

Serum Electrolyte in Acute Exacerbation of Chronic Obstructive Pulmonary Disease

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ABSTRACT

Introduction: Chronic Obstructive Pulmonary Disease (COPD) is one of the leading causes of mortality and morbidity worldwide. Though COPD is mainly a chronic disease, many patients experience exacerbations that are related to worst survival outcome, especially with abnormal serum electrolyte level. The objective of this study was to evaluate serum electrolyte levels among the patients with acute exacerbation of COPD. **Methods:** Structured questionnaire and patients' charts were used to collect data. Data was analyzed using Statistical Package for the Social Sciences (SPSS) software version 16.0 and descriptive statistics were used to generate the research findings. **Results:** The mean age of the patients with Acute exacerbation of COPD was 69.57 ± 9.765 years. Among 100 patients, (83%) belonged to the age group of 60 years and above, (54%) were male, (74%) were married, (52%) were illiterate and (41%) were engaged in agriculture, (41%) consumed alcohol and (67%) were smokers. Dyspnoea (90%) was the most common symptom. The mean level of sodium and potassium were 133.8 ± 4.830 mEq/L, 3.6 ± 0.533 mmol/L, respectively. Fifty seven percent patients had electrolyte disorder. More than half (51%) had hyponatremia and (40%) had hypokalemia. The average value of pH, PaCO₂ and PaO₂ are 7.34 ± 0.727 , 46.64 ± 9.787 mm Hg and 69.38 ± 9.255 mm Hg respectively. Among them, (18%) were in respiratory failure. **Conclusion:** This study concluded that hyponatremia and hypokalemia are prevalent electrolyte disorder with AE of COPD patients. Therefore, we recommend routine monitoring of the serum electrolytes for better outcomes of patients.

Keywords: Chronic Obstructive Pulmonary Disease, Potassium, Sodium

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Submitted: 27th May 2020

Accepted: 13th June 2020

To cite: Acharya CP, Paudel K. Serum electrolyte in Acute Exacerbation of Chronic Obstructive Pulmonary Disease. JGMC Nepal. 2020;13(1):9-13.

DOI: [10.3126/jgmcn.v13i1.29141](https://doi.org/10.3126/jgmcn.v13i1.29141)

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a common preventable and treatable disease characterized by persistent respiratory symptoms and airflow limitation usually caused by significant exposure to noxious particles or gases.¹ The Global Burden of Disease Study reports a prevalence of 251 million cases of COPD globally in 2016.² Latest global estimates illustrate 3.2 million deaths from COPD and more than 90% of COPD deaths occur in low and middle income countries. Disease burden due to COPD was highest in Papua New Guinea, India, Lesotho and Nepal in 2015.³ COPD is likely to increase in coming years due to higher smoking prevalence and aging populations in many countries and it is a major public health problem and its prevalence varies according to country, age and sex.⁴ Estimation of Global Initiative for Chronic Obstructive Lung Disease (GOLD) suggest that COPD will be the third most common cause of death worldwide by 2020.¹

COPD is complicated by frequent and recurrent acute exacerbations (AE) that compromise quality of life, diminish

respiratory functions and increased enormous health care expenditures and high morbidity. An exacerbation of COPD is an acute worsening of respiratory symptoms beyond normal day-to-day variations. It is a significant cause of mortality and morbidity and categorized in terms of clinical presentations or healthcare utilization.⁵⁻⁷ Exacerbations may cause increased dyspnea, productive cough with altered sputum, and fever. The symptoms may be more nonspecific, such as malaise, fatigue, insomnia or sleepiness, depression and might be associated with impaired lung function, it is estimated that only 50% of all exacerbations are reported to physicians.⁵

Exacerbations are the most common cause of hospitalization among COPD patients. The economic and social burden created by acute exacerbations of COPD is extremely high.⁸ Majority of the patients experience a temporary or permanent decrease in the quality of life due to acute exacerbation of COPD. Though the COPD patients mostly present with the features of acute respiratory infections, there may be a number of metabolic derangements arising out of the disease process or as a consequence of the therapy instituted like hyponatremia, hypokalemia, hyperbilirubinemia, elevated transaminases, elevated blood urea and elevated serum creatinine etc.⁹ Thus, it is important to identify factors associated with exacerbation. Since electrolytes are important for nerve conduction as well as smooth muscle and skeletal muscle contraction, it may significantly alter the outcome of COPD exacerbation if untreated.¹⁰

A study conducted in Mysore, India among 100 COPD patients and 100 healthy controls shows that serum electrolyte levels were significantly low among patients of acute exacerbation of COPD. Hence screening for these abnormalities may improve outcome.¹⁰ Similarly study conducted in Kerala among 100 COPD patients (50 stable COPD and 50 acute exacerbation of COPD patients) also demonstrates, there were changes in levels of sodium, potassium and magnesium in acute exacerbation of COPD patients compared to stable COPD patients. Timely screening with earlier detection and intervention would be useful in controlling acute exacerbation of COPD patients.⁵

In spite of such alarming outcomes, very less data are available there regarding the precipitating factors and predictors of prognosis in patients with acute exacerbation of COPD especially from the developing countries. Thus, this study aimed at evaluating serum electrolyte levels in acute exacerbation of COPD to assess the occurrence of dyselectrolytemia.

