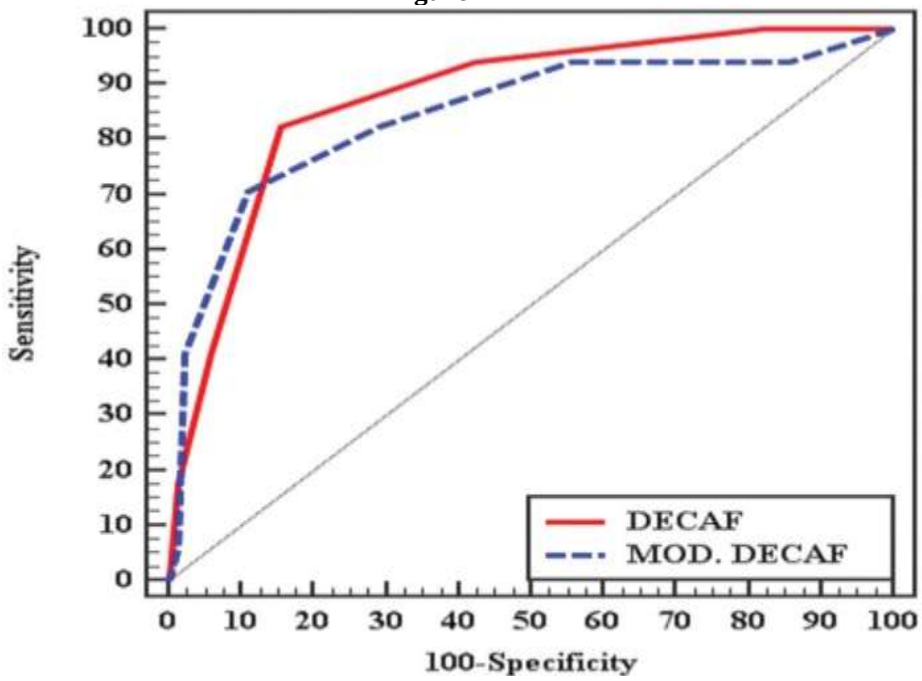
In our cohort, both conventional DECAF score and modified DECAF score were performed well for the prediction of in-hospital mortality. But the modified DECAF was higher in accuracy. The area under the receiver operating characteristic curve (AUROC) for prediction of mortality (Fig. 1) for the DECAF score was 0.920 [95% confidence interval (CI)= 0.862–0.978) and for the modified DECAF score was 0.948 (95% CI=0.905–0.991). Sensitivity to predict in-hospital mortality for both scores was 100%. The modified DECAF score was more specific, with a specificity of 86.81% while in the conventional DECAF it was 80.81%. The AUROC

Figure 1:-



Receiver operating characteristic curve for dyspnea, eosinopenia, consolidation, acidemia, frequency of hospital admission and modi- fied dyspnea, eosinopenia, consolidation, acidemia, frequency of hospital admission score to predict mortality

Figure 2



Receiver operating characteristic curve for dyspnea, eosinopenia, consolidation, acidemia, frequency of hospital admission and modi-fied dyspnea, eosinopenia, consolidation, acidemia, frequency of hospital admission score to predict the need for mechanical ventila-tion.

for predicting the need for MV (Fig. 2) was 0.875(95% CI=0.790–0.961) for DECAF score and 0.846 (95% CI=0.728–0.964) for the modified DECAFscore.

The steer et al. [11] study of the original DECAF score reported an in-hospital mortality rate of 10.4%. while Zidan et al. [12] showed a mortality rate of 11% in patients with AECOPD who required hospitalization

Discussion:-

COPD is considered a major cause of morbidity and mortality all over the world and cause a major progressive economic and social burden [15].

AECOPD if severe requires hospitalization or visiting the ER and is commonly associated with acute respiratory failure [16,17]. Early recovery is very important in determining the prognosis of patients with COPD and late recovery from exacerbation will increase the decline in forced expiratory volume in 1 s [17]. The prevention of exacerbation will save efforts to recover from this major disaster.

The study was carried out on 100 adult patients,13 women and 87 men with COPD exacerbation. The age ranged from 30 to 90 with a mean of 57.46 ±13.12 years. Recent studies have shown that the majority of COPD exacerbators were elderly men [18,19].

This study showed in-hospital mortality rates in 9% of COPD exacerbators who required hospitalization, whereas the in-hospital mortality rate reported byUK National COPD Audit was 7.7% in 2008 [20]. at Alexandria's main university hospital.

Nafea et al. [21] found a mortality rate of 12.5% duringthe in-hospital stay at Zagazig main university hospital.

Mortality rates in multiple studies ranged from 4% to30% in patients with AECOPD requiring hospitalization [22]. This variability in published in- hospital mortality rates for patients with AECOPD reflected the variabilities in patient characteristics rather than in the quality of care.

In this study,14 patients were admitted to the ICU. Sixpatients required noninvasive MV, while eight patients required MV.

Eight-six patients were admitted to the ward and received medical treatment, of which 11 patients required noninvasive MV and seven patients required invasive MV.

The total number of patients who received NIV was 17 patients (two patients were shifted to invasive MV) and the total number of patients who received MV was 17.

Invasive mechanical ventilation statistically significantly affected the mortality rate while noninvasive mechanical ventilation had no impact on mortality.

Steer et al. [11] showed that195 patients received noninvasive MV and four patients required invasive MV. All of them died which reflected that the requirement of invasive MV had a significant impact on death rate.

