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Original Research Article

Study of Fasting Blood GlucoseLevel, C-Peptide, Insulin and Glycosalated Haemoglobin (HbA1c), In Pre-Diabetics

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Abstract:

Background and Objectives: Diabetes mellitus is the commonest endocrine disorder in population. This clinical syndrome due to either absolute or relative insulin deficiency. To correlate the level of fasting Insulin, fasting glucose level, c-peptideand HbA1c, level in prediabetic person. Suggestion to decide line of treatment as per his status of glucose, insulin,C-peptide and HbA1c particulars in pre diabetic person.

Material and Methods: It is a prospective study done in the prediabetic outpatient clinic of ourhospital, 50 prediabetic patients will be evaluated for fasting plasma glucose level,fasting C-peptide level, Insulin and Glycosalated haemoglobin HbA1c.

Conclusion: Early screening of subjects with risk factor of pre-diabetes, C-peptide and serum insulin testing should be done in patients with poorblood glucose control to decide treatment modalities and, To create awareness about lifestyle modifications and education toPrevent obesity and encourage to physical activity.

Keywords: Insulin, C-peptide, HbA1c.

Introduction

Diabetes mellitus is the commonest endocrine disorder in population. This clinical syndrome due to either absolute or relative insulin deficiency. Currently number of diabetics worldwide is 422 million [1]. In India the projected increase is from 20 to 62 million, [2,3] The term diabetes is derived from Greek words „Dia" meaning „through, Bainein meaning „to go".

This disease causes loss of weight as if the body mass is passed through urine. It is a disease known from ancient times. Charaka in his treatise, elaborated this disorder as Madhumeha" (meaning sweet urine) around 400 BC4. Type 1 DM is caused by pancreatic β cell destruction by auto antibodies, leading to defect in insulin synthesis and secretion [5], Type 2 DM results from a combination of impaired β cell function6 and marked increase in peripheral insulin resistance at receptor/ post receptor levels.

Studies from Urban India suggests that one in four adults over the age of 20 years has IGT or DM7 Type 2, DM causes long term damage, dysfunction and failure of various organs especially the eyes, kidneys, nerves, heart and blood vessels. Complications include both micro & macro angiopathy. Though macro angiopathy is the major cause of morbidity and mortality, the microvascular complications are more common. Treatment should be based on underlying pathophysiology. Research suggests that pre-diabetes may cause some damage to the body, especially the heart and circulatory system. People with prediabetes have a greater stroke risk as well. Diabetes is a progressive disease, and once diagnosed with pre-diabetes, it may take years to develop into diabetes. HbA1c is a glycoprotein separated from other forms of haemoglobin by using a chromatographic column. Its increase in diabetes.

The use of HbA1c for monitoring the degree of glucose control in Diabetics People who have genetic or lifestyle risk factors are more likely to develop insulin resistance or prediabetes. This is true even if your body mass index (BMI) falls within the normal range. However, research has shown that Asian Americans may have an increased risk for insulin resistance even without a high BMI. Researchers used to think that fat tissue was only for energy storage.

However, studies have shown that belly fat makes hormones and other substances that can contribute to chronic, or long-lasting, inflammation in the body. Inflammation may play a role in insulin resistance, type 2 diabetes, and cardiovascular disease. Excess weight may lead to insulin resistance, which in turn may play a part in the development of fatty liver disease [8].

Objectives

Prevent the patients to develop from pre-diabetic to diabetic. It is a prospective study done in the prediabetic outpatient clinic of our hospital

Material and Methods

It is a prospective study, 50 Prediabetic patients who attended the outpatient clinic of our hospital were randomly selected for the study, then methods, procedures of the study were adequately explained to the patient and consent obtained.

The study subjects were asked to come in the fasting state. Then sample for HbA1c, FBS, S.INSULIN,S.C- peptide were taken in the fasting state and its level estimated.

Inclusion criteria: Pre diabetes patients.

Exclusion criteria: Patients with acute infections, renal failure.

It is based on a solid phase ELISA. In this test, microtiter well coated with anti C – peptide antibody and horseradish peroxidase enzyme labelled with anti-C-Peptide antibody is used. To the anti-C-Peptide antibody coated microtiter wells, the standards and test specimen are added.

