

Original Research

Evaluation of serum magnesium level in bronchial asthma patients

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ABSTRACT:

Background: Magnesium (Mg) is an intracellular cation which takes part in various functions including smooth muscle contractility. Studies have shown that serum Mg level has no significant effect on asthma severity. To evaluate serum magnesium levels in asthmatic subjects. **Materials & methods:** A total of 40 subjects were enrolled. They were divided into 20 cases and 20 controls. The subjects with respiratory medicine with stable asthma were randomly selected. The statistical significance was calculated using Chi-square test. The result was analysed using SPSS software. **Results:** There was a linear relationship between serum magnesium level and FEV1. As the FEV1 decreased, there was an associative decrease in serum magnesium levels. **Conclusion:** Hypomagnesaemia is more prevalent in stable asthmatics.

Keywords: Magnesium, Asthma, Serum hypomagnesaemia.

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INTRODUCTION

Magnesium (Mg⁺⁺) is the fourth most common cation in the body and the major intracellular divalent cation. Mg⁺⁺ in extracellular fluid is crucial for normal neuromuscular activities; intracellular Mg⁺⁺ 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. ¹ Total body Mg⁺⁺ is about 25 g (1000 mmol). About 50% of it is in the bones, only 1% is in the extracellular fluid, and the rest is within the cells. About 30% of the serum Mg⁺⁺ is bound to albumin. Mg⁺⁺ has several actions on rabbit bronchial airways including relaxation of airway smooth muscle, bronchodilation, anticholinergic effects, and stabilization of mast cells. ² Magnesium deficiency has been shown to correlate with a number of chronic diseases like hypertension, diabetes mellitus, and hyperlipidemia. ³ Mg⁺⁺ is proved to be useful in the management of acute coronary syndrome, ⁴ Pre-eclampsia and eclampsia, ⁵ and ventricular tachyarrhythmia. ⁶

Hypomagnesemia leads to muscle contraction and hypermagnesemia to muscle relaxation. ⁷ There are studies documenting usefulness of Mg in treating acute asthma. ^{8,9} There are several studies on serum Mg levels in asthma patients which show that hypomagnesemia is commonly seen in asthmatics. ^{10,11} Mg²⁺ deficiency is associated with airway hyperreactivity, wheezing, and impaired lung function. Several studies have suggested that Mg²⁺ might play a beneficial role in the prevention and treatment of asthma through relaxation of the bronchial smooth muscles. ¹² Beneficial effects of Mg²⁺ on lung function, airway reactivity, and wheezing were observed in two observational studies. ^{13,14} However, other studies could not confirm these results. ¹⁵ Potential beneficial effects of dietary factors including Mg²⁺, copper, and zinc have been suggested and require further investigation. ¹⁶ Hence, this study was done to evaluate serum magnesium levels in asthmatic subjects.

MATERIALS & METHODS

A total of 40 subjects were enrolled. They were divided into 20 cases and 20 controls. The subjects with respiratory medicine with stable asthma were randomly selected. They were assessed clinically and their serum magnesium levels were measured. This was compared with the serum magnesium values of 20 non-asthmatic healthy controls. Pulmonary function test was done. Serum magnesium was measured using ELISA kit. The statistical significance was calculated using Chi-square test. The result was analysed using SPSS software.

RESULTS

A total of 40 subjects were enrolled. There was a linear relationship between serum magnesium level and FEV1. As the FEV1 decreased, there was an associative decrease in serum magnesium levels.

Table 1: Change in serum magnesium level (meq/lit) with FEV1% in asthmatics

FEV1%	Magnesium level
Mild >80	1.2
Moderate 50-79	0.8
Severe 30-49	0.6
Very severe <30	0.4

The mean (SD) serum magnesium concentration in asthmatic patients was significantly lower than that obtained in the control with $p < 0.001$. The mean (SD) Forced Expiratory Volume (FEV1 %) in asthmatic patients is significantly lower than in controls with p value < 0.001 .

