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Usefulness of DECAF Score as a Predictor of 30-day Mortality in Patients with Dyspnea Aged 60 Years

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ABSTRACT

Objective: In this study, we aimed to investigate the prognostic values of dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation (DECAF), BAP-65, and CURB-65 scores in predicting hospitalization and 30-day mortality in elderly patients who received at least one of the diagnoses of chronic obstructive pulmonary disease (COPD), asthma, community-acquired pneumonia (CAP), and congestive heart failure (CHF).

Methods: Data from patients hospitalized for acute exacerbations of COPD, asthma, CAP, and CHF within 6 months from November 15, 2018 were obtained from hospital medical records. Clinical and laboratory parameters were examined, and discharge or hospitalization, intensive care unit (ICU) admission, and 30-day mortality were recorded. DECAF, CURB-65, and BAP-65 scores were calculated.

Results: This retrospective study included 369 patients aged 60 years. The DECAF score was found to be significant in predicting hospitalization according to BAP-65 and CURB-65 (odds ratio: 2.054, 1.263, 1.404, respectively). When we divided the patients into two groups, those who died within 30 days and those who did not, the DECAF scores were significantly higher in the group with mortality ($p<0.001$), whereas there was no significant difference between the two groups in terms of CURB-65 ($p=0.329$) and BAP-65 scores ($p=0.678$).

Conclusion: Our study demonstrated that the DECAF score was an effective predictor of hospitalization, need for ICU, and 30-day mortality in patients aged 60 years who presented with dyspnea and received at least one of the following diagnoses: COPD, asthma, CAP and CHF.

Keywords: Ageing, BAP-65, CURB-65, dyspnea, DECAF, geriatric medicine

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INTRODUCTION

Dyspnea is one of the most common reasons for the admission of elderly patients to the emergency department (ED). Patients may describe dyspnea in various ways: breathlessness, air hunger, painful breathing, or shortness of breath (1). In elderly patients, shortness of breath should not be considered a natural consequence of aging due to decreased functional capacity; however, the underlying possible pathology should be clarified. Although there is no direct algorithm to facilitate the management of dyspnea in the ED, cardiopulmonary disease should be excluded in the differential diagnosis of dyspnea (2).

Chronic obstructive pulmonary disease (COPD), asthma, community-acquired pneumonia (CAP), and congestive heart failure (CHF) are common causes of dyspnea in EDs. Although COPD is a common, preventable, and treatable disease presenting with persistent respiratory symptoms and airway obstruction, it is still a leading cause of mortality and morbidity (3). Asthma affects approximately 6.3% of patients aged 65 years (1,4,5). In asthma patients, the interval between symptoms and asymptomatic periods tends to shorten with increasing age, and the need for systemic steroids increases (4). A common cause of mortality and morbidity in the geriatric population is CAP, which has a prevalence of 34/1000, particularly in the elderly population over the age of 75 (6). Another cause of dyspnea that increases with advanced age is heart failure.

The CURB-65 score is a scoring system that has been used for many years to determine the severity and management of pneumonia. The dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation (DECAF) score is a scoring system that predicts in-hospital mortality in acute COPD exacerbation (AECOPD) based on the severity of DECAF. Dyspnea severity was determined using the Extended Medical Research Council Dyspnea scale (eMRCD), with eMRCD 1-4 0 points, eMRCD 5a 1 point, and eMRCD 5b 2 points. The BAP-65 score is used to predict MV and in-hospital mortality in patients with AECOPD. Although disease-specific scoring systems have been developed for estimating mortality due to acute dyspnea caused by these diseases, there is no scoring system containing objective parameters proven to predict hospitalization or 30-day mortality among patients admitted to the ED due to dyspnea.

In our study, we aimed to investigate the usefulness of the DECAF, CURB-65, and BAP-65 scores in determining hospitalization and predicting mortality in patients admitted to the ED for acute dyspnea who received at least one of the diagnoses of AECOPD, asthma attack, pneumonia, or decompensated CHF, as well as their efficacy in predicting hospitalization and 30-day mortality by comparing these three scores.

