



THE STUDY OF SERUM CALCIUM LEVEL IN ESSENTIAL HYPERTENSION IN COMPARISON WITH NORMOTENSIVE SUBJECTS

Dr Samarat

Assistant professor, Department of Medicine, HSK, Bagalkot

Dr Kiran L Hunashikatti\*

Junior Resident, Department of Medicine, HSK, Bagalkot \*Corresponding Author

ABSTRACT

Hypertension is one of the leading causes of death and disability among adults all over the world and emerging health problem in India. Alterations in the intracellular free Calcium regulation as well as disturbances of extracellular calcium homeostasis have been observed in patients with essential hypertension. To study the levels of serum Calcium in patients with primary hypertension and correlate the serum Calcium levels with severity of disease. Information for the study was collected from patients admitted to S.NIJALINGAPPA MEDICAL COLLEGE AND HANGAL SHRI KUMARESHWAR Hospital and Research center, Bagalkot from April 2018 to August 2019. Patients met inclusion criteria were studied. A Comparative Study was done. Serum calcium was done in total 164 patient which were divided equally in 3 groups Stage I Hypertensives, Stage II Hypertensives, and Controls, 41 patients in each groups of Hypertension and 82 patients in control group, results were obtained compared. In patients of Essential hypertension mean serum Calcium levels were found to be low in comparison to Normotensives. Further, Stage II Hypertensive patient has more reduced levels of serum calcium than Stage I hence low Serum Calcium levels were associated as the severity of the disease increases.

KEYWORDS : Hypertension, Calcium, Stage

INTRODUCTION

Hypertension is one of the leading causes of the global burden of disease. Approximately 7.6 million deaths and 92 million disability adjusted life years worldwide were attributable to high blood pressure in 2001.(1)(2)The WHO rates Hypertension as one of the most important causes of premature death worldwide.(3)(2) There is strong positive and continuous correlation between BP and the risk of cardiovascular disease (myocardial infarction, heart failure), renal disease, stroke and mortality. This correlation is more related with systolic than diastolic Blood Pressure.(4) Hypertension is due to specific causes in a small fraction of cases, but in the vast majority of individuals (≈90-95%), its etiology cannot be determined; therefore, the essential hypertension term is employed.(5-7) Essential hypertension is currently understood as a multifactorial disease arising from the combined action of many genetic, environmental, and behavioral factors.(8-10). Alterations in the intracellular free Calcium regulation as well as disturbances of extracellular calcium homeostasis have been observed in patients with essential hypertension. (11) Many researchers even recommend a regular consumption of the recommended daily levels of dietary calcium to combat with hypertensive disorders.(12)(13) In a country like India, people tend to have a diet rich in Sodium and poor in Potassium and Calcium, this change in diet can change hypertension course and progress.(11)

OBJECTIVES

1. To study the levels of serum Calcium in patients with Essential Hypertension.
2. To correlate the serum Calcium levels with severity of disease.
3. To correlate the serum calcium levels in the patients with essential hypertension and in comparison with normotensive subjects.

METHODOLOGY

The information for the study will be collected from patients admitted to S.NIJALINGAPPA MEDICAL COLLEGE AND HANGAL SHRI KUMARESHWAR Hospital and Research center, Bagalkot from April 2018 to August 2019. Information will be collected through prepared proforma from each patient. Qualifying patients will be undergoing detailed history, clinical examination and laboratory investigations and will be matched for sex and age.(11) Included the Patients who are diagnosed as essential hypertension and who are not on any medication ,age above 18 years, both the sexes. Exclu

ded patients with renal disease or on drugs that alter the calcium levels, already on anti hypertension drugs

SAMPLE SIZE

This was calculated by using OpenEpi, Version 2, open source calculator SS Mean software.

SAMPLING:

It will be done by simple SD MEAN table. With confidence levels of 95% and power of 80%. Hence 41 cases will be included in group (Stage I, Stage II) and 82 will be included in controls. Total sample size = 164. Statistical Analysis-Mean +/- SD<sup>2</sup>, Statistical tests like students t test / comparative test. It was done using Software SPSS version 17 . The patients who have been diagnosed as essential hypertension after excluding the secondary cause of hypertension will be taken the 5ml blood sample for the estimation of the serum calcium levels and correlating the severity of the levels with the disease

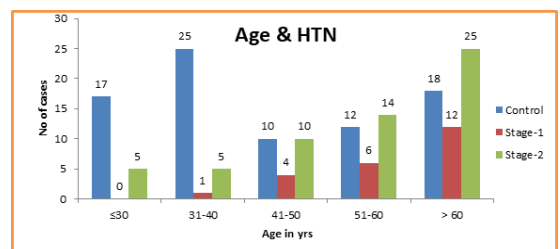
RESULTS

A study of s. total calcium was done in total 164 patient were, 82 cases are divided equally in 2 groups named stage 1 hypertensives and stage 2 hypertensives and 82 as controls or normotensive subjects.

