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ASSOCIATION OF SERUM MAGNESIUM LEVEL WITH DIABETES MELLITUS

Medicine

Dr.Veena Munavalli Asstistant Professor, M.D, Department of Medicine, HSK AND S N Medical College, Bagalkot, Karnataka, India.

Dr. Sneha Patil* Senior Resident, Department of Medicine, Department of Medicine, Gadag Institute of Medical Sciences, Gadag, Karnataka, India. *Corresponding Author

ABSTRACT

Magnesium is an essential ion for human health, as it is involved in virtually every mechanism in the cell. Multiple factors in diabetic patients lead to hypomagnesemia. Hypomagnesemia in turn leading to deterioration of glycemic control and increased incidence of microvascular complication of diabetes mellitus. Thus, this study is undertaken to evaluate the relationship of serum magnesium with glycemic control and microvascular complications of type 2 DM.

Aims and objectives: To estimate serum magnesium levels in type 2 Diabetes mellitus. To study the association of hypomagnesemia with glycemic control and microvascular complications of type 2 diabetes mellitus.

Settings and Design: Case-control study

Methods and Material: 70 type 2 diabetes mellitus patients' serum magnesium was assessed and was grouped into cases and controls according to the serum magnesium. Cases have Mg of 1.6mg/dl or less and controls with Mg of more than 1.6mg/dl. Glycemic control was compared among both the groups.

Statistical analysis used: Data were entered in MS-Excel and analyzed in SPSS V22. Chi-square test, t-test were applied to find significance. Karl Pearson correlation or spearman correlation was applied depends on nature of the data. P<0.05 was considered as statistically significant.

Results: There was no significant difference in mean duration of diabetes among both groups. Mean FBS was significantly (p= 0.03) high among the cases (221.33mg/dl) compared to controls (175.31mg/dl). Mean glycosylated hemoglobin, an important marker of glycemic control is 9.99g% and 8.46 g% among cases and controls respectively. (p = 0.002).

Conclusion: Hypomagnesemic diabetic patients have poor glycemic control when compared with patients with normal magnesium levels.

KEYWORDS

Diabetes, Magnesium

INTRODUCTION:

Magnesium is the fourth most abundant cation in the human body. It serves as co-factor for all the enzymatic reactions requiring ATP and kinases. It is an essential enzyme activator for neuromuscular excitability, cell permeability, regulator of ion channels and mitochondrial functions. It also acts as critical element in cellular proliferation, apoptosis, cellular and humoral immune reactions.[1-4]

Diabetes is included among the diseases with increased frequency of electrolyte abnormalities, where hypomagnesemia is frequent mainly by osmotic diuresis, poor dietary intake glomerular hyperfiltration, altered insulin metabolism, diuretic administration, recurrent metabolic acidosis and diabetic enteropathy causing magnesium loss due to diarrhea. Prevalence of hypomagnesemia in diabetic patients ranges from 14 to 48% compared to 2.5 to 15 % in healthy controls.[5]

Magnesium being important mediator of insulin action, alteration in homeostasis of Mg leads to damage to tyrosine kinase activity, unchaining the insulin resistance.[6] There is an inverse relationship of serum magnesium with glycemic control and microvascular complications in diabetes.[5] Studies have shown oral magnesium supplements improves secretion insulin sensitivity in both type 1 and type 2 diabetes.[7]

This reflects a viscious cycle as hypomagnesemia being a cause for insulin resistance, also a consequence of hyperglycemia and if it is chronic leading to micro and macro vascular complication of diabetes.[8] Thus this study was undertaken to study relation of hypomagnesemia with glycemic control in patients with diabetes mellitus.

SUBJECTS AND METHODS:

After obtaining institutional ethical clearance this study was conducted in our tertiary care hospital. We included both male and female patients with following inclusion criteria.

INCLUSION CRITERIA:

1. Patients with confirmed diagnosis of type 2 diabetes mellitus

Exclusion criteria:

1. Patients on injection insulin.
2. Patients on drugs affecting magnesium levels like diuretics, aminoglycosides and amphotericin-B.
3. Patients on vitamin and mineral supplements.
4. Patients during pregnancy or lactation.
5. Patients with chronic diarrhoea or malabsorption state.

For all the diabetic patients serum magnesium was assessed using semi automated machine. Fasting and post prandial blood sugars was assessed using fully automated analyser machine. Hba1c was assessed using naco card test.

RESULTS:

Data were entered in MS-Excel and analyzed in SPSS V22. Chi-square test, t-test were applied to find significance. Karl Pearson correlation or spearman correlation was applied depends on nature of the data. P<0.05 was considered as statistically significant.

