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ORIGINAL ARTICLE

Comparison of NEWS2 and CURB65 Score in Predicting Mortality of Hospitalized patients with AECOPD

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ABSTRACT

Aim: To determine the diagnostic accuracy of the NEWS2 and CURB-65 scores in predicting in-hospital mortality in patients with acute exacerbations of COPD, mortality during hospital stays is considered the gold standard.
Study Design: Cross-sectional study-design.
Place and duration of study: Department of Chest Medicine, JPMC, Karachi, from September 25, 2020, to January 25, 2021. Two hundred and twelve patients of both genders were included who were admitted because of acute COPD exacerbations. The National Early Warning Score 2 (NEWS2) and CURB-65 Score in the estimation and evaluation of hospital-related mortality were noted.
Results: NEWS2 predicted 156(73.6%), CURB-65 predicted 72(34%) as high-risk patients, and in-hospital mortality was 39(18.4%). NEWS2 had shown sensitivity of 100%, specificity of 32.4%, diagnostic accuracy of 45%, PPV of 25.1%, and NPV of 100% as a prediction value of in-hospital mortality. CURB-65 had shown sensitivity of 76.9%, specificity of 75.7%, and diagnostic accuracy of 76%, PPV of 41.7%, and NPV of 93.6% as a prediction value of in-hospital mortality.
Implication: It is recommended that individual analyses of these associated factors be performed in future studies for the formulation of novel, efficient scores that may be better predictors of mortality in AECOPD patients.
Conclusion: Both of the scoring systems can be used for the purpose of AECOPD patients risk stratification as per clinicians' preference and as the basic tools of assessment in a resource-poor country.
Keywords: Acute exacerbation of COPD, NEWS2, CURB-65, In-hospital mortality

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is considered one of the most reported non-communicable diseases, characterised by airflow limitation as well as having a debilitating effect on life quality and life expectancy[1].

In recent research, COPD has been reported as the third major cause of mortality all over the globe[2]. It is chronic, punctuated with sudden aggravating patterns and acute dyspnea episodes, as well as a productive cough. These acute exacerbations of COPD (AECOPD) have various triggering factors, including tobacco usage, passive smoke, or air pollution, which can have fatal implications for health[2,3].

The frequency of AECOPD increases with the progression of COPD, with a high risk of recurrence during the first eight weeks. The in-hospital mortality rate for AECOPD ranges between 2.5 and 25%, with an incidence of readmission rates between 25 and 55% for patients who survived earlier. Unfortunately, around 25–50% of AECOPD patients lose their life battle within the first year of their disease. 4 Hypoxemia as well as hypercapnia are also considered high-risk factors. These are diagnosed through arterial blood gas (ABG) analysis with other clinical representations, including short walks within a fixed time and the functional severity of dyspnea in addition to the low body mass index. However, among all the risk factors, the major single risk feature is the forced-expiratory volume within a second (FEV1)[1].

Identification of community-acquired pneumonia (CAP) at risk of thirty-day mortality was very crucial until Lim published the data on the CURB-65 score. 5 In recent years, the CURB-65 score has been widely used, with its implications within various societies, including British thoracic society. However, most components of CURB-65 have been applied in the general-prediction tools as well as in the particulars of age linked with mortality[6].

The National Early Warning Score (NEWS) is another predictor of mortality that has been validated and recommended for acutely sick patients. However, as a consequence of significant concerns regarding this scoring system, there has been a proposal for NEWS2 as an adjusted score[7]. NEWS2, published half a decade ago, has proven its efficacy for hypercapnic respiratory failure patients. It suggests an alternative scoring system for oxygen saturation (SpO_2), which is similar to the Salford NEWS.

