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Case Study

Role of C -Peptide Estimation In Newly Detected Type- 2 Diabetes Cases

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A B S T R A C T

Type 2 Diabetes Mellitus (T2DM) is increasingly being diagnosed among young individuals due to lifestyle changes and genetic predisposition. C-peptide, a by-product of insulin synthesis, serves as a reliable marker of endogenous insulin secretion and β-cell function.

This study was conducted to evaluate the role of C-peptide estimation in newly diagnosed Type 2 diabetic patients. A prospective observational study was carried out on 200 patients aged 18–35 years. Data including fasting blood sugar, postprandial blood sugar, HbA1c, and C-peptide levels were collected and analyzed.

The results showed that patients with higher C-peptide levels had better glycemic control, while those with lower levels required early insulin therapy. A negative correlation was observed between HbA1c and C-peptide levels.

The study concludes that C-peptide estimation plays an important role in assessing β-cell function and guiding treatment strategies in young Type 2 diabetic patients.

Keywords: C-peptide, Type 2 Diabetes Mellitus, HbA1c, β-cell function, insulin resistance, glycemic control, endogenous insulin secretion, young-onset diabetes, diabetes management, biomarker

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INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder characterized by hyperglycemia resulting from insulin resistance and progressive β-cell dysfunction. It is one of the fastest-growing non-communicable diseases globally, with a significant increase in prevalence among young individuals, particularly in developing countries like India. The rising burden of diabetes is associated with lifestyle changes, urbanization, and genetic susceptibility. [17, 15, 16]

C-peptide, a cleavage product of proinsulin, is released in equimolar amounts with insulin and serves as a reliable marker of endogenous insulin secretion. Unlike insulin, C-peptide has a longer half-life and is not significantly affected by hepatic metabolism, making it a more stable and accurate indicator of pancreatic β-cell function. Measurement of C-peptide levels has gained importance in clinical practice for evaluating insulin secretion and differentiating various types of diabetes. [1, 2, 3]

The clinical utility of C-peptide extends beyond diagnosis, as it plays a crucial role in guiding treatment decisions. Higher C-peptide levels are generally associated with preserved β-cell function and better glycemic control, whereas lower levels indicate β-cell dysfunction and the need for early insulin therapy. Additionally, studies have shown that C-peptide levels are inversely related to HbA1c and may help predict long-term glycemic outcomes and risk of complications. [4, 5]

Differentiating between various types of diabetes, including Type 1 Diabetes Mellitus, Type 2 Diabetes Mellitus, Latent Autoimmune Diabetes in Adults (LADA), and Maturity-Onset Diabetes of the Young (MODY), is essential for appropriate management. C-peptide estimation serves as a practical and cost-effective tool for distinguishing these conditions, particularly in resource-limited settings. [9, 10]

Young-onset Type 2 diabetes is associated with a more aggressive disease course, rapid decline in β-cell function, and early development of complications compared to late-onset disease. In India, a significant proportion of patients are diagnosed at a younger age, emphasizing the need for early assessment and individualized management strategies. [6, 14, 18]

Understanding the pathophysiology of Type 2 diabetes, which involves a combination of insulin resistance and progressive β-cell failure, is essential for effective disease management. Early identification of β-cell reserve through C-peptide estimation can help optimize treatment approaches and improve patient outcomes. [8, 20]

Therefore, the present study aims to evaluate the role of C-peptide estimation in newly diagnosed young patients with Type 2 Diabetes Mellitus and its association with glycemic control.

Materials and Methods

Study design

This study was designed as a prospective cohort study conducted to evaluate the role of C-peptide estimation in assessing blood sugar control and pancreatic beta-cell function in young newly diagnosed individuals with type2 diabetes mellitus.

Study setting

The study was carried out at Chalmeda Anand Rao Institue of Medical Sciences, bommakal, karimnagar.

Study duration

The study was conducted over a 3 months.

Study population

The study population included young adults aged 18-35 years who were diagnosed with type2 diabetes mellitus and attended the study center during the study period.

Sample size

A total of 200 participants who fulfilled the inclusion criteria were enrolled in the study.

Inclusion criteria

- Patients ages between 18-35 years
- Newly diagnosed cases of type2 diabetes mellitus
- Both male and female patients
- Patients willing to participate and provide written informed consent

Exclusion criteria

- Patients diagnosed with insulin dependent diabetes mellitus.
- Pregnant and lactating women
- Patients with renal diseases, pancreatic disorders, or chronic liver diseases.
- Patients with secondary causes of diabetes
- Patients on long-term insulin therapy prior to diagnosis

Data collection Procedure

Written informed consent was obtained from all participants prior to enrollment. Demographic and clinical data, including age, gender, and relevant medical history, were collected using a structured data collected form.

