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Assessment of Serum Electrolytes in Patients of Chronic Obstructive Pulmonary Disease

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Abstract

Background: The aim is to assess serum electrolytes in patients of chronic obstructive pulmonary disease. **Subjects and Methods:** One hundred twenty acute exacerbations of COPD patients and eighty stable COPD patients of both genders were recruited in the study. Assessment of serum sodium, serum potassium, serum chloride using direct ion selective electrode and serum magnesium, serum calcium using arsenazo dye was performed. **Results:** Group I comprised of 70 males and 50 females and group II comprised of 45 males and 35 females. The mean serum sodium level was 131.4 mmol/L in group I and 137.5 mmol/L in group II, serum potassium level was 3.42 mmol/L in group I and 3.96 mmol/L in group II, serum chloride level was 93.2 mmol/L in group I and 99.7 mmol/L in group II, serum calcium was 7.65 mmol/L in group I and 8.38 mmol/L in group II and serum magnesium level was 1.14 mmol/L in group I and 1.62 mmol/L in group II. The difference found to be significant (P< 0.05) (Table II, graph I). The The mean serum sodium level <135 mmol/L was seen in 64% in group I and 45% in group II and >135 mmol/L in 36% in group I and 55% in group II. The mean potassium level <3.5 mmol/L was seen in 53% in group I and 22% in group II and >3.5 mmol/L in 47% in group I and 78% in group II. The mean chloride level <98.0 mmol/L was seen in 60% in group I and 38% in group II and >98.0 mmol/L was seen in 40% I group I and 62% I group II. The mean calcium level <8.7 mg/dl was seen in 81% in group I and 69% in group II and >8.8 in 19% in group I and 31% in group II. The mean magnesium level <1.30 mmol/L was seen in 74% in group I and 14% in group II and >1.30 mmol/L in 26% in group I and 86% in group II. **Conclusion:** Acute exacerbation of COPD patients exhibited abnormal serum electrolyte levels such as serum sodium, potassium, chloride and magnesium. Therefore, careful evaluation of serum electrolytes is mandatory in COPD patients.

Keywords: Acute exacerbation, Chronic Obstructive Pulmonary Disease, electrolyte.

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Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a chronic disease which involves the airways, lung parenchyma, and pulmonary vasculature. It has considerable systemic manifestations.[1] The disease is progressive with possible gene environment interaction and hence can be prevented by avoiding exposure to the noxious particles. The most common studied attributing risk factor is cigarette smoking in any form. Acute Exacerbations and comorbidities play important role in contributing to overall severity.[2]

COPD is a leading cause of morbidity and mortality worldwide. With increasing industrialization and smoking, the prevalence of COPD is increasing.[3] Exacerbations are the most common cause of hospitalization among COPD patients. Acute Exacerbations of chronic obstructive pulmonary disease (COPD) are defined as acute events characterized by a worsening of the patient's respiratory symptoms, particularly dyspnea, beyond day-to-day variation, leading to a change in medical treatment and/or hospitalization.[4] In patients with COPD, edema is almost invariably associated with gas exchange impairment and in particular with carbon dioxide (CO2) retention. The solute water retention in COPD has been considered to be the result of electrochemical imbalance (enhanced renal/tubular H+/Na+ exchange) and/or renal hemodynamic abnormalities.[5]

Severity of COPD exacerbation included moderate, severe, very severe, and life threating. Rang of exacerbation severity includes mild: managed with antibiotics without need for steroids; moderate: need treatment with parenteral steroids with or without an antibiotic; severe: hypoxemia without CO2 retention or acidosis, with PaO2 45 mmHg, and pH more than 7.35; and life-threatening: acidosis and CO2 retention, with PaCO2 >45 mmHg and pH<7.35.[6] Considering this, we selected present study to assess serum electrolytes in patients of chronic obstructive pulmonary disease.

Subjects and Methods

A sum total of one hundred twenty adult patients in age ranged 18- 55 years of acute exacerbations COPD patients and eighty stable COPD patients of both genders were

recruited in the study. The study protocol was approved from institutional ethical review and clearance committee. All enrolled patients were informed regarding the study and their written consent was obtained.