Hodgson and his colleagues8 have reported in their research that the NEWS2 Score has 28% sensitivity and a 93% specificity in terms of prediction of in-hospital mortality in acute-exacerbation COPD patients. Similarly, in the research of Parras et al. (9), the CURB-65 Score sensitivity has been predicted at 93.4%, whereas it had a specificity of 54.5% in the in-hospital mortality prediction of AECOPD patients. Ahmed et al.10 have elaborated CURB-65 sensitivity, specificity, PPV, NPV, and accuracy as 64.71%, 68.75%, 46.81%, 82.09%, and 67.54%, respectively, in hospital mortality prediction of AECOPD patients.

It is evident that the CURB-65 score, which was originally designed for pneumonia scoring, has also been applied to AECOPD, and the NEWS2 scoring system has also been used for the prediction of hospital mortality in various populations. In addition to these scoring systems, many researchers have also evaluated various other scoring systems, as DECAF has been reported as a better predictor of hospital mortality when compared with the Acute Physiology and Chronic Health Evaluation (APACHE) II prognostic index (AUROC =0.73; DECAF vs. APACHE II p<0.001). Similarly, the COPD and Asthma Physiology Score (AUROC =0.71, p<0.001) as well as the BAP-65 (elevated blood urea nitrogen, altered mental status, pulse >109/min, age >65 years) Score (AUROC =0.68, p<0.001) have also been reported as efficient predictors of in-hospital mortality in patients with AECOPD. In research, multiple scoring systems were studied, and BAP outperformed as a scoring predictor of hospital mortality. 11 This proves that comparison of scoring systems is significantly required within an emergency room for diagnostic accuracy and the life expectancy of the patients, as proposed and conducted in this research, wherein the diagnostic accuracy of the NEWS2 and CURB-65 scores has been evaluated in detail. The results of this study would benefit in choosing the most appropriate gold standard scoring options to timely identify AECOPD patients at risk of early mortality.

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MATERIALS AND METHODS

This cross-sectional study was conducted at the Department of Chest Medicine, JPMC, Karachi, from September 25, 2020, to January 25, 2021, and 212 patients were enrolled. All patients aged 40–80 years, both genders, admitted due to acute exacerbations of COPD as per the operational definition were included. Patients with a history of myocardial infarction, chronic kidney disease, hypertension, acute kidney injury, or any other malignancy left or referred without completing treatment were excluded. Baseline demographic information of patients (age, gender, weight at admission, history of diabetes) was taken. Informed consent was obtained from patients, ensuring confidentiality and the fact that there was no risk involved for the patient while taking part in this study. The NEWS2 and CURB-65 scores in the prediction of in-hospital mortality were noted as per the operational definition of inclusion in the study at admission time. In all patients, the outcome was noted as in-hospital mortality (defined as mortality within 10 days after admission) or otherwise. Data was entered and analysed through SPSS-23. Sensitivity, specificity, positive predicted value, negative predictive value, and diagnostic accuracy for the NEWS2 and CURB-65 scores against mortality during admission were calculated using the 2X2 model.

RESULTS

The age range in this study was from 40 to 80 years, with a mean age of 60.113±11.52 years and a mean weight of 82.259±7.69 kg (Table 1). The percentage and frequency of patients according to gender and diabetes mellitus are shown in Table 2. NEWS2 predicted 156(73.6%), CURB-65 predicted 72(34%) patients as high-risk, and in-hospital mortality was 39(18.4%) [Table 3]. NEWS2 had shown a sensitivity of 100%, specificity of 32.4%, and diagnostic accuracy of 45%, PPV of 25.1%, and NPV of 100% in predicting hospital mortality (Table 4). CURB-65 showed sensitivity of 76.9%, specificity of 75.7% and diagnostic accuracy of 76%, PPV of 41.7% and NPV of 93.6% in predicting hospital mortality (Table 5).