Blood samples were collected under standard laboratory conditions and analyzed for the following biochemical;

- Fasting Blood Sugar(FBS)
- Post meals sugar levels
- Sugar bound hemoglobin(HbA1c)
- Fasting C-peptide levels

Statistical analysis

Data was entered into Microsoft excel and analyzed using SPSS software.

- A p value <0.05 was considered statistically significant.
- Appropriate statistical tests(paired t test, correlation) were applied to assess the relationship between C-peptide levels and glucose control.

Ethical considerations

The study protocol was reviewed and approved by Institutional Ethics Committee. Written informed consent was obtained from all participants. Confidentiality of patient data was strictly maintained throughout the study

RESULTS

A total of 200 newly diagnosed Type 2 Diabetes Mellitus patients were included in the present study. The age of the participants ranged from 19 to 35 years, with a mean age of 27.85 ± 5.13 years, indicating that the disease is increasingly affecting young adults. The majority of the participants were clustered in the mid-age group, suggesting a rising trend of early onset Type 2 diabetes in the population.

The gender distribution revealed a slight male predominance, with males accounting for 55% of the study population, while females constituted 45%. This distribution indicates that although both genders are affected, males showed a marginally higher representation in this study.

The baseline biochemical parameters demonstrated significantly elevated glycemic levels among the participants. The mean fasting blood sugar (FBS) was found to be 166.99 ± 24.00 mg/dL, while the mean postprandial blood sugar (PPBS) was 208.61 ± 25.25 mg/dL. The mean random blood sugar (RBS) level was 188.83 ± 21.85 mg/dL. These values indicate poor glycemic control at the time of diagnosis. The mean glycated hemoglobin (HbA1c) level was 7.86 ± 0.68%, further supporting the presence of sustained hyperglycemia in the study population.

The mean C-peptide level observed in the study was 6.19 ± 1.29 ng/mL, with values ranging from 3.30 to 8.90 ng/mL. A wide variation in C-peptide levels was noted among the participants, reflecting heterogeneity in endogenous insulin secretion and β-cell function.

Correlation analysis between HbA1c and C-peptide levels revealed a significant inverse relationship. Patients with higher C-peptide levels were found to have relatively lower HbA1c values, indicating better glycemic control and

preserved β-cell function. In contrast, patients with lower C-peptide levels exhibited higher HbA1c levels, suggesting poor glycemic control and reduced β-cell reserve.

Furthermore, it was observed that patients with higher C-peptide levels responded well to lifestyle modification and oral hypoglycemic agents. On the other hand, patients with lower C-peptide levels required early initiation of insulin therapy to achieve adequate glycemic control. These findings highlight the clinical importance of C-peptide estimation in guiding treatment decisions in newly diagnosed Type 2 diabetes patients.

Overall, the results of the study demonstrate that C-peptide levels play a crucial role in assessing β-cell function and are significantly associated with glycemic status. The inverse relationship between C-peptide and HbA1c emphasizes its utility as a predictive marker for disease severity and treatment planning.

Tables & Graphs

Table 1: Age distribution of study participants

Parameter	Value
Sample size(N)	200
Mean age(years)	27.85
Median age(years)	29.00
Standard Deviation	5.137
Minimum age(years)	19
Maximum age(years)	35

Table 2: Gender Distribution of Study Participants

Gender	Frequency(n)	Percentage (%)
Male	110	55.0
Female	90	45.0
Total	200	100.0

Table 3: Baseline clinical & biochemical parameter

Parameter	N	Minimum	Maximum	Mean± SD
Fasting Blood Sugar (FBS) (mg/dL)	200	117	216	166.99±24.00
Postprandial Blood Sugar (PPBS) (mg/dL)	200	151	280	208.61±25.25
Random Blood Sugar (RBS) (mg/dL)	200	139	232	188.83±21.85
HbA1c(%)	200	5.20	8.90	7.86±0.68
C-Peptide(ng/mL)	200	3.30	8.90	6.19±1.29

Table 4: Correlation between baseline HbA1c and C-peptide levels (N=200)

