



Observational study of hypomagnesemia and its association with severity of chronic stable asthma at Tertiary Care Hospital, Mysuru

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ABSTRACT

Background

Magnesium has several actions on bronchial airways including relaxation of airway smooth muscle, bronchodilation, anticholinergic effects, and stabilization of mast cells. The present study aimed to measure the level of serum magnesium and assess the relationship of hypomagnesaemia with severity of asthma.

Material and Method

Present prospective observational study included the patients with chronic stable asthma, attending OPD at K.R. Hospital, Mysore, attached to Mysore Medical College and Research Institute during the period of April 2015 to September 2016. All the subjects were evaluated for detailed history, clinical examination, complete blood count, and pulmonary function test and serum magnesium. The study subjects were grouped; Group I - include 60 cases with chronic stable bronchial asthma and group II - includes 20 controls, who belong to normal population.

Result

60 Asthmatic cases, selected for the study, 45% were males, 55% were females with mean age of 37.25 ± 11.16 years. Mean serum magnesium levels among patients with chronic stable asthma was 2.03 ± 0.66 mEq/L. Hypomagnesemia was seen in 47.06% of severe chronic stable asthma when compared to 9.09% of cases with moderate chronic stable asthma & 4.78% of cases with mild chronic stable asthma. ($p < 0.05$) Severe chronic stable asthma cases had low mean serum magnesium, compared to mild and moderate chronic stable asthma cases.

Conclusion

Hypomagnesemia need to be corrected in patients with chronic stable asthma, who have more severe chronic stable asthma for a longer duration. Severity of acute exacerbations can be reduced by magnesium administration in addition to routine management of acute exacerbation of chronic stable asthma.

Key words: Asthma, Magnesium, Hypomagnesemia, Severity.

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INTRODUCTION

Magnesium is the 4th most common cation in the body and the 2nd most common intracellular cation. Magnesium is critical to normal human homeostasis.^{1,2} Intracellular Mg^{2+} forms a key complex with ATP and is an important cofactor for a wide range of enzymes, transporters, and nucleic acids needed for normal cellular function, replication, and energy metabolism.³ Extracellular Mg^{2+} is crucial for normal neuromuscular activities. The utility of magnesium as a therapeutic modality in the treatment of asthma is a known fact since decades. Mg^{2+} has several actions on bronchial airways including relaxation of airway smooth muscle, bronchodilation, anticholinergic effects, and stabilization of mast cells.⁴ Studies have shown that magnesium infusions increased the forced expiratory volume in 1 second (FEV_1).^{5,6}

Epidemiologic evidences suggest that, low dietary intake of magnesium is associated with impaired lung function and hyperactivity of bronchial airways but, the actual prevalence of hypomagnesemia in asthma is not known.^{7,8,9,10} The present study aimed to measure the level of serum magnesium and assess the relationship of hypomagnesaemia with severity of asthma.

MATERIAL AND METHOD

Present Prospective observational study was conducted on 60 subjects with chronic stable asthma, attending OPD at K.R. Hospital, Mysore, attached to Mysore Medical College and Research Institute during the period of April 2015 to September 2016. The sample size was calculated using the SPSS samples size calculator. Cases diagnosed with Chronic Stable Asthma. (Defined as a known case of asthma with no history of asthma exacerbation, within last 2 weeks). Patients with medical disorders like Diabetes mellitus, Hypertension, Ischemic heart disease, alcoholism, diarrhea, trauma, collagen vascular disease, malignancy, and COPD. On diuretic therapy, CCBs, Digoxin, Laxatives, any form of magnesium supplements and smokers were excluded from the study.

METHOD

Data was collected using a pretested proforma meeting the objectives of the study. The cases for the study were selected in accordance with the above mentioned inclusion and exclusion criteria and purpose of the study was explained

to the patient and informed consent was obtained. The study obtained ethics clearance from the institutional ethics committee (IEC/MMC/2015/0051). All the subjects were evaluated for detailed history, clinical examination, complete blood count, and pulmonary function test and serum magnesium. The Spirometry was done using Spirolab-111, Ver 3.5, SN309707. The measurements were done with the subjects standing. The mouthpiece of the meter was placed in the subject's mouth, and lips were sealed around the mouthpiece. As spirometry measurements depend significantly on the subject's effort and technique, instructions for proper use were given and followed by a demonstration of technique prior to measurement. Each subject was asked to perform the test three times, and the highest of the three readings was taken as the recorded value.