AGE DISTRIBUTION:

	Stage			Total
	Control	Stage I	Stage 2	
<30	17	0	5	22
31-40	25	1	5	31
41-50	10	4	10	24
51-60	12	6	14	32
>60	18	12	25	55
Total	82	23	59	164

\* Chi Square test P < 0.000, Highly Significant

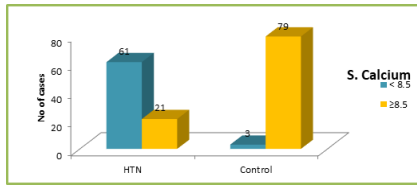


**TABLE 2: DISTRIBUTION OF CASES BY NORMAL AND LOW SERUM CALCIUM IN TOTAL CASES OF HYPERTENSION**

S. Calcium	Groups		Total
	HTN	Control	
< 8.5	61	3	64
≥8.5	21	79	100
Total	82	82	164

Chi Square test P<0.000, Highly Sig

**FIGURE 2: GRAPHICAL DISTRIBUTION OF CASES BY NORMAL AND LOW SERUM CALCIUM IN TOTAL CASES OF HYPERTENSION**

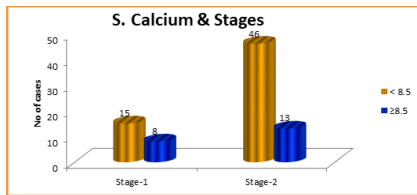


**TABLE 3: DISTRIBUTION OF CASES BY NORMAL AND LOW SERUM CALCIUM IN DIFFERENT STAGES OF HYPERTENSION**

S.Calcium (mg/dl)	HTN Stage		Total
	Stage-1	Stage-2	
< 8.5	15	46	61
≥8.5	8	13	21
Total	23	59	82

Chi Square test P<0.08, Not Significant

**FIGURE 3: GRAPHICAL DISTRIBUTION OF CASES BY NORMAL AND LOW SERUM CALCIUM IN DIFFERENT STAGES OF HYPERTENSION**

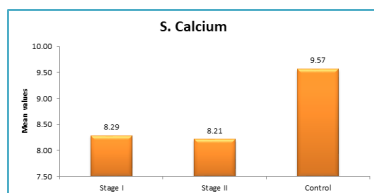


**TABLE 4: COMPARISON OF SERUM CALCIUM LEVELS BETWEEN ALL HYPERTENSIVE CASES AND CONTROLS**

Groups	Serum calcium (mg/dl)		Unpaired t test
	Mean	Std. Deviation	
Hypertensive	8.23	0.97	P = 0.001*
Control	9.57	0.64	
Total	8.90	1.06	

**TABLE 5 : COMPARISON OF SERUM CALCIUM BETWEEN HYPERTENSION STAGE I, STAGE II AND CONTROL GROUPS**

Hypertension	Serum calcium		Kriskal wallis test
	Mean	Std. Deviation	
Stage I	8.29	0.78	P = 0.001*
Stage II	8.21	1.04	
Control	9.57	0.64	
Total	8.90	1.06	



**DISCUSSION**

Considering the above study was conducted S.NIJALINC GA PPA MEDICAL COLLEGE AND HANGAL SHRI KUMARE SHWAR Hospital and Research center, Bagalkot over a period of 2 year in which A Study of serum calcium was done in total 164 patients which were divided as 42 in each groups named Stage I Hypertensives, Stage II Hypertensives, and Controls or Normotensives, 82 patients in one group and the results were obtained and compared.

Lian IA and Asberg A(51), did a study which has concluded that Unadjusted Total calcium has better diagnostic accuracy than commonly used adjustment formulas, so clinician should stop use of this formulas. In our study corrected S.Calcium levels were not obtained and compared.

