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Original Article

DOI: https://doi.org/10.3329/jninb.v5i1.42167

Journal of National Institute of Neurosciences Bangladesh,
January 2019, Vol. 5, No. 1, pp. 38-41

ISSN (Online) 2518-6612
ISSN (Print) 2410-8030

Assessment of Serum Magnesium Level in Patients with Bronchial Asthma

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[**Received:** 1 October 2018; **Accepted:** 12 November 2018; **Published:** 1 January 2019]

Abstract

Background: Asthma is one of the most common chronic diseases worldwide and has been increasing in prevalence over the last few decades. Magnesium (Mg++) has been shown to relax bronchial smooth muscle and influence the function of respiratory muscles. Hypomagnesemia has been associated with diminished respiratory muscle power. **Objective:** The purpose of the present study was to assess the serum Mg++ level in bronchial asthma patients during stable state and during exacerbation (Acute severe asthma). **Methodology:** This comparative cross-sectional study was conducted in the OPD and IPD of Department of Pulmonology at Enam Medical College and Hospital, Savar, Dhaka, Bangladesh and this study was carried out from January 2017 to December 2017 for a period of one year. Subjects were enrolled from Enam Medical College and Hospital. Patients diagnosed as bronchial asthma were taken as group A and healthy individuals were as a group B. The asthmatic patients were divided into groups those having chronic stable bronchial asthma and those having acute severe asthma. **Results:** Serum Mg++ level was significantly (p=0.000) lower in asthmatic patients 1.59±0.24 as compared with healthy controls (2.05±0.34) and significantly lower (p=0.006) in asthmatic patients during exacerbation (1.49±0.27) when compared to stable asthmatics (1.69±0.15). Asthmatic on ≥3 drugs has significantly (p=0.000) lower serum Mg++ 1.43±0.23 than those on <3 drugs (1.65±0.22). **Conclusions:** Serum Mg++ level was significantly lower in asthmatic patients during exacerbations compared with stable asthmatics. *[Journal of National Institute of Neurosciences Bangladesh, 2019;5(1): 38-41]*

Keywords: Asthma; Magnesium; Acute severe asthma; Chronic stable asthma

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Conflict of interest: There is no conflict of interest relevant to this paper to disclose.

Funding agency: This research project was not funded by any group or any institution.

Contribution to authors: Rashid MH, Chowdhury MRK contributed from the protocol preparation, data collection up to report writing. Manuscript writing was performed by Faraji MAH, Rahman S. Statistical analysis was performed by Rashid MH. Faraji MAH involved in revision of manuscript.

How to cite this article: Rashid MH, Chowdhury MRK, Faraji MAH, Rahman S. Assessment of Serum Magnesium Level in Patients with Bronchial Asthma. J Natl Inst Neurosci Bangladesh, 2019;5(1): 38-41

Introduction

Asthma is a chronic inflammatory disease of large, small and medium airways with typical symptoms like cough, wheeze, breathlessness, chest tightness and airway narrowing that is partially or completely reversible either spontaneously or by treatment associated with increased airway responsiveness to a variety of stimuli[1]. The prevalence of asthma increased steadily worldwide over the last several decades. Current estimates suggest that asthma affects 300 million people worldwide, with a predicted additional 100 million people to be affected by 2025 and approximately 250000 to 34500 people die per year from the disease[2]. Magnesium (Mg++) is the fourth most abundant cation in the body and the second most common intracellular cation. Total body magnesium (Mg++) is about 25gm (1000 mmol). About 50% of it is in the bones, only 1.0% is in the extracellular fluid, and the rest is within the cells[3].

Since magnesium intervenes in calcium transport mechanisms and intracellular phosphorylation reactions, it constitutes an important determinant of the contraction and relaxation state of bronchial smooth muscle[4].