METHODS

In this study, we retrospectively analyzed patients aged 60 years who presented with dyspnea and were diagnosed with COPD, asthma, CAP, or CHF within 6 months from November 15, 2018. Data were obtained from hospital medical records. Approval was obtained from the Clinical Researches Ethics Committee of the University of Health Sciences Turkey, Haydarpaşa Numune Training and Research Hospital [HNEAH-KAEK 2018/49 (HNEAH-KAEK 2018/KK/49), date: 22.10.2018]. This study was conducted in compliance with the principles of the Declaration of Helsinki. The hospital ethics committee waived written informed consent because the study was retrospective and evaluated only the clinical data of the patients and did not involve any potential risk. The epicrises of patients admitted to the ED because of dyspnea were reviewed by two independent emergency medical physicians. Patients' final diagnoses explaining dyspnea were categorized as CAP, AECOPD, acute heart failure, asthma, and others. Patients presenting with shortness of breath were diagnosed with pneumonia if their symptoms included dry or phlegmatic cough, fever, chest and back pain, and radiological findings suggestive of pneumonia. The diagnosis of AECOPD was confirmed by worsening respiratory symptoms in patients with AECOPD compared with normal pulmonary function. The diagnosis of acute heart failure was confirmed by transthoracic echocardiography findings and B-type natriuretic peptide levels. Patients who had been hospitalized in the past month, patients receiving intravenous drug therapy, hemodialysis patients, patients with trauma in the past month, patients diagnosed with acute coronary syndrome, patients with pulmonary embolism, pleural effusion due to another cause, pneumothorax, cancer diagnosis, and epicrisis were excluded from the study. The epicrisis of the patients was examined, and age, sex, degree of dyspnea, AF, eosinophils, altered mental status, respiratory rate (RR), systolic blood pressure (SBP), heart rate, pH, blood urea nitrogen (BUN), partial oxygen pressure, presence of consolidation on radiography, discharge or hospitalization, intensive care unit (ICU) admission, and 1-month mortality were recorded. DECAF, CURB-65, and BAP-65 scores were calculated.

Statistical Analysis

The Shapiro-Wilk test was used to analyze the normality of the data. Continuous variables were summarized with mean ± standard deviation for normally distributed data and median [interquartile range (IQR): 25-75th percentile] for non-normally distributed data. Categorical variables were given with frequencies (n) and percentages (%). Pearson's chi-square test, Yates' chi-square test, and Fisher's Exact test were used for the analysis of categorical variables. The Mann-Whitney U test was performed for non-parametric comparisons of continuous data, whereas the independent t-test was used for parametric comparisons. Post-hoc analysis was performed using the Bonferroni correction. The optimal cutoff values of BAP-65, DECAF, and CURB-65 for differentiating 30-day mortality, need for mechanical ventilation (MV), and ICU stay were assessed using receiver operating characteristic (ROC) curve analysis. The area under the curve (AUC), sensitivity, specificity, and negative and positive predictive values were calculated and reported with 95% confidence intervals (CIs). The method of DeLong et al. (7) was used to compare AUCs.

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Multivariate logistic regression analyses were used to identify independent factors associated with 30-day mortality, ICU stay, service admission, and hospital admission. The results of the model were reported with odds ratios (ORs) and corresponding 95% CIs. Statistical analysis was conducted using IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, NY). The results were considered significant at p<0.05.

RESULTS

The mean age of the 369 patients included in the study was 74.57±9.92 years, and 52.3% of the patients were female. A total of 16.8% of the patients had AF, 49.3% had eosinopenia, 52.6% had consolidation, and 11.4% had acidemia. A total of 5.4% of the patients required non-invasive mechanical ventilation (NIMV) and 10.3% required MV. A total of 216 patients (58.5%) had pneumonia, 165 patients (44.7%) had AECOPD, 51 patients (13.8%) had CHF, and 69 patients (18.7%) had AECOPD + pneumonia. Forty-two patients (11.4%) presented to the ED with a complaint of acute change of consciousness. The eMRCD score was 0 in 250 patients (67.8%), 1 in 99 patients (26.8%), and 2 in 20 patients (5.4%). The median DECAF score was 2 (IQR: 1-2), the CURB-65 score was 4 (IQR: 4-5), and the BAP-65 score was 4 (IQR: 3-4). According to BAP-65, 11.9% of the patients were classified as class 1, 30.9% as class 2, 42.3% as class 3, 11.7% as class 4, and 3.3% as class 5.

