“Study Of Serum C-Peptide Levels In 50 Newly Detected Diabetes Subjects Of Age Group 30-40 Years In Nellore”

V.V.N.Goutham, M.V.K.Chaitanya, Kale Dasu

ABSTRACT: Background: Diabetes mellitus, a chronic metabolic disorder, is a major cause of mortality and morbidity worldwide. Measurement of C-peptide, which is co-secreted with insulin from beta cells of pancreas (proinsulin, insulin C-peptide) provides an index of endogenous insulin Production and pancreatic beta cell function. This study is to demonstrate or test the ability of serum C-peptide levels as a marker in initiating appropriate drug therapy and classifying newly detected diabetes in subjects between the age group 30 and 40 years. Aim: To investigate the ability of classifying diabetes mellitus with serum C-peptide levels in 50 young (30-40 years) newly detected diabetic subjects. To distinguish those who require insulin treatment from others who can be managed by diet, exercise and oral anti diabetic drugs as initial therapy. Method: This is a hospital based cross-sectional study has been carried for more than one and half year in the Department of General Medicine, Narayana Medical College & Hospital, Nellore involving 50 patients. Data collection was done by clinical history, examination and investigations. These details were recorded. The data collected was subjected to statistical analysis for determining the significance of the results. Informed consent and their willingness obtained from these subjects have been documented. Results: Measurement of C-peptide levels in a young newly detected diabetic adult helps us a) to distinguish between type 1 behaviour and type 2 behaviour b) in initiation of treatment. Majority of the subjects who had low serum C-peptide levels also had low BMI, suggesting a positive correlation between C-peptide levels and BMI. Majority of the subjects with positive family history had normal or high serum C-peptide levels suggesting a positive family history favours type 2 behaviour. Conclusions: This study suggests measurement of C-peptide levels in newly detected diabetic subjects is of great value.

Key words: c-peptide, Diabetes, Age, BMI.

Introduction

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. Depending on the etiology of the DM, factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and increased glucose production. The metabolic dysregulation associated with DM causes secondary pathophysiologic changes in multiple organ systems that impose a tremendous burden on the individual with diabetes and on the health care system. The prevalence of diabetes for all age groups worldwide was estimated to be 2.8% in 2000 and about 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030. The greatest absolute increase in the number of people with diabetes will be in India from 31.7 millions in 2000 to 79.4 millions in 2030. India is thus designated to become the diabetes capital of the world.

The magnitude of the problem is compounded by the various complications targeting vital organs. Type 2 Diabetes mellitus is the most common type of diabetes in the world constituting 90-95% of the diabetic population. The global prevalence of Type 2 Diabetes mellitus is estimated to increase from 4% in 1995 to 5.4% by the year 2025. Type 1 Diabetes mellitus accounts for only 5-10% of the diabetic population. The prevalence of Type 2 Diabetes mellitus is 2.4% in rural population and 11.6% in the urban population of India. Measurement of C-peptide, which is co-secreted with insulin from beta cells of pancreas (proinsulin, insulin C-peptide) provides an index of endogenous insulin production and pancreatic beta cell function. Once diabetes is diagnosed, assay for C-peptide can be used to differentiate type 1 and type 2 behaviour and to distinguish those who require insulin treatment from others who can be managed by diet, exercise and oral antidiabetic drugs. The incidence of Type 1 behaviour among adults initially classified as Type 2 was found to be around 10%. The world statistics show that common age of detecting Type 2 Diabetes is 40-45 years. The Asian (Indian) Statistics show that it is 5-10 years earlier than that of world statistics. So our study focuses on individuals between 30-40 years. This study is to demonstrate or test the ability of serum C-peptide levels as a marker in initiating appropriate drug therapy and classifying newly detected diabetes in subjects between the age group 30 and 40 years.

Objectives:

1. To investigate the ability of classifying diabetes mellitus with serum C-peptide levels in 50 young (30-40 years) newly detected diabetic subjects.
2. To distinguish those who require insulin treatment.

