



ORIGINAL RESEARCH PAPER

General Medicine

ASSOCIATION OF SERUM MAGNESIUM AND HYPERTENSION

KEY WORDS:

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ABSTRACT

Background: Hypertension is a global health epidemic which is the leading cause of mortality and morbidity in adult population. Trace element deficiencies are linked to the development of hypertension and its complications. Serum magnesium is a potential biomarker for prediction of magnesium status in body. One of the major homeostatic functions of magnesium is to regulate blood pressure (BP). **Objective:** This study was aimed to evaluate the association of serum magnesium with hypertension in western Rajasthani adult population. **Methods:** This cross-sectional study was conducted at Department of General Medicine, PIMS Hospital, Udaipur, Rajasthan from March 2022 to October 2023. A total of 100 adults (age ≥18 years) were enrolled purposively following selection criteria. Of them, 50 were diagnosed cases of hypertensive patients and rest 50 were normotensive healthy subjects as control group. Both hypertensive and normotensive group were selected according to blood pressure (BP) measurement and history taking. Estimation of serum magnesium was done by automated biochemistry analyzer, using the principle of photometric technique. All data were analyzed and compared by statistical tests. **Results:** The mean(±SD) age was found 46.9±12.7 years in hypertensive individuals and that was 43.1±8.5 years in normotensive individuals. Mean(±SD) serum magnesium level was 1.73±0.24 mg/dl in hypertensive group and that was 2.02±0.19 mg/dl in normotensive group. It was observed that, mean(±SD) serum magnesium level was significantly lower in hypertensive group compared to control group (p<0.001). In hypertensive group, serum magnesium had significant moderate negative correlation with systolic blood pressure (SBP) (r=-0.475, p<0.001) and diastolic blood pressure (DBP) (r=-0.410, p=0.003). **Conclusion:** The present study showed that low serum magnesium level is associated with hypertension. Determination of serum magnesium may be helpful for the better management of hypertension and to reduce hypertension associated complications.

INTRODUCTION

Hypertension is a condition characterized by persistently elevated pressure in the blood vessels [1]. Hypertension is defined as having a systolic blood pressure ≥140 mmHg and/or a diastolic blood pressure ≥90 mmHg on two separate occasions [2]. According to World Health Organization (WHO), about 1.13 billion adult people worldwide have hypertension [3]. In South Asia, prevalence of hypertension was ranged from 17.9% to 33.8% in adult population [4]. Hypertension is divided into two classes: primary or essential hypertension and secondary hypertension [1]. Majority of the patients suffer from primary or essential hypertension of unknown etiology [1]. High salt intake, lack of trace elements (zinc, magnesium, and potassium) in diet, lack of physical activity, smoking and stress are the risk factors for primary or essential hypertension [5]. Only 5-10% patients have secondary hypertension which is influenced by pre-existing chronic diseases [6]. Hypertension is a significant risk factor for a variety of cardiovascular diseases, cerebrovascular disease, and chronic kidney disease [7].

Trace elements are recognized as necessary for optimal human health and well-being [5, 7, 8]. Trace elements have an impact on fluid and electrolyte balance, as well as acid base balance and neuromuscular functions [8]. Magnesium (Mg) is the fourth most abundant mineral in human and plays an important physiological role in the body [9]. Magnesium contributes to the synthesis of numerous proteins in our body and functions as a cofactor in a number of body's enzymes [9]. Magnesium plays a key role in homeostasis by regulating blood pressure (BP) [9]. Magnesium has modulating effects on vascular tone and reactivity, acts as a calcium channel antagonist to stimulate production of prostacyclin and nitric oxides [9]. These vasodilator substances then cause endothelin dependent and independent vasodilation [10]. Magnesium deficiency is associated with altered glucose homeostasis, atherosclerotic vascular disease, myocardial infarction, osteoporosis, migraine, asthma [11]. Serum magnesium concentrations can predict an increased

cardiovascular mortality. Low serum magnesium level results in vasoconstriction, increased peripheral resistance and finally progress to hypertension. Magnesium deficiency is associated with development of essential hypertension and dyslipidemia [5, 7, 11]. Prospective cohort studies and clinical trials found magnesium supplementation has blood pressure lowering effects [5].

Subjects And Method:

Study was conducted in the department of General Medicine, PIMS, Udaipur, Rajasthan for the period of six months. Fifty known cases of mild uncomplicated hypertension were selected. Same numbers of healthy control were also selected. The information about name, age, sex, duration of their illness and blood pressure smoking habits, and family history of cardiovascular disease were recorded. Patients with diuretic therapy, thyroid abnormalities, liver failure, renal failure or alcoholics were excluded from the study. Fifty healthy controls were selected with no pre-existing cardiovascular disease. A supine blood pressure measurement was obtained by using a standard mercury sphygmomanometer according to W.H.O criteria. Blood samples of patients and healthy controls were drawn by taking aseptic measures for determination of serum magnesium levels. Statistical analysis was done by student's t-test.

