OUTCOME OF PATIENTS ADMITTED TO THE CCU (CRITICAL CARE UNIT) OF A TERTIARY CARE HOSPITAL WITH ACUTE EXACERBATION OF COPD AND RESPIRATORY FAILURE

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ABSTRACT

AIM
To study the outcome and predictors affecting the mortality in COPD patients with acute exacerbation and respiratory failure following pharmacotherapy, non-invasive ventilation and invasive ventilation.

MATERIAL AND METHODS
Forty patients with acute exacerbation of COPD admitted to the CCU for one year period were studied. Baseline clinical assessment, investigations, APACHE II, APACHE III and OSF scorings were done.

RESULTS
Out of 40 patients 24 responded to pharmacotherapy, of these 2 patients died due to other causes. Five patients were initiated on non-invasive ventilation of which 2 patient’s required invasive ventilation. Remaining 11 patients required invasive ventilation on admission, of these 7 patients died. Mortality was 43.75%. Multivariate analysis was done and APACHE II and Alveolar-arterial oxygen gradient (A-a) DO₂ were independent predictors of mortality.

CONCLUSION
Although significantly high mortality was seen in mechanically ventilated patients (43.75%), the overall mortality in this study was 22.5% and hence it can be concluded that the results of aggressive treatment of acute respiratory failure in COPD patients is favourable.

KEYWORDS
COPD, Mechanical Ventilation, APACHE II Score.

HOW TO CITE THIS ARTICLE: Ramarathnam V, Venkataramanappa AB. "Outcome of patients admitted to the CCU (Critical Care Unit) of a Tertiary Care Hospital with acute exacerbation of COPD and respiratory failure." Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 105, December 31; Page: 16984-16987, DOI: 10.14260/jemds/2015/2565

INTRODUCTION
COPD is characterized by chronic irreversible airway obstruction leading to gradual, progressive decline of lung function punctuated by repeated episodes of exacerbations requiring hospitalization. In the United States, COPD accounts for about 14 million outpatient visits annually. In the United Kingdom, it is estimated that 1.5% of the population has COPD. Some studies report that 3-6% of AECOPD (Acute Exacerbations of COPD) patients require hospitalization and the mortality ranges from 3 to 10% during these admissions. This rate is much higher in the Intensive Care Unit (ICU) setting and approaches 30% in patients older than 65 years.¹

Many such patients respond to conservative pharmacotherapy, while some patients require ventilatory support. The incidence of patients requiring mechanical ventilation ranges from 9.8-67.6% in different studies.² Patients requiring prolonged mechanical ventilation are candidates for potential weaning failure and high mortality. Mortality rates for patients requiring ventilator support range from 20% to 60%.³,⁴,⁵ Earlier studies have shown advanced age,³,⁴ associated comorbid illness,³,⁵ and APACHE II scores to be independent predictors of in-hospital mortality.

FINANCIAL OR OTHER COMPETING INTEREST: None.
SUBMISSION 13-12-2015, Peer Review 14-12-2015, Acceptance 26-12-2015, Published 29-12-2015
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DOI:10.14260/jemds/2015/2565

These data may be a valuable aid to the clinicians as well as to the patients and their relatives in predicting the outcome and decisions with regard to the initiation of mechanical ventilation.

The present study was carried out to evaluate the outcome of COPD patients and possible predictors of inhospital mortality.

MATERIALS AND METHODS
Forty patients with acute exacerbation of COPD admitted to the CCU (Critical Care Unit) for a period of one year were included in this study. Depending on the severity of exacerbation, these patients received either pharmacotherapy, Non-Invasive Ventilation (NIV) or invasive ventilation. Baseline clinical assessment, investigations, APACHE II, APACHE III and OSF (Organ System Failure) scorings were done on all patients. Other variables which were evaluated were age, Alveolar-arterial oxygen gradient (A-a) DO₂ and the duration of mechanical ventilation.

STATISTICAL ANALYSIS
SPSS for Windows Version 12 was used for analysis. Parameters significant on univariate analysis (P<0.05) were identified as potential predictors of mortality and were further evaluated using multivariate logistic regression analysis with the clinical outcome as the dependent variable.

RESULTS
The majority of the patients in the study group were males (M: F=77.5:22.5) and the mean age being 60+/-10 as shown in Tables 1 and 2.
Out of these 40 patients, 24 patients responded favourably to pharmacotherapy. Two patients in this group died due to unrelated causes, one patient had acute myocardial infarction and the other due to hypovolemic shock following severe haemoptysis. Mortality in this group was 8.33%.

