### **Research Article**

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# Acute exacerbation of chronic obstructive pulmonary disease: predictors of outcome: single center prospective study from India

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#### **ABSTRACT**

**Background:** Acute exacerbations are associated with high rates of morbidity and mortality and hospital readmissions. With the rise in the rate of COPD and increased rate of mortality, this study was performed to predict the outcome of acute exacerbations in chronic obstructive pulmonary disease.

**Methods:** 124 patients were admitted with exacerbations of chronic obstructive pulmonary disease presented in the Emergency Department in our hospital were included into the study. Apart from the regular demographic details, blood tests and X rays, spirometric analysis was done for all patients. The patients were asked to describe the level of dyspnoea before the onset of exacerbation and their MRC score was noted. Record of previous hospitalization before the present episode of exacerbations was noted and the length of the hospital stay was also recorded. Partial pressure of arterial oxygen and carbon dioxide (PaO<sub>2</sub>, PaCO<sub>2</sub>) and pH were measured on arterial blood sample taken before the oxygen therapy.

**Results:** The mean age of the patients was  $66.9 \pm 7.3$ , and the predominant MRC score of the patients was 2. Mortality rate of the patients was 14.5% most of whom were during the in-hospital stay. The PaO<sub>2</sub> was 63 on average but in all the patients who died, the PaO<sub>2</sub> level was below 60mmHg and the PaCO<sub>2</sub> levels were above 46mmHg. Comorbidities include diabetes, hypertension, pneumonia, among others.

**Conclusions:** Age is an independent predictor for the outcome of AECOPD apart from PaO<sub>2</sub> and PaCO<sub>2</sub> levels. Other predictors for mortality whether in-hospital or after discharge are smoking, both active and ex, low FEV1 comorbidities like diabetes, hypertension, pneumonia, tuberculosis, renal failure etc.

Keywords: Exacerbations, Chronic obstructive pulmonary disease, Predictors, Outcome

#### INTRODUCTION

Chronic obstructive pulmonary disease is a type of obstructive lung disease characterized by chronically poor air flow which worsens over time. The main symptoms are shortness of breath, cough and production of sputum. Most people with chronic bronchitis are known to have COPD.

Worldwide, 329 people are estimated to be affected by COPD which is nearly 5% of the world's population.<sup>3</sup> In

2013, 2.9 million people were affected which was 0.5 million more than in 1990.<sup>4</sup> This rate is projected to increase further due to increased smoking and pollution rates and increase in aging population in many countries and is set to be the third largest cause of mortality worldwide.<sup>5,14</sup> In the United Stated of America, it is estimated the in-hospital care is the largest contributor to the annual costs of COPD.<sup>6-7</sup> In India, COPD is a major health care problem in India which constitutes the second largest cause of mortality especially in rural places after asthma.<sup>8</sup> Thus, the hospital costs for COPD in India also

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is expected to be very high as it involves mechanical ventilation and ICU treatment, apart from causing anxiety to family.<sup>8</sup>

The knowledge of prognosis of the disease and the factors that predict the outcome of the disease is very important to the patients as well as the clinician, so that he can advise the patients on the course of the disease and chances of complications. This is also important so that proper management, monitoring, treatment and when to withdraw treatment of the disease and effective follow up after discharge, can be done. <sup>15</sup>

There are many studies regarding predictive factors in community acquired pneumonia, long term outcomes when the disease is stable, the scoring systems on these predictive values which have been implemented in clinical practice, but there are very few studies identifying the outcomes in AECOPD patients especially in India. 16-20

This study was mainly done to identify the outcomes of acute exacerbations in chronic pulmonary disease.

#### **METHODS**

This retrospective and observational study was conducted in the Department of TB and Chest and Medicine at Fathima Institute of Medical Sciences. 124 patients over the age of 40 years with acute exacerbations of chronic obstructive pulmonary disease presented in the Emergency Department in our hospital were included into the study. Patients with sputum positive for tuberculosis were excluded from the study, although TB patients with sputum negative were included in the study.

The demographic details of the patients like age, sex, height, weight were collected and BMI was calculated. Risk factors of all the patients like smoking, diabetes, allergies etc. were noted. All the patients were subjected to clinical examination including blood pressure, chest x rays and blood tests for haemoglobin, WBC counts and other regular tests.

The MRC dyspnoea scale is a set of 5 questions asked to the patients for dyspnea and the score is given accordingly. Grade 1 is given for "Not troubled by breathlessness except on strenuous exercise", Grade 2 for "shortness of breath when hurrying or walking up the hill", Grade 3 for "walks slower than contemporaries on the level because of breathlessness, or has to stop for breath when walking at own pace", Grade 4 "Stops from breadth after about 100m or after a few minutes on level", Group 5 "To breadth less to leave the house, when dressing or undressing".

Record of previous hospitalization before the present episode of exacerbations was noted and the length of the hospital stay was also recorded. Partial pressure of arterial oxygen and carbon dioxide (PaO<sub>2</sub>, PaCO<sub>2</sub>) and

pH were measured on arterial blood sample taken before the oxygen therapy.

#### RESULTS

Males were predominant than females among the 124 patients admitted with exacerbations. The number of males was 113 and females were 11. All the males were either current smokers or were smokers earlier. Of the females, 3 were smokers of local cigarettes (bidis), and the others had a smoker in the family.

The mean age of the patients was  $66.9 \pm 7.3$ , with a range of 57 - 82 years.

Long term hospital stay and short term hospital stay was noted as > 8 days or < 9 days respectively. This was in agreement too many studies where the mean was 8-9 days.

Table 1: General demographic details and blood tests.

