



## SERUM CALCIUM AND VITAMIN-D LEVELS IN NEWLY DETECTED HYPERTENSIVES AND ITS CORRELATION WITH SEVERITY OF DISEASE

### General Medicine

**Dr. Anis Siddiqui** Assistant Professor, Department of Medicine, RIMS, Raipur, CG, India-492006.

**Dr. Nitin Sharma\*** Assistant Professor, Department of Medicine, RIMS, Raipur, CG, India-492006.  
\*Corresponding Author

**Dr Brajendra Kumar** Dean and Professor, Department of Medicine, RIMS, Raipur, CG, India-492006.

### ABSTRACT

Alterations in the intracellular free Calcium regulation as well as disturbances of extracellular calcium homeostasis have been observed in patients with essential hypertension. Present study centers on estimating serum calcium level in patients with essential hypertension and establishing relationship between serum calcium level and severity of hypertension. In this study serum calcium levels were measured in 80 cases of essential hypertension which included 37 cases of grade I and 43 cases of grade II hypertension. The result showed that serum Calcium levels were significantly decreased in grade I ( $P < 0.001$ ) as well as grade II ( $P < 0.001$ ) hypertension cases when compared to age matched normotensive control. Furthermore, Grade II hypertension cases were having significantly lower serum Calcium level ( $P < 0.001$ ) than grade I hypertension cases.

### KEYWORDS

Serum calcium, Essential hypertension, Intracellular calcium, Prehypertension.

### INTRODUCTION

Abnormalities of calcium metabolism in cases of essential hypertension have been described by many researchers in recent past. The calcium ion plays a major role as an intracellular second messenger in excitation contraction coupling in cardiac and smooth muscle cells. The free intracellular calcium concentration thus, determines the tension in vascular smooth muscle cells thereby resulting in peripheral vascular resistance. Abnormal Calcium metabolism has been projected as one of the important hypothesis causative factor for essential hypertension by many workers. It has been hypothesized that a generalized defect of calcium regulation might be of importance in the pathogenesis of essential hypertension. In one a primary calcium deficiency in essential hypertension has been linked to subsequent membrane instability and altered intracellular free calcium concentrations. Many workers have come to a conclusion that highly positive co-relation exists between serum calcium level and essential hypertension. Serum calcium level was found to be higher in hypertensive patients than in controls. This work is an attempt to find out a possible co-relation between serum total calcium and hypertension (and its severity).

### MATERIAL AND METHOD

The study was carried out on eighty newly diagnosed or untreated essential hypertension patients (i.e. patients with no known cause of hypertension) randomly selected from those admitted in various wards or attending various outdoors of RIMS, Raipur. Blood pressure of the subjects were measured and classified strictly in adherence to JNC 7 recommendations. Ethical clearance had been taken from the appropriate institutional authority. Twenty five persons with normal blood pressure selected from the attendants of the patients, medical / nursing students and hospital staffs were taken as normotensive age and sex matched controls. Both the groups i.e. case and control groups were examined thoroughly and systematically including routine investigations to exclude any diseases or factors known to cause hypertension. Subjects having any condition or taking any drug known to alter serum calcium have been excluded from the study. Serum total calcium was estimated by using Arsenazo III method.

### RESULTS

In our study the mean serum calcium concentration of control subjects was found to be  $2.53 \pm 0.08$  mmol/l with a range of 2.37 to 2.70 mmol/l. The females were found to have lower mean serum calcium level ( $2.5$  mmol/l  $\pm$   $0.08$ ) than males ( $2.55$  mmol/l  $\pm$   $0.07$ ) but the difference was not significant ( $p = 0.1$ ). The mean calcium values were found to be in agreement with recommended normal range of serum calcium concentration in both sexes. The mean serum calcium concentration of grade I hypertension cases was found to be  $2.30 \pm 0.072$  mmol/l ranging between 2.16 to 2.58 mmol/l which was significantly lower ( $p < 0.001$ ) than that of control group but, was significantly higher ( $p = .009$ ) than grade II hypertensive individuals (mean serum calcium

level  $2.25 \pm 0.09$  mmol/l). Both grade I and Grade II hypertensive subjects of male and female sub-group showed significantly lower values of serum calcium than their respective control counterparts ( $p < 0.001$  in all subgroups).

