

## A HOSPITAL BASED PROSPECTIVE STUDY TO EVALUATE THE CORRELATION OF SERUM MAGNESIUM LEVEL IN STABLE COPD AND PATIENTS OF AECOPD AT THE TIME OF HOSPITAL ADMISSION

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Received : 02/02/2024  
Received in revised form : 25/02/2024  
Accepted : 11/03/2024

**Keywords:**  
AECOPD, Serum Magnesium, Stable COPD, Hypomagnesium.

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DOI: 10.47009/jamp.2024.6.2.108

Source of Support: Nil,  
Conflict of Interest: None declared

*Int J Acad Med Pharm*  
2024; 6 (2); 500-502



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### Abstract

**Background:** Acute exacerbations of COPD are frequently associated with many complications and hospital readmissions among elderly male population. Hypomagnesemia is associated with increased airway hyperactivity and impaired pulmonary function. The aim of this study to investigated the relations between serum magnesium levels and frequency of hospital readmissions due to acute exacerbation of chronic obstructive pulmonary disease. **Material & Methods:** This is a case control study conducted in 80 patients. Forty COPD patients attending OPD for follow up and 40 patients admitted with acute exacerbation of COPD in Shri Kalyan Govt Medical college, Sikar, Rajasthan, India during one year period. In patients admitted with acute exacerbation of COPD, serum Mg level was measured at the time of admission and again at the time of discharge. Blood sample in stable COPD patients was sent for serum Mg levels during their OPD visit. Student t-test and one-way ANOVA were used to compare the means. Chi-square test was used for categorical data. P value < 0.05 was considered statistically significant. **Results:** There was no significant difference in the age of the subjects in between groups. Patients with exacerbation averaged 52.56±9.32 yr while stable patients averaged 50.94±8.23yr (p >0.05). Relationship of magnesium levels and hospital readmission among COPD patients shows negative correlation (r=-0.582) which was statistically significant (p<0.01). Serum magnesium level was less than 1.60 mg/dl in 70% in the AECOPD group. Only 12.5% in stable COPD group had serum magnesium less than 1.60 mg/dl. **Conclusion:** We concluded that there is a low magnesium level seen among COPD individuals compared with normal healthy smokers and a significant reduction of magnesium Levels with severity of airway obstruction.

## INTRODUCTION

Chronic obstructive pulmonary disease is common among the smoking population. Acute exacerbations of COPD are frequently associated with many complications and hospital readmissions among elderly male population. This is one of the major causes of morbidity in elderly males and mortality to some extent. Acute exacerbation of COPD is defined as acute worsening of respiratory symptoms including cough dyspnoea and change in the quality

of sputum production beyond normal day to day variations.

Some studies throw a light on the role of magnesium in chronic respiratory illness. Magnesium is the second most abundant cation in the intracellular fluid. Magnesium is involved in some important functions of the respiratory system like dilatation of bronchus and bronchioles, stabilization of mast cells and clearance of debris from mucociliary system and neurohormonal mediator release. Hypomagnesemia is associated with increased airway hyperactivity and impaired pulmonary

function. It is said that due to its bronchodilating effect, a decreased level of magnesium may increase COPD exacerbations.

Dietary magnesium intake is independently related to lung function, the occurrence of airway hyper-reactivity and self-reported wheezing in the general population.<sup>[1]</sup> There is evidence to suggest that magnesium deficiency contributes to exacerbations of bronchial asthma and magnesium supplementation is useful in alleviating bronchospasm in these patients.<sup>[2-4]</sup> Although the precise mechanism of this action is unknown, it has been suggested that Magnesium plays a role in the maintenance of airway patency via relaxation of bronchial smooth muscle.<sup>[5]</sup> The role of Magnesium in acute exacerbation of COPD is unclear. Lower serum Magnesium levels are seen in patients with acute exacerbation as compared to patients with stable COPD.<sup>[6,7]</sup> Also, it is not clear whether serum Magnesium continues to remain low after exacerbation subsides or spontaneously corrects after stabilization of patients with improvement in acid-base balance in the stable state. The aim of this study to investigate the relations between serum magnesium levels and frequency of hospital readmissions due to acute exacerbation of chronic obstructive pulmonary disease.

