



ELECTROLYTE DISTURBANCES IN ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE AT SMS MEDICAL COLLEGE, JAIPUR

Pankaj Verma*

Resident, Department of Respiratory Medicine, Sawai Man Singh Medical College, Jaipur *Corresponding Author

Manisha Jain

Senior Resident, Department of Respiratory Medicine, Sawai Man Singh Medical College, Jaipur

Ambika Sharma

Assistant Professor, Department of Respiratory Medicine, Sawai Man Singh Medical College, Jaipur

Narendra Khippal

Senior Professor, Department of Respiratory Medicine, Sawai Man Singh Medical College, Jaipur

ABSTRACT

Background: COPD is a leading cause of morbidity and mortality worldwide. With increasing industrialization and smoking, the prevalence of COPD is increasing. Serum electrolyte imbalance is a very common finding in patients with acute exacerbation of COPD which results in significant morbidity and mortality. This study attempts to measure the concentration of major serum electrolytes (sodium and potassium) in COPD patients with acute exacerbation to determine the possible effects of these electrolyte disorders. **Objective:** The main objective of this study was to determine the prevalence of electrolyte disturbances in patients with acute exacerbation of COPD and to determine possible effects of these electrolyte disorders. **Materials and Methods:** A hospital-based observational study was conducted at S.M.S. Medical College, Jaipur. 104 patients with AECOPD were selected after applying inclusion and exclusion criteria. Clinical characteristics, arterial blood gases analysis and serum electrolytes were assessed. Results were interpreted and data analysis was done. **Results:** The proportion of male (75.96%) AECOPD patients was significantly higher than the female (24.03%) and the mean age (years) of patients were 62.40 ± 9.056 . The majority of patients were smokers (77.88%). The proportion of respiratory failure was 79.8% out of which 57.56% was in Type II respiratory failure and 19.2% was in Type I respiratory failure. Low levels of serum sodium (131 ± 5.66 mEq/L) and potassium (3.20 ± 0.44 mEq/L) were found in subjects with acute exacerbation of COPD. In patients with respiratory failure, sodium and potassium levels were markedly reduced. The unfavourable outcome was significantly higher in patients with hyponatremia. **Conclusion:** Serum electrolytes in acute exacerbation of COPD patients should be monitored routinely and should be corrected early to avoid poor outcomes.

KEYWORDS : COPD; Acute exacerbation; Sodium; Potassium; ABG; PaO₂; PaCO₂

1. INTRODUCTION:

COPD is a leading cause of morbidity and mortality worldwide. With increasing industrialization and smoking, the prevalence of COPD is increasing¹. An acute exacerbation of chronic obstructive pulmonary disease (AECOPD) is a clinical diagnosis made when a patient with COPD experiences a sustained (e.g., 24–48 h) increase in cough, sputum production, and/or dyspnoea¹. Sputum that is beyond normal day-to-day variations, is acute in onset and may warrant a change in regular medication in a patient with underlying COPD.¹ The average patient with COPD experiences two episodes of AECOPD per year, and 10% of these episodes require hospitalization. Acute exacerbations compromise quality of life and diminish respiratory functions often resulting in respiratory failure. Type I respiratory failure is defined as a decrease in partial pressure of oxygen (PaO₂ < 60 mmHg) with a normal or decreased partial pressure of carbon dioxide (PaCO₂) and Type II respiratory failure is defined as an increase in PaCO₂ > 45 mmHg with a pH < 7.35.

The acute exacerbation of COPD patients presents not only with the features of respiratory failure but also several metabolic disorders like dyselectrolytemia, hyperbilirubinemia, uremia, hyperuricemia, etc. This may arise either due to the disease process itself or as a consequence of the therapy instituted like beta two agonists, steroids, diuretics, etc. Out of all serum electrolytes imbalance, hyponatremia and hypokalemia play a crucial role in disease progression and exacerbation. Very often these important abnormalities are missed, thus overlooking the coexisting metabolic disorders that may contribute to great morbidity and in-hospital mortality in these patients. Thus this study aims to measure the concentration of major serum electrolytes like sodium and potassium in AECOPD patients and also assess the outcome in these patients.

METHODOLOGY

This hospital-based observational study was conducted at the department of Respiratory Medicine at S.M.S. Medical College, Jaipur after the ethics committee approval. The study period was from January 2021 to August 2022.

