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Evaluation of Serum Electrolytes in Patients of Chronic Obstructive Pulmonary Disease: A cross-sectional Study

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Abstract

Background: Chronic obstructive pulmonary disease (COPD) is a globally recognized condition characterized by persistent respiratory symptoms and airflow limitation, typically exacerbated by significant exposure to harmful particles or gases.

Aim: To evaluate the serum electrolytes (Sodium, potassium, calcium, and magnesium) levels in patients suffering from chronic obstructive pulmonary disease.

Method: The study was carried out in the Department of Biochemistry in collaboration with the Department of Pulmonary Medicine at Rohilkhand Medical College and Hospital, Bareilly Uttar Pradesh. After approval of the Institutional Ethical Committee.

Results: We have found statistically significant low levels of serum calcium in Acute exacerbation chronic obstructive pulmonary disease patients as compared to Stable COPD patients.

Conclusion: This study shows that hypocalcemia is a prevalent electrolyte disorder with Acute exacerbation of COPD patients.

Keywords: Chronic obstructive pulmonary disease, Acute exacerbation chronic obstructive pulmonary disease (AECOPD), Electrolytes, hypercalcemia.

Introduction:

Chronic obstructive pulmonary disease (COPD) is one of the most familiar pulmonary diseases in the universe.[1] It is world well-known familiar and curable disease specified by constant respiratory symptoms and breathing limitations generally catalyzed by notable exposure to pernicious particles or gases.[2] The main symptoms of COPD are breathlessness and cough with phlegm.[3] Disease burden due to COPD was highest in countries like Papua New Guinea, India, Lesotho, and Nepal in 2015. In 2016, a global study reported a prevalence of 251 million cases of COPD worldwide Latest global estimates illustrate 3.2 deaths from COPD and more than 90% of COPD deaths occur in low- and middle-income countries. Based on endemic data, by 2020.[4] Most of the patients are affected by COPD which is associated with significant morbidity, disability, and mortality.[5] COPD is likely to increase in coming years due to higher smoking prevalence and aging populations in many countries and its prevalence varies according to country age and sex. In addition to the financial burden required to care for these patients' other costs such as days missed from work and severe limitations in quality of life are important features of this condition. COPD presents with features of acute respiratory infections, namely productive cough and dyspnoea, and may cause metabolic changes like hyponatremia, and hypokalemia.[3] Electrolytes disorder also cause respiratory muscle weakness and impair airway function in COPD patients.[6] COPD is likely to increase in coming years due to higher smoking prevalence and aging populations in many countries and its prevalence varies according to country age and sex. Acute exacerbation of COPD is defined as a sudden worsening of COPD symptoms, such as shortness of breath and quantity and colour of phlegm, that typically lasts for several days. Exacerbations are most cause of hospitalization among COPD patients.[7] Hyponatremia is the most common electrolyte disorder among hospitalized patients, particularly among the elderly and women, and in the presence of comorbidities.[8] Serum electrolyte imbalance in acute exacerbated chronic

obstructive pulmonary disease is the major cause of morbidity and mortality which can be minimized if diagnosed and treated at the correct time. There are various studies conducted in this field with contradicting or conflicting data therefore, the present study was designed to evaluate the possible role of serum electrolyte levels as a biomarker for the prediction of mortality and morbidity in patients for acute exacerbation of COPD.

Materials and methods:

A cross-sectional study was carried out in the Department of Biochemistry in collaboration with the Department of Pulmonary Medicine, Rohilkhand Medical College and Hospital, Bareilly. The study was conducted for one year after obtaining ethical clearance from the Institutional Ethics Committee. All COPD patients were included in this study who attended O.P.D & admitted to the Wards of Rohilkhand Medical College & Hospital, Bareilly. A total of 96 subjects were included in this study after the calculation of sample size. So, in this study, 48 subjects of AECOPD and 48 Stable COPD subjects were taken based on inclusion and exclusion criteria and Aged between 20 to 60 years. Already diagnosed cases of Patients with chronic renal failure, Diabetic ketoacidosis, chronic hepatic disease, and cardiac disease were excluded from this study.
After getting approval from the Institutional Ethics Committee (IEC), Under all aseptic conditions, 5 ml of venous blood was collected from both cases in a serum-separating tube. Blood was allowed to clot for 30 minutes at 37^0C & then centrifuged at 2000 rpm for 10 minutes and obtained serum stored at 2^o – 8^0 C for further analysis maximum of 3 days. Serum sodium & potassium were assessed by the Ion selective electrode method and Serum Calcium was assessed by the Ortho-cresol phthalein complexone method & magnesium by the Calmagite method.