The mean age of the patients who died in the first 30 days after admission to the ED was higher than that of the patients who did not die (p<0.001), and the sex distribution of the groups was statistically similar (p=0.549). The median eMRCD score was higher in the mortality group (p=0.022), patients with an eMRCD score of 2 were found to be higher in the mortality group (14.9% and 4%), and those with a score of 0 were found to be higher in the surviving group (69.6% and 55.3%) (p=0.006). AF (p=0.019), consolidation (p<0.001), and acidaemia (p=0.002) were observed more frequently in the mortality group. NIMV (p=0.007) and MV requirements (p<0.001) were higher in the mortality group. In the mortality group, the rates of pneumonia (p=0.004) and asthma in the surviving patients (p=0.035) were higher. While the DECAF scores of patients in the mortality group were significantly higher (p<0.001), no significant difference was found between the two groups in terms of CURB-65 (p=0.329). According to BAP-65, the rate of patients classified as class 1 (13.7% and 0%) and class 2 (32.9% and 17%) was higher in surviving patients, and the rate of patients classified as class 4 was higher in the mortality group (31.9% and 8.7%) (p<0.001). In the mortality group, patients with altered mental status (p<0.001), BUN >19 (p<0.001), BUN >25 (p<0.001), RR >30 (p=0.007) and SBP <90 mmHg (p<0.001) was at a higher rate (Table 1).

The mean age of the patients admitted to the ward was higher and according to ICU admission the mean age was was similar (p<0.001 vs. p=0.604). While the mean age value was significantly higher in the patients admitted to the ward, no significant difference was found according to age in the patients admitted to the ICU (p<0.001 vs. p=0.604). According to the mean age values of the patients who were hospitalized and discharged; the mean age of hospitalized patients was higher than those discharged, and the difference was significant between the two groups (p<0.001). The median eMRCD score was higher in patients with ICU admission (p<0.001), and patients with eMRCD scores of 1 (39.6% and 24.9%) and 2 (14.6% and 4%) were in the group with ICU admission and patients with a score of 0 were found to have a higher rate (71% and 45.8%) in the group without ICU admission (p<0.001). When the characteristics of hospitalized and discharged patients were examined, it was found that patients with an eMRCD score of 1 (31.4% and 20.1%) and 2 (8.2% and 1.3%) were higher in the hospitalized group, and those with a score of 0 were higher in the non-hospitalized group (78.5% and 60.5%) (p<0.001). In patients treated in the ward, eosinopenia (p=0.002) and consolidation (p<0.001) were at a higher rate, and acidemia (p=0.001) was at a lower rate. The incidence of eosinopenia, consolidation and acidemia was higher in ICU and hospitalized patients (p<0.05). The incidence of AF was found to be higher in hospitalized patients (p=0.023). NIMV (p=0.026) and MV (p<0.001) were lower in patients admitted to the ward. The need for NIMV and MV was observed more frequently in ICU patients (p<0.001). In ward patients, asthma rate was lower (p=0.003), pneumonia (p<0.001), CHF (p=0.003) and COPD + pneumonia rate (p=0.002) were higher. Pneumonia (p=0.008), altered mental status (p<0.001), BUN >19 (p<0.001), BUN >25 (p<0.001), RR >30 (p<0.001), SBP <90 (p<0.001) and heart rate ≥109 (p=0.003) were higher in ICU patients. The rate of patients with a heart rate ≥109 was lower in ward patients (p=0.019). The DECAF (p<0.001) and CURB-65 scores (p=0.018) of the hospitalized patients were higher. There was no significant difference in the BAP-65 scores of the patients according to hospitalization (p=0.661). DECAF scores of ward patients were found to be significantly higher (p<0.001). No significant correlation was observed between hospitalization and CURB-65 (p=0.883) and BAP scores (p=0.730). DECAF and CURB-65 scores of ICU patients were found to be significantly higher (p<0.001). According to BAP-65, the proportion of patients classified as class 1 (13.4% and 2.1%), class 2 (33.3% and 14.6%), and class 3 (44.5% and 27.1%) were in patients without ICU admission, whereas the proportion of patients classified as class 4 (31.3% and 8.7%) and class 5 (25% and 0%) was higher in ICU patients (p<0.001). The rate of patients classified as class 5 according to BAP-65 was found to be higher in unadmitted to the service group (6.1% vs. 0%; p=0.005) and the rate of patients classified as class 1 was higher in the without hospitalization group (18.8% and 7.3%), class 4 (16.4% and 4.7%), and class 5 (5.5% and 0%) (p<0.001) (Table 2).

