

PREVALENCE OF ELECTROLYTE ABNORMALITIES AND ITS CORRELATION OF SEVERITY OF DISEASE AMONG PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE EXACERBATION

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ABSTRACT

Background: Acute exacerbation of COPD (Chronic Obstructive Pulmonary Disease) is associated with significant morbidity, mortality and decreased quality of life. Due to lack of awareness of precipitating factors and predictors of prognosis in acute exacerbation of COPD in developing countries, often leads to fatal outcomes. **Objective:** This study aims to find the prevalence of electrolyte abnormalities and its correlation with disease severity. **Materials and Methods:** This was a cross-sectional observational study done in patients admitted with COPD exacerbation in a tertiary care centre. After obtaining institutional ethics committee clearance, all cases satisfying the inclusion criteria and consent to take part in the study were recruited. Each patient was interviewed using a semi-structured proforma. Serum Electrolytes during admission was noted and patients were classified into three groups based on the severity of exacerbation. Prevalence of electrolyte abnormalities, its correlation with severity and association was calculated. **Results:** The study revealed that 53% of COPD patients had hyponatremia, with a higher prevalence in those with severe exacerbations (81%) compared to those with mild or moderate exacerbations (mild-19%, moderate-67%). Hypokalemia was observed in 22% of the patient. Additionally, 13% of patients had hypocalcemia, and no abnormal phosphorus levels were seen. The statistical analysis showed a significant correlation between lower sodium levels and COPD severity ($p < 0.05$), while the correlations for potassium, calcium, and phosphorus were less pronounced. **Conclusion:** This study highlights the significant prevalence of electrolyte imbalances, particularly hyponatremia, in patients with acute COPD exacerbations and their association with disease severity. The findings suggest that routine monitoring of these electrolytes could improve patient outcomes, despite the study's limitations such as its single-center focus. Overall, the research emphasizes the importance of electrolyte management in COPD care and encourages further investigation into the long-term effects of correcting these imbalances.

INTRODUCTION

COPD is one of the main cause for morbidity and mortality worldwide,^[1] Electrolyte abnormalities in patients who are admitted with COPD exacerbation will lead to prolonged hospitalisation,^[2] and increase the disease burden. It accounts for almost 5,00,000 deaths per year. Major risk factor is tobacco smoking.

Smoke from biomass, occupational exposure to noxious gas or particles, passive smoking, alpha-1 antitrypsin deficiency are the other risk factors.

The disease process itself or the therapy initiated can cause abnormalities in serum electrolytes such as hyponatremia, hypokalemia, hypocalcemia, hypophosphatemia and hyperuricemia.

Hypokalemia can cause respiratory muscle weakness, cardiac conduction abnormalities and can impair airway function.^[3]

Gas exchange impairment lead to hypercapnia which is retention of carbon di oxide that may lead to hormonal abnormalities including Renin, Angiotensin II, Aldosterone, Atrial Natriuretic Peptide, Vasopressin which can cause hyponatremia. Hyponatremia reduces patient's sensorium that may further aggravate CO2 retention.

MATERIALS AND METHODS

This was a hospital-based cross-sectional study conducted at Government Medical College, Thiruvananthapuram.

Study duration: One year.

A total of 204 patients diagnosed with COPD were included in the study.

COPD severity was assessed based on GOLD guidelines.

Inclusion Criteria

- Age between 30 – 60 years.

Exclusion Criteria

- Individuals with pre-existing renal, hepatic, endocrinal or cardiac illness.
- Patients on diuretics.
- Individuals with coexisting pneumonia or lung malignancy.
- Pregnant and lactating women.

Data Collection and Analysis

- Data was collected using a semi-structured proforma.
- Based on the GOLD criteria of exacerbation of COPD, patients were classified as mild,

moderate and severe, based on the clinical examination findings like respiratory rate, heart rate, oxygen saturation, dyspnea VAS scale and laboratory investigations like CRP, ABG. Serum electrolytes like sodium, potassium, calcium and phosphorus are measured and their prevalence is calculated.

- Data collected from each participant was entered into an excel sheet after coding variables and appropriate analysis was done with the help of Statistical Package for Social Sciences (SPSS) version 27 software.

RESULTS

Electrolyte abnormalities were common among the participants, with 53% displaying abnormal sodium levels, as indicated by a 95% confidence interval (CI) ranging from 46% to 60%.

A significant negative correlation was found between dyspnea VAS scores and serum sodium levels, suggesting that lower serum sodium levels are associated with higher dyspnea VAS score among the participants.

The association between dyselectrolytemia and the severity of Chronic Obstructive Pulmonary Disease (COPD) patients was assessed across various electrolyte abnormalities. The sample reveal a significant increase in the prevalence of abnormal sodium levels with disease severity: only 19% of patients with mild COPD exhibited abnormal sodium, compared to 67% in moderate COPD and 81% in severe COPD, with a p-value of less than 0.001. This indicates a strong association between sodium abnormalities and the severity of COPD.