Details	observations
Age (in years, SD)	$66.9 \pm 7.3$
Male: female ratio	113:11
Current smokers (n, %)	84 (67.8%)
Ex-smokers	31 (25%)
Passive Smokers	9 (7.25%)
BMI	$27.3 \pm 4.8$
Mean Blood pressure (range)	130/90 (110/70- 220/130)
Comorbidities (n)	116
Haemoglobin mg/dl (Mean, SD)	12.9 ± 3.6
Blood Urea mg/dl(Mean, SD)	$41.67 \pm 2.98$
Serum Albumin mg/dl (Mean, SD)	$3.56 \pm 1.23$
Serum Sodium mEq/l (Mean, SD)	$137.87 \pm 2.5$
Potassium (Mean, SD)	$4.68 \pm 0.45$

**Table 2: Variables in patients with COPD.** 

Respiratory rate (breaths /min)	35 ( 15- 65)
MRC Score	19/53/36/16/0
No of prev. hospitalizations (0/1/2/3/4/>4)	57/4 8/12/6/1
PaO2 (mmHg)	$63.24 \pm 6.9$
PaCO2 (mmHg)	$44.3 \pm 5.7$
pН	$7.41 \pm 0.01$
Alveolar arterial oxygen difference	42.13
FVC (L)	$2.35 \pm 0.78$
FEV <sub>1</sub> (L)	$1.01 \pm 0.23$
LTOT (yes/no)	65/59
LOS (mean days)	9

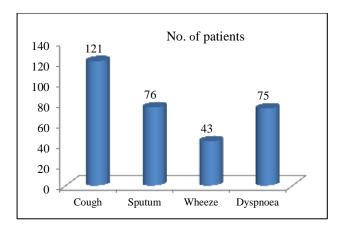


Figure 1: Symptoms in the patients.

Predominant MRC score of the patients was 2 while many of the patients were hospitalized for the first time, as known to them (Table 2). There were 18 (14.4%) patients who died during the in hospital stay. The  $PaO_2$  was 63 on average but in all the patients who died, the  $PaO_2$  level was below 60 mmHg and the  $PaCO_2$  levels were above 46 mmHg.

Table 3: Comorbidities seen among the patients.

Hypertension	21
Pneumonia	9
Rheumatic Heart disease	7
Anemia	12
Chronic renal failure	2
Coronary Heart disease	3
Pneumothorax	2
Tuberculosis	15
Empyema	7
Diabetes	29

Most of the patients had cough and most of it with sputum production. 43 patients had wheezing problem and 75 patients had dyspnoea (Figure 1).

Many of the patients had various comorbidities when they presented into the emergency room (Table 3). Diabetes was the mainly the common associated disease, followed by tuberculosis.

#### **DISCUSSION**

The mean age in our study was around 66 years which was in concordance to other studies in USA, Europe and Australia. <sup>21-26</sup> In a study by Chandra et al, the mean age was much lower (61.3 years).

The mortality rate in our study was 14.5% (18 patients) which was similar to other studies where the rate was 10-15%. 24-27 In these 18 patients were found the BMI and the MRC scores to be significantly higher than the other cases. These two variables seem to be predicting the length of the hospital stay and outcome of COPD. Similar

results were found by simple analyses on BMI and MRC scores by Tsimogianni et al where they predicted the length of hospital stay and 3 year mortality rate.

Other than old age, the reasons associated in morbidity were poor nutritional status, hypotension, diabetes, prior hospitalizations, and other acute comorbidities. Tuberculosis was another comorbidity which was also highly associated with COPD especially after discharge. Poor nutritional status, diabetes, low FEV<sub>1</sub> was other causes of morbidity after discharge. These findings were in similar to another study by Steer et al.<sup>35</sup>

The duration of exacerbation was significantly associated with its severity and season, which is in accordance to other studies.<sup>29-31</sup> It was also shown that a patient with exacerbations in the past is more likely to show them in future too, most of them requiring hospitalization. We also found that the patients who had come to our hospital with previous hospitalizations all had exacerbations in the past, that being the reason for past hospitalizations. This was in accordance to other studies by Husebo et al and others.<sup>32-35</sup>

There was no difference in the number of exacerbations between the smokers and ex-smokers. This could conclude that the stoppage of the smoking was too late. This observation was made in another study by Hasebo et al.<sup>32</sup>

The  $PaO_2$  levels in all the non survivors, was below 60 mmHg while in the patients who survived, most of them were either mild or moderate hypoxemic. The  $PaCo_2$  levels were above 46 mmHg in all these cases while they were in the normal levels in the live patients. This shows that the  $PaO_2$  levels and  $PaCO_2$  levels independently were some of the predictors of morbidity and mortality.

 $FEV_1$  was also one of the important independent predictors for mortality and was observed in almost all the cases. This relationship between COPD and predictors of hospitalization was observed in other studies. A study in Sweden reported that patients under LTOT,  $FEV_1$  and the performance status were the best predictors of survival in men.<sup>37</sup>

We had not associated long term home mechanical ventilation with exacerbations. It was observed that long term home mechanical ventilation, might result in a significant reduction in the frequency of hospitalizations for acute exacerbations as may improve alveolar ventilation. <sup>38</sup>

This study has many limitations, one of it being the sample size. We could not follow up the patients for very long time and our association with them was when they were re-hospitalized into our hospital. Therefore we could not establish a long time survival rate of the patients.

#### **CONCLUSIONS**

We therefore conclude that age is an independent predictor for the outcome of AECOPD. PaO<sub>2</sub> and PaCO<sub>2</sub> were other independent predictors. Other predictors for mortality whether in-hospital or after discharge are smoking, both active and ex, low FEV<sub>1</sub> comorbidities like diabetes, hypertension, pneumonia, tuberculosis, renal failure etc. Although, the number of males was more than females, the association of gender to mortality could not be established as the sample size for the women were very small.

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institutional ethics committee

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