MATERIALS AND METHODS

Descriptive cross sectional research design was used to evaluate the serum electrolyte level in the patient with AE of COPD. The study population was the patient with AE of COPD admitted in Manipal Teaching Hospital, Pokhara. Consecutive sampling technique was used in this study and consisted of 100 samples. All cases with AE of COPD admitted through the emergency or outpatient department were included in the study. COPD patients admitted for causes other than COPD exacerbation, COPD patients requiring mechanical ventilation, and the patients with pre-existing renal, hepatic, endocrinal or cardiac illness were excluded in the study. The serum electrolytes (sodium, potassium) and Arterial Blood Gas (ABG) of the admission day were analyzed in this study. Other data were collected through interview technique and from patients chart. The data was collected within the period of March, 2019 to August, 2019. The obtained data was edited, classified and coded. Then, the data was analyzed using SPSS software version 16 and descriptive statistics were used to generate the research finding and result. Informed consent was taken from each participant and an approval was obtained from Institutional Review Committee of Manipal Teaching Hospital, Pokhara, Nepal.

RESULTS

Hundred patients diagnosed with acute exacerbation of COPD admitted in the Medicine ward of Manipal Teaching Hospital were included in the study. The age of the patients ranged from 49 to 90 years with the mean age of 69.57 ± 9.76 years. Most of the patients (83%), belonged to the age group of more than 60 years and above. More than half (54%) of the patients were male. Regarding religion, majority of them (78%) were Hindu and 36% belonged to relatively advantaged Janajati. Majorities (74%) of the patients were married, 52% of the patients were illiterate and 41% of them were engaged in agriculture. Regarding family type, 73% belonged to joint family (Table 1). Among them, 41% consumed alcohol and 67% were smokers (Table 2).

During the time of admission, patients with AE of COPD had clinical symptoms of dyspnea (90%), cough (89%) and sputum (38%). Regarding the duration of hospital stay, majority (73%) of the patients had stayed hospital for 5 days and above and 27% of them stayed for less than 5 days (Table 3). Average serum Na^+ and K^+ levels in patients with COPD were 133.8 ± 4.83 mEq/L, 3.6 ± 0.53 mmol/L, respectively. Minimum sodium level was 121 mEq/L and maximum was 143 mEq/L and for potassium, minimum level was 2.5 mmol/L and maximum was 5.9 mmol/L. In

this study, it was seen that 57% patients had electrolyte disorder and 43% were in normal range. It was found that 51% patients had hyponatremia and 49% had normal level of sodium. Likewise, 40% patients had hypokalemia and (2%) had hyperkalemia and more than half (58%) were in normal range (Table 4).

The mean value of pH, PaCO₂ and PaO₂ are 7.34 ± 0.72, 46.64 ± 9.78 mm Hg and 69.38 ± 9.25 mm Hg respectively (Table 5). Among patients with AE of COPD, 82% of them were without respiratory failure and 18% of them were in respiratory failure. Out of 100 patients with AE of COPD, 85% were discharged from hospital, 11% had left the hospital against medical advice as well as on request and 4% were expired (Table 6).

Table 1: Socio-demographic Characteristics of the Participants (n=100)

Characteristics	Frequency (Percentage)
Age (in years)	
Below 60	17 (17.0)
60 and above	83 (83.0)
Sex	
Female	46 (46.0)
Male	54 (54.0)
Religion	
Hindu	78 (78.0)
Buddhist	14 (14.0)
Christian	8 (8.0)
Ethnicity	
Dalit	19 (19.0)
Disadvantaged Janajati	11 (11.0)
Relatively advantaged Janajati	36 (36.0)
Upper caste groups	34 (34.0)
Marital Status	
Married	74 (74.0)
Unmarried	7 (7.0)
Widow/widower	19 (19.0)
Educational Status	
Illiterate	52 (52.0)
Can read and write	19 (19.0)
Primary education	14 (14.0)
Secondary education	15 (15.0)
Occupational status	
Agriculture	41 (41.0)
Homemaker	23 (23.0)
Service	29 (29.0)
Business	7 (7.0)
Type of family	
Nuclear	27 (27.0)
Joint	73 (73.0)

Table 2: Alcohol consumption and smoking habit (n=100)

Characteristics	Frequency (Percentage)
Alcohol consumption	
Yes	41(41.0)
No	59(59.0)
Smoking habit	
Yes	67(67.0)
No	33(33.0)

Table 3: Clinical symptoms during admission and hospital stay(n=100)

