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BAP-65 as a predictive tool for assessment of severity and in-hospital mortality in patients with acute exacerbation of COPD

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Abstract*: As COPD progresses, patients develop more frequent and severe exacerbations. AECOPDs can range in severity from mild to life threatening. A disease specific severity of illness score for AECOPD would serve to improve treatment. It would identify patients who might potentially benefit for early and aggressive use of selected interventions, such as noninvasive ventilation. In this study, we selected BAP-65 score as a predictive tool for assessing the severity and the need for mechanical ventilation or mortality in AECOPD patients. 80 patients were included in the study and grouped basing on the score. Accordingly 9, 30, 24,12,5 patients were grouped under score groups 0,1,2,3,4 respectively. Analysing the data statistically for the correlation between the total score and end points showed that as the score increases from 0 to 4 the need for mechanical ventilation as well as the mortality increases in the patients and this correlation is found to be statistically significant (P<0.05). Similarly the individual components of BAP-65 as a predictor of end points showed a statistically significant correlation between them.*

Keywords: *AECOPD, BAP-65 score, need for mechanical ventilation and mortality.*

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I. Introduction

Globally, the COPD burden is projected to be increased in coming decades because of continued exposure to COPD risk factors and aging of the population [1]. Chronic obstructive pulmonary disease (COPD) will become the third most common cause of death and the fourth cause of disability in the world by the year 2020 [2].

As COPD progresses, patients develop more frequent and severe exacerbationsand have an increased rate of emergency room visits and hospitalizations.An exacerbation of COPD is an acute event characterized by a worsening of the patient's respiratory symptoms that is beyond normal day-to-day variations and leads to a change in medication [3, 4].

Beyond its impact on mortality, COPD leads to considerable morbidity.Acute exacerbations of COPD (AECOPDs) contribute to the disproportionate health burden of COPD.AECOPDs present a short-term risk for death and result in an accelerated decline in lung function. Patients often do not suffer a single exacerbation but tend to experience multiple exacerbations over their lifetime [5]. Furthermore, AECOPDs are a common reason for nonsurgical hospitalization and account for approximately one-half of the direct medical costs related to COPD.

AECOPDs can range in severity from mild to life threatening. Some may require mechanical ventilation (MV) for respiratory failure. Unfortunately, physicians lack a simple, validated risk-assessment tool for predicting likely prognosis and severity of AECOPDs.

A disease specific severity of illness score for AECOPD would serve to improve treatment. It would identify patients who might potentially benefit for early and aggressive use of selected interventions, such as noninvasive ventilation.The BAP-65 score (elevated BUN, altered mental status, pulse>109 beats/min, age >65

years) system for application in AECOPD was previously proposed [6]. BAP-65 assigns points based on BUN level, mental status, pulse, and age. In an earlier analysis of nearly 90,000 patients with AECOPD, it was demonstrated that BAP-65 correlated well with both the need for MV and in-hospital mortality [6].

II. Objectives

1. To assess the correlation between the need for mechanical ventilation and BAP65 scoring system in patients with acute exacerbation of COPD.
2. To assess the correlation between the mortality and BAP65 scoring system in patients with acute exacerbation of COPD.

III. Materials And Methods

It is a hospital based prospective observational study done at Government hospital for chest and communicable diseases, Visakhapatnam, Andhra Pradesh. Study conducted from December 2014 to September 2015 on 80 patients admitted to the hospital with acute exacerbation of COPD.

Inclusion Criteria:

- Patients admitted with a diagnosis of acute exacerbation of COPD whose age is greater than 40 years (having dyspnea, chronic cough and expectoration) were included in the study irrespective of their smoking status.

Exclusion criteria:

1. Age <40 years.
2. Recent Myocardial infarction less than 3 wks.
3. Unstable angina.
4. Tuberculosis patients both with active and with previous infection history.

COPD Exacerbation Decision Tool (BAP-65)

Items: BUN >25 = Urea > 53.5
Altered mental status
Pulse > 109 beats/min
Age > 65 years

Altered mental status was defined using an initial Glasgow Coma score<14 or a designation by the physician of disorientation, stupor, or coma.

