



ORIGINAL RESEARCH PAPER

General Medicine

STUDY OF SERUM ELECTROLYTES IN ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

KEY WORDS: Chloride, Electrolytes, Exacerbation, Potassium, Sodium.

Dr. R. Aashish*

Post Graduate, Department of General Medicine, Sree Mookambika Institute of Medical Sciences, Kulasekharam *Corresponding Author

Dr. Gayathri J

Post Graduate, Department of General Medicine, Sree Mookambika Institute of Medical Sciences, Kulasekharam

Dr. Suresh MK

Professor and HOD Department of General Medicine Sree Mookambika Institute of Medical Sciences, Kulasekharam.

ABSTRACT

Background: Chronic Obstructive Pulmonary condition (COPD) is a progressive condition for which there is no cure. Chronic bronchitis and emphysema are part of COPD. Despite the fact that COPD is mostly a chronic condition, many patients do undergo exacerbations, which are associated with much lower survival outcomes, particularly when there is an abnormal serum electrolyte level. These elements make the disease progression even worse. Because of this, COPD-related morbidity, death, and financial burden on healthcare systems are increasing. **Aim:** The aim of the present study was to evaluate the prevalence of serum electrolytes disturbances in patients with acute exacerbation of COPD. **Materials and Method:** Present study was a prospective case control study conducted in Department of General Medicine, Sree Mookambika Institute of Medical Sciences, Kulasekharam for a period of 10 months. The study included 80 participants, who were classified into two groups: 40 patients with exacerbation of COPD under case group and 40 healthy individuals under control group. Patients with acute exacerbation of COPD admitted in medical ward and intensive care units of general medicine department were included in the study under case group. All participants were subjected to measurement of serum levels of Sodium, potassium, magnesium, and chloride. Statistical analysis was done using ANOVA, unpaired T test. Statistical significance was considered if p value was less than 0.005. **Results:** In the case group of 40 patients with COPD exacerbation, 35 (87.5%) showed electrolyte imbalances. Hypokalemia was observed in 14 (35%), followed by hyponatremia in 10 (25%), hypomagnesemia in 7 (17.5%), and hypochloremia in 6 (15%). When compared to healthy controls, individuals with COPD exacerbation had reduced serum electrolyte levels (sodium, potassium, chloride, and magnesium) (P<0.05). Additionally, statistical significance was found when comparing normal and reduced serum electrolyte levels between the study and control groups. **Conclusion:** Patients who come with an acute exacerbation of COPD frequently have abnormal serum electrolytes. Since serum electrolytes and COPD exacerbation are significantly correlated, this previously mentioned problem should be corrected as soon as possible to hasten remission and shorten hospital stays.

INTRODUCTION:

Chronic Obstructive Pulmonary condition (COPD) is the sixth leading cause of mortality worldwide, making it a condition of growing public health significance. In addition to a major cause of death, the majority of COPD patients also suffer from a permanent or temporary decline in quality of life after an acute exacerbation.¹

Dyspnoea with exertion is one of the primary signs of COPD, along with coughing and wheezing. Majority of patients have smoked for a minimum of 20 pack years. The hallmark physiological abnormalities of COPD include a persistent decline in FEV1 and FEV1/FVC.²

COPD Exacerbation is the aggravation of three or more respiratory symptoms over the period of two or more days (dyspnoea, sputum, cough, or wheeze). Environmental contaminants or a bacterial or viral infection could be the cause. 75% or more of exacerbations are typically caused by infections; around 25% of cases have bacteria, 25% have viruses, and 25% have both bacteria and viruses. During the exacerbation, the inflammation of the airways increases, leading to greater hyperinflation, decreased expiratory airflow, and impaired gas exchange.^{3,4}

Significant morbidity and mortality are linked to an acute exacerbation of COPD. COPD accounts for the fourth most common cause of death globally, accounting for 5.6% of all fatalities. For acute exacerbations, 15% of COPD patients require admission to a general hospital or intense respiratory care unit, increasing the demand on medical services and raising the cost.⁵ It is critical to determine the factors related with poor outcome in patients with acute COPD exacerbation.⁶

