

Special Feature: Short Communication**Serum magnesium levels in patients with hypertension**B.V. Ravi,¹ S.M.R. Usha²*Department of¹Biochemistry, Kempe Gowda Institute of Medical Sciences, Bengaluru and**Department of²Biochemistry, Rajarajeshwari Medical College, Bengaluru***Ravi BV, Usha SMR. Serum magnesium levels in patients with hypertension. J Clin Sci Res 2014;4:282-5. DOI: <http://dx.doi.org/10.15380/2277-5706.JCSR.14.004>.****INTRODUCTION**

Cardiovascular disease is one of the leading causes of death in adults and one of the main reasons for morbidity.¹ Hypertension is one of the most important modifiable risk factors for cardiovascular disease.² Factors implicated in the pathogenesis of hypertension, include changes in intracellular concentrations of calcium, sodium, potassium, and magnesium with an inverse correlation between serum magnesium and incidence of cardiovascular events.³ Experimental studies have shown a relationship between low serum and tissue magnesium levels and hypertension.⁴ Clinical and experimental studies have also shown a relationship between low dietary intake of magnesium with hypertension indicating a potential role of magnesium in the pathogenesis of hypertension. However, the mechanism is unclear.^{5,6} Effects of magnesium on smooth muscle cell growth and inflammation have been suggested to play a role.⁷ The role of serum/dietary magnesium intake on cardiovascular disease, carotid intima-media thickness (CIMT), hypertension and cholesterol synthesis has been investigated.⁸ Lower concentrations of magnesium are known to be associated with oxidative stress, proinflammatory state, endothelial dysfunction, platelet aggregation, insulin resistance, and hyperglycemia.⁷ Thus magnesium appears to

play a vital function in cardiovascular stability and health, but an optimal dose and formulation has not been defined. Potentially promising avenues include the combination of magnesium with a statin to reduce cholesterol, C-reactive protein, CIMT, and its early use to reduce stroke morbidity and mortality.⁸ There are also reports on lack of association between low serum magnesium and risk of hypertension.⁹ Also, there are conflicting results on the effect of dietary intake of magnesium and risk of hypertension.^{10,11} Therefore, further studies are needed before advising this mineral supplementation as part of antihypertensive treatment.⁷ With this background the present study was taken up to assess serum magnesium levels in south Indian population with hypertension.

MATERIAL AND METHODS

Eighty subjects with different grades of hypertension¹² and 20 normotensive age matched controls who attended Dr. B.R. Ambedkar Medical College Hospital and KC General hospital, Bengaluru were included in the study. The study was approved by Institutional Ethical Committee and informed consent was taken from all participants. Baseline data including age, gender, detailed medical history, clinical examination was obtained and blood pressure was recorded using mercury sphygmomanometer. Cases with

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secondary causes of hypertension, renal and liver failure cases were excluded from the study.

Five mL of venous blood sample was obtained after overnight fasting by venepuncture from both cases and controls. Serum was separated and processed immediately. Estimation of serum magnesium was done by Titan yellow method.¹³ The difference between parameters was studied using one way ANOVA with Bonferonni post-hoc analysis. Statistical analysis was performed using Microsoft Excel worksheet and Epi-info statistical software.

RESULTS

The mean age of the cases and controls were 53.4 ± 10.4 and 47.9 ± 7.8 respectively. Majority of the study subjects (87.5%) had grade I hypertension [diastolic blood pressure (DBP)] (90-104 mm Hg), 11.3 % had grade II (DBP 105-114) mm Hg and 1.3 % had grade III hypertension (DBP >114 mm Hg). The duration of hypertension was ranging from 1 month to 6 years. Among these 68 patients were on treatment with beta-blockers (n = 19), calcium channel blockers (n = 30) angiotensin converting enzyme (ACE) inhibitors (n = 7) or a combination of these (n = 12).

The demographic features, grading of hypertension, blood pressure levels and serum magnesium level are presented in Table 1. No significant difference was observed in serum

magnesium levels between cases and controls. Similarly, no significant difference was observed in serum magnesium levels in cases and controls across the grades of hypertension ($p = 0.538$). Also, there was no statistically significant change in serum magnesium levels when patients were categorised based on type of treatment type ($p = 0.153$) or duration of treatment ($p = 0.163$).

DISCUSSION

Our results are in line with the findings of another study⁹ where follow-up for eight years did not reveal a significant association between hypomagnesaemia and occurrence of hypertension. However, low serum magnesium has been reported in patients with hypertension from North India.¹¹ It was reported that low serum magnesium levels could play an important role in the pathophysiology of prehypertension in otherwise healthy subjects.¹⁴ Low serum magnesium levels were associated with higher blood pressure values in diuretic-treated hypertensive women.¹⁵ Also, it was observed that diabetes mellitus, dyslipidaemia, and hypertension negatively correlated with serum magnesium levels.¹⁶ The hypomagnesaemia found was related to the socio-economic status in a study from India.¹⁷

Experimental studies have linked hypomagnesaemia with the development of vascular dysfunction, hypertension, and atherosclero-

Table 1: Demographic data, hypertension grading and serum magnesium levels in cases and controls

Parameter	Hypertension			Total	
	Grade I*	Grade II*	Grade III*	Cases	Controls
Number of subjects	70	09	01	80	20
Age (years) †	53.7 ± 10.4	52.33 ± 11.2	42	53.38 ± 10.4	47.9 ± 7.8
Sex					
Males	43	07	0	50	10
Females	27	02	1	30	10
Systolic blood pressure (mm Hg) †	145.9 ± 12.7	163.3 ± 21.8	190	148 ± 15.5	129.5 ± 12.4
Diastolic blood pressure (mm Hg) †	93.2 ± 4.8	109.1 ± 1.8	120	95.3 ± 7.3	79.6 ± 4.8
Serum magnesium (mg/dL) †	2.07 ± 0.26	1.95 ± 0.2	2.0	2.05 ± 0.26	2.11 ± 0.17

*see text for details

† data are presented as mean \pm standard deviation

sis.^{18,19} Clinical studies limited by the use of self-reported magnesium intake or short follow-up periods yielded conflicting results.^{20,21} However, long term followup clinical studies did not yield similar results. The relationship between serum magnesium concentration and incident hypertension, cardiovascular disease (CVD), and mortality was studied in 3,531 middle-aged adult participants in the Framingham Heart Study offspring cohort.⁹ Follow-up was 8 years for new-onset hypertension (551 events) and 20 years for CVD (554 events). There was no association between baseline serum magnesium and the development of hypertension, CVD or all-cause mortality. Similar findings were observed when serum magnesium was modeled in categories (<1.5, 1.5-2.2, >2.2 mg/dL) or in quartiles thus not supporting the hypothesis that low serum magnesium is a risk factor for developing hypertension or CVD.⁹

Recent evidence suggests that urinary magnesium excretion but not the circulating magnesium levels were inversely associated with risk of hypertension across the entire range of habitual dietary intake with no associations being observed between circulating magnesium and risk of hypertension.²² The serum magnesium levels do not necessarily reflect the body magnesium levels. Though serum magnesium may be normal, there may be intracellular magnesium depletion.²³ This study indicates low serum magnesium values need not be evident in hypertensive patient. However, the sample size in the present study is small. Therefore, the findings need to be explored further with larger sample size to confirm these findings.

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