Magnesium ion has an inhibitory action on smooth muscle contraction, histamine release from mast cells and acetylcholine release from cholinergic nerve terminals[5]. Magnesium deficiency is associated with increased contractility of smooth muscle cell[6]. Since contractility of bronchial smooth muscle is important in patients with asthma, magnesium deficiency could lead to bronchial smooth muscle contraction or lack of bronchial muscle relaxation[6].

Epidemiological evidence suggests that a low dietary intake of magnesium is associated with impaired lung function, bronchial hyper-reactivity, and wheezing. It was found that a high magnesium intake is associated with improvement in symptom score, though not in objective measures of air flow or airway reactivity in stable asthmatic subjects[7]. Haury[8] reported significantly lower levels of serum magnesium in asthmatic adults compared with the general population. Similar results also obtained in studies by Ali et al[3] and Agin & Jabari[9]. However other case-control studies[6,10] conducted on asthmatic adults failed to demonstrate a significant difference in serum magnesium between patients with asthma and controls. Several clinical trials[11-13] reported a beneficial response of pulmonary function tests to intravenous infusion of magnesium sulfate in the treatment of acute exacerbation of asthma.

Hence, the aim of this work was to assess the serum magnesium levels in bronchial asthma patients (stable and during exacerbations), compared to those of healthy controls.

Methodology

This comparative cross-sectional study was conducted in the OPD and IPD of Department of Pulmonology at Enam Medical College and Hospital, Savar, Dhaka, Bangladesh which was a tertiary care hospital and this study was carried out from January 2017 to December 2017 for a period of one year. Patients who presented to the emergency department with acute severe asthma and those with chronic stable asthma who came to outpatient department (OPD) for follow-up were included. A sample of blood was drawn through a standard venipuncture technique and was analyzed for a serum magnesium level by using spectrophotometry and calorimetric determination. Normal reference values for serum magnesium was ranged from 1.70 to 2.4 mg/dL in the laboratory. Serum Magnesium level was measured in randomly chosen control group of non-asthmatic persons who were presented to the OPD for other reasons. Informed consent was obtained from the parents or legally authorized representatives. Peak expiratory flow rate using a flow meter was measured. Data regarding the regular use and type of medication and the number of times they received oral corticosteroids. Exclusion criteria for the 3 study groups (Control, acute severe bronchial asthma and chronic stable asthma) included a history of renal disease, cardiac disease, malabsorption, diuretic use, alcoholism, and pregnancy.

Results

Asthmatics (n=40) had mean magnesium level 1.59±0.24 whereas control subjects (n=20) had mean magnesium level 2.05±0.34 with the p value 0.000 (Table 1).

Table 1: Serum Mg++ among asthmatic and controls

Characteristics	Asthmatic	Control	p value
Number	40	20	
Age	32.4±10.9	28.4±9.1	
Sex M/F	17/33	08/12	
Serum Mg++	1.59±0.24	2.05±0.34	0.000

Patients with acute severe asthma had statistically significant (p=0.006) low magnesium level than among stable asthmatics. Magnesium level was 1.49±0.27among with exacerbation (n=20) and 1.69±0.15 among patients with chronic stable asthma (n=20) (Table 2).

Table 2: Serum Mg++ level among chronic stable and acute severe asthma group

Characteristics	Chronic stable	Acute severe asthma	p value
Number	20	20	
Age	32.9±8.3	31.8±13.1	
Sex M/F	11/29	08/12	0.006
Serum Mg++	1.69±0.15	1.49±0.27	

Asthmatic patients using ≥ 3 medications (n=12) had mean magnesium level 1.43±0.23 and patients on < 3 medications (n=28) had Magnesium level 1.65±0.22. This difference is also statistically significant (p=0.000) (Table 3).