In our study mean age in hypertensive patients was 58.10 ± 14.34 and in controls it was 45.28 ± 16.81. There was significant difference was obtained in relation to age in both the Stage of Hypertension but Jorde.,et al.(52), has noticed that there was a significant decrease in serum calcium with increasing age in men as age increases there is significant decrease in S. Calcium levels while in women it increases with age Our study showed there was significant difference in relation to gender (p value <0.02) in both Stages.In our study while comparing S. Calcium values in different groups with each other, the observation was that overall > 50 % of Hypertensive cases has low S.Calcium level. And number of cases with low S. Calcium were more in Stage II than in Stage I group. Out of 82 controls only 3 has low S. Calcium level. In total Hypertensives cases mean ± SD of S. Calcium was 8.23 ± 0.97 mg/dl while in normotensives cases it was 9.57 ± 0.64 mg/dl hence difference of 1.34 ± 0.33. G. Ranjani(43) showed similar difference of S.Calcium levels in which Hypertensive Patient has mean Serum Calcium of 8.9160 ± 0.62529 mg/dl and 9.7042 ± 0.79350 mg/dl in normotensives and difference was 0.7882 0.16821 mg/dl which were statistically significant as in our study. K. Sudhakar et al(47),in Indian population, serum calcium levels were measured in 117 subjects and 77 first degree relatives. Serum Calcium levels were decreased in hypertensive which were statistically significant. Strazzullo P et al.(53), showed there is elevated fractional urinary calcium excretion in cases of Primary hypertension and had obtained significant reduction in Total S. Calcium levels, but no significant reduction in Ionized calcium levels. Tillman DM and Semple PF(45), showed that there is disturbance of calcium metabolism in hypertension, and although result of Ionized calcium, Total Serum Calcium concentration in the hypertensive was not significant, there was significant correlation between total calcium and systolic pressure Wright GL, Rankin was a study in rats showed a lower serum ionized and total serum calcium concentrations in spontaneously hypertensive rates. In all Stage I Hypertensive case mean ± SD of S. Calcium was 8.29 ± 0.78 mg/dl while in Stage II Hypertensive it was 8.21 ± 1.04 mg/dl ( p = 0.0001). This results were significantly low than normotensives. But comparing both Stage of Hypertension mean was lower in stage II but it is not significantly low. So level of S.Calcium has inverse relation with Hypertension severity. Kamlesh Jha M(11) support this observation of inverse relation between Calcium levels and Severity of disease. In Stage I hypertensives mean was 2.30 ± 0.072 mmol/l which was significantly lower (p<.0001) than that of normotensives, but in comparison to Stage II hypertensives it was significantly higher (p=.009) where mean serum calcium level was 2.25 ± 0.09 mmol/l There are difference studies which showed that calcium supplementation can alter outcome of disease or not. Jolma at al, a study in rats showed increased dietary Calcium reduce the development of hypertension there will be the improved vasorelaxation after Calcium supplementation in NO deficient hypertension. On human populations also several similar studies are done for dietary supplementation in

England(54), Oregon(55), Indiana(56) showed reduction in Blood pressure.

The findings have been highly variable across various studies but the largest study (TOHP) - Trials and Hypertension Prevention Study found no significant blood pressure lowering at 600mg per day. Based on the data and experience available, calcium supplementation on increased Dietary intake of calcium rich foods can be recommended non-specifically for prevention of hypertension, and in osteoporosis it will have. Therefore, intake be maintained at 1.0 to 1.5gm per day is recommended through dietary intake on supplements for both adolescent and Adults

## CONCLUSION

Hypertensive cases are found to have low S. Calcium level. Cases with low S. Calcium were more in Stage II than in Stage I group. Average Serum Calcium is low in Hypertensive patients. And when comparing all cases of Stage I and Stage II Groups, average S. Calcium is Normal in Stage I and Low in Stage II. But in comparison to control group both Stages has statistically significant low S. Calcium Level. Low Serum Calcium level in Stage I hypertension and Stage II Hypertension is statistically Significant in comparison to controls. When the cases with Low S.Calcium is compared in both Stages, Stage II hypertensives patients has more reduction in S. Calcium level than Reduction in S. Calcium in Stage I hence there is inverse relation between blood pressure and Serum Calcium Our study shows there is correlation between Serum Calcium levels and essential hypertension and also shows Severity of disease and Serum calcium has inverse relationship.

