EVALUATION OF ASSOCIATION OF SERUM MAGNESIUM AND HS-CRP IN TYPE 2 DIABETES MELLITUS

INTRODUCTION: Type 2 diabetes mellitus is now recognized as an inflammatory condition associated with insulin resistance and abnormal endothelial vascular reactivity. High sensitive C-reactive protein (hs-CRP) is an established marker of low grade systemic inflammation. Low magnesium level has been linked to reduced insulin sensitivity and increased risk of type 2 diabetes mellitus. Low magnesium has a direct role in promoting endothelial dysfunction by generating a pro-inflammatory, prothrombotic and proatherogenic environment. Hypomagnesaemia has been implicated in adversely affecting diabetic complications. Because serum Magnesium and hs-CRP reflect closely related component of the same disease process, a strong relationship between these variables may be anticipated. We selected 50 patients of Type-2 diabetes mellitus and 50 normal healthy individuals to evaluate the association between serum magnesium and hs-CRP. Statistical analysis depicted a non-significant (p > 0.05) negative correlation (r = 0.20) between serum magnesium and hs-CRP in type 2 diabetic patients. This data supports the hypothesis that hypomagnesaemia and hs-CRP may be involved independently in the pathogenesis of diabetes and its complications.

MATERIALS AND METHODS: The present study was a case control prospective study undertaken in the Department of Biochemistry in collaboration with Department of Medicine, Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar. A total of 100 subjects willing to participate in the study. The patients and controls were screened for fasting blood sugar (FBS), lipid profile, serum hs-CRP and magnesium and the values were compared with that of normal healthy subjects. Hs-CRP was estimated by Quantia - CRP (M.A. Mendall et al 1996), a turbidimetric immunoassay. Magnesium was estimated by Calmagite method. Mg depletion negatively affects the glucose homeostasis and insulin sensitivity in diabetic patients as well as the complications such as retinopathy, nephropathy and hypertension. The Recommended Daily Allowance (RDA) for magnesium is 6 mg/kg/day (Jerry L et al 2000). Low Magnesium levels may promote endothelial cell dysfunction and thrombogenesis via increased platelet aggregation and vascular calcification.

Because hs-CRP and Mg seems to be closely related component of the same disease process, a strong relationship between these variables may be anticipated.

RESULTS: There was no significant effect of age (p > 0.05) and sex distribution (p > 0.05) in the study. Table 1 shows that FBS, Hba1c, total cholesterol, triglyceride and hs-CRP levels were significantly high in cases when compared to controls while Mg and HDL-C were significantly low in cases as compared to the controls. Table 2 shows that FBS and Hba1c were significantly correlated with hs-CRP and Magnesium in type 2 diabetics. Total cholesterol, triglycerides and HDL-C had no significant correlation with hs-CRP.

Table 1: Comparison of various parameters estimated in patients and controls

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cases</th>
<th>Controls</th>
<th>p value</th>
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</thead>
<tbody>
<tr>
<td>Fasting blood sugar (mg/dl)</td>
<td>194.38 ± 53.60</td>
<td>100.30 ± 12.46</td>
<td>&lt; 0.001*</td>
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<td>Hba1c (%)</td>
<td>8.758 ± 1.83</td>
<td>5.148 ± 0.51</td>
<td>&lt; 0.001*</td>
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<tr>
<td>Total cholesterol (mg/dl)</td>
<td>223.20 ± 45.41</td>
<td>174.46 ± 33.90</td>
<td>&lt; 0.001*</td>
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<tr>
<td>Triglycerides(mg/dl)</td>
<td>224.70 ± 76.77</td>
<td>161.14 ± 32.42</td>
<td>&lt; 0.001*</td>
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<tr>
<td>HDL-C(mg/dl)</td>
<td>40.48 ± 8.18</td>
<td>55.00 ± 12.04</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>hs-CRP (mg/dl)</td>
<td>1.29 ± 1.79</td>
<td>0.57 ± 0.09</td>
<td>&lt; 0.005**</td>
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<tr>
<td>Magnesium (mg/dl)</td>
<td>1.09 ± 0.29</td>
<td>2.09 ± 0.29</td>
<td>&lt; 0.001*</td>
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</tbody>
</table>

**P < 0.001 = highly significant
*P < 0.05 = significant
***P > 0.05 = non significant
but a significant correlation with Mg in type 2 diabetic patients.