Statistical Analysis:

All the Data was collected and entered into MS Excel sheet. SPSS 23.0 software was used to analyze data for descriptive statistics. The results are presented in mean ± standard deviation (SD). An unpaired t-test was used to calculate the mean difference in both cases. Pearson correlation coefficient tool was used to calculate the r-value, the p-value was calculated with the help of mean difference, and p-value <0.05 was considered as statistically significant.

Observations & Results:

In this study, a total 48 diagnosed cases of acute COPD and 48 stable COPD cases were enrolled and the age group was 20-60 years.

Table 1: Comparative assessment of study based on age distribution among acute & stable COPD.

Age 20-60 years	**Acute COPD n=48**	**Stable COPD n=48**
20-30 years	1 (0.4%)	14 (6.7%)
31-40 years	0	7 (3.3%)
41-50 years	14 (6.7%)	17 (8.1%)
51-60 years	33 (15.8%)	10 (4.8%)

Graph:1 Comparative assessment of study based on gender distribution among acute & stable COPD.

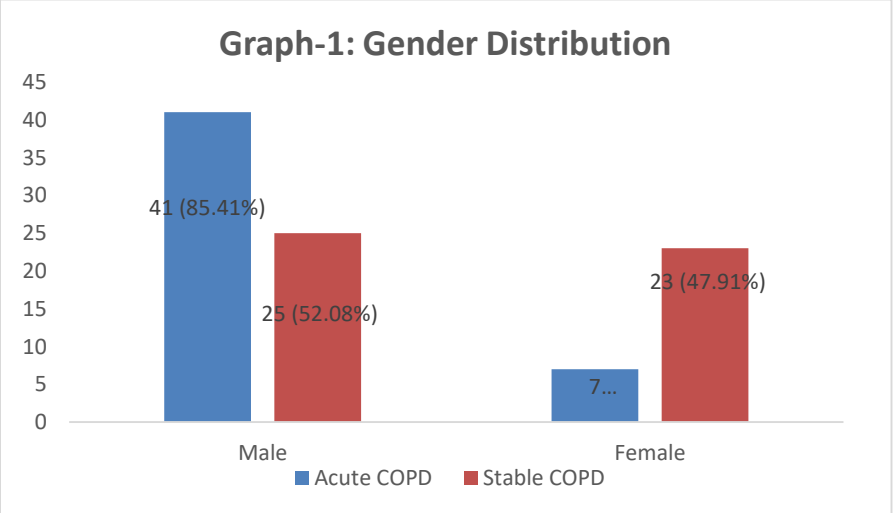
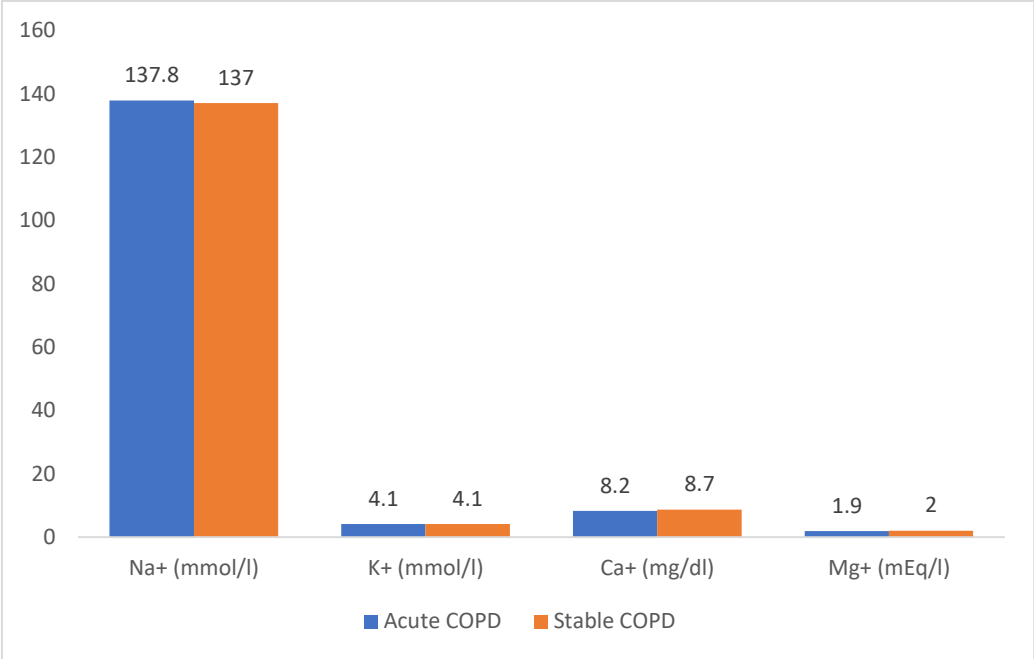