In the multivariate analysis of parameters effective in predicting 30-day mortality, age (OR: 1.065; 95% CI: 1.027-1.105; p=0.001), need for MV (OR: 7.816; 95% CI: 2.055-29.724; p=0.003), SBP <90 mmHg (OR: 2.321; 95% CI: 1.03-5.23; p=0.042), and DECAF score (OR: 1.505; 95% CI: 1.05-2.156; p=0.026) increased the risk of 30-day mortality (Table 3).

ROC analysis findings for BAP-65, DECAF, and CURB-65 scores in discriminating 1-month mortality are presented in Table 4. BAP-65 [AUC =0.704 (95% CI: 0.655-0.750); p<0.001] and DECAF [AUC

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Table 1. Patient characteristics according to 1-month mortality

Variables	Patients (n=369) n (%)	30-day mortality (no) (n=322) n (%)	30-day mortality (yes) (n=47) n (%)	p-value
Age (years)	74.57±9.92	73.68±9.71	80.6±9.36	<0.001
Female	193 (52.3)	166 (51.6)	27 (57.4)	0.549
eMRCD	0 (0-1)	0 (0-1)	0 (0-1)	0.022
0	250 (67.8)	224 (69.6)[a]	26 (55.3)[b]	0.006
1	99 (26.8)	85 (26.4)[a]	14 (29.8)[a]	
2	20 (5.4)	13 (4)[a]	7 (14.9)[b]	
Atrial fibrillation	62 (16.8)	48 (14.9)	14 (29.8)	0.019
Eosinopenia	182 (49.3)	153 (47.5)	29 (61.7)	0.097
Consolidation	194 (52.6)	155 (48.1)	39 (83)	<0.001
Acidemia	42 (11.4)	30 (9.3)	12 (25.5)	0.002
NIMV	20 (5.4)	13 (4)	7 (14.9)	0.007
MV	38 (10.3)	20 (6.2)	18 (38.3)	<0.001
CAP	216 (58.5)	179 (55.6)	37 (78.7)	0.004
AECOPD	165 (44.7)	149 (46.3)	16 (34)	0.156
CHF	51 (13.8)	44 (13.7)	7 (14.9)	0.999
Asthma	28 (7.6)	28 (8.7)	0 (0)	0.035
AECOPD + CAP	69 (18.7)	58 (18)	11 (23.4)	0.493
Altered mental status	42 (11.4)	26 (8.1)	16 (34)	<0.001
BUN >19	210 (56.9)	171 (53.1)	39 (83)	<0.001
BUN >25	150 (40.7)	118 (36.6)	32 (68.1)	<0.001
RR >30/min	60 (16.3)	46 (14.3)	14 (29.8)	0.013
SBP <90 mmHg	59 (16)	43 (13.4)	16 (34)	0.001
Heart rate ≥109/min	87 (23.6)	77 (23.9)	10 (21.3)	0.831
DECAF score	2 (1-2)	2 (1-2)	2 (2-4)	<0.001
CURB-65 score	4 (4-5)	4 (4-5)	4 (4-5)	0.329
BAP-65 score				
Class I	44 (11.9)	44 (13.7)[a]	0 (0)[b]	<0.001
Class II	114 (30.9)	106 (32.9)[a]	8 (17)[b]	
Class III	156 (42.3)	134 (41.6)[a]	22 (46.8)[a]	
Class IV	43 (11.7)	28 (8.7)[a]	15 (31.9)[b]	
Class V	12 (3.3)	10 (3.1)[a]	2 (4.3)[a]	