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from others who can be managed by diet, exercise and oral antidiabetic drugs as initial therapy.

Materials and methods

Study design:- Hospital based, cross sectional, open labelled observational cohort study.

Subjects:- Fifty (50) subjects of newly diagnosed Diabetes Mellitus attending at Narayana Medical College, Nellore were studied.

Inclusion criteria:- Subjects in the age group of 30-40 years, who were newly diagnosed of Diabetes Mellitus according to WHO/ADA 2007 guidelines.

Exclusion criteria:-
1. Patients who were on treatment for type 2 diabetes mellitus.
2. Diabetic subjects less than 30 years age group and more than 40 years age group.
3. Patients who presented with serious infections, DKA, etc. at the time of diagnosis.

Details of the study

Method of Collection of data (including sampling methods):-
This is a hospital based cross-sectional study involving 50 patients. Data collection was done by clinical history, examination and investigations. These details were recorded as per the proforma attached as annexure. The data collected was subjected to statistical analysis for determining the significance of the results. The following data were collected.

1. Clinical history - Age, gender, mode of detection, Symptomatic/Asymptomatic, any past history of hypertension, other endocrinological illness, any family history of diabetes, hypertension, dyslipidemia, liver disease etc., history of smoking and alcohol consumption

2. Clinical examination:-
   a) Anthropometric measurement including height, weight, body mass index were taken.
   b) Complete clinical examination including the blood pressure recordings as supine and standing, fundus examination.

3. Investigations
   (i) Fasting and postprandial blood sugars
   (ii) Fasting and stimulated serum C-peptide levels
   (iii) HbA1C levels
   (iv) Urine microalbuminuria
   (v) Blood urea and serum creatinine
   (vi) Routine blood counts
   (vii) Serum electrolytes
   (viii) ECG (12 lead)

RESULTS

TABLE 1

<table>
<thead>
<tr>
<th>S.NO</th>
<th>FBS 126-180</th>
<th>PPBS</th>
<th>FSC-P &gt;400</th>
<th>SSC-P Low</th>
<th>HBA1C &gt;8.0</th>
<th>Normal</th>
<th>Low</th>
<th>6.0-7.0</th>
<th>7.1-8.0</th>
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<tbody>
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<td>35</td>
<td>13</td>
<td>2</td>
<td>36</td>
<td>12</td>
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<td>42</td>
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</tr>
<tr>
<td>Percentage</td>
<td>70</td>
<td>26</td>
<td>4</td>
<td>72</td>
<td>24</td>
<td>4</td>
<td>84</td>
<td>16</td>
<td>74</td>
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TABLE 2

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<tr>
<th>Age 30-35</th>
<th>Sex Male</th>
<th>Female</th>
<th>Family History Present</th>
<th>Absent</th>
<th>BMI &lt;22.9</th>
<th>23-27.4</th>
<th>&gt;27.5</th>
<th>HBA1C 6.0-7.0</th>
<th>7.1-8.0</th>
<th>&gt;8.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of subjects</td>
<td>33</td>
<td>17</td>
<td>37</td>
<td>13</td>
<td>30</td>
<td>20</td>
<td>26</td>
<td>12</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>No of subjects having low serum c-peptide</td>
<td>8</td>
<td>5</td>
<td>11</td>
<td>2</td>
<td>8</td>
<td>5</td>
<td>122</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>No of subjects having Normal/High serum c-peptide Levels</td>
<td>25</td>
<td>12</td>
<td>26</td>
<td>11</td>
<td>22</td>
<td>15</td>
<td>14</td>
<td>11</td>
<td>12</td>
<td>14</td>
</tr>
</tbody>
</table>
TABLE -3