Variables	Frequency (Percentage)
Symptoms*	
Dyspnoea	90 (90.0)
Cough	89 (89.0)
Sputum	38 (38.0)
Hospital Stay	
Less than 5 days	27 (72.0)
5 days and more	73 (73.0)

*Multiple Responses

Table 4: Serum electrolytes among AE of COPD patients (n=100)

Electrolytes	Frequency (Percentage)
Sodium (Na⁺)	
Hyponatremia (less than 135 mEq/L)	51 (51.0)
Normal (135-145 mEq/L)	49 (49.0)
Hypernatremia (more than 145 mEq/L)	0 (0.0)
Potassium (K⁺)	
Hypokalemia (less than 3.5 mmol/L)	40 (40.0)
Normal (3.5-5 mmol/L)	58 (58.0)
Hyperkalemia (more than 5 mmol/L)	2 (2.0)
Electrolyte disorder	
Yes	57 (57.0)
No	43 (43.0)

Table 5: Arterial Blood Gas parameters among AE of COPD patients

Parameters	Mean ± SD	Range
pH	7.34 ± 0.72	7.00-7.50
PaCO ₂ (mmHg)	46.64 ± 9.78	35-88
PaO ₂ (mmHg)	69.38 ± 9.25	38-92

Table 6: Respiratory failure among AE of COPD patients and Outcome (n=100)

Variables	Frequency (Percentage)
Respiratory failure	
With respiratory failure	18 (18.0)
Without respiratory failure	82 (82.0)
Outcomes	
Discharge	85 (85.0)
LAMA/DOR	11 (11.0)
Expired	4 (4.0)

LAMA=Leave against medical advice DOR= Discharge on request

DISCUSSION

Mean age of the patients with AE of COPD was 69.57 ± 9.76 years. Most of the patients (83%) belonged to the age group of more than 60 years and above. More than half (54%) of the patients were male. Among them, 41% consumed alcohol and 67% were smoker. The finding is consistent with the study done by Adiody et al.⁴ revealed by Keralastate of India which showed that 68% of the patients with AE of COPD were smoker.⁴

At the time of admission, patients with AE of COPD had clinical symptoms of dyspnoea, cough and sputum i.e. (90%), (89%) and (38%) respectively. The study conducted in India depicted that cent percent of the patient with AE of COPD had dyspnoea and 40 percent of them had cough.⁴ Regarding the duration of hospital stay, majority (73%) of the patients had stayed hospital for 5 days and above and 27 percent of them stayed for less than 5 days.

Mean levels of Na⁺ and K⁺ in patients with COPD were 133.8 ± 4.83 mEq/L, 3.6 ± 0.53 mmol/L, respectively. This finding is consistent with the study done in Bangladesh which showed the mean values of serum sodium and potassium were $133.9 (\pm 9.18)$ mEq/L and $3.6 (\pm 0.84)$ mmol/L respectively.¹¹ Minimum sodium level was 121 mEq/L and maximum was 143 mEq/L and for potassium minimum level was 2.5 mmol/L and maximum was 5.9 mmol/L. The finding of the study done by Md Haroon ur Rashid¹² revealed minimum level of Na⁺ 118 mEq/L and maximum level 138 mEq/L and for K⁺, minimum level was 2.1 mEq/L and maximum level was 3.7 mEq/L. In this study, it was seen that (57%) patients had electrolyte disorder and (43%) were in normal range. Similar finding was found in the study conducted in Egypt which showed that (58.5%) patients had electrolyte disorder.¹³ It was found that 51% patients had hyponatremia and 49% had normal level of sodium. Likewise, 40% patients had hypokalaemia and 2% had hyperkalemia and more than half (58%) were in normal range. According to the study done in Bangladesh, 45.4% patients had hyponatremia, 49.6% had normal level of sodium and 5% had hypernatremia, likewise, 41.2% patients had hypokalemia, 54.6% were in normal range and 4.2% had hyperkalemia.¹¹

The mean value of pH, PaCO₂ and PaO₂ are 7.34 ± 0.72 , 46.64 ± 9.78 mm Hg and 69.38 ± 9.25 mm Hg respectively. The study done by Md Haroon ur Rashid showed similar finding of mean value of pH 7.35 ± 0.06 and mean value of PaCO₂ 47.52 ± 10.49 whereas the mean value of PaO₂ was 58.44 ± 8.20 mm Hg.¹² Among patients with AE of COPD, 82% of them were without respiratory failure and 18% of them were in respiratory failure.

CONCLUSION

From this study it can be concluded that hyponatremia and hypokalemia are common electrolyte disorder with exacerbation of COPD patients. As electrolytes are predictor of outcome of critically ill patients, on time identification and abrupt management could lessen the sufferings of the patients with AE of COPD. Therefore, routine monitoring of the serum electrolytes level can be helpful to prevent poor outcomes among the patients with AE of COPD.

Financial support and sponsorship

None

Conflict of Interest

There is no conflict of interest.

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