Values are expressed as means ± standard deviation, median (IQR) or n (%). Independent t-test, Mann-Whitney U test, Yates chi-square test, Pearson chi-square test, Fisher's Exact test. Same letters in a row denote the lack of statistically significant difference
AECOPD: acute exacerbations of chronic obstructive pulmonary disease, BUN: blood urea nitrogen, CAP: community-acquired pneumonia, CHF: congestive heart failure, eMRCD: extended Medical Research Council Dyspnea scale, NIMV: non-invasive mechanical ventilation, MV: mechanical ventilation, RR: respiratory rate, SBP: systolic blood pressure, IQR: interquartile range, DECAF: dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation

=0.745 (95% CI: 0.698-0.789); p<0.001] scores were found to be able to differentiate patients who died. The differential power of the CURB-65 score for 1-month mortality was found to be lower than that of the BAP-65 and DECAF scores (p=0.308, p<0.001, and p<0.001, respectively; Figure 1). The optimal cut-off point for BAP-65 with the Youden index was calculated as more than 2 (sensitivity: 82.98% and specificity: 46.58%), >1 (sensitivity: 87.23% and specificity: 49.38%) for lactate, and more than 3 (sensitivity: 91.49% and specificity: 14.91%) for CURB-65 (Figure 1). The performances of BAP-65 and DECAF scores in distinguishing 1-month mortality were statistically similar (p=0.336).

The results of ROC analysis for BAP-65, DECAF, and CURB-65 scores in predicting ICU admission are shown in Table 5. BAP-65 [AUC =0.781 (95% CI: 0.735-0.822); p<0.001], DECAF [AUC =0.820; (95% CI: 0.777-0.857); p<0.001] and CURB-65 [AUC =0.653; (95% CI: 0.602-0.701); p<0.001] scores were found to be distinctive factors in predicting intensive care. Sensitivity and specificity were 56.25% and 91.28% for BAP-65 >3 cut-off values determined by

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Table 2. Patient characteristics by admission to ward, admission to ICU, and hospitalization or discharge

