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Original Article

Pattern of Serum Electrolytes Imbalance among Patients with Acute Exacerbation of COPD Admitted in a Tertiary Level Hospital

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Abstract:

Chronic Obstructive Pulmonary Disease (COPD) is a progressive disease and there is not yet a cure. Not only in Bangladesh but also worldwide the incidence of COPD is increasing. The disease is associated with some metabolic derangement such as electrolytes imbalance. Those factors further worsen the disease course. As a result COPD related morbidity, mortality and cost to health systems are also increasing. This cross-sectional observational study was conducted in Faridpur Medical College Hospital (FMCH) over 6 months among 100 patients who were admitted with acute exacerbation of COPD. The mean age was (58.13 ± 9.96) years. In this study serum electrolytes were found below the normal range in 68 (68%) cases and within normal range in 32(32%) cases. Isolated hyponatremia was observed in 36(53%) and 15(22%) had isolated hypokalaemia. Both hyponatremia and hypokalaemia was found in 17(25%) cases. The mean serum sodium level was (133.82±2.52) mmol/l. Among patients with isolated hyponatremia, 24(67%) had mild hyponatremia and 12(33%) got moderate hyponatremia. Again the mean serum potassium was (3.45±0.23) mmol/l. Among patients with isolated hypokalaemia, 10(67%) had mild hypokalaemia and 5(33%) had moderate hypokalaemia. Both hyponatremia and hypokalaemia was observed in one fourth of total electrolytes depleted cases and all were within the mild range. No patient had severe hyponatremia or hypokalaemia.

Key words: COPD, Electrolyte imbalance.

Introduction:

COPD has been described as a disease state characterized by airflow limitation that is not fully reversible. The air flow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases[1]. This chronic progressive disease is characterized by inexorable decline in respiratory function, exercise capacity, and health status[2].

Acute exacerbations of COPD are a sustained worsening of the patient's symptoms from his or her usual stable state, which is beyond normal day-to-day variations and is acute in onset[3]. These exacerbations are important, not only because of their impact on an individual's life but also because of their long term effects on health status, morbidity and mortality[4]. Exacerbations are a significant cause of hospital admission and readmission, and burden placed on health resourses in immense[5]. The economic and social burden created by acute exacerbation of COPD is extremely high. Thus, it is important to identify factors associated with exacerbation and poor outcome[6].

The acute exacerbation of COPD patients not only presented with the features of acute respiratory infection (productive cough, dyspnoea etc.) but also a number of metabolic derangements arising out of the disease process or as a consequence of the therapy instituted like hyponatremia, hypokalemia,

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hyperbilirubinemia, elevated transaminases, elevated blood urea and elevated serum creatinine etc. Very often they are missed or confused the diagnosis, thus simple overlooking of the coexisting metabolic abnormalities may contribute to a great deal of mortality and morbidity in the COPD patients[7]. So detection of serum electrolytes imbalance in such cases is important for the improvement of mortality and morbidity.

Materials and methods:

A cross-sectional observational study was done in the department of Medicine and Respiratory medicine in FMCH, Faridpur from June 2015 to November 2015. The study was conducted among 100 patients of both sexes who were above 40 years of age. The clinically diagnosed COPD patients who were admitted in FMCH with acute exacerbation were included in this study. Patients with ICU support requirement, renal failure, congestive cardiac failure, liver failure and non co-operative patients were excluded from study. Before study, informed consent was taken from patient or attendant and aim of the study was explained clearly. After admission, each patient was assessed by history and clinical examination. Serum electrolytes (sodium and potassium) of all patients were measured within 24 hours of admission. After that all data that was checked, verified, analyzed and presented systematically.

Result:

In our study among 100 cases, maximum 34(34%) patients were in the age group of 51-60 years, next 28(28%) were in the age group of 61-70 years, 26(26%) were in the age group of 40-50 years and 12(12%) were above the age of 70 years (Table I). Age of the patient ranges from 40 years to 80 years with a mean age of 58.13 ± 9.96 years.

Table I: Distribution of patients according to age (n=100).

Age (years)	Number of patients (%)
40-50	26(26%)
51-60	34(24%)
61-70	28(28%)
>70	12(12%)

Regarding sex distribution 84(84%) cases were male and 16(16%) were female with a male-female ratio of 5.25:1.

In this study, serum electrolytes were below the normal range in 68(68%) cases and within normal range in 32(32%) cases. Among those 68 cases isolated hyponatremia was observed in 36 cases and 15 patients had isolated hypokalaemia and both hyponatremia and hypokalaemia was found in 17 cases (Table II).

Table II: Distribution of patients according to serum electrolytes status (n=100).

Electrolytes status	Number of patients (%)
Normal	32(32%)
Isolated Hyponatraemia	36(36%)
Isolated Hypokalaemia	15(15%)
Both Hyponatraemia and Hypokalaemia	17(17%)

Table III shows, among patients with isolated hyponatremia, 24(67%) were in the range of mild hyponatremia and remaining 12(33%) got moderate hyponatremia but no patient was in the range of severe hyponatremia. Serum sodium level ranges from 128.24 mmol/L to 137.12 mmol/L with a mean value of 133.82±2.52 mmol/L.