Demographic profile comprised of name, age, gender etc. was included in the study. 5 ml of venous blood was taken in test tube under standard aseptic technique and subjected to assessment of serum sodium, serum potassium, serum chloride using direct ion selective electrode and serum magnesium, serum calcium using arsenazo dye and formazan dye method on Vitros 5600. Results of present study was compiled and entered in MS excel sheet. The results were expressed as mean ± SD. Mann Whitney U test was applied for correct inference. P value less than 0.05 2was considered significant.

Results

Table 1: Distribution of patients

Groups	Group I	Group II
Status	Acute exacerbations COPD	Stable COPD
M:F	70:50	45:35

Group I comprised of 70 males and 50 females and group II comprised of 45 males and 35 females [Table 1].

Table 2: Serum electrolytes in both groups

Serum electrolytes	Group I	Group II	P value
Sodium (mmol/L)	131.4	137.5	<0.05
Potassium (mmol/L)	3.42	3.96	<0.05
Chloride (mmol/L)	93.2	99.7	<0.05
Calcium (mg/dl)	7.65	8.38	<0.05
Magnesium (mmol/L)	1.14	1.62	<0.05

[Table 2, Figure 1] shows that mean serum sodium level was 131.4 mmol/L in group I and 137.5 mmol/L in group II, serum potassium level was 3.42 mmol/L in group I and 3.96 mmol/L in group II, serum chloride level was 93.2 mmol/L in group I and 99.7 mmol/L in group II, serum calcium was 7.65 mmol/L in group I and 8.38 mmol/L in group II and serum magnesium level was 1.14 mmol/L in group I and 1.62 mmol/L in group II. The difference found to be significant (P< 0.05) [Table 2, Figure 1].

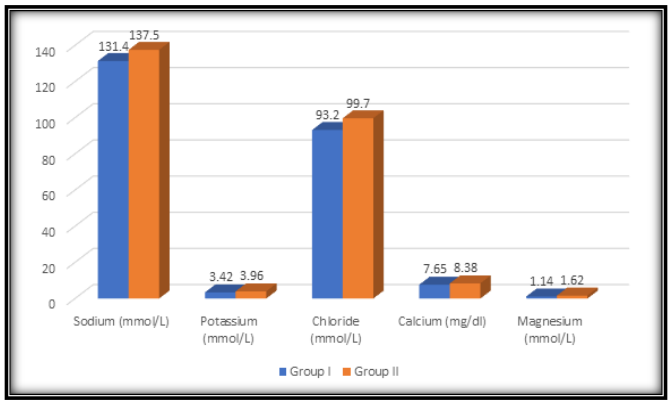

Figure 1: Serum electrolytes in both groups

Table 3: Percentage distribution of patients

Parameters	Values	Group I	Group II	P value
Sodium (mmol/L)	<135	64%	45%	<0.05
	>135	36%	55%	
Potassium (mmol/L)	<3.5	53%	22%	<0.05
	>3.5	47%	78%	
Chloride (mmol/L)	<98.0	60%	38%	<0.05
	>98.0	40%	62%	
Calcium (mg/dl)	<8.7	81%	69%	<0.05
	>8.7	19%	31%	
Magnesium (mmol/L)	<1.30	74%	14%	<0.05
	>1.30	26%	86%	

The mean serum sodium level <135 mmol/L was seen in 64% in group I and 45% in group II and >135 mmol/L in 36% in group I and 55% in group II. The mean potassium level <3.5 mmol/L was seen in 53% in group I and 22% in group II and >3.5 mmol/L in 47% in group I and 78% in group II. The mean chloride level <98.0 mmol/L was seen in 60% in group I and 38% in group II and >98.0 mmol/L was seen in 40% I group I and 62% I group II. The mean calcium level <8.7 mg/dl was seen in 81% in group I and 69% in group II and >8.8 in 19% in group I and 31% in group II. The mean magnesium level <1.30 mmol/L was seen in 74% in group I and 14% in group II and >1.30 mmol/L in 26% in group I and 86% in group II. The difference found to be significant (P< 0.05) [Table 3, Figure 2].