	Ward n (%)			ICU n (%)			Hospitalization n (%)		
Variables	No (n=197)	Yes (n=172)	p-value	No (n=321)	Yes (n=48)	p-value	No (n=149)	Yes (n=220)	p-value
Age	72.45±9.50	76.99±9.87	<0.001	74.40±9.9	75.71±10	0.604	71.37±9.0	76.71±9.9	<0.001
eMRCD	0 (0-1)	0 (0-1)	0.203	0 (0-1)	1 (0-1)	<0.001	0 (0-0)	0 (0-1)	<0.001
0	139 (70.6)	111 (64.5)	0.436	228 (71)[a]	22 (45.8)[b]	<0.001	117 (78.5)[a]	133 (60.5)[b]	<0.001
1	49 (24.9)	50 (29.1)		80 (24.9)[a]	19 (39.6)[b]		30 (20.1)[a]	69 (31.4)[b]	
2	9 (4.6)	11 (6.4)		13 (4)[a]	7 (14.6)[b]		2 (1.3)[a]	18 (8.2)[b]	
Atrial fibrillation	28 (14.2)	34 (19.8)	0.155	51 (15.9)	11 (22.9)	0.314	17 (11.4)	45 (20.5)	0.023
Eosinopenia	86 (43.7)	96 (55.8)	0.020	148 (46.1)	34 (70.8)	0.002	52 (34.9)	130 (59.1)	<0.001
Consolidation	75 (38.1)	119 (69.2)	<0.001	159 (49.5)	35 (72.9)	0.004	40 (26.8)	154 (70)	<0.001
Acidemia	33 (16.8)	9 (5.2)	0.001	17(5.3)	25 (52.1)	<0.001	8 (5.4)	34 (15.5)	0.005
NIMV	16 (8.1)	4 (2.3)	0.026	4 (1.2)	16 (33.3)	<0.001	0 (0)	20 (9.1)	<0.001
MV	33 (16.8)	5 (2.9)	<0.001	5 (1.6)	33 (68.8)	<0.001	0 (0)	38 (17.3)	<0.001
CAP	91 (46.2)	125 (72.7)	<0.001	179 (55.8)	37 (77.1)	0.008	54 (36.2)	162 (73.6)	<0.001
AECOPD	96 (48.7)	69 (40.1)	0.097	145 (45.2)	20 (41.7)	0.764	76 (51)	89 (40.5)	0.045
CHF	17 (8.6)	34 (19.8)	0.003	46 (14.3)	5 (10.4)	0.611	12 (8.1)	39 (17.7)	0.013
Asthma	23 (11.7)	5 (2.9)	0.003	25 (7.8)	3 (6.3)	0.999	20 (13.4)	8 (3.6)	0.001
AECOPD + CAP	25 (12.7)	44 (25.6)	0.002	57 (17.8)	12 (25)	0.316	13 (8.7)	56 (25.5)	<0.001
Altered mental status	27 (13.7)	15 (8.7)	0.180	15 (4.7)	27 (56.3)	<0.001	0 (0)	42 (19.1)	<0.001
BUN >19	104 (52.8)	106 (61.6)	0.087	171 (53.3)	39 (81.3)	<0.001	65 (43.6)	145 (65.9)	<0.001
BUN >25	73 (37.1)	77 (44.8)	0.132	118 (36.8)	32 (66.7)	<0.001	41 (27.5)	109 (49.5)	<0.001
RR >30/min	35 (17.8)	25 (14.5)	0.401	33 (10.3)	27 (56.3)	<0.001	8 (5.4)	52 (23.6)	<0.001
SBP <90 mmHg	34 (17.3)	25 (14.5)	0.476	40 (12.5)	19 (39.6)	<0.001	15 (10.1)	44 (20)	0.016
Heart rate ≥109/min	56 (28.4)	31 (18)	0.019	67 (20.9)	20 (41.7)	0.003	36 (24.2)	51 (23.2)	0.828
DECAF score	1 (0-2)	2 (1-3)	<0.001	1 (1-2)	3 (2-3)	<0.001	1 (0-2)	2 (1-3)	<0.001
CURB-65 score	4 (4-5)	4 (4-5)	0.883	4 (4-5)	5 (4-5)	<0.001	4 (4-5)	4 (4-5)	0.018
BAP-65 score									
Class I	29 (14.7)[a]	15 (8.7)[a]	0.005	43 (13.4)[a]	1 (2.1)[b]	<0.001	28 (18.8)[a]	16 (7.3)[b]	<0.001
Class II	58 (29.4)[a]	56 (32.6)[a]		107 (33.3)[a]	7 (14.6)[b]		51 (34.2)[a]	63 (28.6)[a]	
Class III	76 (38.6)[a]	80 (46.5)[a]		143 (44.5)[a]	13 (27.1)[b]		63 (42.3)[a]	93 (42.3)[a]	
Class IV	22 (11.2)[a]	21 (12.2)[a]		28 (8.7)[a]	15 (31.3)[b]		7 (4.7)[a]	36 (16.4)[b]	
Class V	12 (6.1)[a]	0 (0)[b]		0 (0)[a]	12 (25)[b]		0 (0)[a]	12 (5.5)[b]	

Values are expressed as means ± standard deviation, median (IQR) or n (%). Independent t-test, Mann-Whitney U test, Yates chi-square test, Pearson chi-square test, Fisher's Exact test. Same letters in a row denote the lack of statistically significant difference
AECOPD: acute exacerbations of chronic obstructive pulmonary disease, BUN: Blood urea nitrogen, CAP: community-acquired pneumonia, CHF: congestive heart failure, eMRCD: extended Medical Research Council Dyspnea scale, ICU: intensive care unit, NIMV: non-invasive mechanical ventilation, MV: mechanical ventilation, RR: respiratory rate, SBP: systolic blood pressure, DECAF: dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation

the Youden index, 68.75% and 81.93% for DECAF >2, 64.58% and 63.55%, respectively, for CURB-65 >4. No significant difference was observed in terms of distinguishing performances of BAP-65 and DECAF scores for ICU admission (p=0.379).

DISCUSSION

In our study, the DECAF score was found to be significant in predicting hospitalization and 30-day mortality in patients aged 60 years who applied to the ED with shortness of breath and received at least one of the diagnoses of COPD attack, asthma attack, pneumonia, or decompensated CHF. When DECAF, BAP-65, and CURB-65 were compared with one another by multivariate analysis, DECAF was found to be superior (OR: 1.505) to the others in predicting 30-day mortality. For DECAF cut-off >1, AUC: 0.74, sensitivity 87.23%, specificity 49.38, and negative predictive value (NPV) 96.4% were found.