## MATERIALS AND METHODS

This is a case control study conducted in 80 patients. 40 COPD patients attending OPD for follow up and 40 patients admitted with acute exacerbation of COPD in Shri Kalyan Govt Medical college, Sikar, Rajasthan, India during one year period.

Inclusion Criteria:

- 1) COPD patients with and without exacerbation
- 2) Age > 40 year

### Exclusion Criteria

- Patients with other respiratory diseases
- Patients with renal Failure, congestive Heart Failure, Diabetes mellitus etc.
- Carcinoma in Lung
- COPD patients admitted for other reasons
- Previous GI surgery

### Method

Patients were categorized into two groups: AECOPD and stable COPD. Acute Exacerbation of COPD was defined according to the GOLD 2018 guideline i.e. an acute worsening of respiratory symptoms that resulted in additional therapy (increased dyspnoea, increased sputum production, increased cough, wheeze). Patients were considered

stable when symptoms of COPD including dyspnea, chronic cough, or increased sputum production reverted to baseline. Socio-demographic data were obtained from all patients. A detailed history regarding COPD, its duration, drug history, especially diuretic and PPI, was obtained.

In patients admitted with acute exacerbation of COPD, serum Mg level was measured at the time of admission and again at the time of discharge. Blood sample in stable COPD patients was sent for serum Mg levels during their OPD visit. Serum Mg levels at the time of admission in the acute state was compared to the levels at discharge in the stable state and also with levels in stable COPD patients visiting the Outpatient Department.

### Statistical Analysis

Data was compiled in Microsoft Excel. IBM SPSS ver. 22.0v software was used for analysis of data. Student t-test and one-way ANOVA were used to compare the means. Chi-square test was used for categorical data. P value < 0.05 was considered statistically significant.

## RESULTS

There was no significant difference in the age of the subjects in between groups. Patients with exacerbation averaged 52.56±9.32 yr while stable patients averaged 50.94±8.23yr (p >0.05). The two groups were comparable with respect to baseline sociodemographic variables (p>0.05). [Table 1] Relationship of magnesium levels and hospital readmission among COPD patients shows negative correlation (r=-0.582) which was statistically significant (p<0.01). [Table 2 & graph 1] Serum magnesium level was less than 1.60 mg/dl in 70% in the AECOPD group. Only 12.5% in stable COPD group had serum magnesium less than 1.60 mg/dl. [Table 3]

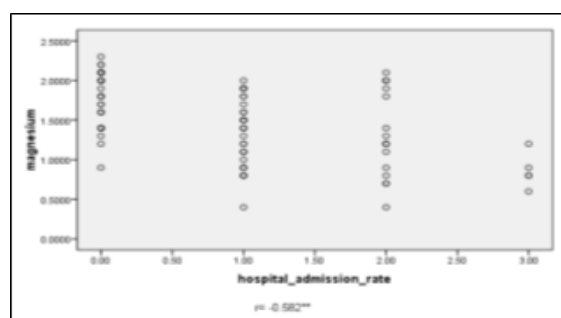


Figure 1: Correlation of magnesium levels and hospital readmission among COPD patients

Table 1: Distribution of patients according to sociodemographic variables

Parameters	AECOPD group (N=40)	Stable COPD group (N=40)	p value
Age (in yrs)	52.56±9.32	50.94±8.23	>0.05
Gender	Male	30	28
	Female	10	12
Residence	Rural	27	24
	Urban	13	16

**Table 2: Comparison of median magnesium levels based on hospital readmissions in 12 months**

Hospital readmissions in 12 month	Magnesium level (mg/dl)					p value
	N	Mean	Std. Deviation	Median	IQR	
0	36	1.82	0.30	2	0.55	0.001*
1	26	1.36	0.43	1.3	0.7	
2	14	1.34	0.55	1.2	1.1	
3	4	0.89	0.23	0.86	0.35	
Total	800	1.55	0.51			

Kruskal wallis test (p<0.05\* shows significant difference)

**Table 3: Number of patients having low and normal Magnesium level in each group**

Group	Serum Magnesium		P value
	<1.6 mg/dl	>1.6 mg/dl	
AECOPD group	28	12	<0.001*
Stable COPD group	5	35	