All AECOPD patients admitted at the hospital, above 40 years of age were included in this study. Patients with other chronic pulmonary diseases, renal failure, immunocompromised states and respiratory failure due to diseases other than COPD were excluded from this study.

The sample size was calculated at a 95% confidence interval and power of 80% to predict the prevalence of electrolyte disturbance to be 56% in the patients with acute exacerbation of chronic obstructive pulmonary disease. At the absolute allowable error of 10 % the required sample size was 99 patients which was further rounded off to 104 subjects as a final sample size with 5% attrition.

Those patients who fulfilled the inclusion criteria were selected and informed consent was obtained. After recruitment the patients underwent detailed history, clinical examination and blood investigations like ABG and serum electrolytes including Sodium (Na⁺) and Potassium (K⁺) using an Automated electrolyte Analyzer.

Statistical analysis-

Results were expressed as mean and standard deviation. Statistical analysis was carried out by student's t-test for parametric data and chi-square test, test for non-parametric data. A p-value < 0.05 was considered statistically significant.

RESULTS:

The proportions of male (75.96%) AECOPD patients is

significantly higher ("p-value" <0.05) than the female (24.03%) and the mean age (years) of patients were 62.40±9.056. The majority of patients were smokers (77.88%). 61. 54% of patients had normal BMI (kg/m²) followed by underweight (35.57%) and overweight (2.8%).(Fig 1)

The proportion of AECOPD patients with respiratory failure (79.8%) was significantly higher than that without respiratory failure (20.19%). Out of them type II respiratory failure (75.9%) was significantly higher than the type I respiratory failure (24.09%) patients.

Serum electrolyte imbalances like hyponatremia and hypokalemia were observed in 74.03% and 40.38% respectively of AECOPD patients. Electrolyte disturbance in patients with respiratory failure was significantly higher than with no respiratory failure. The difference in mean serum sodium and serum potassium between type-I and type-II failure patients was not statistically significant. The mean serum Sodium level of patients with death outcome was significantly lower than the patients with discharge outcome. The difference in mean Potassium level between outcome of discharge and death was not statistically significant. (Table no.2 and 3)

DISCUSSION-

COPD represents an important public health challenge as the disease can be managed by both preventable and treatable measures. Exacerbations and comorbidities contribute to the overall severity in individual patients.[1] In this study there was predominance of male patients as compared to females and the majority of patients was in their sixth decade of life. Similar age and gender-wise distribution were mentioned in the study of Das et al. [39], which reported the average age of patients was 62.22 ± 12.45 years and higher male proportion. This is due to the predominance of smoking habits in males and due to fact that males tend to seek medical attention more frequently than females in our society. It was also observed that the patients were mostly smokers which strengthens the established fact that smoking is the most common preventable and modifiable cause leading to AECOPD.

Majority of patients presented with respiratory failure in which Type II respiratory failure predominated over Type I respiratory failure. Significant ventilation/perfusion mismatching with a relative increase in the physiological dead space leads to hypercapnia and hence respiratory failure in patients with AECOPD.

Both hyponatremia and hypokalemia were common among AECOPD patients. Sodium is the major cation of human body. It is found mostly in the body fluids outside the cells. It is very important for maintaining blood pressure. Sodium is required for nerves, muscles, and other body tissues to work properly. Potassium is an essential nutrient that performs an important role in cellular functions including maintaining osmolality of cells and fluid balance. Thus hyponatremia and hypokalemia play a crucial role in disease progression and exacerbation of COPD as it may lead to impairment in respiratory muscle nerve conduction contraction.

It was observed that electrolyte abnormalities were more common among respiratory failure patients. Our observations on serum electrolytes were similar to the study of Md Rashid et.al. [43]. This is because in COPD patients, the impairment of gas exchange induces several hormones like renin, angiotensin II, aldosterone, atrial natriuretic peptide, vasopressin and endothelial factors leading to water retention and hyponatremia. Chronic hypoxia and hypercapnia as a result of primary lung pathology or the associated comorbidities like cardiac or renal failure and SIADH may also contribute to hyponatremia in those patients. Hypokalemia in COPD may be attributed to respiratory

acidosis and metabolic alkalosis or long-standing steroid therapy⁵. Use of beta 2 agonists may also be an important cause of hypokalemia in COPD patients. Hypokalemia is attributed to high mortality including cardiac arrhythmias or impaired nerve-muscle conduction.

