

Estimation of Serum Calcium Level in the Patients of Hypertension

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ABSTRACT

Background: Hypertension is one of the leading progressive cause of mortality and morbidity in developed as well as developing countries all over the world. Intracellular and extracellular ions of the body regulate the hemostasis of blood pressure.

Objective: To estimate the serum calcium level in the patients of newly diagnosed cases of hypertension with normotensive set of subjects.

Methodology: This case comparative study was conducted at the medical OPD of Bilawal Medical College and LUMHS Hospital Hyderabad and Jamshoro. 100 subjects were chosen and divided into two groups: 50 normotensive as a control group and 50 hypertensive as a case study group. Selection of samples was done on the basis of the non-probability technique. A sphygmomanometer was used to measure blood pressure, and a kit method was used to measure serum calcium levels. The statistical analysis of the data was carried out by SPSS version 22 by applying the student t test.

Results: The mean age of control group subjects was 44 ± 6 years and control group was 42 ± 7 years. The mean systolic Blood pressure of control group was 110 ± 5 mmHg, while in case study group it was 140 ± 10 mmHg. The mean Diastolic blood pressure of control group was 80 ± 5 mmHg, while in case study group it was 105 ± 5 mmHg. The mean serum calcium level in control group was 9.82 ± 0.68 mg/dl and in case study group it was 8.45 ± 0.47 mg/dl. There was significant ($p < 0.05$) difference of serum calcium level was observed in case study group (hypertensive subjects group).

Conclusion: This study concluded that disturbance in intracellular calcium levels can be one of contributory factor in the pathogenesis of essential hypertension.

Keywords: Essential Hypertension, Serum Calcium, Intracellular Calcium, Blood Pressure.

INTRODUCTION

In medical terminology, elevated systolic and diastolic blood pressure are called hypertension.¹ The Hypertension basically classified in two groups.² Primary hypertension, which is idiopathic, accounts for 90-95% of cases of hypertension, while secondary hypertension, which is associated with disorders of the kidney, brain, heart, lungs, and endocrine system, accounts for 5-10% of cases of hypertension.³ Sedentary lifestyle, lack of exercise, salt ingestion in diet, stress, use of fast foods, and other factors all contribute to essential hypertension.⁴ Nowadays, persistent essential hypertension can cause life-threatening complications like myocardial infarction, cerebral stroke, renal failure, etc. The mortality rate is increasing all over the world due to persistent hypertension.⁵

The normal calcium metabolism plays vital role in the hemostasis of systolic as well as diastolic blood pressure.⁶ The disturbance in calcium metabolism can lead to development of essential hypertension.⁷ In smooth muscles of the vascular system, the excitation contraction mechanism is elicited by the action of ionised calcium (Ca^{2+}) as it acts as an intracellular second messenger.⁸ The free calcium also helps to maintain vascular resistance at the vascular smooth muscles, which provide peripheral vascular resistance.⁹

Regular exercise, body mass index control, weight loss, a diet rich in vegetables and natural products, and medication can all help to reduce hypertension-related mortality and morbidity.¹⁰ The calcium channel blockers are used in the treatment of hypertension. This class of drugs causes vasodilation and reduces peripheral resistance by blockage of voltage-gated channels of calcium in vascular smooth muscles.¹¹

The aims of this study are to estimate the serum calcium level and compression of serum calcium level in patients with essential hypertension with normal control subjects.

METHODOLOGY

This case comparative study was conducted at the Department of Medicine of Bilawal Medical College for Boys and LUMHS Jamshoro. A total of 100 subjects were recruited for this study and

divided into two groups. Group A included 50 normal subjects as a control group and group B included 50 patients with hypertension, who were selected from the medical OPD of LUMHS Hospital Hyderabad and Jamshoro. A non-probability technique was used for the selection of subjects. The newly diagnosed cases of hypertension of any gender, male or female, with the age range of 30-60 years, with systolic blood pressure up to 150 mmHg and diastolic blood pressure up to 110 mmHg with no systemic disorder, were included in this study. The subjects with a history of diabetes, renal disorders, hepatic disorders, neurological disorders, and endocrinological disorders like thyrotoxicosis, Addison's diseases, etc., and cases of malignant and secondary hypertension, with an age less than 30 years or more than 60 years, and with systolic blood pressure more than 150 mmHg or diastolic pressure more than 110 mmHg were excluded from this study.