Table III: Distribution of patients according to severity pattern of isolated hyponatremia (n=36)

Severity of Hyponatremia	Number of patients (%)
Mild hyponatremia (130 - 135 mmol/L)	24(67%)
Moderate hyponatremia (120 -129 mmol/L)	12(33%)
Severe hyponatremia (< 120 mmol/L)	0(0%)

Among patients with isolated hypokalaemia, 10(67%) cases were within the range of mild hypokalaemia and moderate hypokalaemia was observed in 5(33%) cases. No one was in the range of severe hypokalaemia (Table IV). Serum potassium level ranges from 2.60 mmol/L to 3.80 mmol/L with a mean value of 3.45±0.23 mmol/L.

Among all cases (100) both hyponatremia and hypokalaemia was observed in 17 cases which was 25% of total (68) electrolytes depleted cases. Their hyponatremia and hypokalaemia were within the mild range.

Table IV: Distribution of patients according to severity pattern of isolated hypokalaemia (n=15)

Severity of Hypokalaemia	Number of patients (%)
Mild hypokalaemia (3.1 - 3.5 mmol/L)	10(67%)
Moderate hypokalaemia (2.5 - 3.0 mmol/L)	5(33%)
Severe hypokalaemia (< 2.5 mmol/L)	0(0%)

Discussion:

In our study, we measured serum electrolytes (sodium and potassium) of COPD exacerbation patients within 24 hours of hospital admission. We found a low level of serum electrolytes in 68(68%) cases. Among the 68 cases, isolated hyponatremia were observed in 36(53%) cases, 15(22%) patients had isolated hypokalaemia, combined hyponatremia and hypokalaemia was found in 17(25%) cases. Study by Terzano C et al[8] shows among 67 patients who were hospitalized for hypercapnic COPD exacerbation, hyponatremia was present in 11 (16.42%) patients, hyponatremia with hypochloraemia and hypokalaemia in 10 (15%) patients and hypochloraemia in 7 (10.45%) patients.

Patients with COPD are susceptible to hyponatremia for a number of reasons. Chronic hypoxia and hypercapnia secondary to the underlying pulmonary illness, heart failure or renal insufficiency, use of diuretics, syndrome of inappropriate antidiuretic hormone secretion, use of bronchodilators or steroids, malnutrition, and poor intake during acute exacerbations are common contributing factors for hyponatremia in such patients. Activation of the renin-angiotensin-aldosterone system and inappropriately elevated plasma arginine vasopressin in COPD may cause hyponatremia[9].

Study by Das P et al[10] shows a significantly low level of mean serum sodium (133±6.86 mmol/L) in subjects with acute exacerbation of COPD. Another study in India by Goli G et al[11] shows mean serum sodium 132±5.65mmol/L. In our study, mean serum sodium level was 133.82±2.52 mmol/L. In these studies mean sodium level are nearer but the standard deviation varies. In our study among all (36) isolated hyponatremic patients, 24(67%) were in mild and 12(33%) were in moderate range. But actual number of mild hyponatremic patients was more because 17 patients had combined depletion and that was in mild hyponatremia level. But in previous two studies standard deviation is more, that indicates a wide fluctuation of serum sodium level.

The degree of hyponatremia in patients with COPD generally correlates with the severity of the lung disease. It is particularly common in patients who are relatively hypercapnic and hypoxic and under substantial physiologic stress, as may occur in severe COPD, serious secondary infection, or acute respiratory failure[12]. Water retention and hyponatraemia are typically observed in the final stages of chronic obstructive pulmonary disease and the onset of edema is a poor prognostic factor. The systemic response to hypercapnia has the effect of reducing the renal blood flow and, as a result, increasing water and sodium retention with the final effect of edema and hyponatraemia[13].

In our study among 15 patients who developed hypokalaemia, 10(67%) cases had mild hypokalaemia and 5(33%) cases had moderate hypokalaemia, no one had severe hypokalaemia. But actual number of mild hypokalaemia was more as because 17 patients had combined depletion and that was mild hypokalaemic level. In our study, mean serum potassium was 3.45±0.23mmol/L. Das P et al[10] in their study found a low level of potassium (3.39 ± 0.96 mmol/L)) in subjects with acute exacerbation of COPD. Another study by Goli G et al[11] in India shows mean serum potassium level of 3.29±0.96 mmol/L). Due to serum potassium maintains a narrow range, the minimum variation of level is important for clinical assessment and management of patient. In this respect our study result is consistent with other studies.

Hypokalemia in COPD may be attributed to respiratory acidosis and metabolic alkalosis or long standing steroid therapy[14]. Use of beta 2-adrenoceptor agonists whether inhaled like formetrol and salbutamol or oral salbutamol or bumbuterol in addition to oral sustained released theophyline are the main stay of treatment in stable COPD. Unfortunately all these treatments have been proven to cause some electrolytes disorders in patients with bronchial asthma and COPD[15]. Moreover, acute respiratory failure associated with hypokalemia was found to have a high mortality rate among the COPD patients[16].

Conclusion:

A significant number of patients have chance of electrolyte imbalance such as hyponatraemia, hypokalaemia those become hospitalized due to acute exacerbation of COPD. Detection of such abnormality is very important. Preventive measures and specific management will be helpful for the reduction of morbidity and mortality.

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