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Original Research Paper

Diabetology

SERUM MAGNESIUM LEVELS IN TYPE 2 DIABETIC PATIENTS AT A TERTIARY CARE HOSPITAL

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ABSTRACT

AIM- The present study was undertaken to measure serum magnesium levels in type 2 diabetic patients as there are less studies reported to indicate the status of serum mg in these patients.

MATERIALS AND METHODS - A total of 100 patients with type 2 diabetic mellitus (50 women and 50 men) were taken for the present study from gmc jammu for diagnosis and treatment of diabetes, and 100 apparently healthy age and sex- matched individuals (42 women and 58 men) acted as control subjects. Body mass index, gender, serum magnesium, glucose and glycated haemoglobin levels were measured by standard methods and subjected to specific statistical methods of analyses.

RESULTS -A significant difference between levels of serum magnesium levels among diabetics and controls was seen. The mean serum magnesium levels in cases and controls are 1.20 mg/dl and 1.44 mg/dl respectively which was statistically highly significant ($p < 0.001$).

CONCLUSION: Hypomagnesemia, is common in patients with type 2 diabetes. It is wise that routine scrutiny for hypomagnesemia to be done in type 2 diabetes mellitus patients and the condition be treated whenever possible since magnesium levels correlates with various complications.

No significant correlation was seen between serum magnesium and age, or bmi. Like other studies there was marked reduction in serum magnesium levels in diabetic subjects with significant correlation to duration.

KEYWORDS : Diabetic Retinopathy, Glycosylated Haemoglobin, Hypomagnesemia, Type 2 Dm

INTRODUCTION:

Total Magnesium exit in three different forms;protein-bound form, complexed one and as a free cation [1]. Intra cellular magnesium is the most abundant form which act as a cofactor for many enzyme reactions [2, 3]. Mg-ATP complex plays an important physiological role in whole body metabolism, muscle contraction, methyl group transfer and few other processes [4]. Magnesium is further needed for insulin signal action, cell proliferation and also for plasma membrane of sodium, potassium and calcium ions. Experimental studies have shown that Mg may be involved in insulin secretion and sensitivity [5]. There is considerable body of evidence to suggest that hypomagnesemia and reduced levels of intracellular magnesium concentrations in diabetics [6]. Patients are considered to have low levels of serum magnesium when its concentration falls below 1.5 mg/dL (hypomagnesemia) and a concentration of ≤1.8 mg/dL as preclinical hypomagnesemia [7]. Increased renal loss of Mg may be witnessed in conditions like diabetes mellitus, aldosteronism or due to prolonged lactation or diuretics use apart from genetic deficiency syndromes [8, 9]. It is reported that type 2 Diabetes Mellitus (T2DM) is associated with hypomagnesemia due to poor reabsorption and increased excretion of Mg [10].

MATERIALS AND METHODS

The study was conducted in the department of Medicine GMC Jammu, from January 2016 to December 2016. One hundred patients of diabetes admitted to Government Medical College, Jammu, were studied. The patients were taken from the medical wards of the hospital based on random selection. Patients were considered to be diabetic as defined by American Diabetes Association (ADA) criteria. ADA criteria for diagnosis of diabetes mellitus which is: Serum Hb A1C ≥6.5%.The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay OR Fasting plasma glucose (FPG) ≥126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 h. OR 2-h FPG ≥200 mg/dL (11.1 mmol/L) during an OGTT. The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water. OR In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥200 mg/dL (11.1 mmol/L). Among diabetics, the above criteria were considered to include the patients for the study.

Inclusion criteria for case selection:

1) Urine sugar – positive 2) FPG > 126 mg/dl

Exclusion criteria for case selection:

1) Patients with congestive cardiac failure, urinary tract infection.
2) Ketonuria
3) pregnant patients

100 age and sex matched non diabetic patients admitted in the hospital were taken as controls after applying the same exclusion criteria which were applied for the cases. A brief examination was done which included personal interview; a physical examination was carried out. 5 ml of venous blood was collected under all aseptic precautions. Serum was separated and estimation of biochemical parameters was carried out within 4-6 h. The samples were analyzed for FPG by the glucose oxidase-peroxidase (GODPOD) method. [11] Serum magnesium by the Calmagite dye method. [12] The reference serum magnesium level by this method is 1.6 to 2.5 mg/dl.

DATA MANAGEMENT AND STATISTICAL ANALYSIS

During data collection completed questionnaires were checked regularly to check, to rectify any discrepancy, logical errors or missing information. The data entry was carried using Microsoft Office Excel worksheet and then exported to statistical software and analyzed using appropriate statistical tests by using Statistical Package for Social Services (SPSS version 21 for MAC IBM, Inc.). Means were calculated and t-test was applied to find out significance level.

