World Applied Sciences Journal 17 (10): 1261-1264, 2012
ISSN 1818-4952

Fasting Blood Glucose and Serum Magnesium Levels in Patients with Hypertension

[1]Muhammed Khalid Shaikh, [2]Javed Akhtar Samo, [1]Ghulam Mustafa Mangrio, [1]Kashif Fazlani, [1]Bikha Ram Devrajani, [1]Syed zulfiquar Ali Shah and [1]Samina Shaikh

[1]Department of Medicine, Liaquat University of Medical and Health Sciences Jamshoro, Hyderabad (LUMHS), Pakistan
[2]Ghulam Muhammad Mahar Medical College (GMMMC) Sukkur, Sindh, Pakistan

Abstract: This study was conducted in relation to determine the fasting blood glucose and serum magnesium levels in patients with hypertension in department of Medicine, Liaquat University Hospital Hyderabad from July 2011 to December 2011. The hypertensive patients were recruited and evaluated for their fasting blood glucose and serum magnesium levels. A total of 100 hypertensive patients was evaluated, of which, 72 were males and 28 were females. The mean ages of male and female hypertensive subjects were 47.76±7.53 and 51.83±8.62 respectively. The mean serum magnesium in overall subjects was 2.86±0.63. Hypomagnesemia was observed in 62% subjects and raised fasting blood glucose was identified in 55% of individuals. The mean fasting blood sugar level in overall subjects was 137±5.00. The mean serum magnesium levels in hypermagnesemic, normomagnesemic and hypomagnesemic hypertensive individuals were 3.15±1.53, 2.25±0.72 and 1.25±0.63 respectively. The mean blood glucose levels in hyperglycemic, normoglycemic and hypoglycemic individual were 148.00±7.00, 92.00±4.00 and 59.00±6.00 respectively. The mean systolic and diastolic blood pressure levels in overall population were 180.00±12 and 108±10 respectively. Majority of the patients belonged to rural population (78%). Occurrence of low serum magnesium and raised blood sugar level in patients with hypertension was observed.

Key words: Magnesium · Hypertension · Fasting Blood Glucose

INTRODUCTION

Hypertension is defined as systolic blood pressure (SBP) level higher than 140mmHg and/or a DBP higher than 90mmHg. An elevated arterial blood pressure (chronic hypertension) is a common health problem worldwide and with ongoing global increase in the incidence. It is the most common cardiovascular disease with a prevalence ranging from 10 to 20% among adult population [1]. The subjects with hypertension possess two folds higher risk of developing coronary artery diseases, four times higher risk for congestive cardiac failure and seven times higher risk for stroke compared to normotensive subjects [2, 3]. Hypertension is an iceberg disease that could be described as the sleeping snake which bites when it wakes up but is a controllable disease and a 5 mmHg decrease in blood pressure can prevent 1,51,000 strokes and 1,53,000 chronic heart disease death [4].

Magnesium (Mg) is present in its greatest concentration within the cell and is the second most abundant intracellular cation after potassium. It is the 11th most abundant element by mass in the human body and its ions are essential to all living cells, where they play a major role in manipulating important biological polyphosphate compounds [4]. Many reports have carried out in recent years discussing the association between serum magnesium levels and hypertension [5, 6].

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 [7].

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

Corresponding Author: Muhammed Khalid Shaikh, Department of Medicine, Liaquat University of Medical and Health Sciences Jamshoro Hyderabad (LUMHS), Pakistan.

MATERIAL AND METHODS

This cross sectional study was conducted in a medical ward at Liaquat University Hospital Hyderabad from July 2011 to December 2011 on patients with history of hypertension for ≥ 02 years duration attending the medical OPD. The inclusion criteria for the study were; patient ≥ 18 years of age presented at Liaquat university hospital, of either gender, known cases and the patients who agreed to give consent for participation in the study where the secondary hypertensive cases were excluded from the study.

The detail history of the patients was taken and relevant clinical examination was performed. A written consent was taken from all patients for participation in the study and the blood pressure was measured in all subjects as per the recommendations of Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC –VII) [8]. 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 [9]. The subjects with levels between 101 and 125 mg/dL have impaired fasting glucose, a type of prediabetes. These levels are considered risk factors for diabetes mellitus and its complications. Diabetes / hyperglycemia was labeled in subjects with fasting blood glucose levels of 126 mg/dL or higher.

The data were collected on pre-designed proforma and all such maneuvers were under medical ethics. 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 between categorical variables at 95% confidence interval while independent t-test was also applied as far as mean±SD concerned. The p-value ≤ 0.05 was considered as statistically significant.

