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Original Research Article

Serum Electrolytes and Oxygen Saturation in Acute Exacerbation of Chronic Obstructive Pulmonary Disease Patients

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Abstract: ***Background:*** Chronic obstructive pulmonary disease, or COPD, refers to a group of diseases that cause airflow blockage and breathing-related problems. It includes emphysema and chronic bronchitis. Patients with COPD are at increased risk of developing heart disease, lung cancer and a variety of other conditions. Although COPD is mostly a chronic disease, a substantial number of patients experience exacerbations that are related to a significantly worse survival result, especially with abnormal serum electrolyte level. ***Objectives:*** The aim of this study is to assess the Serum Electrolytes and Oxygen saturation in acute exacerbation of chronic obstructive pulmonary disease patients. ***Methods:*** *This is an observational study*. The study was carried out in the admitted patient's Department of Medicine, Netrokona Medical College and hospital, Bangladesh. The duration of the study from October 2019 to March 2021. ***Results:*** This study shows that the according to age of 120 Patients aged 40 to 69 years. Here according to Age distribution, 6(5%) were <40 years, 8(6.66%) were 40- 49 years, 21(17.5%) were 50-59 years, 48(40%) were 60-69 years and 37 (30.83%) were ≥ 70 years. Distribution of the study according to sex of 120 Patients aged 40 to 69 years. According to gender 102(85%) were Male, 18(15%) were Female. According to Parameter, the Mean±SD of Serum Sodium, Serum Potassium, O_2 Flow (L/min), pH, $PaCO_2$ (mmHg), HCO_3 (mmol/L), SpO_2 (%) and Respiratory Rate (Breaths/min) were 131±5.07, 3.31±0.33, 0.6±0.4, 7.43±0.02, 40±4, 27±2, 90±1.2 and 22±3 respectfully. ***Conclusions:*** The levels of parameters should be measured and corrected during AECOPD treatment to decrease mortality and the correct use of supplemental oxygen therapy during exacerbations of COPD is an important factor that can strongly influence outcomes.

Keywords: Chronic obstructive pulmonary disease; COPD; Utilization; Morbidity; Emphysema; Chronic bronchitis.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a Global health problem and is anticipated to be the 3rd main purpose of mortality international through 2020 [1]. It is defined by ongoing flow restriction and acute symptoms of chronic conditions that are more severe than expected and required a change in treatment [2]. Acute exacerbations of COPD are related with quicker lung typical deterioration [3], worsened health status and elevated mortality [4], Impaired gas exchange leading to hypoxemia is a vital function of COPD6 and is probable to underlie many of its pathophysiological consequences.

While the use of supplemental oxygen in steady disorder incorporates a negative prognosis [5], it remains one of the few evidence-based

interventions to enhance mortality. However, though hypoxemia worsens at exacerbation [6], there is growing evidence that injudicious use of oxygen is additionally dangerous.

Chronic obstructive pulmonary disease (COPD) is a primary health problem worldwide [7], COPD is intricate with the aid of acute exacerbations that are related with healthcare expenditures and excessive morbidity. Patients with extreme COPD exacerbation have elements that impact serum electrolyte imbalance, such as hypoxia, respiratory acidosis and metabolic abnormalities such as serum electrolyte imbalance, uremia, and liver feature abnormalities [8]. Serum electrolyte imbalance such as hyponatremia, hypokalemia, hyperbilirubinemia, and multiplied levels of transaminases, blood urea, and serum creatinine are both induced by means of the disease process or the therapy initiated [9].

Electrolyte imbalances can additionally motive respiratory muscle weak point and impair airway feature in this group of patients [10]. Hypercapnia happens at some stage in COPD exacerbations; the unexpected limit in ventilation leads to acute respiratory acidosis or deteriorates pre-existing continual respiratory acidosis. Owing to the excessive occurrence of comorbidities and corresponding multi-drug therapies in these patients, combined acid-base and hydro- electrolyte issues are turning into more and more common, especially in severely unwell and aged populations [11].

METHODS

This is an observational study .The study was carried out in the admitted patient's Department of Medicine, Netrokona Medical College and hospital. The duration of the study from October 2019 to March 2021. This study was carried out on 120 patients the find out about the population including male and female patients above 16 years of age in the Department of Medicine, Netrokona Medical College and hospital. The medical medicine specialist, pulmonologist and the cardiologist were primarily involved in the decision-making process. The choice of treatment was made by the patient after a full discussion with the multidisciplinary team consisting of medicine specialist, pulmonologist and the cardiologist.

The data for this study about had been accumulated from patients' medical information and radiographs. Statistical evaluation of the results used to be got via the use of a window-based computer software program devised with Statistical Packages for Social Sciences (SPSS-24).