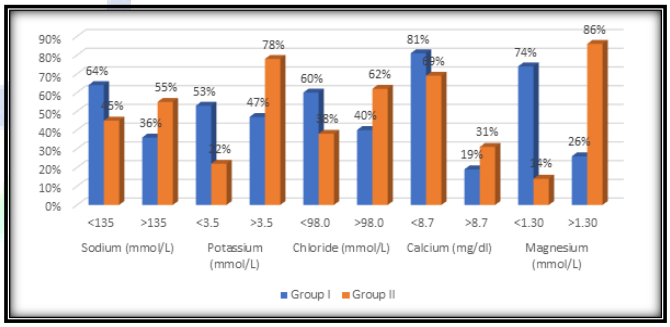

Figure 2:

Discussion

Chronic obstructive pulmonary disease (COPD) is the third leading cause of mortality worldwide.[7] Although COPD is mainly a chronic disease, great numbers of patient complain of exacerbations, which is known as change in the ordinary pathway of the disease with change in the usual shortness of breath, cough, and/or expectoration and beyond normal daily variations, which is sudden and may warrant a change in regular medication in a patient with underlying COPD.[8] Exacerbations are a principal medical and health care issue. Severe exacerbations of COPD are associated with worse survival consequence.[9]

COPD is one of the main cause of morbidity and mortality all over the world. With increasing industrialization and smoking, the prevalence of COPD is increasing. Exacerbations are the most common cause of admission into hospital among patients with COPD.[10] There may be a number of metabolic disturbances arising owing to effect of

drugs used in COPD treatment (i.e., beta 2 agonists and corticosteroids) which can decrease levels of Na and K and increase levels of hyperbilirubinemia, transaminases, blood urea, and serum creatinine.[11] Although most of these features are correctable, very often they are missed or confuse the diagnosis. Presence of coexisting metabolic disorder may cause severe health abnormalities and even death.[12] We selected present study to assess serum electrolytes in patients of chronic obstructive pulmonary disease.

Our study showed that group I comprised of 70 males and 50 females and group II comprised of 45 males and 35 females. Rathore et al,[13] evaluated electrolyte disturbance in patient with acute exacerbations of COPD patients and 50 stable COPD patients. The mean serum sodium, serum potassium and serum chloride levels were significantly lower in acute exacerbation COPD patients as compared to stable COPD patients.

We found that mean serum sodium level was 131.4 mmol/L in group I and 137.5 mmol/L in group II, serum potassium level was 3.42 mmol/L in group I and 3.96 mmol/L in group II, serum chloride level was 93.2 mmol/L in group I and 99.7 mmol/L in group II, serum calcium was 7.65 mmol/L in group I and 8.38 mmol/L in group II and serum magnesium level was 1.14 mmol/L in group I and 1.62 mmol/L in group II. Hendy et al,[14] detected changes in serum sodium, potassium, and ionized calcium (Na, K, and ionized Ca) during COPD exacerbation. A total of 45 patients with exacerbation of COPD and 15 apparently healthy participants were included. Serum electrolytes (Na, K, and ionized Ca) were obtained from patients and controls. Full clinical history, complete blood count, renal and liver function, serum electrolytes (Na, K, and ionized Ca), and oxygen saturation measurement were done for patients. Serum Na, K, and ionized Ca were decreased in patients than controls (with statistically significant difference). These electrolytes levels were lowest in life threatening exacerbation than other grades of exacerbations (with statistically significant difference).

Our results showed that the mean serum sodium level <135 mmol/L was seen in 64% in group I and 45% in group II and >135 mmol/L in 36% in group I and 55% in group II. The mean potassium level <3.5 mmol/L was seen in 53% in group I and 22% in group II and >3.5 mmol/L in 47% in group I and 78% in group II. The mean chloride level <98.0 mmol/L was seen in 60% in group I and 38% in group II and >98.0 mmol/L was seen in 40% I group I and 62% I group II. The mean calcium level <8.7 mg/dl was seen in 81% in group I and 69% in group II and >8.8 in 19% in group I and 31% in group II. The mean magnesium level <1.30 mmol/L was seen in 74% in group I and 14% in group II and >1.30 mmol/L in 26% in group I and 86% in group II. Das et al,[15] reported a significant decrease in serum Na and K in patients with COPD (133±6.86, 3.39±0.96 mEq/l, respectively) than in healthy participants (142±2.28, 4.52±0.02 mEq/l, respectively, P<0.05). Terzano et al,[16] found that among 67 patients hospitalized for type 2 respiratory failure, decreased Na level occurred in 11 patients, decreased levels of Na, chloride, and K occurred in 10 patients, and decreased chloride level occurred in seven patients.

Conclusion

Acute exacerbation of COPD patients exhibited abnormal serum electrolyte levels such as serum sodium, potassium, chloride and magnesium. Therefore, careful evaluation of serum electrolytes is mandatory in COPD patients.

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