Table 2: analysis

Variables	Case (n =20)	Control (n =20)	p- value
FEV1 (%)	45.18	97.52	0.001
Serum magnesium (meq/lit)	1.54	2.44	0.001

DISCUSSION

The relation between Mg and asthma is well established over the years. Among these, the most well-known association is the therapeutic utility of MgSO₄ in acute severe asthma. Asthma is characterized by airway obstruction. Increased airway smooth muscle tone is the main mechanism leading to this obstruction. Mg is an essential macro element, which takes part in smooth and skeletal muscle contraction and neurosynaptic function.¹⁷ It has an inhibitory effect on acetylcholine secretion.¹⁸ Several studies have established this inhibitory action as the basis for MgSO₄ use in acute asthma. Hence, this study was done to evaluate serum magnesium levels in asthmatic subjects. In the present study, a total of 40 subjects were enrolled. There was a linear relationship between serum magnesium level and FEV1. As the FEV1 decreased, there was an associative decrease in serum magnesium levels. A study by Yuvaranjan S et al,

showed that serum magnesium value between 1.5 and 2.5mg/dl was considered normal and any value below 1.5 mg/dl was considered as hypomagnesaemia. Using this cut-off value, a total of 40 patients is compared with 40 healthy individuals. About 35(87.5%) patients were found to have hypomagnesaemia and their serum magnesium value ranged between 0.70 and 1.4 mg/dl. Rest 5(12.5%) patients had normal serum magnesium level. It can be concluded from the present study that hypomagnesaemia is more prevalent in stable asthmatics than non-asthmatic control.¹⁹

In the present study, the mean (SD) serum magnesium concentration in asthmatic patients was significantly lower than that obtained in the control with $p < 0.001$. The mean (SD) Forced Expiratory Volume (FEV1 %) in asthmatic patients is significantly lower than in controls with p value < 0.001 . Another study by Daliparty VM et al, showed 256 patients who met the inclusion criteria. After 96 patients were removed based on exclusion criteria, 160 patients were grouped into three based on the level of symptom control. Forty-eight patients belonged to the "well controlled" group, 59 in "partly controlled" group, and the remaining 53 in "uncontrolled" group. The mean serum Mg level (mg/dl) was 2.08 ± 0.37 , 2.07 ± 0.28 , and 1.83 ± 0.34 in well, partly, and uncontrolled groups, respectively. As the level of control of asthma decreased from well controlled to uncontrolled, the level of mean serum Mg also decreased. Serum Mg levels have a positive correlation with the level of symptom control in asthma. In uncontrolled asthma, serum Mg is significantly low. Hence, it might be useful as a biomarker in assessing control or severity of asthma.²⁰ Kilic H et al, depicted that in the asthma group, 10% (n = 9) of the patients had hypomagnesemia and 5.5% (n = 5) had hypophosphatemia. Patients with asthma were divided into two groups: the hypomagnesemic group (n = 9) and the normomagnesemic group (n = 41). Forced expiratory volume in 1 s (FEV1), FEV1%, peak expiratory flow (PEF), and PEF% were lower in the hypomagnesemic group than in the normomagnesemic group ($p = 0.02$). Multiple logistic regression analysis revealed a statistically significant association between hypomagnesemia and PFT in the hypomagnesemic asthmatic group. The correlations of age with FEV1, FEV1%, PEF, and PEF% were as follows: $p = 0.00$, $r = 0.29$; $p = 0.00$, $r = 0.43$; $p = 0.03$, $r = 0.22$; $p = 0.00$, $r = 0.38$; and $p = 0.03$, $r = 0.22$, respectively. The correlation of serum magnesium levels with PFT (FEV1, FEV1%, PEF, PEF%) were as follows: $p = 0.001$, $r = 0.29$; $p = 0.001$, $r = 0.43$; $p = 0.03$, $r = 0.22$; and $p = 0.001$, $r = 0.38$, respectively. The other electrolytes were within the normal range in both groups. Hypomagnesemia and hypophosphatemia were found to be the most common electrolyte abnormalities in patients with chronic stable asthma. FEV1, FEV1%, PEF, and PEF% were significantly lower in asthmatic patients with hypomagnesemia compared to asthmatic patients with normomagnesemia.²¹ Hypomagnesemia has been

suggested to be associated with increased incidence of wheezing, airway hyperreactivity, and impaired lung function.²² International guidelines have recommended the use of intravenous Mg²⁺ sulfate (MgSO₄) in the treatment of acute severe asthma. This is particularly important if FEV₁ is between 25 and 30% of predicted value at presentation, or if the patient has demonstrated a poor response to short-acting β_2 -agonists.²³ However, the effects of hypomagnesemia in chronic stable asthmatic adult patients are not well defined. Hypomagnesemia was found to be common in patients with chronic asthma, although the cause was unknown.^{22,23} Asthmatic patients with low serum levels of Mg²⁺ were found to have more severe asthmatic symptoms and a higher incidence of asthma exacerbation and hospitalization than asthmatic patients with normal serum levels of Mg²⁺.^{22,24}

CONCLUSION

Hypomagnesaemia is more prevalent in stable asthmatics. There is statistically significant correlation of hypomagnesaemia with severity of asthma.

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