Regarding comorbidities, the current study illustrated that the most common comorbidities linked to mortality in patients with AECOPD during their hospital admission were hypertension (P=0.004*), diabetes mellitus (P=0.043*), and ischemic heart diseases (P=0.011*). Although heart failure and obstructive sleep apnea are highly prevalent, the direct risk for death is not significant. There was an increase in death rate with increasing number of coexisting morbidities in each patient.

Steer et al. [11] reported that cerebrovascular disease and AF were the most common comorbidities linked to mortality.

Identification of patients at high risk of death during their hospital stay could be useful for selecting the appropriate level of care, deciding suitable therapies, and planning safe discharges.

The DECAF Score: (D) dyspnea, (E) esinopenia, (C) consolidation, (A) acidemia, and (F) atrial fibrillation were derived by Steer and colleagues to predict exacerbators with mortality risk during the hospital stay.

DECAF score was the primarily prognostic tool used to stratify patients with AECOPD requiring hospital admission at risk of dying and to predict the outcome. The score has been published in 2012 with external validation in 2014. According to Steer et al. [11], the DECAF score is a stronger prognostic score when compared with CURB-65, COPD and Asthma Physiological Score and APACHE predictive tools.

The DECAF score was applied in patients with acute exacerbation of COPD at Alexandria University Hospital in 2014 by Zidan et al. [12] and confirmed the strong prediction of DECAF score in expecting the in-hospital mortality and suggested the new modifiedDECAF score.

Further application of the DECAF score in Egypt took place at Zagazig University Hospital. Nafae et al. [21] a found mortality rate of the studied patients with AECOPD was 12.5% and reported that the DECAF score had an excellent identification for patients at high risk of death during their hospital admission (AUROC=0.83) and performed significantly better than the COPD and Asthma Physiology Score (CAPS) (AUROC=0.65, P=0.01) and APACHE II score (AUROC=0.68).

Sanwang et al. [23] studied the efficacy of DECAF score versus BAP? 65 score [(B) elevated blood urea nitrogen, (A) altered mental status, (P)pulse >109,
age >65] in the prediction of mortality rate in COPD
with acute exacerbation. The study was applied in

India at a Haryana hospital and revealed that sensitivity for the prediction of mortality for DECAF score and BAP-65 score was 100% and the specificity was 34.1% for DECAF score and 63.4% for BAP-65 score. Sensitivity for prediction of the need for invasive ventilation for the DECAF score was 80% and 100% for the BAP-65 score. Specificity was 80% for the DECAF score and 60% for BAP-65.
In accordance with the results obtained by Stear et al. [11], Zidan et al [12], and Sanwang [23]. This study demonstrated the effectiveness of the DECAF score in expecting the mortality in patients with acute exacerbation of COPD (AUROC=0.93).

We compared the difference between the original DECAF (AUROC=0.93) [11] score and the modified DECAF (AUROC=0.95) [12] score. We recognized that both scores (original and modified) were sensitive in predicting in-hospital mortality in patients with COPD acute exacerbation. The sensitivity was 100% for both scores.

The modified DECAF was more specific than the original DECAF. The specificity of the modified vs the original was 84.95 and 78.49%, respectively.

The modified DECAF was higher in accuracy than the original one in the prediction of mortality rate in COPD patients with acute exacerbation with an AUROC of 0.948 and 0.920, respectively.

The sensitivity of the DECAF score was 82.35% for prediction of the need for mechanical ventilation and the modified DECAF was 70.59 with an AUROC score of 0.875) for the original DECAF and an AUROC of 0.846 for the modified DECAF.

Table 4:- Univariate analysis for the parameters affecting mortality.

		Univariate	
	B	P	OR (95%CI)
Age (years)	0.081	0.014*	1.084 (1.084–1.156)
Pack-year index of cigarette	0.059	0.014*	1.061 (1.012–1.112)
Hypertension	2.224	0.008*	9.240 (1.797–47.514)
Diabetes	1.569	0.033*	4.800 (1.137–20.258)
Ischemic heart disease	2.116	0.006*	8.300 (1.849–37.262)
Number of comorbidities	0.903	0.007*	2.466 (1.275–4.769)
Dyspnea	3.307	0.003*	27.294 (3.19–233.84)
Consolidation	2.025	0.007*	7.579 (1.734–33.135)
Acidemia	3.384	0.002*	29.50 (3.433–253.51)
Frequency of admission	2.159	0.047*	8.667 (1.032–72.757)
Duration of admission	0.373	0.008*	1.452 (1.102–1.912)
Duration of mechanical ventilation	1.487	0.108	4.422 (0.723–27.064)

B, unstandardized coefficients; CI, confidence interval; OR, odd's ratio. *Statistically significant at P≤0.05.

Furthermore, the MODIFIED DECAF was more specific to predict the need for MV. The specificity was 89.16 vs 84.16% in the original DECAF.

To sum up, predictors that showed significant impact on mortality in acute exacerbation of COPD in the current work are given in Table 4: age with P value 0.014*, severe dyspnea with P value 0.003, respiratory acidosis with P value 0.002, the presence of consolidation with P value 0.007, frequent exacerbation requiring hospitalization with P value of 0.047, hypertension with a P value of 0.014, and ischaemic heart disease with a P value of 0.033.

Conclusion:-

A clinical prediction tool should include practicality, and utility and validity. Both the original DECAF and the modified DECAF scores are practical and can be calculated easily using simple questions and routine investigations. Both were found to be good predictors of mortality and the need for IVM in this study. The modified DECAF score is more specific. We recommend the use of the modified DECAF score routinely in clinical judgment and triage assessment of patients.

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Conflicts of interest
There are no conflicts of interest.

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