

CORRELATION OF CHRONIC PULMONARY DISORDER AND SERUM MAGNESIUM LEVEL: A HOSPITAL-BASED STUDY

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Abstract

Background: Because chronic obstructive pulmonary disease (COPD) is preventable and curable, it remains a significant public health issue. Magnesium (Mg) is required for various physiological activities, including membrane stability. Unfortunately, information on the effect of magnesium on the frequency of COPD acute exacerbations is limited. **Materials and Methods:** The cross-sectional study was conducted at the Department of Medicine at a tertiary care hospital with patients diagnosed with COPD. Patient demographics, age, gender, smoking history, and comorbid conditions were collected. Patients were stratified based on the COPD GOLD stage, and serum magnesium levels were evaluated. **Result:** Of 50 patients enrolled, a mean age of 62.31 ± 8.66 was observed, with a male predominance of 72%. Total of 30% of the patients were smokers, 32% with a history of diabetes, and 42% with a history of hypertension. The mean duration of COPD was reported as 6.48 ± 2.51 . GOLD classification revealed that 29 patients (58%) were in stage 3 of COPD, followed by stage 2 in 11 patients (22%) and stage 4 in 9 patients (18%). Hypomagnesemia was most prevalent in stage 3 patients accounting for 14 patients (48.3%) and six (66.7%) with stage 4 COPD. Normomagnesemia was seen in 15 patients (51.7%) in stage 3 and 8 (72.7%) in stage 2. **Conclusion:** The study shows a high incidence of hypomagnesemia in stage 3 and stage 4 patients with COPD. Assessment of magnesium levels, as well as a suitable treatment for restoring levels, can be effective in treating acute COPD and improving disease outcomes.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is one of the morbid diseases and the third leading cause of mortality.^[1] According to the Global Burden of Disease Survey, COPD affects more than 251 million people worldwide.^[2] The World Health Organization (WHO) projects that COPD will become the third major cause of death by 2030, owing to a drop in heart illnesses and stroke between 1970 and 2002, although COPD incidence and prevalence rates more than doubled over this period.^[3] Magnesium (Mg²⁺) is an intracellular cation that controls respiratory muscle activity and bronchial tone. As a result, Mg²⁺ deficiency can exacerbate lung illnesses since it aids in bronchospasm relief.^[4] Numerous studies and researchers have suggested that magnesium deficiency has contributed to COPD exacerbations and that intravenous magnesium treatment in these individuals helps relieve bronchospasm by

promoting the relaxation of bronchial smooth muscle.^[5,6]

Some research shed insight into magnesium's role in chronic respiratory disorders. The second most abundant cation in intracellular fluid is magnesium. Magnesium is needed for ATP production and is a cofactor in many enzyme systems that govern many biochemical activities, including muscle and neuron function, protein synthesis, blood glucose control, and blood pressure regulation.^[7] Magnesium is engaged in active calcium and potassium transport across the cell membrane. Magnesium is involved in critical respiratory system activities such as bronchodilation, mast cell stability, and mucociliary clearance.

Gumus et al. conducted prospective research in which 89 patients hospitalized with COPD-AE were followed up at three monthly intervals for one year. The number of exacerbations and serum magnesium levels had a strong positive connection.^[8] Serum magnesium levels are an independent predictor of readmissions following an acute exacerbation of

chronic obstructive pulmonary disease. The connection between serum Mg²⁺ levels and illness flare outcomes in COPD patients has not been adequately investigated. A low serum magnesium level independently predicts AECOPD readmission.^[3]

The study aims to identify the prevalence of hypomagnesemia and normomagnesemia in adult patients diagnosed with COPD.

MATERIALS AND METHODS

The cross-sectional observational study was conducted at the Department of Medicine at a tertiary care hospital after ethical approval from the ethics committee. Patients who visited the department and were diagnosed with COPD were included in the study. Patient consent was taken before the study initiation.

Inclusion criteria: Patients with a clinical COPD diagnosis and approved consent were included.

Exclusion criteria: Patients with severe disease and patients who did not provide consent were excluded. Enrolled patients in the study were diagnosed with the clinical staging of COPD by using the GOLD standard criteria. Patient demographic details, such as age, gender, and comorbid conditions, were recorded, and serum magnesium level was measured.

Collected data from patients and laboratory parameters are represented as tables with percentages (%) and the number of patients (n).

RESULTS

Out of 50 patients in the study, the mean age was 62.31±8.66, with a male predominance of 72%. History of smoking was prevalent in 30% of the study population. Medical history interviews reported diabetes mellitus in 16 patients accounting for 32% of the study population, followed by hypertension in 21 patients (42%) [Table 1].

Table 1: Patients characteristics

		Frequency	Percentage
	Age	62.31±8.66	
Gender	Male	36	72.0%
	Female	14	28.0%
Smoking	Yes	15	30.0%
	No	35	70.0%
Comorbid	DM	16	32.0%
	HTN	21	42.0%
	Others	6	12.0%

Based on the clinical evaluation, GOLD Stage 3 was reported in 29 patients, representing 58% of the study population, followed by Stage 2 in 11 patients (22%). The mean duration of COPD is 6.48±2.51 [Table 2].