The blood pressure was measured by a sphygmomanometer on the left arm in both a sitting and relaxed position. The serum calcium level was estimated for each subject. 3 cc of venous blood was taken under aseptic measurement. The sample was immediately centrifuged for serum separation. The serum calcium level was measured by the kit method at the Diagnostic and Research Lab of LUMHS. The data was analysed by SPSS version 22 by applying the student 't' test for determination of significant values.

RESULTS

A total of 100 subjects participated in this small research project. There were two groups; group A control included 50 subjects with no history of hypertension with normal blood pressure during examination, while group B included 50 hypertensive subjects according to inclusion criteria. Table No. 01 shows the demographic parameters of subjects under study, while Table No. 02 shows the comparison of serum calcium levels in both groups.

This study shows there was significant decline in serum calcium level in the case study group i.e hypertensive patients as compared to control group.

Table 1: Demographic Parameters of Control & Case Study Group

Parameters	Group A; Control Group (n=50)	Group B; Case Study Group (n=50)
Age (years)	44 ± 6	42 ± 7
Gender	M= 31, F= 19	M=37, F=13
BMI	25.15 ± 2.61	24.78 ± 1.84
Systolic B.P (mmHg)	110 ± 5	140 ± 10
Diastolic B.P (mmHg)	80 ± 5	105 ± 5

(M= male, F= Female)

Table 2: Serum Calcium Level

Parameter	Control Group	Case Study Group	P.Value
S.Calcium (mg/dl)	9.82 ± 0.68	8.45 ± 0.47*	<0.05

DISCUSSION

Hypertension is the clinical disorder which developed due to disturbance in multiple physiological mechanisms. Many researchers reported that disturbance in hemostasis of water and electrolytes can lead to develop hypertension.^{12,13} Calcium is one of the important ion of human body which maintain the cellular transportation, signal transduction etc.¹⁴ Calcium contributed along with other ions like as sodium, potassium and chloride in the disturbance of blood pressure.¹⁵ Essential hypertension can be caused by a change in cellular transportation of ions due to a change in calcium ion concentration.^{16,17} Basically vascular tone determines by calcium ions. Calcium also contributed in development of essential hypertension because proper concentration of calcium regulates the smooth muscular tone of vessels and peripheral resistance.¹⁸ Some researchers suggested that any change in intracellular calcium level can disturbed the secretion and action of different hormones like catecholamine which can lead in pathogenesis of Hypertension.¹⁹ Intracellular calcium also regulates the renin-angiotensin system, which maintains normal blood pressure, vascular tone, and peripheral resistance.^{20,21} Other studies have found that changes in intracellular calcium levels contribute to the pathogenesis of hypertension caused by secondary diseases such as hyperparathyroidism, nephritis, vitamin D deficiency, multiple myeloma, and so on.^{22,23}

Our study shows that there was significant decline (P< 0.05) in serum calcium level in hypertensive group as compared to control group. Our study was strengthen by (Sudhakar K. et al (2004),²⁴ Fu Y. et al (1998),²⁵ Touyz RM et al (1987),²⁶ these researchers reported there was significant decline in serum calcium levels in essential hypertension. In contradiction with our data, Hazari, et al (2012)²⁷ and Kosch M et al (2011)²⁸ reported that there was so any significant change in serum calcium level in essential hypertension.

This study has certain limitations, including a small sample size and the need for future research on a larger population of hypertension patients using other anti-hypertensive medications, such as calcium channel blockers and ACE inhibitors.

CONCLUSION

This study found a substantial correlation between serum calcium levels and essential hypertension, indicating that disturbances in intracellular calcium levels may be one of the contributing factors in the pathophysiology of essential hypertension.

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