Review Article

Predicting Outcome in AECOPD: A Review of the Scoring Systems

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Abstract

Background: COPD is a chronic lung condition marked by episodes of worsening symptoms such as dyspnea and/ or cough and sputum production known as exacerbations (ECOPD). Patients with COPD experience higher overall morbidity and death as a result of these events. There are fewer validated measures available for patients presenting with ECOPD, despite the fact that indicators like ADO, BAED, BODE, and BODEx have successfully predicted mortality in stable COPD. In this patient population, research on BAP65 and DECAF scores has shown some promise. BAP score was built on four clinical variables and predicts mortality and requirement of invasive ventilation. DECAF score takes into account five parameters and has been found to predict outcome accurately. Over time, modified versions have been proposed including the modified DECAF and DECAF-L scores. Many authors have used the CURB-65 and APACHE II scores for predicting in-hospital mortality in ECOPD as well. Comparison between these indices has shown varied results. This review examines the major scoring systems used to predict mortality and the need for invasive ventilation, from the original BAP 65 and DECAF score to modified DECAF and DECAF-L scores and comparing their performance.

Keywords: Chronic Obstructive Pulmonary Disease; Symptom flare up; BAP65; DECAF; APACHE II; Invasive Ventilation; Mortality; Prognosis.

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Introduction

The definition of Chronic Obstructive Pulmonary Disease (COPD) is: "a heterogeneous lung condition characterized by persistent, frequently progressive airflow obstruction caused by abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema), resulting in chronic respiratory symptoms (dyspnea, cough, sputum production, and/or exacerbations)."[1]

Exacerbations (ECOPD) are episodes that occur throughout the natural course of COPD and are characterized by: "Events that worsen over less than 14 days and are characterized by dyspnea and/or cough and sputum".[2]

These incidents not only have a detrimental impact on health, but they also raise hospitalization rates and accelerate the course of illness. Infections, primarily viral ones, are the primary cause of exacerbations, while environmental factors may have a significant impact.

ADO, BAED, BODE, and BODEx are some of the indicators that have been proposed to assess prognosis in patients with stable COPD. According to several investigations, these indices have been useful in predicting mortality in individuals with stable COPD.[3,4] However, there aren't many of these indices for ECOPD patients. Recent research on DECAF and BAP 65 scores has shown some promise for these patients.

In this manuscript, we have reviewed the various scoring systems that have been used to predict the outcome of patients admitted as ECOPD.

Predictors of mortality in patients with ECOPD:

1. BAP score

It is a clinical instrument for predicting the severity of clinical consequences in patients experiencing a COPD exacerbation. This scoring system was developed by Tabak et al (5).

The tool utilizes four variables:

1. a.Blood urea nitrogen (BUN) > 25 mg/dl
2. b.Altered mental status
3. c.Pulse rate (PR)≥ 109 bpm
4. d.Age> 65 years

A score of 1 is awarded to each parameter; thus, scores range from 0 to 4.

Risk stratification

Patients are classified into various risk categories as follows:

Risk category	Score
Low	0-1
Intermediate	2
High	3-4

The role of the BAP 65 score in predicting death in ECOPD has been shown by a few clinical investigations.

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Tabak et al., classified the patients into 5 groups based on the above parameters and found that the mortality rates varied significantly among them (0.5%, 1.4%, 3.7%, 12.7% and 26.2% respectively; p<0.001). Thus, patients with all 3 risk-factors (BUN more than 25 mg/dl, PR≥ 109 bpm and altered mental status with age >65 years had the highest mortality and need for MV as compared to those more than 65 years of age and without any of the risk factors. A similar trend was observed with the need for mechanical ventilation (0.3%, 0.2%, 1.2%, 5.4% and 10.1% respectively). The study although included 88,074 patients involved collecting information retrospectively from database. Also, patients presenting with acute respiratory failure where intubation and mechanical ventilation was imminent were not included in the study; the inclusion of this subset of patients may have altered the results. The study also did not take into consideration any of the spirometry parameters.[5]

A study by Shorr et al., analysed 34,478 cases of ECOPD from 195 US hospitals. With rising BAP 65 scores, the need for MV rose from 1.4% in patients with a score of 0 to 52% in individuals with a score of 4. The study also showed that BAP 65 score had a better accuracy in predicting need for MV as well mortality (AUROC 0.81 and 0.78 respectively). This study also was retrospective in nature and the diagnosis of ECOPD depended entirely on the database. Also, the study did not include patients with pneumonia. The study also did not include data on the spirometry parameters as well as non-invasive ventilation.[6]

Similar findings were found in another study by Tabet et al. that was published in 2016. The BAP 65 score caused the death rate to rise from less than 1% at score 0 to.50% at score 4 (p<0.0001). This study included 980 subjects from 2 Lebanese Hospitals. However, this study too was retrospective in nature and did not include patients <40 years of age.[7] A study by Gayaf et al., showed that patients of ECOPD with higher BAP 65 score had a higher 30 and 90-day mortality (p< 0.05). The findings were also similar for other scoring tools like DECAF, CURB 65 and PSI. This study included data of 141 patients between January 2018 and March 2019 and was planned as a retrospective study.[8]

