

Study of serum magnesium and fasting blood glucose in hypertension

Dr.Gulab kanwar, Dr.Surekha kirad, Dr.Lokesh chawala, Dr.Mamta Yadav, Dr.Kusum bala jain.

Department of Biochemistry, New Medical college & Hospital, Kota, Rajasthan, India.

Abstract: A study was carried out to determine the fasting blood glucose and serum magnesium levels in patients with hypertension. A total of 80 hypertensive patients were evaluated, of which, 58 were males and 22 were females. The mean ages of male and female hypertensive subjects were 48.06 ± 6.53 and 50.83 ± 7.62 respectively. Hypomagnesemia was observed in 61.25% subjects and raised fasting blood glucose was identified in 55.1% of individuals. Therefore occurrence of low serum magnesium and raised blood sugar level in patients with hypertension was observed.

Keywords: Hypertension, Serum Magnesium, fasting blood glucose.

I. Introduction

Blood pressure is the force that drives blood through blood vessels to supply oxygen and nutrients to the body's organs and carry away metabolites and waste materials. Blood pressure is optimal if the systolic blood pressure (SBP) is lower than 120mmHg and diastolic blood pressure (DBP) is less than 80mm Hg. Hypertension is defined as SBP level higher than 140mmHg and/or a DBP higher than 90mmHg. Although historically defined as "an elevation of blood pressure" alone, hypertension is characterized by abnormalities of cardiac output, systemic vascular resistance, and arterial compliance (1).

Magnesium is an important cation present intracellularly. It is vital for biological functions of cell especially metabolism of polyphosphate compounds. Many studies in past have strengthened a relation between serum magnesium levels and hypertension(2).

Blood glucose levels in hypertensive cases are also included to find out the association of hyperglycemia with hypertension. The reasons for increased rate of hypertension include life style changes, sugar rich diet, high fat processed foods and sedentary behavior (3).

The present study was carried out to evaluate the serum magnesium and fasting blood glucose levels in patients with hypertension.

II. Material And Method:

The study was carried out in Department of Biochemistry, New Medical college & Hospital, Kota, Rajasthan, India, in the period from April 2013 to December 2013. 80 hypertensive subjects (58 males and 22 females) were taken up for the study who attended the department of General Medicine with the age group 34 – 71 years. Blood pressure was measured in all subjects as per the recommendations of JNC –VII (4). All the blood samples were collected from the individual in fasting blood samples without anti coagulant and centrifuged at 1500 rpm for 5 min and serum was collected in fresh vial for biochemical studies by using standard methods as follows -

Serum magnesium :Calmagite method (5)

Blood Glucose :Glucose oxidase and Peroxidase method

The subjects were further evaluated for serum magnesium and fasting glucose levels. The normal serum magnesium level considered was 1.8 – 2.5 mg /dl so the value < 1.8 mg /dl was labeled as hypomagnesemia and >2.5 was considered as hypermagnesemia. Hyperglycemia was labeled in subjects with fasting blood glucose levels of 126 mg/dL or higher. The frequency and percentage were calculated for serum magnesium and blood glucose level in hypertension as well as for gender distribution. The chi-square test was applied for statistical analysis. The p-value ≤ 0.05 was considered as statistically significant.

III. Result

A total of 80 hypertensive patients were evaluated, of which, 58 were males and 22 were females. The mean ages of male and female hypertensive subjects were 48.06 ± 6.53 and 50.83 ± 7.62 respectively. Hypomagnesemia was observed in 61.25% subjects, hypermagnesemia in 5.1% and normal magnesium levels in 33.2% individuals. Raised fasting blood glucose was identified in 55.1% of individual, hypoglycemia in 6.1% and normal glucose levels in 39.1% subjects.

The serum magnesium level percentages in relation to gender are shown in Table

(1). The blood sugar level percentages in relation to gender are shown in Table (2).

The mean systolic and diastolic blood pressure levels in overall population were 178.00 ± 12 and 106 ± 10 respectively.

Table 1: Percentages of serum magnesium level in relation to gender

Serum magnesium	Male	Female	Total	P-value
Hypomagnesemia	31 (54.4%)	18 (82.3%)	49 (61.25%)	0.03*
Hypermagnesemia	3(5.7%)	1 (3.8%)	4 (5.1%)	
Normal level	24(40.2%)	3 (14.2%)	27 (33.2%)	
Total	58(100%)	22(100%)	80(100%)	

*p-value is statistically significant

Table 2: Percentages of fasting blood sugar level in relation to gender

Fasting blood sugar	Male	Female	Total	P - value
Raised	28 (48.6%)	16 (71.3%)	44 (55.1%)	0.05*
Low	3(5.7%)	2 (7.2%)	5 (6.1%)	
Normal	27(45.7%)	4 (21.3%)	31(39.1%)	
Total	58(100%)	22(100%)	80(100%)	

*p-value is statistically significant

IV. Discussion

Epidemiological studies showed that hypertension is present in 25% (34 million) urban and 10% (31.5 million) rural subjects in India. The study included the estimation of magnesium considering the pivotal role of Mg in various metabolic reactions especially those involving cellular energy ATP. Mg is the fourth most abundant cation in the human body and the second most abundant intracellular cation. The average amount of body Mg in an adult weighing 70Kg is about 2,000 mEq. Of this approximately 50-70% is in bones, 1% in ECF and the remaining is intracellular, where it is concentrated mainly in the mitochondria(6).

Magnesium is second most abundant intracellular cation after potassium. It is 11th most abundant element by mass in human body, vital for various functions of body. Many reports in past have proposed a relation between serum magnesium and hypertension (7, 8).

Studies of the association between serum magnesium and blood pressure have yielded conflicting results. Hvarfner *et al.* found a positive association between serum magnesium and blood pressure in 58 hypertensive patients and 124 controls studied in Uppsala, Sweden(9).

Recent studies had shown that subjects with hypertension have a marked increase in the prevalence of hypercholesterolemia, hypertriglyceridemia, hypomagnesaemia, diabetes, insulin resistance, and obesity. Genetic predisposition may be responsible for the inheritance of these metabolic disorders. Mitochondrial inheritance through the maternal lineage may be responsible for the incidence of hypomagnesemia in women than men. A mutation in mitochondrial trna is the cause for the hypomagnesemia linked with hypertension and dyslipidemia (10).

In the present study we identified low serum magnesium level in hypertensive individuals, and this decrease is statistically significant ($p=0.03$) that too more significant in women.

In our study raised fasting blood glucose was identified in 55.1% of individuals, with none of them diabetic. It has been previously demonstrated that the presence of hypertension marks the presence of additional hyperinsulinemia and insulin resistance, independently of any impairment of glucose tolerance (11).

Fuller *et al.* have previously shown, in a cohort study of 18403 men, that in glucose intolerant patients, the risk factors most strongly related to subsequent death from coronary artery disease were age and blood pressure, with less consistent relationships to smoking, cholesterol level, and obesity (12).

V. Conclusion

In the present study, decreased serum magnesium and raised blood sugar levels were detected in patients with hypertension. Therefore health professionals dealing with hypertensive individuals should promote these investigations and a healthy lifestyle in such patients.

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