Table 2: Shows Mean ± SD in both genders.

	Acute Male	Acute Female	Stable Male	Stable Female
Age (years)	55.80±40.41	42.28±5.52	40.56±13.13	40.04±12.31

Table 3: Distribution of study subjects according to given parameters among acute COPD and stable COPD.

Parameters	Acute COPD Mean±SD	Stable COPD Mean±SD	P-Value
Na^+ (mmol/l)	137.8 ± 6.17	137±4.09	0.45
K^+ (mmol/l)	4.1±0.78	4.1±0.89	0.73
Ca^+ (mg/dl)	8.2±0.78*	8.7 ± 0.78*	0.002*
Mg^+ (mEq/l)	1.9±0.45	2.0 ± 0.42	0.39

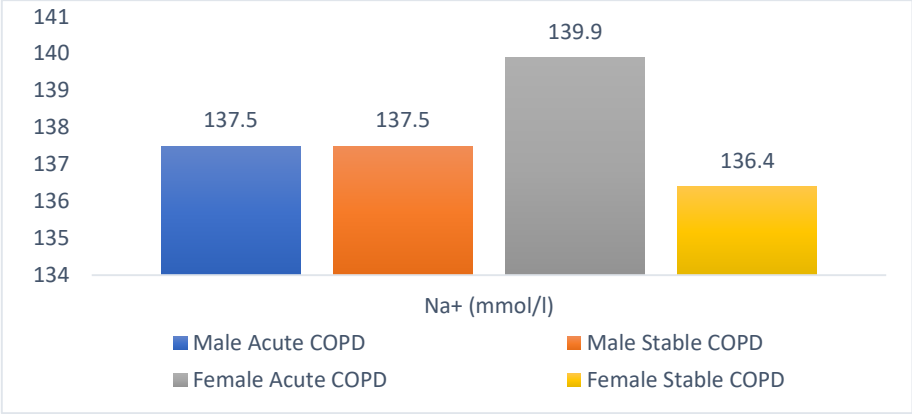


Graph-2: Distribution of study subjects according to given parameters among acute COPD and stable COPD.