Table 3: Serum level Mg++ among different drug user groups

No of drugs	Chronic stable	Acute severe asthma	Mg++ level	p value
≥3 drugs	9	3	1.43±0.23	
< 3 drugs	11	17	1.65±0.22	0.000
Table				

Discussion

In this current study serum magnesium levels is significantly decreased in asthmatic patients compared with the control ones (p value < 0.000) and the mean of serum magnesium levels in asthmatic patients is 1.59±0.24 and in control 2.05±0.34 mg/dL. This result is in agreement with the studies done by Yuvarajan et al[14], Ali et al[3] and Agin and Jabari[9] which have shown that serum magnesium levels is significantly decreased in asthmatic patients compared to their controls. In a study by Hashimoto et al[15] 40% of asthmatic patients demonstrated magnesium deficiency. Yousif et al[5] also concluded after their study that hypomagnesemia was present in patients with chronic stable asthma and also in those with acute asthma exacerbation compared to control. Serum mg level was significantly lower in asthmatic patients during exacerbations compared with stable asthmatics.

Moreover, hypomagnesemia was found to be a common disorder in patients with chronic asthma. Although the cause of hypomagnesemia in patients with chronic asthma was unknown[16], it may be related to either low magnesium intake in asthmatics or increased urinary loss of magnesium, as a side effect of therapy with b2- agonist, corticosteroid, and theophylline[17,18].

However Kakish[19] found among 500 children serum magnesium levels in asthmatic children during acute attacks and between exacerbations are not significantly different from those of controls. Similarly Falkner et al[10] also found in their study that serum magnesium levels in asthmatics are not significantly different from those of a control non asthmatic population.

In the present study serum magnesium levels is significantly decreased in patients with exacerbation than in stable asthmatics, (p value < 0.000) and the mean serum magnesium level in stable asthmatics is 1.69±0.15 and in exacerbation is 1.49±0.27. This is in agreement with Ali et al[3]. Mohammad et al[20] reported that serum magnesium levels were significantly decreased in asthmatic patients during exacerbations than stable asthmatics, and the mean of serum magnesium level in exacerbations was 1.12 ±0.83 and in stable asthmatics was 1.83± 0.44. Asthmatic patients with low serum magnesium levels were found to have more severe asthma and a higher incidence of asthma exacerbation and hospitalization than asthmatic patients with normal serum magnesium levels[21]. This can be explained by an association between magnesium deficiency and an increased airway hyper reactivity. Evidence suggests that magnesium ions participate in numerous biochemical and physiologic processes that directly influence lung function and respiratory symptoms. The mechanisms for effects of magnesium on lung function include alteration in airway smooth muscle function, immune function and oxidative stress. Hypomagnesemia may also increase the neuromuscular irritability, thus making a few individuals more susceptible to the bronchial spasms. Low dietary magnesium was also found to be associated with wheezes and impairment of lung function in normal subjects, while magnesium supplementation can reduce asthma symptoms[22-24].

In this current study there is a statistically significant (p value 0.000) relation between serum magnesium levels and use of ≥3 medications (ICS, beta 2 agonists, theophyllines and/or other drugs) is found. The mean level is 1.43±0.23 among using ≥ 3 medications and the mean level among on < 3 medications was 1.65±0.22. This is in agreement with Ali et al[3]. Das et al[25] have reported that there is statistically significant relationship of hypomagnesemia with the use of LABA and with the use of ≥ 3 medications. In the same study Das et al[25] showed a statistically significant relationship of hypomagnesemia with use of ICS, (p=0.021) and explained this by increased urinary loss of magnesium as a side-effect of therapy with corticosteroid[18].

Conclusion

In conclusion hypomagnesaemia is found in patients with chronic stable asthma and also in those with acute severe asthma when compared to control. Serum Mg++ level is significantly lower in asthmatic patients during exacerbations compared with stable asthmatics. There is a significant correlation between hypomagnesaemia and use of LABA and requirement of multiple medications. So serum Magnesium should be measured in all patients with bronchial asthma particularly in those who are on anti asthma medications and those comes with acute exacerbation of bronchial asthma.

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