Table 2: Correlation of hs-CRP and Magnesium in type 2 Diabetes Mellitus with FBS, HbA1c and lipid profile parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>FBS (mg/dl)</th>
<th>R</th>
<th>P</th>
<th>HbA1c (%)</th>
<th>R</th>
<th>P</th>
<th>Total cholesterol (mg/dl)</th>
<th>R</th>
<th>P</th>
<th>Triglycerides(mg/dl)</th>
<th>R</th>
<th>P</th>
<th>HDL-C(mg/dl)</th>
<th>R</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>hs –CRP (mg/dl)</td>
<td>0.404</td>
<td>0.004</td>
<td>**</td>
<td>0.051</td>
<td>&lt;0.001</td>
<td>*</td>
<td>0.017</td>
<td>0.906</td>
<td>**</td>
<td>0.151</td>
<td>0.294</td>
<td>*</td>
<td>-0.051</td>
<td>0.724</td>
<td>**</td>
</tr>
<tr>
<td>Magnesium (mEq/L)</td>
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<tr>
<td>Fasting blood sugar</td>
<td>0.432</td>
<td>0.002</td>
<td>**</td>
<td>0.320</td>
<td>&lt;0.001</td>
<td>*</td>
<td>0.189</td>
<td>0.011</td>
<td>&lt;0.001</td>
<td>*</td>
<td></td>
<td></td>
<td>-0.176</td>
<td>0.033</td>
<td>**</td>
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<td>Hypomagnesemia</td>
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Discussion:

In our study, a highly significant difference in levels of magnesium were found between patients and controls (p<0.001). Similar observations were found in other studies. [23][24][25] Various clinical studies demonstrated that diabetics with hypomagnesemia showed reduced pancreatic β-cell activity. Insulin receptor autophosphorylation is dependent on intracellular Mg++ concentrations, making Mg++ a direct factor in the development of insulin resistance. Conversely, insulin is an important regulator of Mg++ homeostasis. In the kidney, insulin activates the renal Mg++ channel melastatin type 6 that determines the final urinary Mg++ excretion. Consequently, patients with T2DM and hypomagnesemia enter a vicious circle in which hypomagnesemia causes insulin resistance and insulin resistance reduces serum Mg++ concentrations. [26][27][28] Patients with hypomagnesemia show a more rapid disease progression and have an increased risk for diabetes complications. [29] Preventing hypomagnesemia may therefore be considered in the management of the disease. [30][31] In our study we found a highly significant positive correlation between FBS, HbA1c and Mg. These findings were supported by Sharma A et al (2007) [32] and R D Ankush et al (2009) [33] who showed a strong positive correlation (p<0.001). Mg depletion has a negative impact on glucose homeostasis and insulin sensitivity in patients with type 2 diabetes as well as on the evolution of complications such as retinopathy, thrombosis and hypertension. [34][35] Insulin secretion requires magnesium: magnesium deficiency results in impaired insulin secretion. It has been suggested that hypomagnesemia may induce altered cellular glucose transport, reduced pancreatic insulin secretion, defective post receptor insulin signaling, and/or altered insulin–insulin receptor interactions. [36][37] In our study, we found a highly significant correlation between magnesium and total cholesterol, triglyceride and HDL (Table II) which was supported by Hamid Nasri et al (2008) [38] No significant correlation between magnesium and lipid profile parameter may suggest that magnesium act as an independent marker for cardiovascular risk factor.

Very few studies have been conducted on the analysis of the correlation between serum Magnesium and hs-CRP in the type 2 diabetic patients. In our study, on statistical analysis there was non-significant (p=0.05) negative correlation (r=-0.20) between serum magnesium and hs-CRP. This data supports the hypothesis that hypomagnesemia and hs-CRP may be involved independently in the pathogenesis of diabetes and its complications which might require further evaluation. One drawback in our study can be small sample size. A study by G Romero et al (2011) [39] showed that severe hypomagnesemia (Odds Ratio (OR): 8.1 and Confidence Interval (CI) 95%: 3.6-19.4 and OR: 3.7; CI 95%: 1.1-12.1) was strongly associated with elevated hs-CRP in patients of metabolic syndrome.

References:


