

Frequency of Hypomagnesaemia in Acute Exacerbation of Chronic Obstructive Pulmonary Disease

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ABSTRACT

Introduction: Chronic obstructive pulmonary disease (COPD) is a chronic inflammatory disease of the airways and lungs which occurs secondary to exposure to tobacco, biomass fuel smoke and harmful gases. Every time patient develops acute exacerbations of COPD lung functions further declines compromising quality of life. Magnesium is an important element involved in many functions of respiratory tract by releasing neurohumoral mediators, mucociliary clearance, stabilization of mast cells and bronchodilation of respiratory tract smooth muscles.

Objective: The objective of this study is to find frequency of hypomagnesaemia in acute exacerbation of chronic obstructive pulmonary disease.

Material and Method: This Cross sectional study was conducted at Institute of chest Medicine, Mayo hospital Lahore. A total of 135 cases fulfilling inclusion criteria were enrolled in study. Informed written consent was taken from patients or attendant and then their demographic data (including name, age, gender, address and duration of disease) was also recorded. All patients with COPD exacerbation were assessed for their magnesium levels. A blood sample of 5 cc was drawn in aseptic measures with help of staff nurse. The blood sample was sent to same hospital laboratory and their magnesium level was recorded and hypomagnesaemia was labeled according to operational definition.

Results: Mean age of patients was 47.11 ± 10.92 years. Males were 125(92.59%) and 10(7.41%) were female. There were 33(24.44%) case who had mild, 31(22.96%) cases had moderate, 35(25.93%) cases had severe and 36(26.67%) cases had very severe disease. According to operational definition, 54(40%) cases had hypomagnesemia and 81(60%) cases had normal magnesium levels.

Conclusion: Hypomagnesemia was found in 40% patients of acute exacerbation of chronic obstructive pulmonary disease. Hence, in future magnesium supplementation can be added along with standard treatment to improve the outcome. By correcting magnesium levels, we can further reduce the severity of disease and prevent the related complications.

Keywords: Chronic obstructive pulmonary disease, hypomagnesaemia, Magnesium level, Acute Exacerbation

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a chronic disease which is treatable and preventable. It occurs secondary to inhalation of tobacco, biomass fuel smoke, noxious particles and harmful gases. It is progressive in nature. Inflammatory cells infiltrates in airways and alveoli and causes chronic inflammation, increased mucus production, loss of elastic recoils leading to hyperinflation of lungs¹. This chronic inflammation occurs as a protective phenomenon secondary to inhaled toxins and leading to persistent structural changes. Worldwide COPD is a common disease and it is the fourth leading cause of death².

Patients of stable COPD has certain degree of inflammation in smaller and larger airways and alveoli are also involved in later stages. This persistent inflammation leads to increased mucus production, bronchoconstriction and damage to elastic recoil of lungs³. The course of COPD is accompanied by acute exacerbations. In acute exacerbation inflammation is increased and level of proinflammatory cytokines are also increased⁴.

Magnesium is an important element involved in many functions of respiratory tract by releasing neurohumoral mediators, mucociliary clearance, stabilization of mast cells and bronchodilation of respiratory tract smooth muscles. It is observed in a study that decreased magnesium intake in the diet can lead to increased inflammation in the airways and may lead to worsening of asthma and COPD⁵. In another study it is observed that decreased serum level of magnesium is associated with more admissions in patients of acute exacerbation of COPD⁶.

Low magnesium level can lead to increase bronchial hyper reactivity and decreased lung function. Magnesium relaxes bronchial smooth muscles and maintain normal airway patency. A study reported that 34% cases with an exacerbation COPD had hypomagnesaemia⁷.

The current study is designed to find frequency of hypomagnesaemia in acute exacerbation of chronic obstructive pulmonary disease. There is no local study available and data on

other part of region is also lacking, so the current study can help us to know the status in local context. If through this study hypomagnesaemia is found in COPD patients, then in future magnesium supplementation may be added along with standard treatment to improve the outcome.

Operational Definition:

COPD with Acute Exacerbations: It was defined as worsening of dyspnea, cough, fatigue, wheezing, sputum production from day to day in patients already diagnosed with COPD at by 6 months ago.