Venous blood samples were collected from participants using plain vacuum tubes (Red). The serum magnesium concentration and other electrolytes were measured with auto analyzer method using Erba CHEM-5 Plus V2 auto analyzer machine (Erba Diagnostics, Mannheim GmbH, Germany). The normal serum Magnesium value measured in the laboratory was 1.3 to 2.5 mEq/L.

The study subjects were divided into two groups as; Group I - include 60 cases with chronic stable bronchial asthma and group II - includes 20 controls, who belong to normal population were matched with gender and age distribution.

Group I: subjects were further subdivided, according to asthma severity into 3 groups based on the level of airflow limitation and lung function.

- Group Ia, includes cases of mild chronic stable asthma with $FEV_1 > 80\%$,
- Group Ib, includes cases of moderate chronic stable asthma with FEV_1 : 60-80%,
- Group Ic, includes cases of severe chronic stable asthma with $FEV_1 < 60\%$.

Their mean serum magnesium levels will be compared with Group II.

Statistics: Data was entered into Microsoft excel

and analyses were done using Statistical Package for Social Sciences (SPSS) for Windows software (version 20.0; SPSS). Descriptive statistics such as mean and standard deviation (SD) for continuous variables, and frequency and percentage for categorical variables were determined. The chi-square test and ANOVA test for significance (when appropriate) were used. The level of significance was set at 0.05.

RESULT

A total of 60 cases of chronic stable bronchial asthma were recruited for this study. Among them 33(55%) were females and 27(45%) were males, with male to female ratio of 1:1.2. Majority of the study participants were in the age group of 26-35 yrs, which accounts for nearly 33.4% of the total cases, & 40% of controls. (Table 1)

Table 1: Age-wise distribution of chronic stable asthma subjects based on Severity.

Age group	Severity of chronic stable asthma			Number of cases (%) (n=60)	Number of Controls (%) (n=20)
	Mild (n=21)	Moderate (n=22)	Severe (n=17)		
16-25	5(23.8%)	4(18.2%)	1(5.9%)	10 (16.6%)	4 (20%)
26-35	8(38.1%)	10(45.5%)	2(11.7%)	20 (33.4%)	8 (40%)
36-45	6(28.6%)	3(13.6%)	7(41.2%)	16 (26.6%)	2 (10%)
46-55	1(4.75%)	4(18.2%)	4(23.5%)	9 (15%)	3 (15%)
>55	1(4.75%)	1(4.5%)	3(17.6%)	5 (8.4%)	3 (15%)

There were 35% cases with Mild Chronic stable asthma ($FEV_1 > 80\%$), 36.67% cases with Moderate Chronic stable asthma, ($FEV_1 = 60-80\%$), and 28.33% cases with Severe Chronic stable asthma, ($FEV_1 < 60\%$) in the present study. 38.1% of mild stable asthma subjects were seen in 26-35 yrs of age group followed by 28.6% in 36-45 yrs age group & 23.8% in the age group of 16-25 yrs. 45.5% of moderate chronic stable asthma cases were seen in 26-35 yrs of age group followed by 18.2%

in both 46-55 yrs age group & 16-25 yrs age group & 13.6% in the age group of 36-45 yrs. 41.2% of severe chronic stable asthma cases were seen in 36-45 yrs of age group followed by 23.5% in 46-55 yrs of age group, followed by 17.6% in >55 yrs age group & 11.7% in 26-35 yrs age group. This shows that severe chronic stable asthma was seen more in higher age group in the present study. This implies that as age increases, severity of asthma also increases with respect to chronic stable asthma in the present study. (Table 1).

