MORTALITY PREDICTORS IN PATIENTS WITH ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASES

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Abstract

Introduction: COPD is a chronic disease which involves the airways, lung parenchyma, and pulmonary vasculature and also has considerable systemic manifestations. This disease is progressive and there is gene–environment interaction and hence can be prevented by avoiding exposure to the noxious particles. Commonest attributing risk factor is cigarette smoking in any form or air pollution. The in-hospital mortality rate for acute exacerbation of COPD may range from 2.5% - 25%; readmission rates from 25% to 55% for those who survived, and 25% -50% of these patients may die within one year. Most important single most crucial parameter to determine the risk of mortality in patients experiencing acute exacerbation of COPD is the forced expiratory volume in one second (FEV1). This DECAF score can be useful in severely ill patients to predict mortality. This study was carried out to evaluate the DECAF score as a clinical prediction of mortality for patients with acute exacerbation of COPD.

Material and methods: All patients admitted for an acute exacerbation of COPD during study period were included in the study. All included patients were cases of COPD confirmed with pulmonary function test i.e. forced expiratory volume in one second/forced vital capacity <0.7 and irreversible airway obstruction and were treated with a combination of various bronchodilators. The study included patients aged 40 years or older and who were admitted in the hospital and had a primary clinical diagnosis of AECOPD. Sociodemographic data was recorded which includes age, gender, comorbidities, and number of previous AECOPD. Plain chest x-ray, spirometry, electrocardiogram was carried out. Relevant tests such as ABG analysis, complete blood count, kidney function test, liver function test, and serum electrolytes were done. DECAF score was calculated.

Results: A total of 124 patients were included in the study, out of which 104 (83.88%) survived and were placed in group 2 and 20 (16.12%) patients died during the hospital stay were placed in group 1. Hence, the overall in hospital mortality rate for AECOPD was 16.12%. FEV1 in non-survivors group was 38 ± 12.98 while in survivor group it was 45 ± 11.55 . Long-term oxygen therapy was given to 11 (55%) in non-survival group while it was given to 20 (19.23%) in survivors group. DECAF score was calculated, most common score was 3 (48, 39%). On DECAF score 1 there were 2(10%) non survivors and 34 (33%) survivors. 35% mortality was seen in score 4, while no survivor was found on same score, this was statistically significant ($P < 0.0001$). on DECAF score three, 25% patients died while 41% survived. Purulent sputum was observed in 90% of non survivors and 49% of survivors. Respiratory rate/min in Non-survivors ($n=20$) was 29.2 ± 5.4 and in Survivors ($n=104$) was 25.4 ± 3.8 . Arterial blood gases analysis pH in Non-survivors ($n=20$) was 7.29 ± 0.04 and in Survivors ($n=104$) was 7.45 ± 0.08 . PaCO_2 (mm Hg) in Non-survivors was 50.78 ± 13.44 and in Survivors was 43.11 ± 11.49 . Body mass index (kg/m^2) in Non-survivors was 21.65 ± 7.4 and in Survivors was 26.97 ± 8.96 .

Conclusion: DECAF score can predicts mortality and effectively stratifies COPD patients admitted with acute exacerbations into survivors and non-survivor's category and clinical tests such as PaCO_2 , arterial pH, purulent sputum can be used to predict the mortality in AECOPD.

Keywords: COPD, PaCO_2 , AECOPD, DECAF

Introduction:

Acute exacerbations of chronic obstructive pulmonary disease (COPD) can be fatal and it is the third leading cause of death¹. COPD is a chronic disease which involves the airways, lung parenchyma,

and pulmonary vasculature and also has considerable systemic manifestations. This disease is progressive and there is gene–environment interaction and hence can be prevented by avoiding exposure to the noxious particles. Commonest attributing risk factor

is cigarette smoking in any form or air pollution. Exacerbations and comorbidities play their role in contributing to overall severityⁱⁱ. COPD is the common noncommunicable diseases in pulmonary medicine which is characterized by limited airflow and has a debilitating impact on both quality of life and life expectancyⁱⁱⁱ. The in-hospital mortality rate for acute exacerbation of COPD may range from 2.5% - 25%; readmission rates from 25% to 55% for those who survived, and 25% -50% of these patients may die within one year^{iv}.

Mortality in hospitalized patients is approximately 10% during the hospital stay and may go up to 40% during the first year of discharge from the hospital in mechanically ventilated patients. During the 3 years of hospitalization may go as high as 49%^{v, vi}.

Most important single most crucial parameter to determine the risk of mortality in patients experiencing acute exacerbation of COPD is the forced expiratory volume in one second (FEV1). For predicting the prognostic indices for stable COPD various scores are available. One such is the BODE index which includes body mass index, airflow obstruction, dyspnoea, and exercise. Other risk factors for acute exacerbation of COPD are hypercapnia upon arterial blood gas (ABG) analysis, short distance walked in a fixed time, the severity of functional dyspnoea, and low body mass index³.