Table 1: Prevalence of Electrolytes Abnormalities

Characteristic	N = 204 ¹	95% CI ²
Abnormal sodium	109 (53%)	46%, 60%
Abnormal potassium	44 (22%)	16%, 28%
Abnormal calcium	27 (13%)	9.1%, 19%
NA	1	
Abnormal phosphorous		
No	204 (100%)	98%, 100%

¹ n (%)² CI = Confidence Interval

Table 2: Correlation between Variables

Correlation Variables	Estimate	P - value
Pulse rate and Serum sodium	-0.04	0.49
Respiratory rate and Serum sodium	-0.11	0.09
Dyspnea VAS and Serum sodium	-0.21	<0.001
Oxygen saturation and Serum sodium	0.29	<0.001
CRP and Serum sodium	-0.04	0.50
Pulse rate and Serum potassium	-0.04	0.49
Respiratory rate and Serum potassium	0.13	0.05
Dyspnea VAS and Serum potassium	0.07	0.27
Oxygen saturation and Serum potassium	0.11	0.08
CRP and Serum potassium	0.21	<0.001

Table 3: Association between Dyselectrolytemia in COPD Patients

Characteristic	Mild, N = 721	Moderate, N = 851	Severe, N = 471	p-value ²
Abnormal sodium	14 (19%)	57 (67%)	38 (81%)	<0.001
Abnormal potassium	13 (18%)	22 (26%)	9 (19%)	0.4
Abnormal calcium	7 (9.9%)	14 (16%)	6 (13%)	0.5
Abnormal phosphorous				
No	72 (100%)	85 (100%)	47 (100%)	
1 n (%) ² Pearson's Chi-squared test				

DISCUSSION

This cross sectional study aimed to evaluate the demographic characteristics, vital signs, biochemical markers, and the prevalence of electrolyte abnormalities among patients with varying severities of COPD. The study population predominantly consisted males (76%) with a median age of 57 years. This gender distribution aligns with previous studies,^[4] indicating a higher prevalence of COPD among men, likely due to historical smoking pattern and occupational exposures.

Our study population had a median age of 57 years, consistent with other studies on COPD, which typically report average ages ranging from 60 to 65 years including,^[1] and GOLD 2023 updates,^[5] which is on higher range. This might be due to the age limit included in the study 30-60 years, this is to avoid other confounding factors related to old age. Sodium abnormalities was the most consistent finding as in,^[6] which also has poor prognosis according to a study done by xiao et al,^[7] also described as independent predictor of earlier ED return by tokgoz et al.^[8]

Potassium abnormalities were observed in 22% of the sample which is similar to the previous studies^[9] and by goli et al,^[10] which showed the prevalence of hypokalemia was 15%.

Calcium abnormalities were less prevalent, affecting 13% of participants, with a 95% CI of 9.1% to 19% but its correlation with disease severity could not be established as done in^[11] where hypocalcemia may be related to the disease progression, this could probably be because of reduced prevalence of hypocalcemia in our Indian population.

The lack of a significant association between potassium and calcium abnormalities and COPD severity in our study contrasts with some research suggesting that these imbalances can impact disease severity and progression,^[11] Variability in findings may result from differences in study populations, measurement methods, or disease management practices.

Notably, there were no reported cases of abnormal phosphorous levels, as all participants had values within the normal range (95% CI: 98% to 100%) which is almost similar to a study done by,^[12] where the prevalence of abnormal phosphorus was only 3.3% but is contrast to the study done by El-sayed et al,^[13] which found hypophosphatemia is associated with increase in copd exacerbation and the need for ventilation.

Serum uric acid which our study did not focus has been found to be associated with increased duration and severity of copd exacerbation as described by sarangi et al,^[14]

CONCLUSION

This study highlights the significant prevalence of electrolyte abnormalities among patients with acute exacerbations of Chronic Obstructive Pulmonary Disease (COPD) in a tertiary care center in Kerala. The findings reveal that electrolyte imbalances, particularly in sodium and potassium levels, are common in these patients and are closely associated with the severity of COPD exacerbations.^[15]

Limitations

- The study was conducted in a single tertiary care center in Kerala, which may limit the generalizability of the findings to other regions or healthcare settings.
- The study's cross-sectional design captures data at a single point in time, which restricts the ability to assess causal relationships between electrolyte imbalances and COPD severity. Longitudinal studies would be necessary.