Mean Serum Magnesium levels among the cases with chronic stable asthma is 2.03 ± 0.66 (SD) mEq/L. with values ranging from 0.9 mEq/L to 3.5mEq/L. Hypomagnesemia (<1.3 mEq/L) was observed in 18.4% of the cases with chronic stable asthma compared to 5% in controls. Most cases (66.6%) had serum magnesium levels in the normal range (1.3-2.5mEq/L). 15% of subjects with chronic stable asthma had hypermagnesemia

(>2.5 mEq/L) in the present study, compared to 20% in controls. Hypomagnesemia was seen in 47.06% of severe Chronic stable asthma subjects when compared to 9.09% of subjects with moderate chronic stable asthma & 4.75% of subjects with mild chronic stable asthma, which was statistically significant ($p < .007$). (Table 2)

Table 2: Distribution of serum magnesium levels in the present study

		Serum magnesium levels (mEq/L)		
		<1.3	1.3-2.5	>2.5
Chronic stable asthma cases (n=60)		11 (18.4%)	40 (66.6%)	09 (15%)
Controls (n=20)		1 (5%)	15 (75%)	4 (20%)
Asthma categories	Mild (n=21)	01 (4.75%)	16 (76.19%)	05 (23.82%)
	Moderate (n=22)	02 (9.09%)	16 (72.73%)	03 (13.63%)
	Severe (n=17)	08 (47.06%)	08 (47.06%)	01 (5.88%)

This shows that cases with severe chronic stable asthma had low mean levels of Serum Magnesium (1.55 ± 0.65 mEq/L) compared to mild and moderate chronic stable asthma & controls in the present study, which was statistically significant ($P < .001$). The mean serum magnesium was lower

in patients with severe chronic stable asthma when compared to controls, which was statistically significant ($P < 0.001$) in the present study. This implies that as the severity of asthma increases, serum magnesium falls to a significant extent. (Table 3).



Table 3: Comparison of mean Serum magnesium levels in different categories of Chronic stable Asthma in the present study.

Categories of Chronic stable asthma	Mean Serum magnesium levels (mEq/L) \pm SD
Mild (n=21)	2.32 \pm 0.66
Moderate(n=22)	2.12 \pm 0.65
Severe(n=17)	1.55 \pm 0.65*
Controls(n=20)	2.21 \pm 0.54*
p-value	(P<0.001) Severe vs Control