A decrease in cardiopulmonary capacity with aging, systemic circulation, and stiffening of the pulmonary circulation are expected changes (8). The prevalence of heart failure increases to 10% between the ages of 60 and 79 years, whereas this rate is 12-

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Table 3. Multivariate logistic regression analysis of parameters effective in predicting 30-day mortality

Variables	OR (95% CI)	p-value
Age	1.065 (1.027-1.105)	0.001
CAP	1.194 (0.482-2.962)	0.701
NIMV	0.629 (0.136-2.905)	0.553
MV	7.816 (2.055-29.724)	0.003
RR >30/min	0.726 (0.279-1.888)	0.512
SBP<90 mmHg	2.321 (1.03-5.23)	0.042
DECAF score	1.505 (1.05-2.156)	0.026
BAP-65 score	1.312 (0.847-2.031)	0.224

CAP: community-acquired pneumonia, NIMV: non-invasive mechanical ventilation, MV: mechanical ventilation, RR: respiratory rate, SBP: systolic blood pressure, OR: odds ratio, CI: confidence interval, DECAF: dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation

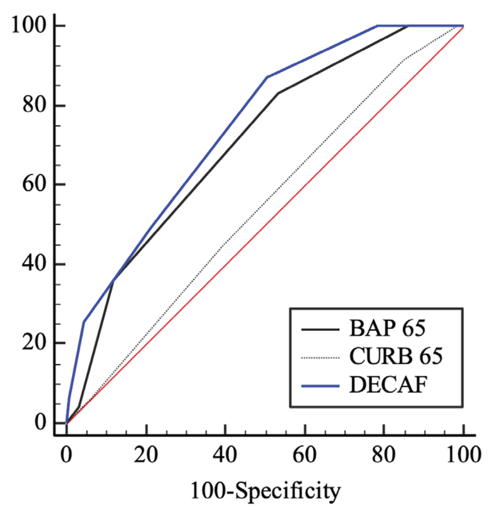

Figure 1. Comparison of BAP-65, DECAF and CURB-65 scores in distinguishing 30-day mortality
DECAF: dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation

14% over the age of 80 (9). While the rate of hypertension between the ages of 60 and 69 is above 50%, the rate of hypertension above the age of 70 increases to 75% (10). The prevalence of COPD is 9.2% in the 40-59 age group and 22.6% in the 60-79 age group (11). CAP is 4 times more common in the elderly population than in the young population, and hospitalization and cap-related deaths are also more common in the elderly population (12). Asthma, on the other hand, causes lower airway inflammation and can occur at any age, with an incidence of 5.4/1000 between the ages of 50 and 70 (13). Today, the elderly population rate is gradually increasing, and aging leads to a decrease in organ function and an increase in chronic diseases and polypharmacy (6,10,14). Considering the additional medical history of elderly patients, it is possible that they will be diagnosed more than once at the time of admission. Thus, the evaluation of geriatric patients may require a more complex and multidisciplinary approach than that of younger individuals.

Dyspnea may be an important symptom of underlying cardiopulmonary diseases in elderly patients. It may be difficult to differentiate acute cardiac from pulmonary causes of dyspnea, particularly in the elderly population (15). The Borg scale and modified Borg scale were developed for evaluating shortness of breath, and the use of these scores in patients with COPD and asthma has been confirmed (15,16). However, the fact that these scoring systems contain subjective parameters may limit their applicability. Gondos et al. (15) developed a scoring system to accelerate the triage of patients with dyspnea in the ED by using more objective parameters in the evaluation of dyspnea. Using bedside scoring systems, clinicians can quickly assess the patient, predict their mortality, and decide if they should be hospitalized. In fact, some researchers have argued that clinicians can evaluate the risk of early mortality and plan treatment using this scoring system by improving the geriatric pneumonia index in the evaluation of patients diagnosed with geriatric pneumonia (6). The effectiveness

Table 4. Discriminative performance of BAP-65, DECAF and CURB-65 scores in predicting 30-day mortality in dyspnea patients

