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Study of Serum magnesium levels in Type -2 Diabetes Mellitus

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ABSTRACT

Background: The global burden of diabetes and its related complications is growing at an unprecedented level. India has the highest no of diabetics in the world. Various modalities of treatment are being explored to retard the progression of the disease apart from the traditional hypoglycemic agents. Newer theories have tried to link elements like magnesium and Vitamin D to the glucose metabolism. This study tries to associate deficiency of magnesium levels with the risk of diabetes mellitus.

Objectives: To compare the levels of serum magnesium in patients with type 2 diabetes mellitus and normal healthy individuals and a correlation of these values with the glycemic control.

Materials and Methods: It is an observational study done comparing the magnesium levels in 50 patients with diabetes with 50 matched healthy individuals.

Results: The mean FBS levels among cases and controls were 230. ±17.8 mg/dl and 99.42±25.4 mg/dl respectively. The mean serum magnesium levels among diabetic group and control group were 1.67±0.37 mg/dl and 2.03±0.25 respectively, the difference being statistically significant (p<0.01). Among the diabetic group the mean serum creatinine levels among those with controlled and uncontrolled group were 0.93±0.56 mg/dl and 1.33±0.29 mg/dl respectively. There was statistically significant (p<0.01) difference between controlled and uncontrolled diabetes group with respect to serum creatinine levels.

Conclusion: This study revealed a definite lowering of serum magnesium in diabetic patients and the levels are inversely proportional to the level of glycemic control. Magnesium levels are further lower in patients with diabetic complications.

Key Words: Hypomagnesemia, Diabetes mellitus, Glycemic control

INTRODUCTION

There has been increased interest about the role of magnesium ion in the pathogenesis of diabetes mellitus particularly the progression of the disease. Studies have associated hypomagnesaemia occurring at an increased frequency among patients with diabetes Mellitus compared with their counterparts without diabetes. Although diabetes is known to induce hypomagnesaemia, magnesium deficiency has also been proposed as a risk factor for diabetes mellitus type 2. Lower than normal levels of magnesium occurs at an incidence of 13.5 to 47.7% among diabetes patients. Hypothesis explaining this deficiency include decreased dietary intake, altered insulin metabolism, glomerular hyperfiltration, osmotic diuresis, autonomic dysfunction, recurrent metabolic acidosis, hypophosphatemia, and hypokalemia. In diabetics hypomagnesaemia is more commonly linked to those subset who have poor control of sugars, atherosclerotic arteries specifically coronary arteries, hypertension, micro and macro vascular

complications like diabetic retinopathy, nephropathy, neuropathy, and foot ulcerations. It has been postulated that the increased incidence of hypomagnesaemia among diabetics is multifactorial.¹ Many studies have suggested that magnesium supplementation has a beneficial effect on insulin action and glucose metabolism in diabetics.² Low serum magnesium levels have been reported in type 1 and type 2 diabetes mellitus regardless of the type of therapy.³

To compare the levels of serum magnesium in patients with type 2 diabetes mellitus and normal healthy individuals and a correlation of these values with the glycemic control.

MATERIALS AND METHODS

The study was conducted in medical college hospital and research and research center in Vijayapur. A total of 50 cases of type-2 diabetes mellitus were included in the study after sat-

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isfying the inclusion and exclusion criteria. 50 non diabetic patients were included as controls.

The inclusion criteria included patients diagnosed as diabetes mellitus as per WHO criteria. Patients excluded from this study were those diabetics who had associated hypertension, gastrointestinal disorders, impaired renal function, alcoholism, pancreatitis, other endocrinal disorders, those on diuretic therapy and aminoglycosides.

Fasting blood samples were collected for glucose levels. Serum magnesium and creatinine levels were also done in both groups of patients. Serum magnesium was measured by Calmagite endpoint method.^{4,5}

The Data was analyzed using z test and chi square test.

RESULTS

The mean age of the patients in diabetic group was 55.42±12.65 years whereas in controls it was 55.58±12.84 years.

Both among the cases and controls the sex distribution was same i.e. 62% males and 38% females. The maximum numbers of patients were in the age group of 41-50 years (42%).

The mean FBS levels among cases and controls were 230.±17.8 mg/dl and 99.42±25.4 mg/dl respectively. The mean serum magnesium levels among diabetic group and control group were 1.67±0.37 and 2.03±0.25 mg/dl respectively (Table 1), the difference being statistically significant ($p<0.01$). Among the diabetic group the mean serum magnesium levels in that subset with uncontrolled diabetes were 1.45±0.34 compared to 1.59±0.16 in those with controlled diabetes. (Table 2)

Among the diabetic group the mean serum creatinine levels among those with controlled and uncontrolled group were 0.93±0.56 mg/dl and 1.33±0.29 mg/dl respectively. There was statistically significant ($p<0.01$) difference between controlled and uncontrolled diabetes group with respect to serum creatinine levels.

DISCUSSION

Magnesium is a very important element for the human body. It is the fourth most abundant cation and the second most abundant intracellular cation after potassium. It serves as a cofactor in more than 300 enzymatic reactions mainly involving transfer of phosphate group. It is indispensable for maintaining neuromuscular excitability and has an important role in the maintenance of cardiac function.⁶ The ubiquitous nature of magnesium in a wide variety of cellular processes critical to glucose metabolism, insulin action and cardiovas-

cular functions has been well studied.⁷ The incidence of sub-clinical magnesium deficiency is common in diabetes and cardiovascular disorders.⁸

Our observations revealed a definite lowering of serum magnesium in diabetic patients. These observations correlate well with previous studies.

Nagase N et al. studied the interrelationships between hypertension, ischemic heart disease and diabetes mellitus. They concluded that serum magnesium level of poorly controlled diabetic patients is lower than that of well controlled diabetic patients.⁹ Similar conclusions were also derived by Nadler JL et al.

The present study did not evaluate the interrelations between hypertension, ischemic heart disease but had similar results. All three studies showed lower serum magnesium levels in diabetics when compared to controls.

Dietary supplementation with magnesium in addition to classical therapies for diabetes may help in prevention or delaying of diabetic complication. Some studies have documented that oral magnesium supplementation improves insulin sensitivity and metabolic control in type 2 diabetics with lower serum magnesium levels.¹⁰ It has also been shown that it has beneficial effect on lipid profile of diabetic patients.

CONCLUSION

Consequently, we suggest hypomagnesaemia as a possible risk factor in development and progress of diabetic complications. Exact cause of diabetic hypomagnesaemia is still unknown but an increased urinary loss of magnesium may contribute to it.^{11, 12}

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Table 1 : Comparison between cases and controls

	Cases	Controls
Fasting Blood glucose	230. ±17.8 mg/dl	99.42±25.4 mg/dl
Mean serum magnesium levels	1.67±0.37 mg/dl	2.03±0.25 mg/dl

Table 2: Comparison between Controlled and uncontrolled diabetics

	Controlled Diabetes	Uncontrolled Diabetes
Mean serum magnesium levels	1.59±0.16 mg/dl	1.45±0.34 mg/dl
Mean serum creatinine levels	0.93±0.56 mg/dl	1.33±0.29 mg/dl