## REFERENCES

1. Anchala R, Kannuri NK, Pant H, Khan H, Franco OH, Di Angelantonio E, et al. Hypertension in India. *J Hypertens* [Internet]. 2014;32(6):1170-7. Available from: <http://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=00004872-201406000-00003>
2. Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. *Lancet* (London, England) [Internet]. 2005 Jan 15 [cited 2016 Aug 30];365(9455):217-23. Available from: <http://www.thelancet.com/article/S0140673605177411/fulltext>
3. Bell K, Twigg J, Olin BR. Hypertension : The Silent Killer : Updated JNC-8 Guideline Recommendations. *Alabama Pharm Assoc*. 2015;1-8.
4. Carretero OA, Oparil S. *Clinical Cardiology : New Frontiers*. Am Hear Assoc. 2000;101(February):329-35.
5. Messerli FH, Williams B, Ritz E. *Essential hypertension*. 2007;370.
6. Staessen JA, Wang J, Bianchi G, Birkenhager WH. *Essential hypertension*.2003;361:1629-41.
7. *Hypertension E. Clinical Cardiology : New Frontiers*. 2000;329-35.
8. Meneton P, Jeunemaitre X, Wardener HEDE, Macgregor GA. Links Between Dietary Salt Intake , Renal Salt Handling , Blood Pressure , and Cardiovascular Diseases. 2018;679-715. 9. Takahashi H, Yoshika M, Komiyama Y, Nishimura M. The central mechanism underlying hypertension : a review of the roles of sodium ions , epithelial sodium channels, the renin - angiotensin - aldosterone system , oxidative stress and endogenous digitalis in the brain. 2011;34(11):1147-60. Available from: <http://dx.doi.org/10.1038/hr.2011.105>
10. Blood R, To F. *Genetic and Non-Genetic Basis of Essential Hypertension : M Maladaptation of Human Civilization to High Salt Intake*. 1998;
11. Jha K. Serum Calcium in Essential Hypertension and its Co-relation with Severity of the Disease. *Adv Stud Biol*. 2011;3(7):319-25.
12. Peer Reviewed Title : Calcium and Hypertension Journal Issue : Author : Martinez , Christina , University of California , Los Angeles Publication Date :Permalink : Keywords : Calcium , Hypertension Abstract : Hypertension affects millions of Americans. . 1998;4(2):2-6.
13. Karen L. Margolis, Roberta M. Ray, Linda Van Horn et al. *Pressure : the Women ' s Health Initiative randomized trial*. NIH Public Access. 2009;52(5):847-55.
14. Ranjani G. Estimation of serum calcium and serum phosphorus levels in newly detected essential hypertensive patients. 2017;4(9):47-53.
15. Article O, Pawade YR, Ghangale SS, Apte IC, Nagdeote AN, Warade JP. Serum Calcium : Can It Be A Diagnostic And Prognostic Marker In Essential Hypertension ? 2011;5(1):58-62.
16. Sharma B, Sarmah D. Serum calcium and magnesium in patients with Essential hypertension and their first degree relatives. *Int J Basic Med Sci Pharm*[Internet]. 2012;2(2):66-9. Available from: <http://ijbmsp.org/index.php/IJBMSPP/article/view/13>
17. Lian IA, asberg A. Should total calcium be adjusted for albumin ? A retrospective observational study of laboratory data from central Norway. 2018;1-7.
18. Jorde R, Sundsfjord J, Fitzgerald P, Bonaa KH, Jorde R, Sundsfjord J, et al. Serum Calcium and Cardiovascular Risk. 1999;484-90.
19. Halhali A, Diaz L, Avila E, Ariza AC, Garabedian M, Larrea F. Decreased fractional urinary calcium excretion and serum 1,25-dihydroxyvitamin D and

- IGF-I levels in preeclampsia. *J Steroid Biochem Mol Biol*. 2007 Mar;103(3-5):803-6.
20. Ferrier KE, Muhlmann MH, Baquet JP, Cameron JD, Jennings GL, Dart AM, et al. Intensive cholesterol reduction lowers blood pressure and large artery stiffness in isolated systolic hypertension. *J Am Coll Cardiol*. 2002 Mar;39(6):1020-5.
21. Stamler R, Stamler J, Riedlinger WF, Algera G, Roberts RH. Weight and blood pressure. Findings in hypertension screening of 1 million Americans. *JAMA*. 1978 Oct;240(15):1607-10.
22. Hill C, Carolina N, Hill C, Carolina N. NIH Public Access. 2010;124(5)