### DISCUSSION

The present study shows significantly reduced serum calcium level in hypertensive individuals as compared to control group. Grade II hypertensive subjects were found to have lowest value compared to grade I hypertensive and control group subjects. This shows a direct inverse relationship between serum calcium level and grade of hypertension. The results were in close agreement with that of others. The NAHNES I study was probably the 1st and one of the largest epidemiological surveys linking the inverse relationship between calcium level (and its dietary intake) and blood pressure. Toyuz et al, also reported reduced serum calcium level in hypertensive individuals. However, Koschet al. did not find any change in serum calcium levels in hypertensive individuals. In approximately two third of the studies, increase in calcium intake produced a mild antihypertensive response, with an average decrease of 4-7 mm Hg systolic and 2-4 mm Hg diastolic blood pressure. These changes in the blood pressure with low serum calcium level could possibly be attributed to some poorly known alterations in cell membrane transport mechanisms. Abnormal cellular ion transport resulting in altered membrane control over intracellular calcium may be related to essential hypertension. The free intracellular calcium concentration determines the tension in vascular smooth muscle cells, thereby resulting in peripheral vascular resistance. Calcium has direct effect on peripheral vascular tone. Alterations in intracellular calcium are thought to be involved in the common pathway mediating the secretion and action of many hormones, including the presser action of catecholamines and angiotensin II. Ionized serum Ca is reported to be lower in low-renin hypertensive patients and higher in high-renin hypertensive patients than in normal-renin hypertensives or in normotensives. Plasma renin activity in essential hypertension has a continuous negative correlation with serum Mg and a positive correlation with serum ionized Ca. Hence, plasma renin in hypertension may reflect (or contribute to) Ca and Mg flux changes across cell membranes. Endothelial cell dysfunction is one of them which is accompanied by a decrease in the production and/or the release of nitric oxide and the increase of contracting factors with resultant increase in peripheral vascular resistance. Another notable factor which is indirectly involved in the pathogenesis of essential hypertension is altered lipid metabolism in the situation of low serum calcium level or decreased dietary calcium intake. Low calcium diet or low serum calcium stimulates increased production of 1,25-dihydroxyvitamin D which in turn, stimulates adipocyte  $Ca^{2+}$  influx and, as a consequence, stimulates lipogenesis, suppresses lipolysis, and increases lipid accumulation; whereas increasing dietary calcium inhibits these effects and markedly accelerates fat loss. Many researchers even recommend a regular

consumption of the recommended daily levels of dietary calcium to combat with hypertensive disorders.

## CONCLUSION

In approximately two third of the studies, increase in calcium intake produced a mild antihypertensive response, with an average decrease of 4-7 mm Hg systolic and 2-4 mm Hg diastolic blood pressure. As an extension to this study it can be proposed safely that diet high in calcium could possibly alter the course and progression of hypertension as evidenced by so many other studies.

## REFERENCES

1. N.Kaplan, Clinical Hypertension, 6th Ed.
2. Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7 )December 2003 in Hypertension. 2003;42:1206
3. Bayer, P.J.: Anal. Biochem, 110: 61, (1981) [11] Fu, Y., Wang, S., Lu, Z., Li, H. and Li, S. (1998). Erythrocyte and plasma  $Ca^{2+}$ ,  $Mg^{2+}$  and cell membrane adenosine triphosphatase activity in patients with essential hypertension. Clin. Med. J. (Engl) 111, 147-149.
4. Touyz, R.M., Milne, F.J. and Reinach S.G. (1992). Intracellular  $Mg^{2+}$ ,  $Ca^{2+}$ ,  $Na^{2+}$  and  $K^{+}$  in platelets and erythrocytes of essential hypertension patients: relation to blood pressure. J. Hypertens., 14, 1189-1209.
5. Touyz, R.M., and Milne, F.J. (1995). Alterations in intracellular cations and cell membrane ATPase activity in patients with malignant hypertension. J. Hypertens., 13, 867-874.
6. The Journal of Endocrinology & Metabolism vol. 90; 2005
7. Symposium notes: Non-pharmacologic Management of Hypertension; National Kidney Foundation; 1994.
8. DC Hatton and DA McCarron; Dietary calcium and blood pressure in experimental models of hypertension. A review Hypertension, Vol 23, 513- 530.
9. K. Sudhakar, M. Sujatha, S. Ramesh Babu, P. Padmavathi and P. P. Reddy, serum calcium levels in patients with essential hypertension and their First degree relatives. Indian Journal of Clinical Biochemistry, 2004, 19 (1) 21-23.
10. Resnick, Lawrence M.; Laragh, John H.; Sealey, Jean E.; Alderman, Michael H. Divalent Cations in Essential Hypertension — Relations between Serum