FREQUENCY OF RESPIRATORY FAILURE IN PATIENTS WITH ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

Background: Acute exacerbations of chronic obstructive pulmonary disease is a major health burden. There is accompanying hypoxia, hypercapnia and acidosis leading to deterioration of vital body functions.

Objective: To determine the frequency of respiratory failure in patients admitted with acute exacerbation of chronic obstructive pulmonary disease.

Study Design: Cross sectional descriptive study.

Setting: Department of Pulmonology, Lady Reading Hospital, Peshawar.

Duration: 6 months from 19th April, 2010 to 19th October, 2010.

Subjects and Methods: The total number of patients included in the study was 383 presenting with acute exacerbation of COPD. Arterial blood sample was collected immediately at the time of presentation, analyzed for partial pressures of carbon dioxide, oxygen, PH and HCO3 using arterial blood gas analyzer and analyzed by using Statistical Package for Social Sciences version 10.0.

Results: The total number of patients was 383 including 257 (67.10%) males and 126 (32.90%) females. The mean age was 59.3 years ± 10.76SD. Respiratory failure in acute exacerbation of COPD was observed in 136 (35.51%) patients including 90 males (23.50%) and 46 females (12.01%). Maximum number with respiratory failure was in 51 to 60 years age group which was 67 (17.49%) and minimum number was recorded 15 (3.91%) in the age group of 71 to 80 years.

Conclusion: Respiratory failure is very common in patients presenting with acute exacerbation of chronic obstructive pulmonary disease and Tertiary care hospitals must be well equipped for management of these patients.

Key words: Chronic obstructive pulmonary disease; Acute exacerbation of chronic obstructive pulmonary disease; Respiratory failure

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a slowly progressive disorder characterized by fixed or partially reversible airflow obstruction FEV_1 /FVC (forced vital capacity) ratio less than 70%.[1,2] Worldwide prevalence of COPD is about 9-10% in adults over the age of 40 years.[3,4]

Acute exacerbations of chronic obstructive pulmonary disease (COPD) contribute considerably to the increased morbidity, mortality and health care costs associated with the condition. [5,6] Exacerbation of Chronic obstructive pulmonary disease (COPD) is characterized by a change in patient's base line dyspnea, cough and/or sputum, that is beyond normal day-to-day variations.[7,8] Clinical consequences of exacerbation of COPD range from a self limited illness to progressive respiratory failure.[9] Arterial blood gas analysis revealed respiratory failure in 46.5% patients hospitalized with acute exacerbation of COPD in a

study conducted in China.[10]

Respiratory failure is defined by an arterial oxygen tension (PaO_2) of less than 60 mmHg and/or an arterial carbon dioxide tension ($PaCO_2$) greater than 45 mmHg.[11] Hospital management of respiratory failure includes controlled oxygen therapy, bronchodilator therapy, glucocorticosteroids, antibiotics and/or ventilation support including non invasive or invasive ventilation[12-15] Non-invasive ventilation is an effective treatment for respiratory failure in patients with exacerbation of COPD with good results.[16]

Outcome of respiratory failure depends on underlying factors and the facilities available for its treatment. Appropriate facilities including non-invasive ventilation are available in limited centers in Pakistan, which must be arranged in hospitals admitting acutely ill patients, if reduction of high mortality (28%) associated with the condition is desired.[17] Data is available regarding the frequency of respiratory failure at international level,[18] but no data is available at local set up or Peshawar.

We did this study with the objective of to determine the frequency of respiratory failure in patients admitted with acute exacerbation of chronic obstructive pulmonary disease in our setup. Results of this study will help to know the magnitude of the problem which will guide us to set recommendations regarding required health facilities for management of these serious patients, according to the magnitude of the problem in our hospital.