REFERENCES

1. Rathore, Hitesh kumar et al. "evaluation of serum electrolytes in patients of chronic obstructive pulmonary disease" mahatmagandhi medical college and hospital, Jaipur, rajasthan. 10.21276/ijmp.2020.6.3.01.
2. Chalela R, González-García JG, Chillarón JJ, Valera-Hernández L, Montoya-Rangel C, Badenes D, Mojal S, Gea J. Impact of hyponatremia on mortality and morbidity in patients with COPD exacerbations. *Respir Med.* 2016 Aug;117:237-42. doi: 10.1016/j.rmed.2016.05.003. Epub 2016 Jun 29. PMID: 27492537.
3. Yang CT, Lin HC, Lin MC, Wang CH, Lee CH, Kuo HP. Effect of beta 2-adrenoceptor agonists on plasma potassium and cardiopulmonary responses on exercise in patients with chronic obstructive pulmonary disease. *Eur J Clin Pharmacol.* 1996;49(5):341-5. doi: 10.1007/BF00203774. PMID: 8866625.
4. Das, P., Bandyopadhyay, M., Baral, K., Paul, R., & Banerjee, A. K. (2010). Dyselectrolytemia in chronic obstructive pulmonary diseases with acute exacerbation. *Nigerian Journal of Physiological Sciences*, 25(1), 25-27
5. Global Initiative for Chronic Obstructive Lung Disease 2023 Report: GOLD Executive Summary.
6. Deep A, Behera PR, Subhankar S, Rajendran A, Rao CM. Serum Electrolytes in Patients Presenting With Acute Exacerbation of Chronic Obstructive Pulmonary Disease (COPD) and Their Comparison With Stable COPD Patients. *Cureus.* 2023 Apr 24;15(4):e38080. doi: 10.7759/cureus.38080. PMID: 37252565; PMCID: PMC10208846.
7. Xiao M, Wang X, Wang H, Du F, Yao Y, Wang X, Wang J, Yang J, Xiong W, Wang Q, Ren X, Zhu T. Risk factors for

- hyponatremia in acute exacerbation chronic obstructive pulmonary disease (AECOPD): a multicenter cross-sectional study. *BMC Pulm Med.* 2023 Jan 28;23(1):39. doi: 10.1186/s12890-023-02328-4. PMID: 36709254; PMCID: PMC9884134.
8. Tokgöz Akyıl F, Tural Önür S, Abalı H, Sökücü S, Özdemir C, Boyracı N, Kocaoğlu A, Altın S. Hyponatremia is an independent predictor of emergency department revisits in acute exacerbation of COPD. *Clin Respir J.* 2021 Oct;15(10):1063-1072. doi: 10.1111/crj.13409. Epub 2021 Jun 21. PMID: 34097800.
 9. Saha SK, Ali MY, Islam MMSU, Arif KM, Hawlader MAR, Quader MR, et al. Pattern of serum electrolytes imbalance among patients with acute exacerbation of chronic obstructive pulmonary disease admitted in a tertiary level hospital. *Journal of Science Foundation.* 2020;15(1):24-27.
 10. Goli G, Mukka R, Sairi S. Alterations in Serum Electrolytes in Acute Exacerbation of Chronic Obstructive Pulmonary Disease (COPD) Patients
 11. Qin J, Deng X, Wei A, Qin Y, Wu Y, Liao L, Lin F. Correlation between hypocalcemia and acute exacerbation of chronic obstructive pulmonary disease in the elderly. *Postgrad Med.* 2019 Jun;131(5):319-323. doi: 10.1080/00325481.2019.1585689. Epub 2019 Mar 4. PMID: 30806122
 12. Farah, R., Khamisy-farah, R., Arraf, Z., Jacobson, L., & Makhoul, N. (2013). Hypophosphatemia as a prognostic value in acute exacerbation of COPD. *The clinical respiratory journal*, 7(4), 407-415.
 13. El-Sayed, I., El-Dosouky, M., Mashhour, K., & Fawzy, S. (2017). The prognostic value of hypophosphatemia in acute exacerbation of chronic obstructive pulmonary disease (COPD). *The Egyptian Journal of Critical Care Medicine*, 5(2), 57-60.
 14. Sarangi R, Varadhan N, Bahinipati J, Dhinakaran A, Anandaraj, Ravichandran K. Serum Uric Acid in Chronic Obstructive Pulmonary Disease: A Hospital Based Case Control Study. *J Clin Diagn Res.* 2017 Sep;11(9):BC09-BC13. doi: 10.7860/JCDR/2017/29300.10605. Epub 2017 Sep 1. PMID: 29207693; PMCID: PMC5713715.
 15. Adiody, S., Fabeena, M. S., Narmadha, M. P., & Varghese, P. R. (2017). Dyselectrolytaemia in stable and acute exacerbation chronic obstructive pulmonary disease patients- a cross sectional study. *Journal of Evolution of Medical and Dental Sciences*, 6(28), 2296-2300.