The subjects were classified into five classes according to the presence or not of the three variables and older or younger than 65 years:

Class 1 None of the three variables present and younger than 65 Years.
Class 2 None of the three variables present and age greater than or equal to 65 years.
Class 3 Age>65 and one of the three variables present.
Class 4 Age>65 and two of the three variables present.
Class 5 Age>65 and all of the three variables present.

The primary end points were need for mechanical ventilation and mortality in the study group.

Data analysis:

The relation between the individual variables, which are discrete, final score, and the primary end points were calculated by the area under the receiver-operator curve (ROC). A 'P' value <0.05 was considered statistically significant. The relation between categorical variables and primary end points of the study were calculated by Fischer's 't' test

IV. Results

80 patients who met the inclusion criteria were included in the study and grouped basing on the BAP-65 scoring. Accordingly 9 patients fell in to the score group '0', 30 patients fell in to the score group '1', 24 patients fell in to the score group '2', 12 patients fell in to the score group '3', 5 patients fell in to the score group '4'. The patient baseline characteristics were shown in Table 1. The mean age of total study population was 67.22 ± 4.33 years, whereas it is observed that mean age of the population rises from the score group 0 (59.22 yrs) to score group 4 (71 yrs). Of 80 patients, 66(82.5%) were males.

Co-morbidities like hypertension, diabetes, congestive heart failure, malignant lung disease, chronic kidney disease and smoking were seen in 24, 18, 2, 4, 2, 75 patients respectively.

From Table 1 it is showed that the mean age, mean BUN, mean pulse rate rises from score group 0 to score group 4. The mean BUN value of total population was 22.71 ± 4.85 while that of score groups 0 and 4 were 17 ± 2.12 and 30.8 ± 3.63. The mean pulse rate of the total population, score groups 0 and 4 were 103.32 ± 12.4, 94.6 ± 8.42 and 120 ± 5.47 respectively. Altered mental status was seen in 12 patients in total of which 1, 7, 4 patients belong to score groups 2, 3, 4 respectively. It was observed that total 10 patients needed mechanical

ventilation among which 1, 4, 5 patients belong to score groups 2, 3, 4 respectively i.e., the need for mechanical ventilation is about 3% in the score group 2 and it increased to 100% in the score group 4. Similarly mortality was seen in 5 patients in total among which 1, 4 patients belong to score groups 3 and 4 respectively i.e., the Mortality is about 8% in the score group 3 and it increased to 80% in the score group 4.

Analysing the data statistically for the correlation between the total score and end points showed that as the score increases from 0 to 4 the need for mechanical ventilation as well as the mortality increases in the patients and this correlation is found to be statistically significant (P<0.05) .By Plotting an ROC curve for Need for MV and BAP65 score (Figure 1), results showed that BAP65 score has a AUC value of 0.949, sensitivity of 90.00%, specificity of 88.57% and a 'P' value of <0.0001 which is statistically significant. The curve showed that as the score increases above 2 the sensitivity decreases and specificity increases.By Plotting an ROC curve for Mortality and BAP65 score (Figure 2), results showed that BAP65 score has a AUC value of 0.977, sensitivity of 100.00%, specificity of 84.00% and a 'P' value of <0.0001 which is statistically significant. The curve showed that as the score increases above 2 the sensitivity decreases and specificity increases.

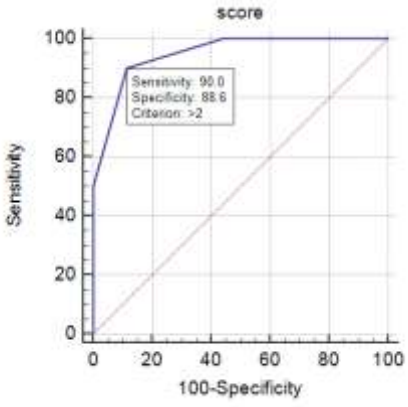
Similarly the individual components of BAP-65 as a predictor of end points, from Table 2, showed a statistically significant correlation between them.