This study also observed that the lower S. sodium level of AECOPD patients was associated with the worse (death) outcome while levels of S. potassium were comparable in various outcomes in AECOPD patients. Hyponatremia itself may be a predictor of poor outcome in patients with COPD. It may lead to central nervous system malfunction (confusion, convulsions, coma), reversible defects in cardiac conduction, renal insufficiency and even death. Along with hyponatremia, hypokalemia may be another morbid accompaniment in patients with COPD.⁵ Hypokalemia may be present independently or associated with hyponatremia. As electrolytes are a predictor of outcome of critically ill patients, timely identification and appropriate management could lessen the sufferings of the patients with AECOPD.

Limitations-

- First, the study was conducted in a single center and also the relatively small sample size reduce the generalizability of the study results to the country's population.
- The study was observational, hence there is a possibility of unidentified or unmeasured confounders.

CONCLUSION-

Patients with acute exacerbation of COPD are at a higher risk of electrolyte imbalance most commonly hyponatremia and hypokalemia leading to increased morbidity and mortality. Therefore the treating physician should be vigilant towards routine monitoring of the serum electrolyte levels to prevent poor outcomes among the AECOPD patients.

Conflict of interest = No

Acknowledgment = No

Table 1. Distribution of age, gender and BMI in patients with AECOPD

Gender	Male	Female	Test of significance
Total Patients	79	25	Chi-square test 54.1, df - 1 p-value<0.01 (significant)
%	75.96	24.03	
Mean Age			
N	64.6	61.65	62.40
SD	8.4	9.4	9.056
Test of significance	T-test- 1.487 df- 102 p-value 0.140 (non-significant)		

AECOPD Patients and BMI classification

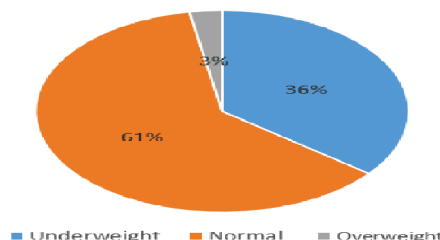


Figure no. 1 AECOPD Patients and BMI classification

Table no.2 electrolyte level and presence of respiratory failure

Variable	Respiratory failure (present, N=83)		Respiratory failure (absent, N=21)		Test of significant		
	Mean	SD	Mean	SD	t-value	p-value	significance
Sodium	130.80	4.49	133.11	4.50	2.105	0.038	S

Potassium	3.15	0.72	4.071	0.66	5.43	<0.01	S
chloride	97.74	4.45	94.92	3.84	2.662	0.009	S

Table no.3 serum electrolyte with type of respiratory failure
All values in meq/L, NS= nonsignificant

variable	Type-I respiratory failure (N=20)		Type-II respiratory failure(N=63)		Test of significant		
	Mean	SD	Mean	SD	t-value	P-value	significance
Sodium	133.07	4.37	132.52	4.56	0.475	0.636	NS
Potassium	3.57	0.62	3.68	0.76	0.587	0.559	NS
variable	Discharge N=90		Death N= 14		Test of significant		
	Mean	SD	Mean	SD	P-value	T-value	
Serum Sodium	134.70	4.48	130.26	5.61	3.327	0.001	Significant

REFERENCES:

1. World Health Report. Geneva: World Health Organization. Available at: <http://www.who.int/whr/2000/en/statistics.htm>; 2000. Accessed July 2017.
2. Donnell DE, Parker CM. COPD exacerbations: pathophysiology. *Thorax* 2006;61:354–361.
3. Rodriguez-Roisin R. Toward a consensus definition for COPD exacerbations. *Chest* 2000; 117(5 Suppl2):398s–401s.
4. Sullivan SD, Ramsey SD, Lee TA. The economic burden of COPD. *Chest* 2000;117:5S–9S.
5. Makled, Sameh & Basiony, FareedS. (2019). Electrolyte disturbances in patients with acute exacerbation of chronic obstructive pulmonary disease. *The Scientific Journal of Al-Azhar Medical Faculty, Girls*. 3. 427. 10.4103/sjamf.sjamf_50_19.