Severity of disease: It was assessed through GOLD criteria as follows on spirometry

Mild: FEV1/FVC < 70%, FEV1 > 80% predicted, Moderate: FEV1/FVC < 70%, FEV1 50-80% predicted, Severe: FEV1/FVC < 70%, FEV1 30-50% predicted, Very severe: FEV1/FVC < 70%, FEV1 < 30% predicted.

Hypomagnesaemia: it was labeled with serum magnesium below 1.80mg/dl.

MATERIAL AND METHODS

This Cross sectional study was conducted at Institute of Chest medicine, Mayo hospital Lahore. Sampling technique was Non probability consecutive sampling. Treatment allocation was done by using randomization / lottery method. A total of 135 cases are estimated using frequency of hypomagnesaemia as 34% in cases with an exacerbation COPD. The sample size is calculated at 95% confidence level and 8% margin of error⁷. Inclusion criteria was Cases with age 30-60, Either gender, COPD cases (diagnosed at least 6 months ago), Patients diagnosed as acute exacerbation of chronic obstructive pulmonary disease (as per operational definition). An exclusion criterion was history of asthma, heart failure, Ischemic heart disease, lung cancer, and chronic alcoholism, patients taking digoxin and proton pump inhibitors.

A total 135 cases fulfilling inclusion criteria were enrolled in the study. Informed written consent was taken from patients or attendant and then their demographic data (including name, age,

gender, address and duration of pain) was also recorded. All patients with COPD exacerbation were assessed for their magnesium levels. A blood sample of 5 cc was drawn in aseptic measures with help of staff nurse. The blood sample was sent to same hospital laboratory and reports was collected through patients and their magnesium level was recorded and hypomagnesaemia was labeled as per operational definition. Patients were treated as per standard protocol after admission.

For data analysis SPSS version 23 was used. For quantitative data like age, duration of disease, weight, height and BMI Mean ± S.D was calculated. For categorical data like gender and hypomagnesaemia Frequency (%) was used. Data stratification was done for age, gender, Obesity (BMI> 30) and severity of disease. Post stratification Chi-square test was applied; p-value ≤ 0.05 was taken as significant.

RESULTS

Mean age of patients was 47.11 ± 10.92 years, 34 (25.19%) cases were 30-40 years old and 101(74.81%) cases were 41-60 years old. There were 125(92.59%) male and 10(7.41%) female cases. The mean weight, height and BMI were 79.02 ± 11.53 kg, 1.64 ± 0.03 m and 29.38 ± 4.16 respectively. There were 67(49.63%) obese and 68(50.37%) non-obese cases. The mean duration of disease was 8.33 ± 4.01 months with minimum and maximum duration of disease as 2 and 15 months. There were 33(24.44%) case who had mild, 31(22.96%) cases had moderate, 35(25.93%) cases had severe and 36(26.67%) cases had very severe disease.

According to operational definition, 54(40%) cases had hypomagnesaemia and 81(60%) cases had normal magnesium levels. Fig-1. The frequency of hypomagnesaemia in 30-40 years old cases was (35.3%) and in 41-60 years old cases was (41.6%), which is statistically insignificant, p-value > 0.05. The frequency of hypomagnesaemia in male cases was (39.2%) and in female cases it was (50%), statistically not significant, p-value > 0.05. The frequency of hypomagnesaemia in obese (43.3%) and non-obese cases (36.8%) was statistically same, p-value > 0.05. The frequency of hypomagnesaemia was in mild (36.4%), moderate (41.9%), severe (34.3%) and very severe diseased cases (47.2%), statistically insignificant, p-value > 0.05. Table -1.

Hypomagnesaemia

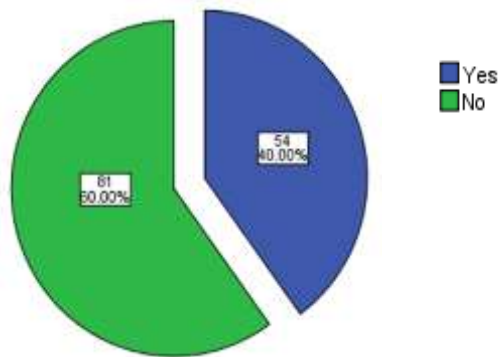


Fig-1: Distribution of hypomagnesaemia

Table-1: Comparison of Hypomagnesaemia and Severity of Disease

		Hypomagnesaemia		Total
		Yes	No	
Severity of disease	Mild	12(36.4%)	21(63.6%)	33(100%)
	Moderate	13(41.9%)	18(58.1%)	31(100%)
	Severe	12(34.3%)	23(65.7%)	35(100%)
	Very severe	17(47.2%)	19(52.8%)	36(100%)
Total		54(40%)	81(60%)	135(100%)

