

A Cross Sectional Analytical study of Serum Magnesium Levels in patients of Acute Exacerbation of Chronic Obstructive Pulmonary Disease and Stable Chronic Obstructive Pulmonary Disease

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Abstract

Background: Mg+2 may have a role in maintaining disease stability in COPD patients. However, information about the effect of magnesium on COPD exacerbation is insufficient. So the purpose of our study is to investigate the relationship of serum magnesium levels on the incidence of exacerbation.

Methods: The hospital based case control (cross-sectional) Study was conducted on patients attending department of respiratory medicine in Sardar Patel Medical College Hospital, Bikaner. We have included hospitalised 50 patients with primary and final diagnosis of AECOPD and 50 patients of stable period of COPD.

Results: Mean magnesium significantly lower in AECOPD patients (1.82±0.12 mg/dl) as compared to stable COPD patients (2.17±0.36mg/dl). The difference in both groups was found statistically significant. Sensitivity, specificity, PPV and NPV of serum magnesium

levels was 56.00%, 76.10%, 71.01% and 63.50% respectively in stable COPD & AECOPD patients.

Conclusion: We conclude COPD exacerbation is associated with hypomagnesemia. We recommend to monitor serum magnesium levels in COPD patients with acute exacerbation at the time of admission and during their stay in the hospital.

Keywords: COPD, Mg, Acute exacerbation

Introduction

Chronic obstructive pulmonary disease (COPD) a preventable and treatable disease which consists of constant expiratory limitation of the flow of air which is not fully reversible.¹

There are few evidences which suggest that Mg+2 deficiency contributes to exacerbations of asthma and, as a consequence, that Mg+2 is useful in mitigating bronchospasm in these patients. Chronic Obstructive Pulmonary Disease (COPD) is characterized by two most common conditions i.e., chronic bronchitis and emphysema which

represent an overlap and there is an element of asthma bronchitis in patients with COPD.²⁻³

As bronchospasm is a contributing factor in exacerbation COPD and magnesium plays a role in airway smooth muscle relaxation and broncho dilation, thus hypo magnesemia may be a correctable risk factor for the exacerbation COPD.⁴

Thus, Mg+2 may have a role in maintaining disease stability in COPD patients. However, information about the effect of magnesium on COPD exacerbation is insufficient. So the purpose of our study is to investigate the relationship of serum magnesium levels on the incidence of exacerbation.

Materials and methods

Study place

The study is will be conducted on 100 patients of COPD attending department of pulmonary medicine in Sardar Patel Medical College &PBM Hospital, Bikaner.

Design of Study

Hospital based Cross-sectional analytical study

Sample Size

Sample size is calculated at 95% confidence level and alpha error of 0.05 assuming minimum detectable difference of serum magnesium 0.15 mmol/ l (including study group + control group) as per reference {Serum Magnesium Levels and Acute Exacerbation of Chronic

Obstructive Pulmonary Disease

A Retrospective Study Hany S. Aziz, Adeli, Annals of Clinical & Laboratory Science2005;35(4):423-427}.

$$n = 2(Z_{\alpha} + Z_{1-\beta})^2 \sigma^2 / \Delta^2$$

Sample size was calculated to be to be minimum 35 subjects which was enhanced and rounded off to 100 subjects (50 cases and 50 controls)

Study duration

6 Months

Methods of study

Data will be collected using pre-test proforma according to the objectives of the study. After getting informed signed consent, detailed history and examination will be done in 100patients.

Those patients who satisfied all the inclusion and exclusion criteria will be selected for the study. Data will be collected and will be analyzed by required statistical test.

Inclusion Criteria for GROUP 1 (COPD A/E)

1. Cases fulfilling criteria of COPD according to GOLD 2022.
2. Those who will give Written informed consent
3. Patients of age more than 40 years of either sex
4. COPD patients who have been diagnosed earlier clinically and by spirometry and who had presented with acute exacerbation requiring hospitalization based on the criteria of Anthonisen et al, 1981, i.e, presence of either shortness of breath or severe coughing with or without increased sputum volume.

Inclusion criteria for GROUP 2(STABLE COPD)

1. Stable COPD patients aged more than 40 years of either sex who have been diagnosed earlier clinically and by spirometry attending our hospital.
2. Not fulfilling the criteria of Anthonisen et al,⁸¹ i.e, presence of either shortness of breath or severe coughing with or without increased sputum volume.
3. In the stable group, only diagnosed cases of COPD whose respiratory function was stable for the past 4 weeks were included.
4. Written informed consent.

Exclusion criteria

1. Patients with other causes of chronic airway obstruction such as Bronchial asthma, Cystic fibrosis, Bronchiectasis, Bronchiolitis obliterans.