<table>
<thead>
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<th>Age group</th>
<th>No of subjects</th>
<th>percentage</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-35</td>
<td>23</td>
<td>74</td>
<td>&lt;22.9</td>
</tr>
<tr>
<td>36-40</td>
<td>14</td>
<td>21</td>
<td>23-27.4</td>
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<tr>
<td>male</td>
<td>37</td>
<td>8</td>
<td>&gt;27.5</td>
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<tr>
<td>Female</td>
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<td>4</td>
<td>4</td>
</tr>
<tr>
<td>total</td>
<td>50</td>
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Fifty patients fulfilling the inclusion criteria were studied. In our study, majority of the study population were in the age group of 30-35 years. Out of 50 subjects, there were 37 male and 13 female subjects. 23 out of 37 male subjects and 10 out of 13 females were in the age group of 30-35 years. The mean age of the study population was 34±2.64 years. In our study, male to female ratio was 2.84:1. In our study of the 8 subjects (16%) who were symptomatic, 2 subjects (4%) had diabetes related symptoms like weight loss and fatigue, 2 subjects (4%) had diabetes related symptoms and fever with myalgia, 4 subjects (8%) had only fever with myalgia and joint pains. Out of 50 patients in this study there was a positive family history in 30 subjects (60%), 13 subjects had only mother as a diabetic among parents, 14 subjects had only father as a diabetic and 3 subjects had both mother and father as diabetic. Twelve subjects out of 50 subjects had as BMI > 27.5 kg/m² i.e. obese and 12 subjects out of 50 had as BMI > 23 and < 27.5 kg/m², i.e. over weight, and the rest (26 subjects) were lean i.e. BMI <23 kg/m². Of 12 subjects who had BMI >27.5 kg/m², 8 were male subjects and 4 were female subjects. Majority of subjects had FBS values in range of 126-180 mg/dl (35 subjects 70%) and only 2 subjects (4%) had FBS value more than 250 mg/dl. Majority of subjects had their PPBS values in range of 201-400 mg/dl(48 subjects, 96%) and only 2 subjects (4%) had PPBS value more than 400 mg/dl. Normal value=0.3-1.5 mg/dl, Minimum value=0.10 mg/dl, Maximum value=1.60 mg/dl(fasting serum c-peptide levels). Eight subjects out of 50 subjects had a fasting serum C-peptide value less than 0.3 mg/dl. Thirteen subjects out of 50 subjects had a low stimulated serum C-peptide. Nineteen subjects had HbA1C value is the range 6.0-7.0 and 29 subjects had in the range of 7.1-8.0. Majority of subjects who had low serum C-peptide were in the age group of 30-35 years (8 out of 13 subjects). Eleven male subjects out of 37 subjects had low serum C-peptide and 2 female subjects out of 13 had low serum C-peptide. Eight out of 13 subjects who had low serum C-peptide had a positive family history of diabetes mellitus. Twelve subjects out of 13 subjects who had low serum C-peptide value had a BMI ≥23 kg/m² i.e. lean. None of the 13 subjects who had low serum C-peptide values had a high WC or a high WHR or both. None of the 13 subjects who had low serum C-peptide value had high TG or low HDL. Seven out of 13 subjects who had low serum C-peptide value had HbA1C in range of 7.1-8.0.