The controls and cases were age and sex matched, mean age of controls and cases was 54.66 years and 59.43 years respectively (p = 0.06). Among controls15 were males and 20 were females. In cases, 19 were male and 16 were females (p=0.47).Mean duration of diabetes in controls was 4.61 years and among controls was 5.15 years [Table no 1].

The mean fasting blood sugar among cases is 221.33mg/dl and among controls is 175.31mg/dl. There is statistically significant difference between mean fasting blood sugars among cases and controls, p value being 0.003.[Table-2, Graph-1]

Mean post-prandial sugar in cases is 290.37mg/dl and among controls is 243.62mg/Dl. P value is 0.012, which is statistically significant. [Table-3]

Mean glycated hemoglobin is an important marker of glycemic control. Mean Hba1c among cases is 9.99g% and 8.46 g% among controls. P value is 0.002, is statistically significant.[Table-4]

DISCUSSION:

In this is case-control study, conducted among 70 type 2 diabetes mellitus patients were studied. After confirming Type 2 diabetes status, serum magnesium of patients is assessed. Patients with serum magnesium of 1.6mg/dl or less is are considered as cases. Patients with serum magnesium of more than 1.6mg/dl are considered as controls.

Mean duration of diabetes in controls was 4.61 years and among

controls was 5.15 years.

In our study, there is significant difference between mean FBS of patients among cases and controls. Mean FBS in cases being 221mg/dl and in controls it is 175mg/dl. **P value is 0.003.** In 2017, Abdul Wahib et al, conducted a study on 100 diabetic patients and concluded that prevalence of hypomagnesemia in Type 2 diabetics was 34%.[5] Diabetics with hypomagnesemiahad poor glycemic control and FBS among the patients with hypomagesemia was 172 compared to 137 among patients with normal magnesium.[9]

Arundhati Dasgupta et al in the year 2013, conducted study on 150 diabetic patients. Prevalance of hypomagnesemia was 11.33%. mean Hba1c in patients with hypomagnesemia was 11.9% and in normomagnesemic patients was 9.8% when compared to 9.99% and 8.46% respectively in our study.[10] The study also showed that hypomagnesemia was associated with poor glycemic control and other complications. In a study conducted on 60 diabetic patients in 2013 by Kundu D et al, it s seen that hypomagnesemia and albuminuria together or individually can be used as marker of diabetic retinopathy and are always associated with poor glycemic control with HbA1c of 10.54% in normal magnesium patients and 7.85% in other group.[11]

Other study done by Asha Khubchandani et al(2013) also had same results and they concluded that Hba1c provides a conceptual framework for the pathogenesis of secondary sequelae of diabetes and higher level of HbA1C increases risk for development of microangiopathy and macroangiopathy in diabetics.[11]

CONCLUSION:

Hypomagnesemia being a known complication of diabetes mellitus due to various causes, can lead to poor glycemic control. Studies regarding magnesium supplementation and its outcome in such cases are necessary to support this evidence and for better management of diabetes mellitus.

Table 1: Age and sex distribution of patients among each group.

	CASES	CONTROL
MEAN AGE (in years)	54.66	59.43
SEX-MALE FEMALE	19(54.3%) 16(45.7%)	15(42.9%) 20(57.1%)

Table 2: Comparison of fasting blood sugars among cases and controls

Variable	Group	N	Minimum	Maximum	Mean	SD	P-value
Fasting Blood Sugar	Cases	35	90.0	380.0	221.33	70.93	**0.003**
	Control	35	97.0	314.0	175.31	51.28	

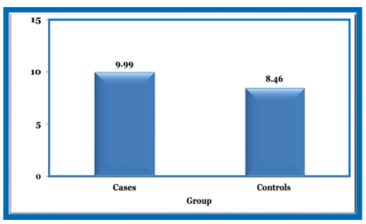
Table 3: Comparison of post prandial blood sugars among cases and controls

Variable	Group	N	Minimum	Maximum	Mean	SD	P-value
Post- prandial blood Sugars	Cases	35	140.0	492.0	290.37	83.66	**0.012**
	Control	35	109.0	396.0	243.62	65.99	

Table 4: Comparison of glycosylated hemoglobin among cases and controls

Variable	Group	N	Minimum	Maximum	Mean	SD	P-value
Glycosylated Hemoglobin	Cases	35	6.8	14.2	9.99	2.21	**0.002**
	Control	35	6.6	12.0	8.46	1.41	

Graph 1- Comparisons of glycosylated hemoglobin among the cases and control groups



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