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

	Gender			
	Male	Female	Total	P-value
Serum magnesium				
Hypomagnesemia	39 (54.2%)	23 (82.1%)	62 (62.0%)	0.03*
Hypermagnesemia	04 (5.6%)	01 (3.6%)	05 (5.0%)	
Normal level	29 (40.3%)	04 (14.3%)	33 (33.0%)	
Total	72(100%)	28(100%)	100(100%)	

*p-value is statistically significant

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

	Gender			
	Male	Female	Total	P - value
Fasting blood sugar				
Raised	35 (48.6%)	20 (71.4%)	55 (55.0%)	0.05*
Low	04 (5.6%)	02 (7.1%)	06 (6.0%)	
Normal	33 (45.8%)	06 (21.4%)	39 (39.0%)	
Total	72(100%)	28(100%)	100(100%)	

*p-value is statistically significant

RESULTS

Out of 100 hypertensive subjects, 72 were males and 28 were females. The mean age of male and female hypertensive subjects was 47.76±7.53 and 51.83±8.62 respectively. The mean serum magnesium in overall subjects was 2.86±0.63. The serum magnesium level percentages in relation to gender were shown in Table (1). The mean blood sugar level in overall subjects was 137±5.00. The blood sugar level percentages in relation to gender were shown in Table (2). The mean serum magnesium levels in hypermagnesemic, normomagnesemic and hypomagnesemic hypertensive individuals were 3.15±1.53, 2.25±0.72 and 1.25±0.63 respectively. The mean blood glucose levels in hyperglycemic, normoglycemic and hypoglycemic individuals were 148.00±7.00, 92.00±4.00 and 59.00±6.00 respectively. The mean systolic and diastolic blood pressure levels in overall population were 180.00±12 and

Table 3: Magnesium and fasting blood sugar levels in hypertensive patients

	Fasting blood sugar				
	Raised	Low	Normal	Total	P - value
Serum magnesium					
Hypomagnesemia	51 (92.7%)	01 (16.7%)	10(25.6%)	62 (62.0%)	<0.01*
Hypermagnesemia	02 (3.6%)	01 (16.7%)	02(5.1%)	05 (5.0%)	
Normal	02 (3.6%)	04 (66.7%)	27(69.2%)	33 (33.0%)	
Total	55(100%)	06(100%)	39(100%)	100(100%)	

*p-value is statistically highly significant

108±10 respectively. The tabulated presentation of magnesium and blood sugar levels in hypertensive patients was shown in Table (3). The majority of the investigated patients (78%) belonged to rural population.

DISCUSSION

High blood pressure is one of the common cardiovascular risk factors in Pakistan affecting one in three individuals over the age of 45 years [10]. The National Health Survey of Pakistan (NHSP-1990-94) shows that 5.5 million men and 5.3 million women were hypertensive [11]. Hypertension is a multifactorial disorder but any individual risk factor can contribute to overall increase in blood pressure [12]. It is the most important modifiable risk factor of cardiovascular diseases. It is a disease of disordered auto-regulation of blood pressure [13]. Approximately 30% of adults are still unaware of their hypertension; up to 40% of people with hypertension are not receiving treatment; and, of those treated, up to 67% do not have their blood pressure (BP) controlled to less than 140/90 mm Hg [14]. Investigations of the association between serum magnesium and blood pressure have yielded conflicting results. Hvarfner *et al*. [15] found a positive association between serum magnesium and blood pressure in 58 hypertensive patients and 124 controls studied in Uppsala, Sweden.

In the present study we identified low serum magnesium level in hypertensive individuals, and this decrease is statistically significant (p=0.03) which correlates with the observed higher incidence of hypomagnesaemia in men compared to women. A study by Champagne *et al*. [5] 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. [16]. Peterson and co-workers [17] reported a significant increase in correlation between serum magnesium levels and systolic blood pressure. Rinner *et al*. [18] found a relation between serum magnesium and blood pressure in Dutch population.

In present study the fasting blood glucose was statically significant in hypertensive cases but the significance may be due to the presence of 55% diabetic cases among the hypertensive patients. The association found in our population between hypertension and impaired fasting glucose (IFG) could probably be related to the metabolic syndrome [19]. Hyperglycemia clusters with hypertension, dyslipidemia and obesity occurs in isolation in less than 20% of the population [20]. 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 [21] An elevated incidence of systolic hypertension was found in Pima Indians with glucose intolerance: 13.0% had SBP =160 mm Hg compared with only 7.1% in normoglycemic patients and 19.8% in diabetic patients [22]. Moreover, Fuller *et al.* [23] 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.

In the present study, raised serum magnesium and blood sugar levels were detected in patients with hypertension. Therefore, health care professionals must not only identify and treat patients with hypertension but also promote a healthy lifestyle and preventive strategies to decrease the prevalence of hypertension in the general population.

REFERENCES

1. Pimenta, E., K.K. Gaddam, S. Oparil, I. Aban, S. Husain, L.J. Dell'Italia and D.A. Calhoun, 2009. Effects of Dietary Sodium Reduction on Blood Pressure in Subjects With Resistant Hypertension Results From a Randomized Trial. Hypertension, 54: 475-481.
2. Falaschetti, E., M. Chaudhury, J. Mindell and N. Poulter, 2009. Continued Improvement in Hypertension Management in England Results From the Health Survey for England 2006. Hypertension, 53: 480-486.
3. Feldman, R.D., G.Y. Zou, M.K. Vandervoort, C.J. Wong, S.A.E. Nelson and B.G. Feagan, 2009. A Simplified Approach to the Treatment of Uncomplicated Hypertension A Cluster Randomized, Controlled Trial. Hypertension, 53: 646-653.