Of the remaining 16 patients, 5 were initiated on non-invasive ventilation. Of which, 2 required invasive ventilation and they recovered. No mortality was seen in these patients.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Overall Mean</th>
<th>Alive Mean (SD)</th>
<th>Died Mean (SD)</th>
<th>'P' Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>70.31</td>
<td>71.11(10.56)</td>
<td>69.28(13.06)</td>
<td>0.761</td>
</tr>
<tr>
<td>Duration of ventilation (days)</td>
<td>4.43</td>
<td>3.88(3.84)</td>
<td>5.14(7.11)</td>
<td>0.619</td>
</tr>
<tr>
<td>(A-a) DO₂</td>
<td>324.34</td>
<td>245.43(118.47)</td>
<td>425.95(203.66)</td>
<td>0.043</td>
</tr>
<tr>
<td>OSF</td>
<td>2.31</td>
<td>1.89(0.78)</td>
<td>2.85(0.37)</td>
<td>0.010</td>
</tr>
<tr>
<td>APACHE II</td>
<td>22.75</td>
<td>20.55(5.74)</td>
<td>25.57(1.27)</td>
<td>0.041</td>
</tr>
<tr>
<td>APACHE III</td>
<td>62.06</td>
<td>56.88(14.69)</td>
<td>68.71(19.07)</td>
<td>0.182</td>
</tr>
</tbody>
</table>

Table 4: Univariate analysis-variables compared using 't' Test

OSF with a p value of 0.0270 was not found to be an independent predictor.

DISCUSSION

Acute exacerbation of COPD represents a major cause of hospital admissions in USA, and majority of the industrialized and developing countries. Acute episodes of respiratory failure in these patients account for 5-10% of emergency admissions to the hospital. The estimated median values of prevalence rates of COPD in India is 5% for males and 2.7% for females. Non-surgical admissions with COPD accounted for about 2.9% of all ICU admissions in a large study involving 129,647 admissions to 128 ICUs across Britain for a period of 6 years.

In this study, acute exacerbation of COPD accounted for 4.64% of all CCU (Critical Care Unit) admissions. In this study all patients received medical therapy with inhaled bronchodilators (Ipratropium and Salbutamol), intravenous (IV) corticosteroids and appropriate antibiotics. The favourable response to pharmacotherapy in this study was 55%, which is comparable to the 46% response rate (64 patients out of 138) reported in the study of Hoo and Hakim.

Remaining 11 patients required invasive ventilation on admission. Out of these 11 patients 7 expired. Overall, mortality for mechanically ventilated patients was 43.75% and those requiring invasive ventilation on admission was 63.63% as shown in Table 3.

Table 3: Mortality in patients with COPD

<table>
<thead>
<tr>
<th>Mode of Therapy</th>
<th>No. of Patients</th>
<th>Deaths</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No. Patients</td>
<td>40</td>
<td>09</td>
<td>22.5%</td>
</tr>
<tr>
<td>1) On pharmacotherapy</td>
<td>24</td>
<td>02</td>
<td>8.33%*</td>
</tr>
<tr>
<td>2) On Ventilatory Support</td>
<td>16</td>
<td>07</td>
<td>43.75%</td>
</tr>
<tr>
<td>a) NIV</td>
<td>03</td>
<td>00</td>
<td>-</td>
</tr>
<tr>
<td>b) NIV → IV</td>
<td>02</td>
<td>00</td>
<td>-</td>
</tr>
<tr>
<td>c) IV → on admission</td>
<td>11</td>
<td>07</td>
<td>63.63%</td>
</tr>
</tbody>
</table>

* UNRELATED CAUSES

The variables which were entered into the univariate analysis were age, duration of mechanical ventilation, Alveolar-arterial oxygen gradient (A-a) DO₂, OSF score, APACHE II and APACHE III scores. (A-a) DO₂, APACHE II and OSF scores were found to predict mortality as shown in Table 4.

These 3 variables (A-a) DO₂, OSF score and APACHE II scores were further evaluated with logistic regression analysis (Table 5). APACHE II (p<0.03) and (A-a) DO₂ (p<0.010) were found to be independent predictors of mortality.

Table 5: Logistic regression analysis
The average duration of mechanical ventilation in this study was 105 hours or about 4.4 days. In the present study OSF score (p=0.010), APACHE II score (p=0.04), and Alveolar-arterial oxygen gradient (A-a) DO2 (p=0.043) were significantly associated with mortality in univariate analysis. However, logistic regression analysis showed only the APACHE II score (p=0.003) (OR: 0.986; 95%CI: 0.963-1.009) and Alveolar-arterial oxygen gradient (A-a) DO2 (p=0.001) (OR: 0.636; 95%CI:0.332-1.22) to be independent predictors of mortality. OSF score was not an independent predictor in the present study. However, Afessa B, Morales II and others have reported the organ failures to be an independent predictor of mortality in their study.

APACHE II score was found to be an independent predictor of mortality in many earlier studies, and the same has been noted in this study.

