Serum Magnesium Levels In Type 2 Diabetes Mellitus And Its Correlation With HbA1C

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Abstract

Background

Type II Diabetes Mellitus is characterized by impaired insulin secretion and resistance to insulin action resulting in hyperglycemia. Magnesium has a role in improving insulin sensitivity. Insulin and glucose are important regulators of Mg metabolism. Intracellular Mg plays a key role in regulating insulin action, insulin-mediated-glucose uptake and vascular tone. Hypomagnesaemia lead to diabetic complication such as retinopathy, thrombosis and hypertension.

Objective

To compare serum magnesium level in diabetes mellitus patients with HbA1c<7 and HbA1c>7.

Material and Method

Prospective observational study was carried out in patients with diabetes mellitus. After detailed history, general and systemic clinical examination serum magnesium and HbA1c level were measured. Patients were divided in to two groups, one with HbA1c <7 and other with HbA1c >7, to find out whether there is any correlation between magnesium levels and glycemic control in diabetic patients.

Result

Out of 261 patients with type2 diabetes mellitus, 164 were male (62.8%) and 97 were female(37.2%). Mean serum magnesium level inpatients having HbA1c>7 was significantly low (1.12±0.50mg/dl) as compared to patients having HbA1c <7 (p-value

<0.0001). Serum magnesium and HbA1c had a negative (r=-0.358) but statistically significant (p-value <0.0001) correlation.

Conclusion

This study revealed that S magnesium levels had an inverse relation with HbA1C levels. If serum magnesium is low in diabetic patients, increased dietary intake of magnesium can be recommended.

Keywords

Type2diabetes, HbA1c, serum magnesium, hypomagnesaemia

Introduction

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia with disturbances of carbohydrate, fat and protein metabolism. Depending on the etiology of the DM, factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization and increased glucose production[.1] A recent report by WHO suggested that over 19% of world's diabetic population currently resides in India. The total numbers of patients are expected to be 366 billion by 2030.Glycosylated Hemoglobin A1c (HBA1c) reveals the overall blood glucose level over a period of 3 months.[2] Inverse relation between glycemic control and serum magnesium level has been observed in some studies. Decrease in magnesium level can lead to diabetic complication such as retinopathy, thrombosis and hypertension.[3]Type 2 diabetes mellitus is characterized by cellular and extracellular Mg depletion. Intracellular Mg plays a key role in regulating insulin action, insulin-mediated-glucose uptake and vascular tone. Mg deficit has been proposed as a possible underlying common mechanism of the "insulin resistance" of different metabolic conditions. Low dietary Mg intake is also related to the development of type2 diabetes.[4]

Magnesium serves as a co-factor for all enzymatic reactions that require ATP and as a key component in various reactions that require kinases.[5]Very few studies have been done to find relation of serum magnesium with Hb A1C, so this study was done to find relation of serum magnesium with Hb A 1 c.

Materials & Methods

A prospective observational study was carried out in patients with type 2 diabetes mellitus.

Inclusion Criteria

Diagnosed or newly diagnosed type 2 DM patients who were willing to participate in the study after taking written informed consent, age >18 years

Exclusion Criteria

Alcoholism, Patients with chronic diarrhea, on diuretic therapy, with malabsorption syndrome, on Magnesium supplementation or with chronic renal failure.

After detailed history, general and systemic clinical examination serum magnesium and HbA1c level were measured. Patients were divided in to two groups, one with HbA1c <7 and other with HbA1c >7. Relation of serum magnesium with Hb A 1c was noted.

Statistical Analysis

Data were entered in Microsoft excel sheet and analysed. Qualitative data or variables were expressed in number and percentages and Quantitative data or Continuous variables were expressed in Mean& Standard Deviation. Significance of difference in percentage were assessed by Chi-square Test. A P value <0.05was considered to be significant and a P value <0.001 as highly significant.

Results

In this study out of 261 cases of type 2 diabetes mellitus,62.8% cases were male while 37.2% were

female, with male female ratio of 1.69:1. It shows that DM had male dominancy.(table 1).