Steer developed a comprehensive score to predict the risk of in-hospital mortality in acute exacerbation of COPD called the DECAF score which consists of consists of five parameters: dyspnoea (D), eosinopenia (E), consolidation (C), acidemia (A), and atrial fibrillation (F)⁴. This DECAF score can be useful in severely ill patients to predict mortality. This study was carried out to evaluate the DECAF score as a clinical prediction of mortality for patients with acute exacerbation of COPD.

MATERIAL AND METHODS

This prospective, observational study was conducted in Department of pulmonary Medicine, Rama Medical College Research Centre and Hospital Hapur, Pilkhuwa.

A total of 124 patients with acute exacerbation of COPD were included in the study. All patients admitted for an acute exacerbation of COPD during study period were included in the study. An exacerbation of COPD was defined by the presence of an increase in at least one of the following three

symptoms: dyspnoea, cough, sputum amount and/or purulence severe enough to warrant hospital admission. All included patients were cases of COPD confirmed with pulmonary function test i.e. forced expiratory volume in one second/forced vital capacity <0.7 and irreversible airway obstruction and were treated with a combination of various bronchodilators. The study included patients aged 40 years or older and who were admitted in the hospital and had a primary clinical diagnosis of AECOPD. Patients excluded were having metastatic malignancy, with domiciliary ventilation. Patients who presented with exacerbation of COPD without any documentary evidence of COPD before present event, known COPD mimics such as bronchial asthma, bronchiectasis, congestive heart failure, those with comorbidities such as known diabetes, renal disease, hepatic disease, neurological disease, coronary artery disease, patients with multiple organ failure, hemodynamic instability, and those patients who were not giving consent were excluded. Patients who were known COPD mimics, such as bronchial asthma, bronchiectasis, and congestive heart failure, those with comorbidities such as known diabetes, renal disease, hepatic disease, coronary artery disease, patients with multiple organ failure, and those patients who were not giving consent were excluded from the study.

Sociodemographic data was recorded which includes age, gender, comorbidities, and number of previous AECOPD. Plain chest x-ray, spirometry, electrocardiogram was carried out. Relevant tests such as ABG analysis, complete blood count, kidney function test, liver function test, and serum electrolytes were done.

DECAF score was calculated according to following table

Table 1: DECAF score calculation^{4, 1}

DECAF: dyspnea, eosinopenia, consolidation, acidemia, and atrial fibrillation; eMRCD, extended Medical Research Council dyspnea score

Variables (DECAF)	Score
Dyspnea	
eMRCD 5a (too breathless to leave the house unassisted but independent in washing and/or dressing)	1
eMRCD 5b (too breathless to leave the house unassisted and requires help with washing and dressing)	2
Eosinopenia (eosinophils <0.05×10 ⁹ /L)	1
Consolidation	1
Moderate or severe acidemia (pH <7.3)	1
Atrial fibrillation (including history of paroxysmal atrial fibrillation)	1
Maximum DECAF score	6

All patients were managed according to Global Initiative for Chronic Obstructive Lung Disease guideline protocol. Patients were divided in to 2 groups, Group 1 – Non-survivors, includes those patients who died during hospital stay and Group 2- survivors, all those patients who survived during hospital stay and discharged

All data was entered in the Excel sheet of Microsoft windows for analysis. IBM SPSS for Windows, Version 19.0 was used. The frequency of the Sociodemographic and clinical characteristics of both study groups were compared. $P < 0.05$ was considered significant. The frequency of each score for survivors and non-survivors were calculated and compared.

OBSERVATIONS AND RESULTS

A total of 124 patients were included in the study, out of which 104(83.88%) survived and were placed in group 2 and 20(16.12%) patients died during the hospital stay were placed in group 1. Hence, the overall inhospital mortality rate for AECOPD was 16.12%.

Table 2: Hospital mortality rate for AECOPD

Group	Number	Percentage
Non survivors (group 1)	20	16.12%
Survivors (group 1)	104	83.88%

Table 3: Characteristics of survivors and non-survivors

Patient characteristics	Non-survivors (n=20)	Survivors (n=104)	P-value
Male	12 (60%)	63 (60.58%)	
Female	8(40%)	41 (39.42%)	
Age in years (mean $\pm$ SD)	72.1 $\pm$ 8.41	67.3 $\pm$ 6.22	P = 0.0035
Number of previous AECOPD (mean $\pm$ SD)	3.6 $\pm$ 1.11	2.9 $\pm$ 0.63	P = 0.0001
FEV1 (mean $\pm$ SD)	38 $\pm$ 12.98	45 $\pm$ 11.55	P = 0.0164
Long-term oxygen therapy (%)	11 (55%)	20(19.23%)	P = 0.0008
eMRCD, median (range)	5 (5a-5b)	4 (3-5b)	

A total of 75 (60.5%) male and 49 (39.5%) female were included in the study. Of which 12 (60%) were in the Non-survivors group while 63 (60.58%) were in survivors group. Of the total 49 female, 8(40%) did not survived and were in Non-survivors group while 41 (39.42%) were in survivors group.