In our study the Alveolar-arterial oxygen gradient (A-a) DO2 was found to be an independent predictor of mortality. Similar results have been reported earlier by Hsu, Wann et al. in patients with respiratory failure due to various causes in a medical ICU and by Senef et al. who found (A-a) DO2 to be more strongly associated with 180 day mortality rates (22% of explanatory power) than in-hospital mortality rates (4% of explanatory power) in patients admitted to ICU with acute exacerbation of COPD. In contrast, Sudarshanam et al. found (A-a) DO2 to be significantly associated with mortality on univariate analysis but was not an independent predictor on logistic regression analysis in a study comprising patients with respiratory failure due to all causes including COPD.

In a large study, Martin J Wildman and others comprised 129,647 patients across 128 CCUs in Britain found 11 factors on multivariate analysis (Age, presence of severe respiratory failure, length of stay in hospital, CPR within 24 hours of admission, intubation status in the first 24 hours in ICU, pH, arterial oxygen tension/fractional inspired oxygen gradient (Pao2/FiO2), albumin, cardiovascular organ failure, neurological and renal organ failure) to be independent predictors of in-hospital mortality.

Similarly, in a large meta-analysis comprising 37 studies which included a total of 189,772 study subjects with risk of death ranging from 3.6% for studies considering short-term mortality, 31.0% for long-term mortality (Upto 2 yr after hospitalization) and 29.0% for studies that considered solely Intensive Care Unit (ICU)–admitted study subjects, twelve prognostic factors (Age, male sex, low BMI (Body Mass Index), cardiac failure, chronic renal failure, confusion, long-term oxygen therapy, lower limb edema, Global Initiative for Chronic Lung Disease criteria stage 4, cor pulmonale, acidemia, and elevated plasma troponin level were significantly associated with increased short-term mortality. Nine prognostic factors (Age, low body mass index, cardiac failure, diabetes mellitus, ischemic heart disease, malignancy, FEV1, long-term oxygen therapy, and Pao2 on admission) were significantly associated with long-term mortality. Three factors (Age, low Glasgow Coma Scale score, and pH) were significantly associated with increased risk of mortality in ICU-admitted study subjects.

Age, duration of ventilation, OSF, APACHE II, APACHE III and (A-a) DO2 were the variables taken into consideration in the present study of 40 patients. APACHE II and (A-a) DO2 were the only two factors that were independent predictors of mortality unlike the large studies quoted above.

CONCLUSION

In conclusion, it can be said that the response to various modalities of the treatment in acute exacerbation of COPD is favourable. Although, a high mortality of 43.75% was seen in mechanically ventilated patients. The overall mortality in this study was 22.5%.

APACHE II score and Alveolar-arterial oxygen gradient (A-a) DO2 were found to be independent predictors of mortality. Consistently, APACHE II score has been found to be an independent predictor of mortality as has been seen in many earlier studies and the same has been seen in this study.

Unlike APACHE II score, OSF score and (A-a) DO2 as indicators of mortality has not been consistent, as seen from earlier studies. In this study (A-a) DO2 was found to be an independent predictor of mortality. The alveolar arterial oxygen difference (A-a) DO2 on admission helps in estimating the amount of shunt fraction or inadequate gas exchange at the level of alveolo-capillary membrane thereby indirectly reflecting the severity of parenchymal damage in COPD. Thus baseline assessment of this parameter may directly predict mortality independent of other factors. APACHE II is one of the most popular and consistently used ICU scoring systems worldwide. An APACHE II score of more than 24 consistently predicts poor outcome independent of the disease and the same has been noted in this study in patients admitted with acute exacerbation of COPD.

Though numerous other scoring systems specific to lung diseases and COPD like CURB 65, CRB 65, BAP 65, 24 BAP 65, 25 or the relatively recent CAUDA 70, 3 scoring systems have evolved and has been evaluated in the recent past, none of them have the universal acceptance except for CURB 65 scoring system which was again primarily developed for community acquired pneumonia. 26 In addition, APACHE II score does always gives the clinician the familiarity and ease of use at the bedside level on admission and within 24 hours. Evaluation of these data not only helps in predicting the outcome and mortality in these patients, but also aids physicians, patients and their relatives in decision making with regards to the initiation of mechanical ventilation considered as the decision point. 19, 26 For reasons of resource utilization and patient counseling, it definitely makes sense to identify variables that may help guide decision making at that point. 27, 28, 29

ACKNOWLEDGEMENTS

The authors gratefully wish to acknowledge the help rendered by Dr. Sheela Seshagiri Rao, Prof. and HOD, Dept. of Anaesthesiology and Critical Care for her constant mentoring role during the conduct of this study, analysis of results and preparation of the manuscript.

LIMITATIONS

None of our patients had PFTs performed before hospital admissions. Depending on the clinical criteria to diagnose COPD might have led to inclusion of patients without chronic airflow obstruction in the study. We were unable to assess other factors, previously shown to influence mortality such as poor nutritional status, serum albumin, presence of cor-pulmonale or cardiovascular dysfunction or impaired renal function.

REFERENCES