Out of 261, 32.9% had HbA1C ≤7 while 67.1% had HbA1c> 7.(table2)

On the basis of duration of disease(years), maximum patients 69% had long duration of disease >5 years followed by 26.4% patients had 3-5years of duration and 4.6% patients had ≤3 years of duration of disease(table3). Table 4 shows that mean serum magnesium level was 1.77±0.56mg/dl in patients with HbA1c levels ≤7.0 while mean serum magnesium level was 1.12±0.50mg/dl in patients with HbA1c >7. The difference was statistically significant (p -<0.0001) (table4)

Table 5 shows that magnesium and HbA1c had negative(r = - 0.358) but significant(< 0.0001) correlation. Serum magnesium level decreases as HbA1c level increases and vice-versa.(figure1)

Discussion

In present study maximum prevalence of type 2 diabetes mellitus was in males than females, and male to female ratio was 1.69:1. Our results were consistent with results of the study conducted by Nipun Saproo et al[6] 2017. They found that maximum patients (71%) of type-2 diabetes mellitus were male, with male to female ratio of 2.45:1. The range of HbA1c was 4.4 to 12.8%. HbA1c of 7% and less considered as good glycemic control, above 7% considered as poor glycemic control so we divided patients of type2 diabetes into 2 categories –one with HbA1c ≤ 7.0 and other with Hb A1c > 7.0. In our study 86(32.9%) patients had HbA1c level ≤ 7.0 while 175(67.1%) patients had HbA1c level >7.0. Most of the patients had HbA1c level >7.0. 12 (4.6%)patient had diabetes ≤ 3years, 69(26.4%) patients had diabetes duration 3-5 years while remaining 180(69.0%) patients had duration of diabetes > 5 years. It shows maximum patients in our study had diabetes duration >5 years. Our

results were similar to that observed by Nipun Saproo et al[6] 2017 in their study. They found that maximum patients (79%) had abnormal glycosylated haemoglobin levels.

In present study patients who had HbA1c ≤ 7.0 mean serum magnesium was 1.77 ± 0.56 mg/dl while in patients with HbA1c > 7.0 mean serum magnesium was 1.12 ± 0.50 mg/dl. and according to magnesium levels, we found that 60.5% patients with HbA1c level ≤ 7.0 had hypomagnesaemia (mg levels ≤ 1.7 mg/dl) and 39.5% patients had normal magnesium level(>1.7 mg/dl) while 89.7%patients with HbA1c >7.0had hypomagnesaemia (mg level ≤ 1.7 mg/dl) and 10.3% patients had normal magnesium level (>1.7 mg/dl). This shows that hypomagnesaemia is more common with uncontrolled diabetes and this difference was statistically significant (p value <0.0001). Similarly S. Ramadass et al[7] in his study observed that serum magnesium levels were found to decline with rise in HbA1c levels and duration of Type 2 DM. Sharma A et al[8] in his study concluded poor glycemic control was associated with hypomagnesaemia. In a study from Zurich, Switzerland, Walti MK et al[9] found that hypomagnesaemia was common in Type 2 DM but did not have any significant correlation with HbA1c.

In present study we found a negative (r = - 0.358) but significant (< 0.0001) correlation between serum magnesium and HbA1c. It shows Magnesium level decreases as HbA1c level increases. This study shows poor glycemic control strongly associate with hypomagnesaemia. Our results were in contrast with the results of Lords et al[10]. They did not find any significant correlation between Mg concentrations and glycemic control (r = -0.165; P = 0.12).

Conclusion

In conclusion, this study revealed that hypomagnesaemia and HbA1C levels are more in uncontrolled type 2 diabetes mellitus patients compared to controlled diabetic patients. Although hypomagnesaemia has been reported frequently in patients with type 2 diabetes mellitus, it is either overlooked or undertreated. If serum magnesium is low, increased dietary intake of magnesium should be recommended.

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Table 1: Distribution of patients on the basis of gender

Gender	No. of cases (n)	Percentage %
Male	164	62.8
Female	97	37.2
Total	**261**	**100**

Table 2: Distribution of patients on the basis of glycemic index (HbA1c)

HbA1c	No. of cases (n)	Percentage %
≤ 7.0	86	32.9
> 7.0	175	67.1

Table 3: Distribution of patients on the basis of duration of disease

Duration of disease(years)	No. of cases (n)	Percentage %
≤ 3	12	4.6
3 – 5	69	26.4
> 5	180	69.0
Total	261	100

Table 4: Comparison of Mean serum magnesium levels with glycemic index

	HbA1c ≤ 7.0	HbA1c > 7.0	t- value	P- value
S. Mg (mg/dl)	1.77 ± 0.56	1.12 ± 0.50	-9.484	< 0.0001

Table 5: Correlation of S Magnesium levels with HbA1c

parameters	Correlation coefficient (r)	P-value
Mg with HbA1c	- 0.358	< 0.0001

Figure 1: Correlation of Serum Magnesium levels with HbA1c.