4. Datla, S.R. and K.K. Griendling, 2010. Hypertension Highlights Reactive Oxygen Species, NADPH Oxidases and Hypertension. Hypertension, 56: 325-330.
5. Champagne, C.M., 2008. Magnesium in hypertension, cardiovascular disease, metabolic syndrome, and other conditions: a review. Nutr. Clin. Pract., 23(2): 142-51.
6. Touyz, R.M., 2003. Role of magnesium in the pathogenesis of hypertension. Mol Aspects Med., 24(1-3): 107-36.
7. Kearney, P.M., M. Whelton, K. Reynolds, P. Muntner and P.K. Whelton, 2005. Global burden of hypertension: Analysis of worldwide data. Lancet, 365(9455): 217-223.
8. Mancia, G., G. Grassi and European Society of Hypertension; European Society of Cardiology, 2005. Joint National Committee VII and European Society of Hypertension/European Society of Cardiology guidelines for evaluating and treating hypertension: a two-way road. J. Am. Soc. Nephrol, Suppl., 1: S74-7.
9. Shaikh, M.K., B.R. Devrajani, A.A. Soomro, S.Z.A. Shah, T. Devrajani and T. Das, 2011. World Applied Sciences Journal, 12(10): 1803-1806.
10. Nishtar, S., A.M.A. Faruqui, M.A. Mattu, K.B. Mohamud and A. Ahmed, 2004. The National Action Plan for the prevention and control of non-communicable diseases and health promotion in Pakistan - Cardiovascular Diseases. J. Pak Med. Assoc., 54(3 Suppl): S14-25.
11. Pakistan Medical Research Council, 1998. National Health Survey of Pakistan 1990-1994. Islamabad 1998.
12. Assmann, G., P. Cullen and H. Schulte, 1998. The Munster Heart Study (PROCAM): results of follow-up at 8 years. Eur. Heart J., 83(19 suppl): 2-1.
13. Imafidon, K.E. and P. Igbinaduwa, 2007. Effect of Dry Powdered Leaves of Loranthus bengwensis L. (African Mistletoe) on Blood Pressure and Electrolyte Level of Normal and Hypertensive Rats. Global Journal of Biotechnology & Biochemistry, 2(2): 51-53.
14. Oyadeyi, A.S., A.O. Afolabi, F.O. Ajao and G.F. Ibironke, 2006. Resting Blood Pressure and Blood Pressure Reactivity: Contributions to Experimental Pain Report in Healthy Males. World Journal of Medical Sciences, 1(2): 90-92.
15. Hvarfner A., R. Bergstrom, R.C. Morlin, L. Wide and R. Ljunghall, 1987. Relationship between magnesium metabolic indices and blood pressure in patients with essential hypertension, compared with a healthy Population. J. Hypertens, 5: 451-6.
16. Ronghua, L., L. Yuqi, L. Zongbin, Y. Li, W. Shiwen and G. Min-Xin, 2009. Failures in Mitochondrial $tRNA^{Met}$ and $tRNA^{Gln}$ Metabolism Caused by the Novel 4401A>G Mutation Are Involved in Essential Hypertension in a Han Chinese Family, 2009. Hypertension, 54(2): 329-337.
17. Peterson, B., M. Schroll, C. Christiasen and I. Transbol, 1977. Serum and erythrocyte magnesium in normal elderly Danish people. Acta. Med. Scand, 201: 31-34.
18. Rinner, M.D., L. Splient-Van-laar and D. Kromhout, 1989. Serum sodium, potassium, calcium and magnesium and blood pressure in a dutch population. J. Hypertension, 7(12): 977-81.
19. Ferrannini, E., G. Buzzigoli, R. Bonadonna, M.A. Giorico, M. Oleggini, L. Graziadei, R. Pedrinelli and L. Brandi, 1987. Bevilacqua S. Insulin resistance in essential hypertension. N Engl. J. Med., 317: 350-357.
20. Reaven, G.M., 1988. Role of insulin resistance in human disease. Diabetes, 37: 1595-1607.
21. Manicardi, V., L. Camellini, G. Bellodi, C. Coscelli and E. Ferrannini, 1986. Evidence for an association of high blood pressure and hyperinsulinemia in obese man. J. Clin. Endocrinol. Metab., 62: 1302-04.
22. Saad, M.F., W.C. Knowler, D.J. Pettitt, R.G. Nelson, D.M. Mott and P.H. Bennett, 1990. Insulin and hypertension. Relationship to obesity and glucose intolerance in Pima indians. Diabetes, 39: 1430-35.
23. Fuller, J.H., M.J. Shipley, G. Rose, R.J. Jarrett and H. Keen, 1983. Mortality from coronary heart disease and stroke in relation to degree of glycemia: the Whitehall Study. BMJ, 287: 867-870.