Variables	Pearson correlation(r)	p-value
Baseline HbA1c vs C-peptide	0.121	0.089

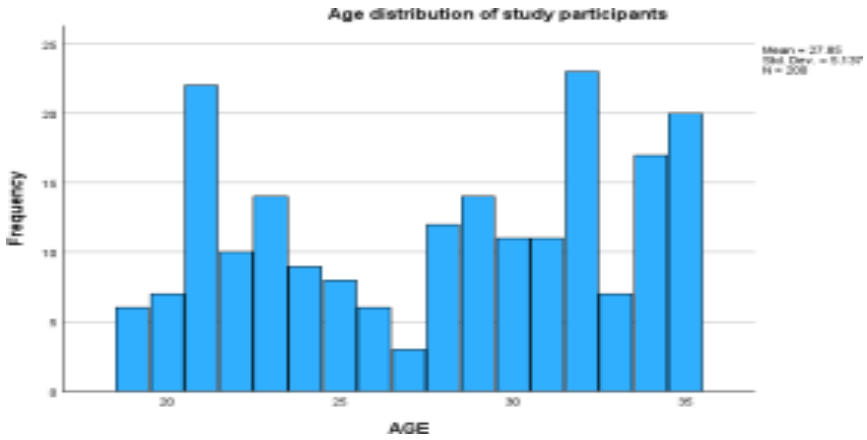

Figure 1: Age distribution of study participants (N=200)

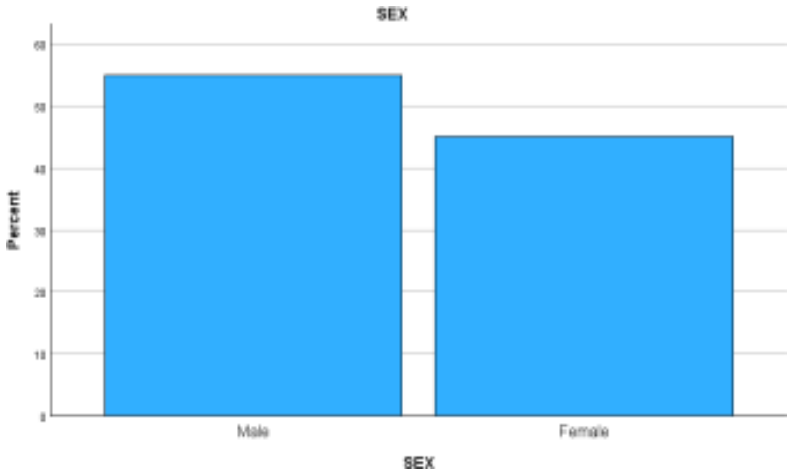

Figure 2: Gender distribution of study participants (N=200)

DISCUSSION

The correct study assessed the function of C-peptide estimation in evaluating beta cell function and glycemic control in young individuals with recently diagnosed non-insulin dependent diabetes mellitus. The prevalence of early onset diabetes is rising, as evidenced by the mean age of 27.85±5.13 years. This is in the line with research from Today Study Group, which found that younger people had faster disease progression.

At the beginning of the study, patients exhibited inadequate glycemic control (HbA1c:7.86 ± 0.68) alongside increased C-peptide levels (6.19 ± 1.29 ng/ml), suggesting a primarily insulin-resistant state. This observation aligns with the findings of Khan SE et al, who noted that early-stage type2 diabetes is marked by compensatory insulin excess and maintained β-cell functionality.

After three months of therapy, there was a notable decrease in HbA1c levels (6.14±1.38, $p < 0.001$) and C-peptide levels (2.99±1.69 ng /ml, $p < 0.001$). The American Diabetes Association Guidelines have also highlighted similar enhancements, underscoring that timely intervention and changes in lifestyle can greatly enhance glycemic results.

The noted reduction in C-peptide levels aligns with the research conducted by Maddaloni E et al, who characterized C-peptide as a variable indicator of β-cell activity that diminishes as insulin sensitivity increases, instead of signifying β-cell dysfunction.

No meaningful relationship was found between initial HbA1c and C-peptide levels, which are consistent with De Fronzo RA, who pointed out that glycemic levels alone might not provide an accurate picture of beta cell function during the early stages of the disease. However, a robust negative correlation at the follow up ($r = -0.820$, $p < 0.001$) suggests that enhanced glycemic control correlates with a decreased demand for insulin secretion.

Overall, the results are in line with earlier research and demonstrate the clinical usefulness of C-peptide estimation in directing tailored treatment, evaluating beta cell function, and tracking treatment response in young individuals with type2 diabetes mellitus.

CONCLUSION

Despite relatively preserved β-cell function at diagnosis, poor glycemic control is associated with early-onset type2 diabetes mellitus. In the current study, appropriate initial therapy led to a decrease in C-peptide levels, which indicates less β-cell workload, and a significant improvement in glycemic parameters. C-peptide estimation supports better clinical outcomes in young, recently diagnosed patients by acting as a trustworthy biomarker for evaluating endogenous insulin secretion, directing customized treatment plans, and tracking therapeutic response.

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