RESULTS

Table-I: Distribution of patients by age (n=120)

Age Distribution	n=120	%
<40	6	5
40-49	8	6.66
50-59	21	17.5
60-69	48	40
≥	37	30.83

Table I demonstrated and distribution of the study according to age of 120 Patients aged 40 to 69 years. Here according to Age distribution, 6(5%) were <40 years, 8(6.66%) were 40-49 years, 21(17.5%) were 50-59 years, 48(40%) were 60-69 years and 37 (30.83%) were ≥ 70 years.

Table -II: Distribution of the patients by sex (n=120)

Sex Distribution	n=120	%
Male	102	85
Female	18	15

Table II demonstrated and distribution of the study according to sex of 120 Patients aged 40 to 69 years. According to gender 102(85%) were Male, 18(15%) were Female.

Table-III: Distribution of the patients according to Smoking Habit

Smoking Habit	n=120	%
Active Smoker	84	70
Ex-Smoker	18	15
Non-Smoker	18	15

Table III demonstrated the patients according to Smoking Habit. Here Smoking Habit of Active Smoker, Ex-Smoker and Non-Smoker were 84(70%), 18(15%) and 18(15%) respectfully.

Table-IV: Distribution of the patients according to predominant Symptoms

Smoking Habit	n=120	%
Cough	62	51.66
Breathlessness	37	30.83
Pedal edema	8	6.66
Fever	8	6.66
Chest tightness	5	4.16

Table IV demonstrated the patients according to predominant Symptoms. According to Smoking Habit, the Cough, Breathlessness, Pedal edema, Fever and Chest tightness were 62(51.66%), 37(30.83%), 8(6.66%), 8(6.66%) and 5(4.16%) respectfully.

Table-V: The mean of the patients according to Serum Electrolytes and Oxygen Saturation

Parameter	Mean±SD	P value
Serum Sodium	131±5.07	0.000
Serum Potassium	3.31±0.33	
O_2 Flow (L/min)	0.6±0.4	0.47
pH	7.43±0.02	0.46
$PaCO_2$ (mmHg)	40±4	0.09
HCO_3 (mmol/L)	27±2	0.13
SpO_2 (%)	90±1.2	0.89
Respiratory Rate (Breaths/min)	22±3	

Table V demonstrated the patients according to Serum Electrolytes and Oxygen Saturation. According to Parameter, the Mean±SD of Serum Sodium, Serum Potassium, O_2 Flow (L/min), pH, $PaCO_2$ (mmHg), HCO_3 (mmol/L), SpO_2 (%) and Respiratory Rate (Breaths/min) were 131±5.07, 3.31±0.33, 0.6±0.4, 7.43±0.02, 40±4, 27±2, 90±1.2 and 22±3 respectfully.

DISCUSSION

Hypokalemia is a frequent electrolyte disturbance in COPD. Serious symptoms, consisting of strokes that lead to respiratory paralysis and tetany, may additionally show up in extreme hypokalemia. A learn about performed via Goli *et al.,* [12] validated that serum K levels had been decrease in AECOPD patients than in manage subjects, which is regular with our results. Similarly, a study through Ouf *et al.,* [13] observed decrease serum K, Na, Mg, Ca, and chlorine levels in patients with AECOPD earlier than cure than in manipulate topics and greater PaCO2 and decrease pH in COPD patients than in manage group. The equal learn about additionally tested extensively diminished serum Na, K, Mg, and Ca levels in patients who required mechanical ventilation. Among our patients, these until now receiving home LTOT and NIMV had greater acidic pH and greater PaCO2 than who did now not receive. In addition, extensively extra hypokalemia was once cited in our AECOPD patients whose hospital admission resulted in mortality. Both Mg and K levels have been appreciably decreased in patients who acquired LTOT and NIMV than in these who did not. A feasible mechanism for this electrolyte imbalance might also be the quintessential diuretic treatment given for cor pulmonale, which develops in late COPD. Besides, beta-agonists, which are used for treating each exacerbation and steady disease, stimulate Na+/K+ ATPase, facilitating intracellular K and Mg uptake [14]. Side effects of systemic corticosteroids that are regularly used to deal with attacks may also be every other explanation for the electrolyte imbalance mechanism. In our study, according to Age distribution, 6(5%) were <40 years, 8(6.66%) were 40-49 years, 21(17.5%) were 50-59 years, 48(40%) were 60-69 years and 37 (30.83%) were ≥ 70 years. And according to gender 102(85%) were Male, 18(15%) were Female.

Advanced age, smoking status, insufficient physical activity, and inhaled/systemic corticosteroid treatments are hazard elements for osteoporosis in COPD patients. Dimai *et al.,* [15] verified expanded bone resorption and bone loss in COPD patients with decompensated respiratory acidosis related with persistent hypercapnia as properly as improved serum calcitonin levels. The authors cited that this would possibly be defined by means of chronic hypercapnia stimulating osteoclastic resorption. In our study, serum Ca levels had been lowering in deceased COPD patients than in alive COPD patients. COPD patients with deadly consequences additionally had drastically decrease blood pH. These acidic surroundings would possibly have elevated the wide variety of ionized Ca fractions, maybe main to a minimize in protein-bound Ca. Another viable clarification would possibly contain prevention of re-absorption of Ca from renal tubules by using systemic corticosteroids used for treating the exacerbation.