MATERIALS AND METHODS

This descriptive, cross sectional study was carried out at Pulmonology department, Lady Reading Hospital, Peshawar during 6 months from 19th April, 2010 to 19th October, 2010 recruiting 383 patients presenting with acute exacerbation of COPD by consecutive (non-probability sampling). Acute Exacerbation of Chronic Obstructive Pulmonary Disease was defined as; patients with diagnosis of COPD as shown by previous record of spirometry (FEV1 less than 80% predicted and FEV1/FVC ratio less than 70%), who present with dyspnea at rest (having more than 25 breaths per minute measured by counting the number of breaths in one minute using stopwatch), increase in amount of sputum (more than 30 ml per 12 hours measured by collecting the sputum and measured in graduated glass beaker performed in ward) and sputum purulence (more than 25 pus cells per low-power field of sputum measured by sputum microscopy performed in medical laboratory using microscope) at least for the last two days. While patients with Respiratory Failure were labeled as by an arterial oxygen tension (PaO_2) of less than 60 mmHg and/or an arterial carbon dioxide tension more than 45 mmHg which is measured by analyzing arterial blood sample using blood gas analyzer machine available in hospital. All patients both males and females above 40 years of age diagnosed as having COPD presenting with acute exacerbation to pulmonology department Lady Reading Hospital, Peshawar were included in the study. Exclusion criteria adopted were Patients having COPD with acute severe asthma, bronchogenic carcinoma, cardiac arrhythmia, left ventricular failure with pulmonary edema and pneumothorax; or Patients presenting with respiratory failure associated with severe pneumonia, pulmonary embolism, acute respiratory distress syndrome, kyphoscoliosis.

Approval was taken from hospital ethical committee. Patients were admitted via emergency or OPD to the Pulmonlogy department Lady Reading Hospital, Peshawar. Informed written consent about the potential risk and benefit was taken from all the patients. After documentation of clinical history and physical examination, Demographic characteristics were recorded. A 3ml blood sample was collected from radial artery using aseptic technique, immediately at the time of presentation. A sterile 5ml disposable syringe heparinized with 0.5ml heparin was used to prevent blood coagulation. The sample was immediately analyzed for partial pressures of carbon dioxide and oxygen using arterial blood gas analyzer (AVL Compact 2 Radiometer, Denmark). Confounding variables were controlled by strictly following the exclusion criteria. The sample was analyzed within 10 minutes of collection at room temperature. Care was taken to avoid venous blood sample by using standard technique. Blood sample was taken before starting oxygen to the patient. Study variables include age, sex, respiratory failure, partial pressure of oxygen (PaO2), Partial pressure of carbon dioxide (PaCO2), arterial blood PH and bicarbonate level. Data was analyzed by using Statistical Package for Social Sciences (SPSS) version 10.0.

RESULTS

The total number of patients was 383 presenting with acute exacerbation of COPD. There were 257 (67.10%) males and 126 (32.90%) females. The male to female ratio was 2.03:1. The mean age of male patients was 57.3 years ± 10.3SD and female was 62.1 years ± 11.2SD with an overall mean age of 59.3 years ± 10.76SD.

The number of patients presenting with respiratory failure in acute exacerbation of COPD was 136 (35.51%) including 90 (23.50%) males and 46 (12.01%) females. Maximum number of patients with respiratory failure was in 51 to 60 years age group which was

67 (17.49%) and minimum number of patients was recorded 15 (3.91%) in the age group of 71 to 80 years (Table 1).

On arterial blood gas analysis, the mean pH in male and female patients was 7.3 ± 2.1SD and 7.3 ± 2.7SD with an overall mean pH value of 7.3 ± 2.5SD. The mean $PaCO_2$ and PaO_2 were 55.0 mmHg ± 7.4SD and 60.8 mmHg ± 6.8SD respectively. The mean HCO_3 level was recorded as 28.4 mmol/L ± 1.4SD (Table 2).

Table 1: Age and Gender wise distribution of patients with and without Respiratory failure in Acute Exacerbation of COPD

Ages (years)	Respiratory failure			
	Yes		No	
	Male	Female	Male	Female
40-50	15(3.92%)	13(3.40%)	24(6.27%)	20(5.22%)
51-60	45(11.75%)	22(5.74%)	103(26.89%)	36(9.39%)
61-70	20(5.22%)	6(1.57%)	15(3.91%)	16(4.18%)
71-80	10(2.61%)	5(1.30%)	25(6.53%)	8(2.10%)
Total	90(23.50%)	46(12.01%)	167(43.60%)	80(20.89%)
Grand Total	136 (35.51%)		247 (64.49%)	

Table 2: Arterial blood gas Analysis of patients with Acute Exacerbation of COPD

Sex	Mean ± Standard deviation			
	pH	$PaCO_2$ (mmHg)	PaO_2 (mmHg)	HCO_3 (mmol/L)
Male	7.3 ± 2.1	54.1 ± 7.6	59.9 ± 6.0	28.4 ± 1.3
Female	7.3 ± 2.7	56.2 ± 7.4	62.0 ± 8.0	28.4 ± 1.6
Total	7.3 ± 2.5	55.0 ± 7.4	60.8 ± 6.8	28.4 ± 1.4