RESULTS

It is a prospective study in which 200 subjects were included. Out of which 100 were Type 2 DM patients confirmed by biochemical investigations as per WHO criteria and 100 were non-diabetic apparently healthy control subjects. The age group of cases and controls were between 20-80 years. (Table 1)

Serum magnesium, FBS and post prandial blood sugar levels was measured in these subjects. FBS, PPBS and Mg levels are as shown in Table 2.

They were significantly higher in cases than in controls. Independent Sample T-Test The result was significant showing that, there is difference in mean Mg, FBS, and PPBS between control and diabetic. Serum magnesium was significantly decreased ($p<0.001$) in diabetics than controls. Correlations Pearson's correlation coefficient was used to find out the association between magnesium, FBS and PPBS. A significant negative correlation between serum magnesium, FBS and PPBS was observed (Table 3).

TABLE 1; COMPARISON OF TWO PARAMETERS IN TWO GROUPS (CONTROL AND CASES)

GENDER	CONTROL(n=100)	MALE	58
		FEMALE	42
	CASE(n=100)	MALE	50
		FEMALE	50
AGE(YRS)	CONTROL	44+_4	
	CASE	52+_3.2	

TABLE 2.COMPARISON OF THREE PARAMETERS IN TWO GROUPS (CONTROL AND CASES)

PARAMETERS		MEAN	S.D	P VALUE
FASTING BLOOD GLUCOSE FBS(mg/dl)	CONTROL	99.9	11.4	<0.001
	CASE	124.80	44.86	
POST PRANDIAL BLOOD GLUCOSE	CONTROL	108.76	25.27	<0.001
	CASE	236.6	88.10	
SERUM MAGNESIUM LEVEL(mmol/l)	CONTROL	1.44	0.766	<0.001
	CASE	1.20	0.345	

TABLE3. PEARSON'S CORRELATION

PEARSON'S CORRELATION	R VALUE	P VALUE
SERUM Mg2+ Vs FBS	-0.198	0.048
SERUM Mg2+ Vs PPBS	-0.206	0.040

TABLE 4.DURATION WISE SERUM MEAN MAGNESIUM LEVELS IN STUDY GROUP

DURATION (YRS)	MEAN	S.D	P VALUE
<3 (n=20)	1.5360	0.1670	0.0001
4-6(n=42)	1.2621	0.2846	
7-9(n=20)	1.044	0.1194	
>10(n=18)	1.015	0.1208	

*p value <0.05 is statistically significant

DISCUSSION

Diabetes accounts for a significant part of the morbidity and mortality. Diabetes is estimated to affect 25.6 million American adults and 366 million people worldwide, and the numbers will continue to increase to 552 million by 2030 globally. Therefore, primary prevention of type 2 diabetes through diet and lifestyle modifications is of paramount public health importance. Research over the past two decades has provided evidence of a clinical correlation between diabetes and low magnesium intake which may be a contributing factor in the progression of DM and its complications, [13] Comparing our study to the study done by Supriya Mohanty, et al (2013) which showed that FBS in their control group was 81.96mg/dL and 218.62mg/dL in case group. This comparison shows that the FBS value in our case group (124.8 mg/dL) was in discordance when compared to theirs (218.62mg/dL). The reason for this might be that most of the diabetics in our study group were probably under strict diabetic diet and hence under control.[14] PPBS value in control group of our study was found to be 108.76mg/dL and in case group it was 236.6mg/dL. This was in concordance with their study which showed 113.56mg/dL for control group and 285.04mg/dL for case group. [14]

The mean value of serum Mg in our control group was found to be 1.44mmol/L and in case group it was 1.20mmol/L. It is observed that serum Mg was significantly decreased ($p<0.001$) in diabetics than controls which is in concordance with the previous study. [14] Similar such decrease in serum magnesium level in diabetic's patients as compared to controls has been reported by some authors. [15-18]. Correlation of serum Mg level with FBS and PPBS levels in type 2 DM patients and control group was assessed using Pearson's correlation coefficient. A significant negative correlation between serum Mg v/s FBS and serum Mg v/s PPBS was observed in our study. Mg depletion has a negative impact on glucose homeostasis and insulin sensitivity in diabetic patients as well as on the evolution of complications such as retinopathy, thrombosis and hypertension. Preventing low Mg status in diabetics may therefore be beneficial in the management of the disease. The reasons for the high prevalence of Mg deficiency in diabetes are not clear, but may include increased urinary loss, lower dietary intake, or impaired absorption of Mg compared to healthy individuals. Several studies have reported increased urinary Mg excretion in type 1 and 2 diabetes. [19].

Conflict of Interest; the authors declare that they have no conflict of interest.

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