Mean age of the patients in non-survivors group was 72.1 $\pm$ 8.41 while in survivor group was 67.3 $\pm$ 6.22. FEV1 in non-survivors group was 38 $\pm$ 12.98 while in survivor group it was 45 $\pm$ 11.55. Long-term oxygen therapy was given to 11 (55%) in non-survival group while it was given to 20 (19.23%) in survivors group. eMRCD median range was 4 (3-5b) in survivors while it was 5 (5a-5b) in non survivors.

Table 4: Comparison of the DECAF scores of survivors and non-survivors.

DECAF score	Total sample (124)	%	Non-survivors (N=20)	%	Survivors (N=104)	%	P value
1	36	29%	2	10%	34	33%	0.0393
2	29	23%	3	15%	26	25%	0.3352
3	48	39%	5	25%	43	41%	0.1797
4	7	6%	7	35%	0	0%	<0.0001
5	4	3%	3	15%	1	1%	0.0013
6	0	0%	0	0%	0	0%	-
Total	124		20		104		

DECAF score was calculated, most common score was 3 (48, 39%). On DECAF score 1 there were 2(10%) non survivors and 34 (33%) survivors. On DECAF score 2 there were 3(15%) non survivors and 25 (25%) survivors. 35% mortality was seen in score 4, while no survivor was found on same score, this was statistically significant ($P < 0.0001$). on DECAF score three, 25% patients died while 41% survived.

Table 5: Clinical and radiological characteristics of survivors and non-survivor

characteristics	Non-survivors (n=20)	Survivors (n=104)	P value
Purulent sputum	18 (90%)	51(49%)	0.0008
Respiratory rate/min	29.2 $\pm$ 5.4	25.4 $\pm$ 3.8	0.0002
Arterial blood gases analysis pH	7.29 $\pm$ 0.04	7.45 $\pm$ 0.08	<0.0001
paCO ₂ (mm Hg)	50.78 $\pm$ 13.44	43.11 $\pm$ 11.49	0.0089
Body mass index (kg/m ²)	21.65 $\pm$ 7.4	26.97 $\pm$ 8.9	0.0134

Purulent sputum was observed in 90% of non survivors and 49% of survivors. Respiratory rate/min in Non-survivors (n=20) was 29.2 ± 5.4 and in Survivors (n=104) was 25.4 ± 3.8 . Arterial blood gases analysis pH in Non-survivors (n=20) was 7.29 ± 0.04 and in Survivors (n=104) was 7.45 ± 0.08 . PaCO_2 (mm Hg) in Non-survivors was 50.78 ± 13.44 and in Survivors was 43.11 ± 11.49 . Body mass index (kg/m^2) in Non-survivors was 21.65 ± 7.4 and in Survivors was 26.97 ± 8.963 .

DISCUSSION:

COPD is common and debilitating non-communicable lung disease. This disease is more severe in middle- and low-income countries due to respiratory exposures associated with poverty and lack of hygiene, inadequate knowledge about the health hazards of smoking, restricted access to healthcare and difficulty in medical care due to various reasons which includes lack of funds and health insurance^{vii}.

A total of 124 patients were included in the present study who presented in hospital with acute exacerbation of COPD. 20 (16.12%) died in the hospital while 104 (83.88%) were survived and discharged from the hospital. Connors *et al.* observed 11% mortality in their study⁵.

The DECAF scoring system is a predictor of in-hospital mortality associated with acute exacerbation of COPD which uses clinical, and radiological parameters. According to our study, DECAF scores of 0-1 are strong predictors of survival, and DECAF scores of 4-6 are strong predictors of mortality. Echevarria C *et al* in their study observed that in hospital mortality was 7.7%^{viii}. The in hospital mortality increases with increase in the DECAF score^{ix}. In a study, most of the patients with 30-day mortality scored four on DECAF; a higher DECAF score was significantly associated with the 30-day mortality score^x.

In present study Purulent sputum, Respiratory rate/min, Arterial blood gases analysis pH and PaCO_2 (mm Hg) were significantly associated with the mortality. PaCO_2 is commonly elevated in chronic COPD as well in AECOPD. Elevation of PaCO_2 is due to alveolar hypoventilation and ventilation perfusion mismatch and this raised PaCO_2 causes decrease in pH which is an indicator of acidosis. Respiratory acidosis was a predictor of mortality in this study. Similar observations were made by Gray-Donald *et al*^{xi}.

CONCLUSION

DECAF score can predicts mortality and effectively stratifies COPD patients admitted with acute exacerbations into survivors and non-survivor's category. PaCO_2 , arterial pH, purulent sputum can be used to predict the mortality in AECOPD.

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