Mg is necessary in bronchodilation and contraction of the smooth muscles of the respiratory system, as properly as in mast-cell stabilization, mucociliary clearance, and neurohumoral mediator administration [16]. The involvement of Mg in respiratory decompensation has been confirmed in research indicating reduced serum Mg stages in patients with extreme respiratory disorders [17]. Hypomagnesemia in patients with steady or exacerbating COPD has been related with the use of steroids, beta-agonists, and diuretics or inadequate dietary intake; however the consequences are contradicting [18]. Cohen *et al.,* [19] mentioned that diuretics did not decrease the levels of serum Mg. Studies in COPD patients set up a nice correlation between serum Mg levels throughout an assault and annual wide variety of attacks. Comert *et al.,* [20] mentioned that Mg had really useful consequences on respiratory muscle features and that it may want to be used as an add-on to preferred therapy as it leads to the healing of dyspnea in patients for the duration of COPD. In our study, the serum Mg level

was decreased in COPD patients than in manage subjects, however a statistically distinction used to be no longer recognized between deceased and alive patients, though the former confirmed decrease serum Mg levels. Moreover, serum Mg stages had been inside regular laboratory limits in each deceased and alive COPD patient. This ought to be due to the small quantity of patients included in this study. Therefore, potential research with giant populations is required to decide the consequences of serum Mg levels on prognosis of AECOPD.

In our study, according to Smoking Habit of Active Smoker, Ex-Smoker and Non-Smoker were 84(70%), 18(15%) and 18(15%) respectfully. And Cough, Breathlessness, Pedal edema, Fever and Chest tightness were 62(51.66%), 37(30.83%), 8(6.66%), 8(6.66%) and 5(4.16%) respectfully.

Phosphoproteins, cellular membrane phospholipids, and phosphorus are current in the shape of 2, 3- diphosphoglycerate, which helps in the launch of oxygen with the aid of hemoglobin; these entire have an effect on the respiratory tract [21]. Some researchers have proven that hypophosphatemia, by using miserable diaphragm contraction, consequences in respiratory failure and make it challenging to wean the affected person from NIMV support. Zhao *et al.,* [4] said an excessive rate of failure while weaning COPD patients with hypophosphatemia from mechanical ventilation, which used to be due to the fact of respiratory muscle weak point related with hypophosphatemia. The possibly pathological mechanisms worried in the prevalence of hypophosphatemia in patients with AECOPD consist of inadequate intake, imbalance between intra- and extra-cellular uptake of serum P, and extended elimination [22]. In our study, we confirmed that serum P value had been insignificant in AECOPD patients than in manipulate subjects. Furthermore, serum P value had insignificant in patients each receiving LTOT and NIMV than in these who had been not; however, there used to be no distinction in mortality. These patients additionally had decrease arterial pH and greater PaCO2. Reduced ranges of P in these patients might also be due to accelerated urinary P excretion via inhibition of anaerobic glycolysis by using respiratory acidosis. [23] This study shows that, according to Parameter, the Mean±SD of Serum Sodium, Serum Potassium, O_2 Flow (L/min), pH, $PaCO_2$ (mmHg), HCO_3 (mmol/L), SpO_2 (%) and Respiratory Rate (Breaths/min) were 131±5.07, 3.31±0.33, 0.6±0.4, 7.43±0.02, 40±4, 27±2, 90±1.2 and 22±3 respectfully. Hyponatremia, defined as a serum sodium concentration of less than 135 mEq/L, is the most serious and common electrolyte imbalance that can be seen isolated or as a complication of other medical illnesses (eg, heart failure, liver failure, kidney failure, pneumonia, cancer) [24, 25], Normal serum sodium concentrations range from 135 to 145 mEq/L. In adults, hyponatremia is classified depending on serum sodium concentration [26],

CONCLUSION

Hyponatremia, Hypocalcemia, hypokalemia, and uric acid elevation have been associated to AECOPD mortality. These parameters must be measured, and electrolyte disturbances must be corrected in patients who had been hospitalized for an acute exacerbation to reduce mortality. Furthermore, extra complete potential research with large populations is warranted to decide the relationship between these serum biochemical parameters and the prognosis of AECOPD.

RECOMMENDATION

The accurate use of supplemental oxygen therapy at some stage in exacerbations of COPD is a vital issue that can strongly impact outcomes. Future research might also focus on new delivery techniques to enhance the titration of oxygen therapy as well as new therapies to deal with the underlying COPD.

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