Chi-square = 1.489 P-value = 0.685 (Insignificant)

DISCUSSION

Chronic obstructive pulmonary disease (COPD) is a chronic disease that affects quality of life. It is the fourth most common cause of death world wide. Mortality associated with cardiovascular diseases has significantly decreased in the last two decades but mortality associated with COPD has doubled in the past two decades which is an alarming situation. More than 210 million peoples around the globe have COPD⁹. Despite the better understanding of the disease and more efforts were done for the prevention of disease in the last decade, World Health Organization (WHO) has predicted that by the 2030, COPD will become the third most common cause of death world wide⁹.

In patients of stable COPD, every time acute exacerbations occurs leads to accelerated decline in FEV1 that affects quality of life and increases economic burden¹⁰.

Magnesium plays an important role in the maintenance of normal airways by releasing neurohumoral mediators, mucociliary clearance, stabilization of mast cells and bronchodilation of respiratory tract smooth muscles. In few studies hypomagnesaemia is observed in COPD patients and it thoughts to increase the severity of disease and prolonged hospital stay. It is observed in a study that in acute exacerbation of COPD patient, serum magnesium levels are lower compared to stable COPD patients¹¹.

In current study 54 (40%) cases had hypomagnesaemia while another study by Niventhi A, reported that 34% cases with an exacerbation COPD had hypomagnesaemia.⁷ These results are comparable with our study. In a study by Singh et al. conducted on 50 patients of acute exacerbations of COPD, 17 patients (34%) had Hypomagnesaemia. Majority (88%) of patients with hypomagnesaemia were in stage II and stage-III¹². In current study it was found that hypomagnesaemia was found in 12(36.4%) case who had mild, 13(41.9%) cases had moderate, 12(34.3%) cases had severe and 17(47.2%) cases had very severe disease.

Another study by Rajjab S, on COPD patients showed hypomagnesaemia in 33.76% patients and amongst those 7.7% were in stage 1, 57.7% were in stage II and 34.6% were in stage-III¹³. These findings are almost similar to the findings of current study. Another research was conducted in Indian occupied Kashmir to study the serum magnesium levels in COPD exacerbations. Hypomagnesaemia was found in 33.8%. In cases mean serum magnesium levels were significantly lower as compare to controls, p<0.0001¹⁴. These results are comparable to our study.

Aziz et al. conducted a study in patients of stable COPD and in acute exacerbations of COPD to see the serum magnesium levels in both. Results showed significant (p <0.0001) lower levels of serum magnesium during acute exacerbations of COPD compared to stable COPD patients¹⁵. These results showed the strong association between serum magnesium levels and acute exacerbations of COPD and by correcting serum magnesium level repeated exacerbations of COPD can be prevented and it can slow the decline in lung functions.

Alcindo et al. studied the relative frequency of hypomagnesaemia and other electrolyte disorders in patients with COPD. Hypomagnesaemia was reported in 27 % of patients¹⁶.

A study from India by Kumar GV et al, reported hypomagnesaemia in 45% of patients of acute exacerbation of COPD. Mean serum magnesium level in patients of acute exacerbation of COPD was less than 1.5 mg/dl as compare to stable COPD having mean serum magnesium level more than 1.5 mg/dl. They suggested a possible association between exacerbations of COPD and low serum magnesium¹⁷. Results of all these studies are comparable to our study and it showed strong association between acute exacerbation of COPD and serum magnesium level and by correcting the magnesium levels may have positive impact on the quality of life of COPD patients.

This study had few limitations. For acute exacerbation of COPD, other factors were not considered, follow up was not done. Further multicentric studies with larger number of sample size and longer follow up should be done to validate these results.

CONCLUSION

Hypomagnesemia was found in 40% patients of acute exacerbation of chronic obstructive pulmonary disease. Hence, in future magnesium supplementation can be added along with standard treatment to improve the outcome. By correcting magnesium levels, we can further reduce the severity of disease and prevent the related complications.

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