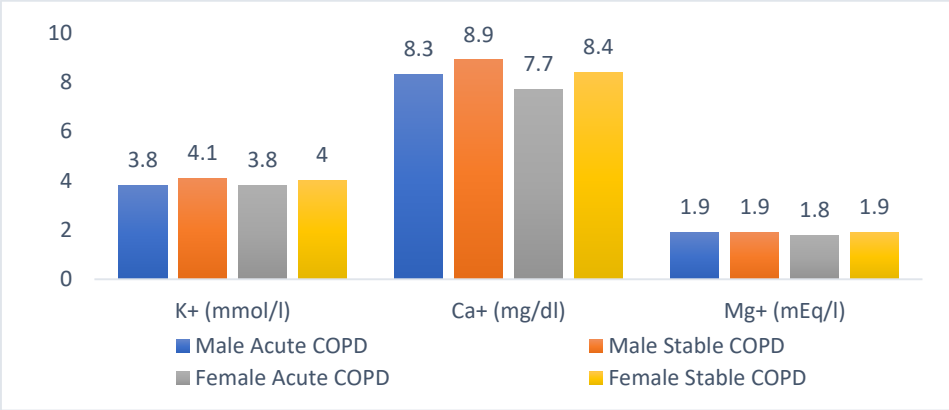
Table 3 and graph chart 2 shows the serum sodium, potassium, and magnesium levels were significantly normal in both groups, and serum calcium levels, were statically significant, (p-value <0.05) in AECOPD patients as compared to stable COPD patients.

Table 4: Comparison of parameters based on gender in acute COPD and stable COPD patients.

Parameters	Male Acute COPD Mean±SD	Male Stable COPD Mean±SD	Female Acute COPD Mean±SD	Female Stable COPD Mean±SD
Na^+ (mmol/l)	137.5±5.98	137.5±4.5	139.9±5.98	136.4±3.61
K^+ (mmol/l)	3.8±0.71	4.1 ±0.80	3.81±0.71	4.01±0.99
Ca^+ (mg/dl)	8.3±0.79*	8.9 ±0.76*	7.7±0.60*	8.41±0.70*
Mg^+ (mEq/l)	1.9±0.45	1.9 ±0.39	1.8±0.49	1.9±0.46



Graph-3: Comparison of sodium level based on gender in acute COPD and stable COPD patients



Graph-4: Comparison of potassium, calcium, and magnesium levels based on gender in acute COPD and stable COPD patients

Table 4, graph chart 3, and graph chart 4 shows the serum sodium, potassium, and magnesium levels were significantly normal in male & female acute COPD patients as compared to male & female stable COPD and serum calcium levels was statically significant in male & female acute COPD patients as compared to male & female stable COPD patients.

Discussion:

The present study was "Evaluation of serum electrolytes in patients of chronic obstructive pulmonary disease: A cross-sectional study" conducted in the department of Biochemistry, Rohilkhand Medical College & Hospital Bareilly, U.P. In this study, the total 48 diagnosed cases of acute COPD and 48 stable COPD cases were enrolled and the age group was 20-60 years. Serum sodium & potassium were assessed by Ion selective electrode method and Serum Calcium was assessed by ortho-cresolphthalein complexone method & magnesium by the calmagite method. The present study suggested that serum sodium & potassium were not significant in AECOPD patients as compared to stable COPD patients. Acharya CP et al [2] (2020) & Rathor HK et al [10] (2020) found decreased levels of Serum sodium, and potassium in their study. In this study, serum magnesium levels were also not significant in AECOPD cases as compared to stable COPD cases when compared with Rathor HK et al [10] (2020) & Maklad SF et al [3] (2019) who found that serum magnesium levels were decreased in their study. Serum calcium levels were significantly low in AECOPD cases as compared to stable COPD cases. Ogan N et al [6] (2020) & Hendy RM et al [11] (2019) suggested decreased levels of serum calcium in their study.

Conclusion:

Finding of the present study suggested that decreased levels of serum calcium in acute COPD cases as compared to stable COPD cases. The study demonstrated normal levels of serum sodium, potassium and magnesium in patients with acute exacerbation. Serum electrolytes should be monitored consistently in such patients and an effect should be made to set them right at the earliest to avoid poor outcomes. From this study, as electrolytes are the major source of the outcome of critically ill patients, so on-time identification and proper management could lessen the suffering of patients with AE of COPD. The limitation of this study, the sample size was very small, and in older age, electrolytes become imbalanced.

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