Table 1: patient baseline characteristics and BAP-65 score group classification

	Overall	Score group 0	Score group 1	Score group 2	Score group 3	Score group 4
Total	80	9	30	24	12	5
Need for MV	10 (12.5%)	0	0	1 (4.16%)	4 (33.33%)	5 (100%)
Mortality	.25%)	0	0	0	1 (8.33%)	4 (80%)
Patient characteristics						
Age in yrs (mean)	67.22 ± 4.33	59.22±4.05	67.83±3.73	67.75±2.48	69.08±2.74	71±2.23
Males	66	6	23	22	10	5
Females	15	3	7	2	2	0
Vital data						
Pulse beats/min (mean)	103.32±12.4	94.6±8.42	95.2±7.80	108±10.81	113.83±10.0	120±5.47
BUN mg/dl (mean)	22.71±4.85	17±2.12	20.03±2.99	24.29±3.25	27.16±3.53	30.8±3.63
Altered mental status	12	0	0	1	7	4

Table 2: correlation between individual components of BAP-65 and primary end points

Variable	Correlation with MV (P value)	Correlation with mortality (P value)
BUN	0.0001	0.0001
Altered mental status	0.0062	0.0001
Pulse rate	0.0001	0.002
Age > 65 yrs	0.0028	0.0001



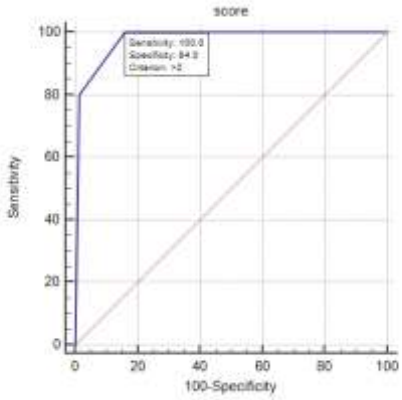


Figure 1: ROC curve for Need for MV among BAP-65 score groups

Figure 2: ROC curve for Mortality among BAP-65 score groups

V. Discussion

For stable COPD, several prognostic staging tools exist, but none have been validated in AECOPD. A model was searched that only requires simple information that was consistently available in ER departments, upon the presentation of the patient (Pulmonary function tests, for instance, are not always available to the physician in the ER). This prompted the establishment of the BAP-65 score. BAP-65 is similar to CURB-65 in that it is structured so as to only require inputs that are generally available to physicians at presentation and assigns points based on the blood urea nitrogen (BUN) level, mental status, pulse, and age. The potential usefulness of this score lies in that as the score increases from 2 or more the risk for intubation and/or mortality rises.

This scoring was actually designed and evaluated in the American population and later evaluated in several other studies in different population groups that were different from the original population in which it was designed. In this study, we evaluated this score in Indian population and that too patients attending the emergency department of a government hospital which has a huge burden of patients. So, a score that is easy to administer, less time consuming and more accurate should be used for evaluating the patient and we find BAP-65 is one such score.

The individual components of BAP-65 score have significant value in predicting the need for mechanical ventilation and mortality in the AECOPD patients. These patients were in respiratory distress, anxious, hyperventilating and decreased per oral water intake leading to decreased intravascular volume, hypoxemic, hypercapnic with altered mental status in some. BUN correlates well with the intravascular volume depletion, pulse rate correlates well with patient distress and hypoxemic status and altered mental status correlates well with hypercapnia. Some patients with respiratory failure tolerate high levels of PaCO2 without any clinical disturbance.So, altered mental status as a component of the score is used to know the clinical disturbance associated with increased PaCO2 levels.

The results obtained in this study were similar to those that were observed in other studies done by Shorr et.al [7], Rabhi Tabet et.al [8].

VI. Conclusion

The score has the ability to predict the need for mechanical ventilation and mortality with a statistical significance (with p value <0.0001). Not only the total score, the individual variables also had the ability to predict the need for mechanical ventilation and mortality with a statistical significance. Measuring BAP65 scoring is quite simple and requires no special equipment which makes it a practical tool of potentially widespread applicability and would help categorize patients with AECOPD as to their risk for adverseoutcomes and to direct healthcare resources to those most likely to benefit and to reduce the significant burden of morbidity in this disease.

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