DISCUSSION

The world statistics show that common age of detecting Type 2 diabetes is 40-45 years. The Asian (Indian) statistics show that it is 5-10 years earlier than that of world statistics, so our study focused on newly detected diabetic subjects of age group 30 to 40 years. In our study, we looked at type I behaviour among these subjects by estimating serum C-peptide levels. C-peptide is the standard marker of endogenous insulin production and pancreatic beta cell function. Fifty subjects with newly detected diabetes mellitus of age group 30-40 years were screened for C-peptide levels and the relation between C-peptide levels and BMI, dyslipidemia, central obesity, family history and habits like alcohol and smoking were studied. The majority of the study population [33 subjects (66%)] were in the age group of 30 to 35 years. The male to female ratio was 2.84:1. Out of 50 subjects, 8 subjects (16%) had low fasting serum C-peptide values and 13 (26%) subjects had low stimulated serum C-peptide levels. These were the subjects who were considered to have type 1 behaviour (insulin dependent) rather than type 2 behaviour, and were started on insulin treatment. Studies done by Turner R et al., Horton V et al., Carlsson A et al., reported that between 5% and 30% of subjects initially thought to have type 2 had type 1 behaviour. According to Zimmet P et al., the incidence of type 1 behaviour among adults initially classified in type 2 is around 10%. Zimmet P reported as many as 10-15% of all adults with diabetes may have Latent Autoimmune Diabetes in Adults (LADA) which is detected by low serum C-peptide levels and anti GAD antibody positive. He also reported that LADA may constitute upto 50% of cases of non-obese type 2 diabetes by other serological markers of autoimmune insulin. In our study, of 26 subjects with BMI less than 23 kg/m², 14 subjects (28%) had normal or high serum C-peptide values. According to Banerji et al., Asian Indians have an unexpectedly high percentage of body fat relative to BMI and muscle mass; this is associated with a
proportionate increase in visceral fat. They are markedly insulin resistant and hyperinsulinemic. Laakso et al. concluded that a low BMI, a need for insulin treatment soon after the diagnosis of diabetes are predictive of insulin deficiency. In our study, of the 13 subjects who had low serum C-peptide values, 12 subjects had a BMI <23 kg/m² indicating that they were lean. In our study, 23 (46%) subjects who were either over weight or obese, had normal or high serum C-peptide values. This strengthens the view, that overweight or obesity associated with type 2 diabetes mellitus may be due to insulin resistance. A positive correlation between BMI and basal serum C-peptide levels was also observed by Park SW et al. Renato Pasquali et al. also reported that BMI was positively correlated with fasting and stimulated C-peptide concentrations. Chandalia M et al. reported Asian populations develop type 2 diabetes at lower BMI values than white population of European descent, which may be due to increased adiposity for a given BMI. None of the 13 subjects who had low serum C-peptide values had dyslipidemia i.e. high TG or low HDL according to NCEP ATP III guidelines. Gaya W Katulanda et al. patients with type 1 diabetes (insulin dependent) had lower TG and higher. HDL-C and patients with type 2 diabetes had higher TG, TC and low HDL C. In our study, of the 12 subjects with BMI >27.5 kg/m², 7 subjects (58.3%) had dyslipidemia according to NCEP ATP III guidelines. Gaya W Katulanda reported measures of obesity (body mass index and waist circumference) were weakly correlated with lipid and apoprotein parameters, suggesting a modest contribution to dyslipidaemia. In our study, there was a positive family history in 30 subjects (60%). This observation supports the guidelines of ADA, which suggests early screening of subjects with first degree relatives having diabetes. Twenty-two out of 30 (73.3%) subjects with positive family history had normal or high serum C-peptide values. Out of 13 subjects who had low serum C-peptide values, 8 subjects (61.5%) had personal history of consumption of alcohol and 5 subjects (38.4%) had history of smoking. In our study, population of 50 subjects, 13 (26%) subjects were detected to have type 1 behaviour by low serum C-peptide values were started on insulin therapy. Rest 37 (74%) subjects who were having type 2 behaviour, were started on either dietary modifications or oral antidiabetic drugs.

**CONCLUSION**

1. Measurement of C-peptide levels (an index of endogenous insulin secretory capacity of β-cells) in a young newly diabetic adult helps to distinguish between type 1 behaviour and type 2 behaviour b) in initiation of treatment.
2. Majority of the subjects (92.3%) who had low serum C-peptide levels also had BMI <23 kg/m², suggesting a positive correlation between C-peptide levels and BMI.
3. Majority of the subjects with positive family history (73.3%) had normal or high serum C-peptide levels suggesting a positive family history favours type 2 behaviour.
4. This study suggests measurement of C-peptide levels in newly detected diabetic subjects especially of younger age group is of value.

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