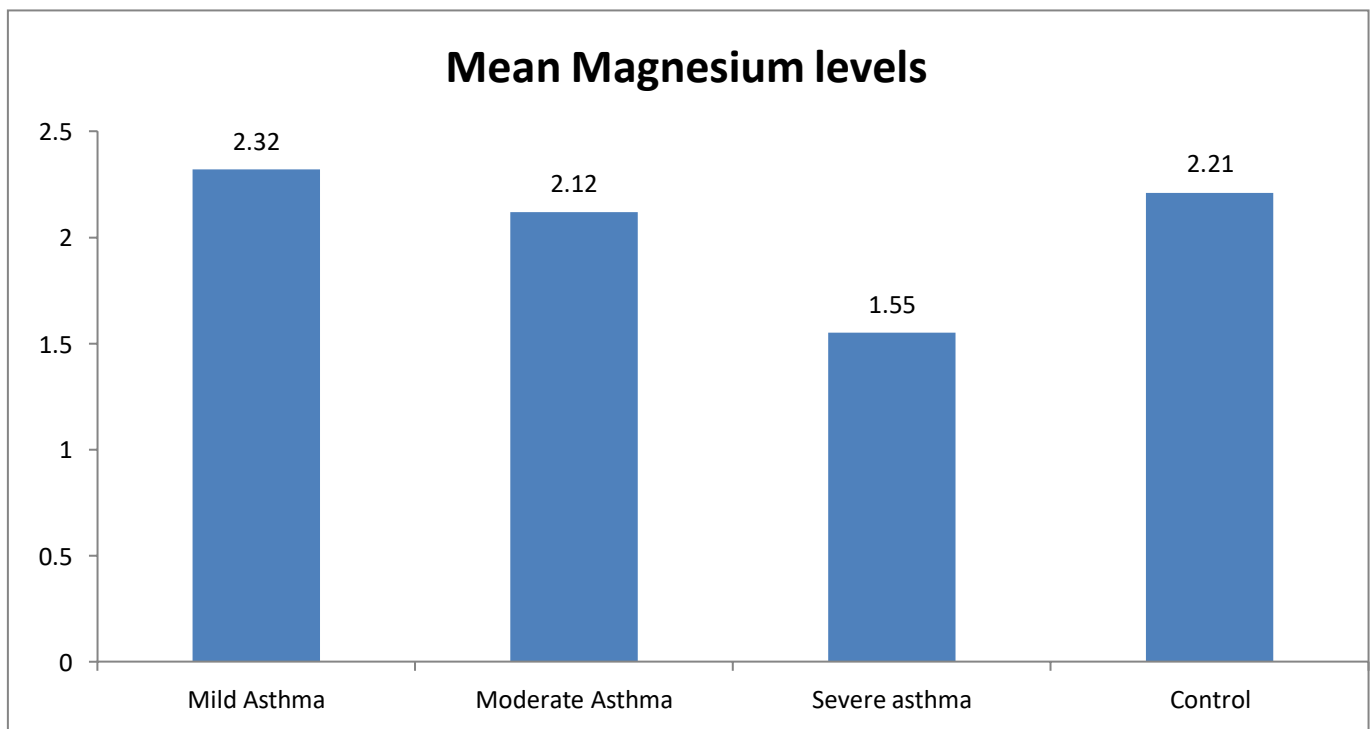


Figure 1: Showing the mean magnesium level among the patients in two groups



DISCUSSION

The present study had more number of patients in the age group of 26-35yrs (33.4%) with mean age of 37.25 ± 11.6 yrs. There were 35% mild chronic stable asthma, 36.7% of moderate chronic stable asthma & 28.33% of severe chronic stable asthma in the present study. The severe chronic stable asthma cases were seen more in higher age group in the present study. In a study conducted by Sibeskumar et al.,¹¹ in Calcutta National Medical College, Kolkata, out of 50 cases, There were 36% males and 64% females, which Shows asthma is more common in females (1:1.5), while our study had male: female ratio of 1:1.2, which was comparable.

Assessment of severity of asthma in Sibes Kumar et al.,¹¹ revealed that 56% had mild, 24% had moderate, and 20% had severe chronic stable asthma. In our study 35% had mild chronic stable asthma, 36.67% had moderate chronic stable asthma, & 28.33% had severe chronic stable asthma. Sibeskumar et al. study had more mild chronic stable asthma when compared to our study, which had more moderate & severe chronic stable asthma. In. study 28% patients were found to have hypomagnesemia compared to our study, which had 18% cases with hypomagnesemia. More percentage of hypomagnesemia in Sibeskumar et al. study can be because of higher defining hypomagnesemia.¹¹ Hypomagnesemia was seen in 18.4% of chronic stable asthma when compared to 8% in controls in the present study.

Duration of asthma was more in severe chronic stable asthma when compared to mild & moderate chronic stable asthma in the present study. Hypomagnesemia was seen in 47.06% of severe chronic stable asthma when compared to 9.09% of cases with moderate chronic stable asthma & 4.75% of cases with mild chronic stable asthma in the present study.

In our study, there is significant change in mean Serum magnesium levels among asthmatics and controls, as the severity of asthma increases the levels of serum magnesium decreases (hypomagnesemia), which is in agreement with the Ahmed Ali study. Also there was a significant difference in serum magnesium levels among asthmatics. Serum Mg levels were significantly lower in asthmatic patients (40; {20 acute+20 chronic}) compared with healthy controls and significantly lower in asthmatic patients during exacerbation compared with stable asthmatics.¹²

LIMITATION

In this study, Magnesium in serum was considered, which may not be the actual representation of the total body stores, as serum magnesium represents only 1% of the total body stores. We did not consider the amount of dietary magnesium in these subjects, which may alter the magnesium measured.

CONCLUSION

Hypomagnesemia need to be corrected in patients with chronic stable asthma, who have more severe chronic stable asthma for a longer duration to prevent more frequent recurrence of acute exacerbations and also the morbidity and mortality associated with the disease. Severity of acute exacerbations can be reduced by magnesium administration in addition to routine management of acute exacerbation of chronic stable asthma. The present study recommend the utility of magnesium levels as a marker for assessment of severity of asthma. However our study also recommend to strengthen the above finding by conducting study on larger sample size at multiple health centres.



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