Table 2: GOLD Staging

		No. of patients	Percentage
GOLD Stage	Stage 1	1	2.0%
	Stage 2	11	22.0%
	Stage 3	29	58.0%
	Stage 4	9	18.0%
Serum magnesium	Hypomagnesemia	21	42.0%
	Normomagnesemia	29	58.0%

Of 50 patients, 21 were diagnosed with hypomagnesemia (42%), and 29 were reported with normomagnesemia (58%) [Table 2].

Table 3: Comparison of hypomagnesemia and normomagnesemia in patients with COPD based on GOLD stages

GOLD Stage	Hypomagnesemia		Normomagnesemia	
Stage 1	0	0.0%	1	100.0%
Stage 2	3	27.3%	8	72.7%
Stage 3	14	48.3%	15	51.7%
Stage 4	6	66.7%	3	33.3%

The current study reports a high prevalence of hypomagnesemia in patients with COPD stage 3, accounting for 14 patients (48.3%) and normomagnesemia in 15 patients (51.7%). Stage 4 COPD patients were seen as majorly with hypomagnesemia, with six patients (66.7%) and three patients with normomagnesemia (33.3%) [Table 3]. The study finds normomagnesemia in one patient with GOLD stage 1 and hypomagnesemia in three patients with stage 2 COPD. However, a higher prevalence of normomagnesemia was seen in stage 2 COPD patients with eight patients [Table 3].

DISCUSSION

The present study was conducted among 50 patients diagnosed with COPD with a mean age of 62.31±8.66 and a male predominance of 72%. Similar study findings were reported by Singh et al., with a mean age of 60.4±6.5 years with a male predominance of 58%.^[9] In contrast to our study findings, Bhatt et al. reported a higher mean age of patients with COPD of 71.9±10.9 years and a lower male ratio (43%) than females (57%).^[10] Kanimozhi et al. reported a mean age of 62.5 years with a higher prevalence of COPD in 58.4% of males compared to 41.6% of females.^[11] Based on the demographic variables, we have observed a difference in the mean age and gender distribution in several studies, which can be attributed to differences in patient criteria and geographical prevalence.

Smoking history was seen in 30% of the 15 patients. However, Bhatt et al. reported that almost 90% of the patients with COPD had a smoking history or were ex-smokers.^[10] A study by Kanimozhi et al. revealed a correlation between serum magnesium levels and acute exacerbation in smokers was similar to that of non-smokers.^[11] Of 50 patients, 16 patients presented with diabetes mellitus, and 21 patients were seen with hypertension. The prevalence of cardiovascular or diabetic conditions can be used as a prognostic marker for mortality in patients with COPD.

Eliasson et al. reported similar findings with a higher prevalence of cardiovascular disease, up to 55% and a 10% prevalence of diabetes in patients with COPD.^[12] The current study reports 29 patients (58%) as GOLD stage 3 of COPD, followed by stage 2 in 11 patients (22%) and stage 4 in 9 patients (18%). Hypomagnesemia was reported in 14 patients diagnosed with stage 3 COPD, followed by six patients in stage 4. This observation can be further summarized by the fact that stages 2 and 3 of COPD are more prone to hypoxemia and chronic respiratory insufficiency. However, hypoxemia has been associated as the major cause of magnesium depletion.

A study by Rajjab S et al. reported hypomagnesemia in 33.76% of patients and normomagnesemia in 66.23%. Stage 2 and stage 3 were reported with 7.7% and 34.6% incidences of hypomagnesemia.^[13] Normomagnesemia was reported in 15 patients diagnosed with stage 3 and eight with stage 2 criteria. The study by Singh et al. also reported hypomagnesemia in 17 patients (34%) and normomagnesemia in 33 (66%). In addition, 34% of patients were in stage 1, 50% in stage 2, and 16% of patients in stage 3.^[9]

The study findings demonstrate that early detection of hypomagnesemia in stage 3 and stage 2 patients can improve favourable deviation of FEV1 and peak

expiratory flow rate (PEFR). According to a recent systematic review and meta-analysis study by Jahangir et al., intravenous magnesium was related to a beneficial deviation of FEV1 and peak expiratory flow rate. It has reduced residual volume and impacted the probabilities of hospitalization in patients with acute COPD exacerbations. It is suggested that magnesium sulfate can be used as adjunctive therapy in treating acute exacerbations of COPD patients.^[14]

The current study reports the need for further larger sample size study to identify the key aspects of the incidence of magnesium levels and its role in improving the disease outcome in patients with COPD.

CONCLUSION

Hypomagnesemia is one of the common findings in patients with COPD affecting patients with stage 3 and stage 4 of COPD. The assessment of magnesium levels and appropriate treatment for restoring the levels can be beneficial in treating acute exacerbation of COPD and improving patient disease outcomes.

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