2. Other conditions like HIV, Active Pulmonary tuberculosis.
3. Patients with serious chronic illness (chronic renal failure, congestive cardiac failure and rheumatic heart disease).
4. Patients on medications like loop diuretics, antibiotics-like amphotericin, aminoglycosides, pentamidine, gentamicin, tobramycin, digitalis, cyclosporine and cisplatin.
5. Other conditions causing hypomagnesaemia like alcoholism, renal causes (ATN), chronic diarrhea, vomiting, Crohn's disease, ulcerative colitis, Whipples disease .
6. Patients refused to give consent for active participation in study

Data Collection

This study will be undertaken with the approval of the Institutional Ethics Committee of S.P. Medical College and PBM Hospital, Bikaner, and written informed consent will be obtained from each participant prior to participation in the study.

Pre-treatment evaluation consists of detailed Clinical evaluation, Complete blood counts, Chest X-ray. Blood samples will be obtained from fifty consecutive patients admitted in the ward in our department with the diagnosis of COPD-AE and fifty patients who are known cases of COPD who have come for review in OPD. The diagnosis of COPD in acute exacerbation patients will be based on pulmonary function tests and arterial blood gas analysis. The blood samples which are obtained will be subjected to estimation of magnesium which will be carried out by automated biochemistry analyzer (photometry) in biochemistry lab of our hospital.

For this study a serum magnesium value less than 1.5 mg/dl is taken as hypomagnesaemia

Data Analysis

To collect required information from eligible patients a pre-structured pre-tested proforma will be used. For Data analysis, Microsoft Excel.

Results

Table 1: Age wise distribution of study subject

Age in yrs	AECOPD	Stable COPD	p-value
Mean age in yrs	64.62±8.24	63.22±9.18	0.455
Male: Female	44:6	41:9	0.576
Smoker	29.00%	15.00%	0.01
Mean pack/yr	24.44±6.23	20.66±8.21	0.02
FEV1%	43.87±14.26	48.12±20.18	0.01
Magnesium (mg/dl)	1.82±0.12	2.17±0.36	0.01

Mean magnesium significantly lower in AECOPD patients (1.82±0.12) as compare to stable COPD patients (2.17±0.36). The difference in both groups was found statistically significant.

Table 2: Sensitivity, specificity, PPV, NPV, odd ratio & relative risk of serum magnesium levels stable COPD & AECOPD patients

	Sensitivity	Specificity	PPV	NPV
Statistics	56.00%	76.10%	71.01%	63.50%

The above table represent that the sensitivity, specificity, PPV and NPV of serum magnesium levels was 56.00%, 76.10%, 71.01% and 63.50% respectively in stable COPD & AECOPD patients.

Discussion

Mean magnesium significantly lower in AECOPD patients (1.82±0.12) as compared to stable COPD patients (2.17±0.36). The difference in both groups was found statistically significant. Sensitivity, specificity, PPV and NPV of serum magnesium levels was 56.00%,

76.10%, 71.01% and 63.50% respectively in stable COPD & AECOPD patients in our study.

In a study of 286 patients, Sambyal and his colleagues⁵ found that the average blood magnesium level in stable COPD patients was 1.84 mg/dl, but the level was only 1.540 mg/dl in patients with exacerbation.

An earlier study of 34 patients by Sanowaral et al.⁶ discovered a greater difference in the mean blood magnesium levels between patients with stable COPD and those with worsening symptoms (1.6 ± 90.27 mEq/L). Another study by Kshirsagar et al.⁷ found that 78% of exacerbated COPD patients had hypomagnesemia. They used 1.7 mg/dL as a reference value for hypomagnesemia, and their study found that the ionized magnesium level of exacerbated COPD patients was significantly lower than those of the stable COPD group.

In 2005, research by Azis et al.⁸ also found that the blood magnesium level in individuals with worsened COPD (0.77 ± 0.10 mmol/L) was considerably lower than that in stable COPD patients (0.91 ± 0.10 mmol/L). Patients with constant magnesium levels of 2.04 had an average of 0.71 hospitalizations in the preceding year, while patients with hypomagnesemia during an exacerbation had an average of 1.27 admissions in the previous year.

Conclusion

We conclude COPD exacerbation is associated with hypomagnesemia. We recommend to monitor serum magnesium levels in COPD patients with acute exacerbation at the time of admission and during their stay in the hospital. We recommend that in patients presenting to the emergency department with symptoms of acute exacerbations of COPD serum magnesium levels should be considered in deciding admission, and further studies are needed to observe the effect of intravenous and

inhalational magnesium in COPD patients in exacerbation with hypomagnesemia.

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