Patients with COPD who are experiencing an acute

exacerbation show signs of acute respiratory infections and number of metabolic disorders including hypokalemia, hyponatremia, hyperbilirubinemia, hypomagnesemia, and elevated renal parameters that can result from the disease process or from treatment with beta 2 agonists, steroids, or diuretics.⁷

Electrolyte imbalances can also result in weak respiratory muscles and reduce airway function. Serum electrolytes are necessary for nerve transmission and muscle contraction. Electrolyte imbalances such as hyponatremia, hypokalemia, and others can result in cardiac arrhythmias, respiratory muscle paralysis, renal failure, impaired nerve and muscle conduction, convulsions, coma, and even death.⁸ Therefore, it is critical to identify any serum electrolyte imbalance in such patients in order to reduce death and morbidity.

AIMS AND OBJECTIVES:

The main objective of the study is to determine the electrolyte disturbances in patients with acute exacerbation of COPD.

MATERIALS AND METHODS:

Present study was a prospective case control study conducted in Department of General Medicine, Sree Mookambika Institute of Medical Sciences, Kulasekharam for a period of 10 months from March 2022 to December 2022. The study included 80 participants, who were classified into two groups: 40 patients with exacerbation of COPD under case group and 40 healthy individuals under control group.

Patients with acute exacerbation of COPD admitted in medical ward and intensive care units of general medicine department were included in the study under case group. Patients with COPD with other clinical conditions that may cause electrolyte disorders such as renal failure, diabetic

ketoacidosis, pregnancy, congestive cardiac failure, liver failure COPD patients admitted for causes other than acute exacerbation were excluded.

Clinical data including age, gender and duration of illness were recorded. Blood samples were collected from the participants for the estimation of serum electrolytes using an autoanalyzer. All participants were subjected to measurement of serum levels of Sodium, potassium, magnesium, and chloride.

Data entered in excel sheet. Statistical analysis was done using SPSS Software version 20.0. Numbers and percentages are used in reporting Categorical values. Mean and standard deviation are used while reporting Numerical values. Statistical significance was assessed was done using ANOVA, unpaired T test. Statistical significance was considered if p value was less than 0.005.

OBSERVATION AND RESULTS:

Patients with COPD were in the age range of 52–77 years, with mean age at presentation being 58.18±9.48 years. In the control group, participants were in the age range of 50–70 years, with average age being 60±7.2 years. Male predominance was noted in both groups with 28 and 31 in cases group and control group respectively.

Among the 40 patients with COPD exacerbation, 35 (87.5%) had electrolyte disorders. hypokalemia was noted in 14(35%) followed by hyponatremia in 10(25%), hypomagnesemia in 7(17.5%), hypochloremia in 6(15%).

Serum electrolytes (sodium, potassium, chloride and magnesium) in patients with COPD exacerbation was lower when compared to healthy controls (P<0.05). (Table-1) Comparison of serum electrolytes (normal and reduced) among study and control groups was found to be statistically significant. (Table 2)

Table 1: Comparison of mean electrolyte values in cases and control group.

Electrolyte	Case group	Control group	p value
Sodium (mEq/l)	130±3.58	139±3.18	0.011
Potassium (mEq/l)	3.11±1.12	4.43±1.09	0.001
Chloride (mEq/l)	83.48±6.72	99.66±3.17	0.018
Magnesium (mEq/l)	1.77±0.14	2.29±0.12	0.032

Table2: Comparison of serum electrolytes among study and control groups

Electrolytes	Cases group (n=40)	Control group (n=40)	p value
Sodium	Hypo	10(25%)	0.037
	Normal	30(75%)	
Potassium	Hypo	14(35%)	0.013
	Normal	26(65%)	
Chloride	Hypo	6(15%)	0.038
	Normal	34(85%)	
magnesium	Hypo	7(17.5%)	0.047
	Normal	33(82.5%)	

DISCUSSION:

Patients with COPD were in the age range of 52–77 years, with mean age at presentation being 58.18±9.48 years. In the control group, participants were in the age range of 50–70 years, with average age being 60±7.2 years. This was comparable to Das P et al. where subjects of COPD were in the age range of 40–78 years, average age of presentation being 62.22 ± 12.45 years. In the control group, subjects were in the age range of 40- 78 years, average age being 61 ± 10.5 years.