Table 1: Descriptive statistics of age and weight (n=212)

Variable	Mean±SD
Age (years)	60.113±11.52
Weight (Kg)	82.259±7.69

Table 2: Demographic information of the patients (n=212)

Variable	No.	%
Gender		
Male	169	79.7
Female	43	20.3
Diabetes mellitus		
Yes	23	10.8
No	189	89.2

Table3: Overall results of NEWS2, CURB-65 and in hospital mortality (n=212)

Variable	NEWS2	CURB-65	In Hospital Mortality
Positive	156(73.6%)	72(34%)	39(18.4%)
Negative	56(26.4%)	140(66%)	173(81.6%)

Table4: Comparison of NEWS2 with in Hospital Mortality

NEWS2	In Hospital Mortality		Total
	Positive	Negative	
Positive	39 (TP)	117 (FP)	156
Negative	0 (FN)	56 (TN)	56
Total	**39**	**173**	**212**

Sensitivity = 39/39x100 = 100%
Specificity = 56/173x100 = 32.4%
PPV = 39/156x100 = 25%
NPV = 56/56x100 = 100%
Diagnostic Accuracy = 95/212x100 = 45%

Table 5: Comparison of CURB-65 versus In Hospital Mortality

CURB-65	In Hospital Mortality		Total
	Positive	Negative	
Positive	30 (TP)	42 (FP)	72
Negative	9 (FN)	131 (TN)	140
Total	**39**	**173**	**212**

Sensitivity = 30/39x100 = 76.9%
Specificity = 131/173x100 = 75.7%
PPV = 131/72x100 = 41.7%
NPV = 131/140x100 = 93.6%
Diagnostic Accuracy = 161/212x100 = 76%

DISCUSSION

The present study results showed that within the AECOPD in-hospital patients, the mortality was 18.4%, significantly higher than the reported validation studies with a 7.7% prediction value or a value between 7.58 and 17% in various studies[12-15]. The justification for this high mortality rate prediction can be the geographical region wherein the country faces a high poverty ratio and is unaware of the associated risk factors and symptoms of AECOPD and other healthcare services.

The current research focused on the CURB-65 score, which has also been widely reported and accepted as a predictor of mortality and its risk in cases of CAP. These studies have focused on the 30-day mortality prediction of CAP-admitted patients, which has represented increased values for area under the receiver-operating feature curve such as AUC = 0.76, 0.756, and 0.835, as reported by Aujesky et al[16], Liu et al[17] and Shindo et al[18] respectively.

In the present study, the sensitivity of the NEWS2 and CURB-65 scoring systems was determined to be 100% and 76.9%, respectively. However, it was also observed that CURB-65 was significantly more specific than NEWS2 (75.7% vs. 32.4%). Similar results have been reported by Parras et al.9 They elaborated that there may be a high risk of recurrence of the disease even after the patient has been discharged from the hospital. Another study reported that the re-exacerbation rate within ninety days was interpreted as 48.9% and was related to clinical features and parameters, including the status of the current exacerbation as well as the previously reported exacerbation[19].

Hodgson et al[8] as well as Parras et al.9 have reported the sensitivity and specificity of the NEWS2 Score as 28–93.4% and 93–54.5%, respectively in predicting in-hospital mortality in AECOPD patients. Another study by Ahmed et al.10 showed that the CURB-65 Score has sensitivity, specificity, PPV, NPV, and accuracy of 64.71%, 68.75%, 46.81%, 82.09%, and 67.54%, respectively, in predicting in-hospital mortality in patients with acute exacerbations of COPD.

A systematic review that has been conducted over a 90-day to six-month period has identified various factors such as demography, comorbidities, acute-physiologic derangements, and the severity of COPD, which are considered factors associated with mortality post-hospital admission. These factors may assist in the development of a new scoring system for accurate prediction of in-hospital mortality as well as of secondary outcomes and clinical decisions in the context of the appropriate care level of patients[20].

The present study has limitations in its relevance to the assessment of various components of two scoring systems.

CONCLUSION

Both scoring systems can be used for the purpose of AECOPD patients risk stratification as per clinicians' preferences and as the basic tools of assessment in a resource-poor country. Despite the similarities, the CURB-65 has presented significantly better results in comparison to the NEWS2 in the context of in-hospital mortality prediction and also in terms of guiding physicians about timely treatment escalation in high-risk groups.

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1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
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