Variables	AUC (95% CI)	p-value	Cut-off value	Sensitivity (%)	Specificity (%)	NPV (%)
BAP-65	0.704 (0.655-0.750)	<0.001	>2	82.98	46.58	94.9
DECAF	0.745 (0.698-0.789)	<0.001	>1	87.23	49.38	96.4
CURB-65	0.541 (0.489-0.593)	0.308	>3	91.49	14.91	92.3

AUC: area under curve, CI: confidence interval, NPV: negative predictive value, DECAF: dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation

Table 5. Discriminative performance of BAP-65, DECAF and CURB-65 scores in predicting ICU admission in patients

Variables	AUC (95% CI)	p-value	Cut-off value	Sensitivity (%)	Specificity (%)	NPV (%)
BAP-65	0.781 (0.735-0.822)	**<0.001**	>3	56.25	91.28	93.3
DECAF	0.820 (0.777-0.857)	**<0.001**	>2	68.75	81.93	94.6
CURB-65	0.653 (0.602-0.701)	**<0.001**	>4	64.58	63.55	92.3

AUC: area under curve, CI: confidence interval, NPV: negative predictive value, AUC: area under curve, CI: confidence interval, DECAF: dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation, ICU: intensive care unit

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of the DECAF score in predicting mortality in patients with AECOPD has been demonstrated in different studies (17,18). In the study by Bansal and Gaude (19) with 228 patients, it was shown that mortality increased as the score increased, and the DECAF score was successful in predicting in-hospital mortality in AECOPDs. In a study conducted with 118 low-risk AECOPD patients, it was shown that the DECAF score could distinguish patients who could be treated quickly and safely at home (20). In another study, it was found that the DECAF score was more successful in predicting 1-month mortality in patients with AECOPD than the CURB-65 and BAP-65 scores (21). However, to the best of our knowledge, this scoring system consisting of more objective parameters has not been studied in terms of its effectiveness in predicting mortality in older individuals suffering from at least one of the following diagnoses: AECOPD, asthma, pneumonia, and acute heart failure. When we examined patients who had dyspnea and at least one of the diagnoses of AECOPD, asthma, pneumonia, and CHF, we found that the DECAF score was significantly predictive of hospitalization when compared with the BAP-65 and CURB-65 scores (OR: 2.054, 1.263, 1.404, respectively). While BAP-65 was not found to be significant in predicting hospitalization, the sensitivity for cut-off >2 was 82.98%, the specificity was 46.58%, and the NPV was 94.9% in predicting 30-day mortality. In predicting 30-day mortality, the CURB-65 score had the lowest AUC (AUC: 0.745, sensitivity 91.49%, specificity 14.91%, NPV 92.3%) for a cut-off >3. Specifically, when we examined the literature, we find that an AUC value of >0.8 was found to be reliable in predicting mortality in patients with AECOPD (18,22). In our study, the AUC value was 0.820 (95% CI 0.777-0.857), sensitivity was 68.75%, and specificity was 81.93% for the DECAF >2 cut-off value in predicting ICU admission.

Study Limitations

One of the most important limitations of our study is that it is a single-center study, and therefore, a relatively small number of patients participated in the study. Due to the rapid increase in the geriatric population today, it is also becoming increasingly likely that patients in EDs will include geriatric patients. Multicenter studies in this field are likely to assist clinicians in managing geriatric patients by predicting mortality and will have a significant impact on reducing health expenditures by preventing unnecessary hospitalizations in geriatric patients.

CONCLUSION

In conclusion, our study demonstrated that the DECAF score is an effective indicator of mortality in patients aged 60 years presenting with dyspnea and receiving at least one of the diagnoses of AECOPD, asthma, pneumonia, or acute CHF. The DECAF score can be used to determine patient hospitalization and mortality risk in the crowded environment of EDs.

Ethics Committee Approval: Approval was obtained from the Clinical Researches Ethics Committee of the University of Health Sciences Turkey, Haydarpaşa Numune Training and Research Hospital [HNEAH-KAEK 2018/49 (HNEAH-KAEK 2018/KK/49), date: 22.10.2018].

Informed Consent: The hospital ethics committee waived written informed consent because the study was retrospective and evaluated only the clinical data of the patients and did not involve any potential risk.

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