It has been noted that in addition to the symptoms of acute infection, there may also be a number of co-morbid diseases, such as type II respiratory failure metabolic abnormalities such dyselectrolytemia, uremia, and abnormal liver function,

etc.⁹ Even if the most of them can be corrected, active attempts are sometimes unsuccessful due to oversight or a lack of resources for 24-hour laboratory monitoring.

In the present study, hypokalemia was noted in 14(35%) followed by hyponatremia in 10(25%), hypomagnesemia in 7(17.5%), hypochloremia in 6(15%). Serum electrolytes (sodium, potassium, chloride and magnesium) in patients with COPD exacerbation was lower when compared to healthy controls (P<0.05).

For a variety of reasons, patients with COPD are vulnerable to hyponatremia. Common contributing factors for hyponatremia in such patients include malnutrition, poor intake during acute exacerbations, chronic hypoxia and hypercapnia resulting from the underlying pulmonary illness, Syndrome of Inappropriate Antidiuretic Hormone Synthesis (SIADH), use of diuretics, bronchodilators or steroids, and heart failure or renal insufficiency. In COPD, inappropriately high plasma arginine vasopressin (AVP) and renin-angiotensin-aldosterone system activation may result in hyponatremia.¹⁰

Hypokalemia in COPD patients may be brought on by pulmonary acidosis, metabolic alkalosis, or long-term steroid medication. Beta 2-adrenoceptor agonist use, such as that of fenoterol or salbutamol, may also be a factor. Moreover, it was found that COPD patients had a high death rate for abrupt respiratory failure linked to hypokalemia.¹¹

In their study, Das P et al.¹² found that average serum sodium and potassium levels of COPD patients were 133 ± 6.86 mEq/l and 3.39 ± 0.96 mEq/l respectively. The concentrations in the control group were, respectively, 142 ± 2.28 mEq/lit and 4.52 ± 0.02 mEq/l

Maklad SF et al.¹³ found that COPD patients had significantly lower levels of sodium, potassium, magnesium and chloride (131.45, 3.19, 0.96, 1.85, and 84.75 mEq/l, respectively) than the healthy controls (138.2 mEq/l, 4.50 mEq/l, 2.20 mEq/l, and 100.30 mEq/l, respectively) (P<0.05). Additionally, 20% of participants had hypokalemia, 13.33% had hyponatremia, 6.66% had hypomagnesemia, 3.33% had hypochloremia, and 15% had mixed abnormalities.

In their study, Adeep an et al.¹⁴ found that 16(47.1%) patients with stable COPD and 29(70.7%) patients with acute exacerbation COPD, respectively, experienced hyponatremia and was the the most commonly reported dyselectrolytemia. Ogan N et al.¹⁵ reported that in comparison to COPD patients, control participants had higher serum levels of magnesium, potassium, and calcium (p=0.006, p=0.015, and p0.001, respectively).

Serum electrolytes were found to be out of low in 68 (68%) patients and in 32 (32%) cases in a study conducted by Saha SK et al.¹⁶ Isolated hyponatremia was detected in 36 (53%), while isolated hypokalemia was observed in 15 (22%). The average serum sodium concentration was (133.82 ± 2.52) mmol/l. The average level of serum potassium was 3.45 ± 0.23 mmol/l.

CONCLUSION:

Because of its prevalence, variety of etiologies, and potential consequences for prognosis, the diagnosis of electrolyte abnormalities among individuals with COPD exacerbations is challenging for clinicians. The detection of such abnormalities is critical. Therefore, these levels in those patients should be periodically evaluated. The lowering of morbidity and death will be helped by preventive strategies and targeted management.

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Conflicts Of Interest:

There are no conflicts of interest

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