## DISCUSSION

COPD exhibits two diseases namely of chronic bronchitis and emphysema. Patients of COPD have hyper responsive airways. There is increasing awareness of serum magnesium level in pulmonary diseases especially asthma and COPD. Magnesium deficiency is a better-known abnormality seen in patients with lung disease. Mean serum magnesium level was significantly lower in the AECOPD group than in the stable COPD group. Hypomagnesemia (serum magnesium < 1.60 mg/dl) was more frequent in the AECOPD (70%) than in the stable COPD group (12.5%). These findings were similar to the findings of Sanowara et al,<sup>[8]</sup> and Aziz et al.<sup>[9]</sup>

Also, magnesium levels which are low is a common finding in acute exacerbation of COPD. It is frequently encountered in patients who present to hospital after 8 days of developing an illness. Also these patients usually have advanced disease, stage II (50%) and stage III (16%), prolonged hospital stay (> 7 days) and need mechanical ventilation more often. The mortality rate has no correlation with serum Magnesium levels.

A study conducted by Surya Prakash Bhatt and Pooja Khandelwal et al discussed that there have been few predictors of readmission for acute exacerbation of COPD, and there have been no consistent indicators of readmission like hypomagnesemia. The factors seemed important in previous studies have mostly been reflectors of poor functional status, and in some cases like age, smoking status not modifiable. Many objective parameters like FEV1% and hypercapnea have been inconsistent in their ability to predict readmission. Only one previous study, that looked at factors associated with frequent readmissions, a possibly different subset of patients. Another study conducted by Sujatha and Kanimozhi,<sup>[11]</sup> at the Thiruvannamalai medical college concluded that

hypomagnesemia leads to frequent COPD exacerbations.

## CONCLUSION

We concluded that there is a low magnesium level seen among COPD individuals compared with normal healthy smokers and a significant reduction of magnesium Levels with severity of airway obstruction.

## REFERENCES

1. Britton J, Pavord I, Richards K, Wisniewski A, Knox A, Lewis S, Tattersfield A, Weiss S. Dietary magnesium, lung function, wheezing, and airway hyper-reactivity in a random adult population sample. *The Lancet*. 1994; 344 (8919):357- 62.
2. Roy SR, Milgrom H. Managing outpatient asthma exacerbations. *Curr Allergy Asthma Reports* 2003; 3:179–89.
3. Hughes R, Goldkorn A, Masoli M, Weatherall M, Burgess C, Beasley R. Use of isotonic nebulized magnesium sulphate as an adjuvant to salbuterol in treatment of severe asthma: randomized, placebo-controlled trial. *Lancet* 2003; 361: 2114–7.
4. Alter HJ, Koepsell TD, Hilty WM. Intravenous magnesium as an adjuvant in acute bronchospasm: a meta-analysis. *Annals Emerg Med* 2000;36:191–7.
5. Gourgoulianis KI, Chatziparasidis G, Chatziefthimou A, Molyvdas PA. Magnesium as a relaxing factor of airway smooth muscles. *J Aerosol Med* 2001; 14:301–7.
6. Nagomi-Obradovic L. Evaluation of Magnesium in serum and urine in patients with pulmonary diseases. *Clin Lab* 2005; 51(11-12):647-52.
7. Rajab S. The relationship between serum Magnesium levels and acute exacerbation of COPD 2009:63-5.
8. Sanowara R, Keliat EN, Abidin A. Difference in serum magnesium level among patients with stable chronic obstructive pulmonary disease (COPD) and exacerbated COPD. *Earth Environ. Sci* 2018; 125 012151.
9. Aziz H. S., Blamoun A. I., Shubair M. K., Ismail M. M. F., DeBari V. A., Khan M. A. Serum magnesium levels and acute exacerbation of chronic obstructive pulmonary disease: a retrospective study. *Annals of Clinical and Laboratory Science*. 2005; 35(4):423–427.
10. Bhatt SP, Khandelwal P, Nanda S, Stoltzfus JC, Fioravanti GT. Serum magnesium is an independent predictor of frequent readmissions due to acute exacerbation of chronic obstructive pulmonary disease. *Respir Med*. 2008; 102:999–1003.
11. Kanimozhi J, Sujatha S. A study on association between serum magnesium and acute exacerbation of COPD. *J Dent Med Sci*. 2017; 16:9–12.