RESULTS:

This cross-sectional study was intended to evaluate the association of serum magnesium with hypertension among adult population. The sample size was 100. Among them 50 individuals were in hypertensive group (Group I) and 50 healthy normotensive individuals were in control group (Group II). Both groups were selected according to clinical history, blood pressure measurement and laboratory reports. Data were collected through a pre-designed data collection sheet.

In group I; 33(66%) patients were male and 17(34%) patients

were female, in group II; 27(54%) patients were male and 23(46%) patients were female (Figure 1).

It was observed that, mean(\pm SD) systolic blood pressure (SBP) [155.00 \pm 1.52mmHg versus 115.1 \pm 8.8 mmHg] and mean(\pm SD) diastolic blood pressure (DBP) [96.2 \pm 12.7 mmHg versus 76.7 \pm 1.37 mmHg] were significantly higher in hypertensive group compared to control group (p<0.001) (Table 1).

Data analysis revealed that, the mean(\pm SD) serum magnesium level was 1.73 \pm 0.24 mg/dl in hypertensive group and that was 2.02 \pm 0.5 mg/dl in control group. Mean serum magnesium level was found significantly low in hypertensive group (p<0.001) (Table 1).

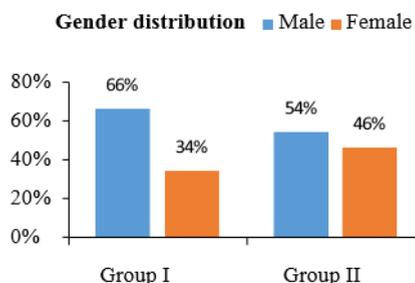


Figure 1: Gender distribution between the groups (N=100)

Table. Comparison of mean values serum magnesium (mg/dl) in controls and hypertensive patients.

| Group | Blood pressure (mmHg) | Systolic/diastolic | Serum magnesium (mg/dl) | P-value |
|-----------------|-----------------------|--------------------|-------------------------|---------|
| Controls (n=50) | 115.1 \pm 8.82 | 76.7 \pm 1.39 | 2.02 \pm 0.5 | <0.001 |
| Patients (n=50) | 155.0 \pm 1.52 | 96.2 \pm 12.7 | 1.73 \pm 0.24 | <0.001 |

Each value represents mean of individual observation \pm indicates standard error of mean.

DISCUSSION:

Hypertension is a complex condition in which multiple factors and mechanisms interact to cause cardiovascular and cerebrovascular complications [1]. Hypertension is a global health epidemic that is the leading cause of mortality and morbidity worldwide [2-3]. It was reported that, deficiencies of trace elements are closely related with development of hypertension and associated complications.

Magnesium deficiency is associated with development and adverse clinical outcome of essential hypertension [7, 10-11]. Serum magnesium is a potential biomarker for prediction of magnesium status in the body. Estimation of serum magnesium in hypertensive patients may be helpful for management of hypertension.

In this background current study was aimed to evaluate the association of serum magnesium with hypertension among west Rajasthan adult population. In this current study, it was observed that mean(\pm SD) serum magnesium level was 1.73 \pm 0.24 mg/dl in hypertensive group and that was 2.02 \pm 0.19 mg/dl in normotensive group. Mean serum magnesium level was found significantly lower in hypertensive group than control group (p<0.001).

Rekha et al. found that, the mean serum magnesium level in normotensive controls was 2.068 \pm 0.4515 mg/dl but it was 1.5560 \pm 0.40320 mg/dl in stage 1 hypertensive patients and 1.3920 \pm 0.4081 mg/dl in stage 2 hypertensive patients, there was a significant low serum magnesium levels between these hypertensive groups (p<0.05). In accordance, Han et al. in a metanalysis also found similar findings. Results of these previous studies were consistent with this current study.

CONCLUSION:

This study concluded that serum magnesium level is significantly low in hypertensive Bangladeshi adults. Low serum magnesium level has an inverse relationship with hypertension among adult Bangladeshi population. Estimation of serum magnesium may be considered for better management of hypertension.

Limitations OfThe Study

It was a single centre study with a relatively small sample size. In this study detailed dietary habit of the study population was not noted. Besides, longitudinal follow-up study to observe the effect of magnesium supplementation in hypertensive individuals was not done.

Conflicts of interest

The authors declare that they have no conflicts of interest related to the research, authorship, or publication of this article.

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