Hypomagnesemia in Type-2 Diabetes Mellitus
SUDHA PRASANNA
Department of Biochemistry, MADRAS MEDICAL COLLEGE AND GOVERNMENT GENERAL HOSPITAL

Abstract: Magnesium is an intracellular cation. Insulin favours reabsorption of Magnesium from the loop of henle. In insulin resistance states like Type 2 Diabetes Mellitus, reabsorption of Magnesium from the loop of henle is reduced. Insulin dependent glucose uptake is decreased in hypomagnesemia. The objective of this study is to assess the serum level of magnesium in Type 2 Diabetic patients attending our hospital. This case-control study was conducted in the department of Diabetology in Rajiv Gandhi Government General Hospital Chennai. 100 patients of Type 2 Diabetes Mellitus, defined by fasting plasma glucose level more than 126 mg per dL were included in the study. The controls were 100 healthy subjects matched for age and sex. Serum magnesium was measured by spectrophotometry. The reference values are 1.8-3mg per dL. Results: The mean serum magnesium level in cases and controls were 1.79 (plus or minus 0.619) and 2.03 (plus or minus 0.356) respectively. Student t test was used to calculate statistical significance and significant difference was found in magnesium levels between cases and controls. Conclusion: Serum magnesium maybe a significant risk factor for the Type 2 Diabetes Mellitus

INTRODUCTION:
Diabetes Mellitus is a metabolic disorder characterized by chronic hyperglycaemia. There is disturbance of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, action or both. When fully expressed it is characterized by fasting hyperglycaemia.

The majority of cases fall into two broad aetiopathogenic categories, now called Type 1 and Type 2 Diabetes Mellitus(1,2). Type 2 Diabetes involves both genetic susceptibility and environmental factors, although the genetic component may be greater in Type 2 than Type 1 Diabetes. Type 2 Diabetes is more common and it is characterized by disorder of insulin action or secretion either of which may predominate. They exhibit insulin resistance and relative rather than complete or absolute insulin deficiency. It is noted that individuals predominantly experience insulin resistance and others experience insulin deficiency which is preceded by insulin resistance (3). Type 2 Diabetes constitutes ~ 90% of the diabetes cases in India. Hypomagnesaemia defined as serum magnesium concentration  

Hypomagnesaemia occurs at the incidence of 13.5 to 47.7% among patients with Type 2 Diabetes (4,13). In particular although hypomagnesaemia has been reported to occur with increased frequency among patients with Type 2 Diabetes, it is frequently over looked and under treated.

MATERIALS AND METHODS:
Cases between 40-60 yrs of age were selected from patients attending the diabetic out patient department of our hospital. 100 cases of Type 2 Diabetes Mellitus patients were selected. 100 age and sex matched healthy volunteers were selected as controls. The study was conducted after obtaining informed consent from the study population. Patients with hypertension, ischaemic heart disease, and chronic infections were excluded.

Five milliliters of fasting venous blood was collected from the study population. The samples were centrifuged, separated and analyzed for fasting plasma glucose. Serum samples were used for serum magnesium estimation.

Fasting plasma glucose was investigated by the enzymatic GOD – POD Method. Serum Magnesium by Calmagite method.

STATISTICAL ANALYSIS Independent t-test was used to compare and P value obtained. P value < 0.05 was considered significant.

RESULTS
This study conducted with 100 Type 2 Diabetic patients (cases) and 100 healthy volunteers (controls). The result comparing cases with controls are shown in table-1. T-test comparison for various biochemical parameters between cases and controls. There was significant difference in fasting plasma glucose values when compared between cases and controls (P=0.0003) as shown in Table1.
There was significant difference in serum magnesium values when compared between cases and controls (P=0.0005) as shown in Table 1.

<table>
<thead>
<tr>
<th>Biochemical parameters</th>
<th>Cases</th>
<th>Controls</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting Plasma Glucose mg/dl</td>
<td>100.1±10.35</td>
<td>94.9±3.99</td>
<td>0.0003</td>
</tr>
<tr>
<td>Serum Magnesium</td>
<td>1.79±0.61</td>
<td>2.03±0.36</td>
<td>0.0005</td>
</tr>
</tbody>
</table>

DISCUSSION:

Diabetes mellitus is the commonest non-communicable disease with increasing incidence and poses a greatest global and public health problem (14). Hypomagnesemia has been linked to poor glycaemic control. The increased incidence of hypomagnesemia among patients with Type 2 Diabetes presumably is multifactorial (4,15).

Possible causes of hypomagnesemia in patients with Type 2 diabetes

Decreased intake Oesophageal dysfunction Diabetic gastroparesis Enhanced gastrointestinal loss Diarrhoea as a result of autonomic dysfunction Enhanced renal magnesium loss Enhanced filtered load Glomerular hyperfiltration Osmotic diuresis (glucosuria)

Volume expansion as a result of excessive volume replacement Metabolic acidosis (diabetic ketoacidosis) Hypoaalbuminemia, microalbuminuria and overt proteinuria

Reduced renal reabsorption Endocrinologic dysfunction: insulin deficiency or resistance

Low magnesium levels may promote endothelial cell dysfunction and thrombogenesis via increased platelet aggregation and vascular calcification (16). Magnesium is crucial in DNA synthesis and repair, it is possible that magnesium deficiency may interfere with normal cell growth and regulation of apoptosis (17).

Hypo magnesemia may induce altered cellular glucose transport, reduced pancreatic insulin secretion, defective postreceptor insulin signaling and altered insulin-insulin receptor interactions.

Hypo magnesemia also leads to various diabetic micro-macro vascular complications. There was an inverse association between serum magnesium and risk for coronary heart disease (18) observed among men with diabetes. The link between hypomagnesemia and diabetic retinopathy was reported in patients with type 2 diabetes (20). Hence, efforts to minimize hypomagnesemia in the routine management of diabetes are warranted. Oral magnesium treatment during a 16 weeks period was suggested to improve insulin sensitivity and metabolic control (21).

CONCLUSION:

There is significant different in serum magnesium level between cases (Type 2 diabetes mellitus) and controls. Serum magnesium level in diabetic patients in lower when compared to So, monitoring serum magnesium levels and supplementation of magnesium may help to prevent adverse outcomes.

REFERENCES


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