Table 3: Stratification of the total study population and percentages of each age group

Ages in Years	Respiratory Failure Patients	Percentages
40-50	28	7.32%
51-60	67	17.49%
61-70	26	6.79%
71-80	15	3.91%
Total	136	35.51%

DISCUSSION

Exacerbation of chronic obstructive pulmonary disease leads to clinically significant consequences especially respiratory failure and major health care resource utilization.[19] COPD is a leading cause of death worldwide with a continued rising mortality rate due to complications like respiratory failure, and is a major socioeconomic burden. The natural course of COPD is characterized by progressive decline in lung function and recurrent exacerbations. Respiratory failure may develop, requiring admission to the ICU for assisted ventilation.[20]

Our study is the first to determine the frequency of respiratory failure in patients admitted with acute exacerbation of chronic obstructive pulmonary disease in our country. In our study, frequency of respiratory failure in patients presented with acute exacerbation was 35.51% on arterial blood gas analysis. Frequency of respiratory failure in our study is comparable to international literature. In an Indian study, the laboratory abnormalities at presentation on arterial blood gas analysis revealed respiratory failure in 33.8% patients.[21] A multicentre retrospective study conducted in four hospitals of China, 46.5% patients had respiratory failure during acute exacerbation of chronic obstructive pulmonary disease on arterial blood gas analysis.[22] Other studies in the literature have reported the frequency of respiratory failure ranging from 16% to 35% with overall mortality 35% to 43%.[23] Corrado et al has reported that 12.5% patients with acute exacerbation of chronic obstructive pulmonary disease have acute on chronic respiratory failure.[24] 20% patients with COPD exacerbation were having chronic type 2 respiratory failure in elderly hospitalized patients in China.[20]

In our study, there was male dominancy i.e. 67.10% with male to female ratio of 2.03:1. Similar male dominancy has been shown by other studies in the international literature. In the Indian study, there were 80.7% male.[20] In another study, there were 87.9% male patients with acute exacerbation of COPD.[21] The reason for male dominancy in our study is related to prevalence of smoking in our population. Smoking is more common in males with resultant higher COPD prevalence than females, which are why more male patients presented with acute exacerbation of COPD.

In our study, the mean age of patients was 59.3 years ± 10.76SD while in literature; the mean age of patients has been reported as 70 years ± 8.0SD years[20] and 62.1 years ± 9.8SD.[21] In the study conducted in China, the mean age reported is 73.4 years.[9] Advanced age is a prognostic factor for in-hospital mortality as described by some authers.[20]

On arterial blood gas analysis, the mean pH value was 7.3 ± 2.5SD in our study. Ventilatory support (Non-invasive) should be considered in patients with severe acidosis (pH <7.26) and/or a rising Partial pressure of arterial CO_2 level, who fail to respond to supportive treatment and controlled oxygen therapy. A pH of more than 7.26 is a better predictor of survival during an acute episode.[25]

Due to lack of health facilities, most of COPD patients remain undiagnosed in the peripheral areas of our province and are diagnosed in advanced stages of COPD. Lady Reading Hospital is a tertiary care hospital and patients are referred from far areas of the province where health facilities are deficient. Most of the patients with acute exacerbation are not managed properly in periphery, leading to deterioration of the condition. This is the main reason of high frequency of respiratory failure in our study.

Respiratory failure was not classified into acute and chronic respiratory failure in our study, which was a major limitation in our study. As this is one centered study, so the results may not be generalized but still there is good evidence that respiratory failure is very common in patients with acute exacerbation of COPD in our setup. Large multi-centered studies should be carried out to confirm these findings.

CONCLUSION

This study showed that respiratory failure is very common in patients presenting with acute exacerbation of chronic obstructive pulmonary disease. This finding points towards very important health problem and is a significant complication of acute exacerbation of chronic obstructive pulmonary disease.

Given the high prevalence of COPD in our country, the consequences in terms of morbidity and mortality are significant. It also indicates that steps must be taken to arrange facilities required for the management of such patients. Tertiary care hospitals receiving such a heavy number of patients with respiratory failure must be well equipped with facilities like controlled oxygen therapy, NIPPV, mechanical ventilation and respiratory ICU with specialized staff trained in the management of these patients. This will help to reduce the morbidity and mortality associated with the condition.

Keeping in mind the impact of COPD on health care resources, it is essential to develop effective strategies for prevention of COPD exacerbations and smoking cessation.

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