Hassan et al.found a significant difference between BAP 65 scores among patients of ECOPD who were discharged and those who died.[9]

Sangwan et al., in their prospective study found a high BAP 65 score in patients who died. In predicting mortality, the sensitivity and specificity of BAP 65 score were 100% and 63.4% respectively. The BAP 65 score has 100% sensitivity and 60% specificity in predicting the requirement for invasive ventilation. This study had a small sample size of 50 patients and thus raises questions about the generalisability of results.[10]

DECAF score:

Steer et al. created a clinical tool called the DECAF score. The tool takes into consideration the following parameters:

Parameter		**Score**
Dyspnea	eMRCD 5a	1
	EMRCD 5b	2
Eosinopenia (eosinophil count <0.05*10^9/l		1
Presence of consolidation in radiology		1
Acidemia (pH <7.3)		1
Presence of atrial fibrillation		1

Steer et al., first published the DECAF score where they included 920 patients of ECOPD from 2 neighbouring hospitals. The score's internal validity in predicting mortality was found to be good (AUROC = 0.86). It outperformed other metrics such as the BAP 65 score (AUROC=0.68; p<0.001), the COPD and Asthma Physiology Score (p<0.001), and APACHE II (AUROC=0.73; p<0.001).[11]

The meta-analysis by Huang et al., involved 17 studies (8329 participants). Raised DECAF scores were associated with higher mortality. The prognostic value was proved to be better than modified DECAF score, COPD and Asthma Physiology Score, BAP 65 score and APACHE II score.[12]

Hu et al., reported in their meta-analysis that the sensitivity and specificity of DECAF score in predicting mortality to be 77% and 76% respectively. The AUC was 0.83 (95% CI: 0.79-0.86).[13]

Additionally, patients with ECOPD have been predicted using the DECAF score. Additionally, Prajapati et al. observed that the AUROC for the DECAF score was 0.84 for ICU hospitalization and 0.89 for mortality. However, there were only 83 patients in the research.[14]

Ahmed et al. included 92 patients 92 patients in their cross-section observational study. The AUROC was 0.974 for DECAF score in predicting the need for NIV in patients with ECOPD. The sensitivity and specificity for a cut-off value of 3 was 84.21% and 94.4% while those for a cut-off value of 4 were 84.52% and 100% respectively.[15]

Modified DECAF Score: These parameters are part of the updated DECAF score:

-Dyspnea
-Eosinopenia
- Consolidation on chest X-ray
-Acidosis
-Frequency of hospital stays

Results from comparative studies have been inconsistent. According to Huang et al.'s meta-analysis, the modified DECAF score had a worse predictive value than the DECAF score..[12]

The modified DECAF score outperformed the DECAF score in predicting mortality in prospective research by Zidan et al. in terms of AUROC (0.95), accuracy (0.92), and specificity (0.86). Nevertheless, the sample size for this investigation was small. To establish this grading system, more assessment is necessary.[16]

DECAF-L Score: To improve predictive accuracy in patients with AE-COPD, the DECAF-L score adds serum lactate levels to the DECAF score. In a prospective trial with 200 patients, Oral et al. found a significant correlation between the DECAF-L score

and 30-day mortality (AUROC=0.653; p=0.039). When the DECAF-L value rose by one unit, this risk rose by 29.6%.[17] However, further validation is required before routine clinical application.

Other scoring systems

CURB 65 score:

Originally developed to assess the severity of community-acquired pneumonia, the CURB-65 score has also been applied to ECOPD patients. The parameters include:

- Confusion
- > 7 mmol/L (or > 20 mg/dL) of blood urea nitrogen
- Respiratory rate ≥ 30/min
- Systolic blood pressure < 90 mmHg or diastolic blood pressure < 60 mmHg
- Age ≥ 65 years

A score of 1 is attributed to each parameter; the overall score thus varies between 0 and 5. The chances of mortality increase with the score.

Zhang et al., reported that ECOPD patients who died had significantly higher CURB-65 scores, with sensitivity and specificity of 94% and 67.2%, respectively, and an AUROC of 0.882.[18] Shorr et al compared CURB-65 and BAP-65 scores for predicting the need for mechanical ventilation. The AUROC for BAP-65 was higher both for early mechanical ventilation (0.81 vs 0.76) and for ventilation at any time during hospitalisation (0.78 vs 0.74).[16]

Other than these scoring systems, those used in patients admitted to ICU (APACHE II, NEWS etc) have also been used in predicting outcome of patients with ECOPD; their use and validation is however, limited.

Conclusion

Various scoring systems have been proposed for predicting the outcomes in a patient with ECOPD, with BAP 65 and DECAF score being the most widely studied. BAP-65 score is simpler to apply while DECAF score has good prognostic utility in predicting mortality and the need for invasive ventilation and has outperformed other scoring systems in some studies. The regular use of these scoring systems will definitely help clinicians in predicting outcome and thus scrutinizing treatment in these cases.

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