Then the enzyme labelled anti-C-Peptide antibody is added to the well. If C- peptide is present in the serum then it forms a sandwich between the solid phase and enzyme-linked antibodies. Then chemi luminescent substrate is added and read in a Luminometers. Anti-C-Peptide Antibody Coated Microtiter Wells - 96 wells Enzyme conjugate reagent - 12 ml Reference Standard : 0, 0.5, 1.0, 2.0, 5.0, and 10.0 ng/ml, liquid, ready for use - 1 set 50x Wash Buffer - 15 ml Chemiluminescence Reagent A - 6.0 ml Chemiluminescence Reagent B - 6.0 ml Heterophile antibodies in human serum, interfere with in vitro immunoassays. Lipemeic, haemolysed samples should not be used.

Also called Quetelet index, is defined as the body mass divided by the square of the body height and is expressed in units of kg/m2. BMI =Weight in kilogram/ (Height in metre square) 2.

Results

Table 1: Distribution of the patients based on age ofprediabetic and normal patient

Age Group	Prediabetic		Normal	
	No. ofcases (N=50)	% Out of 100	No. of cases(N=50)	% Out of 100
20 to 29 years	4	8	8	16
30 to 39 years	13	26	10	20
40 to 49 years	22	44	14	28
50to 59 years	2	4	10	20
Above 60 years	9	18	8	16
	50	100	N=50	100

From the above table it was inferred that out of 50 cases with Prediabetics, a maximum of 22 (44 %) cases were between the 40 – 49 years, 13 (26 %) cases were between the 30-39 years. Mean age group = 44.10 ± 11.70. From the above table it was inferred that out of 50 cases with normal, amaximum of 14 (28 %) cases were between the 40 – 49 years, 10 (20 %) cases were between the 30-39 years, 10 (20 %) cases were between the 50-59 years, Mean age group = 45.76 ± 13.20. In this study it was found that there is negative correlation between age of normal and pre-diabetic patients indicated by p value which is insignificant (p = 0.79).

Table 2: Distribution of predibatic patients based on sex

Sex	No. of cases (n=50)	100%
Male	27	54%
Female	23	46%
	N = 50	100

From the above table it was inferred that out of 50 cases of Prediabetic, males constitute 27 (54 %) and females constitute 23 (46 %). Male: Female = 1.17: 1.

Table 3: Distribution of normal patients based on sex

Sex	No. of Patient (N=50)	%
Mal	27	54%
Female	23	46%
	N=50	100%

From the above table it was inferred that out of 50 cases of normal, males constitute 27 (54 %) and females constitute 23 (46 %). Male: Female = 1.17: 1.

Table 4: Distribution of pre diabetic patients based on HbA1c

HbA1c	No of cases	%
5.5 to6	25	50%
6.1to 6.5	24	48%
6.6 to 7	1	2%
	N=50	100%

From the above table it was inferred that out of 50 cases with Prediabetics, a maximum of 25(50 %) were between 6.1 to 6.5. Mean HbA1c =6.05±0.21.

Table 5: Distribution of Normal Patients Based on HbA1c

HbA1c	No of casesN=50	% 100
4.6 to 5	4	8%
5.1 to 5.5	34	68%
5.6 to 6	12	24%
	N=50	100%

it was inferred that out of 50 cases with Normal, a cases were between 5.1 To 5.5, 12 (24%) cases were Mean FBS HbA1c =5.34 ±0.22 cases were between 5.5 to 6 HbA1c, 24 (48%) cases From the above table maximum of 34(68%) between 5.6 to 6.

Table 6: Distribution of normal patients based on fasting s. insulin

Fasting s. insulin Pmol/L	No of case (N=50)	%
131 to 140	2	4%
141 to 150	14	28%
151 to 160	10	20%
161 to 170	19	38%
171 to 180	5	10%
	N=50	100%

From the above table it was inferred that out of 50 cases with Normal, a maximum of 19(38%) cases were between 161 to 170 , 14 (28%) cases were between. 141 to 150. Mean FS.INSULIN =158.14 ±9.77. The above observation suggests that the association between fasting serum insulin of normal and pre-diabetic was significant (p = 0.0001)

Table 7: Distribution of Pre Diabetic Patients Based on Fasting S.C-Peptide

Fasting S.C-Peptide ng/ml	No of caseN=50	%
1.6 to 2	48	96%
2.1 to 2.5	2	4%
	N=50	100%

From the above table it was inferred that out of 50 cases with Prediabetic, a maximum of 48(96%) cases were between 1.6 to 2,2(4%) cases were between 2.1 to 2.5 Mean F S.C-peptide=1.9 ±0.10

Discussion

In this study, there were totally 50 patients labelled as Prediabetic and 50 patients normal, of which female patients constitute 23 (46%) and males constitute 27 (54%). Age group of study patients is in the range of 20-80 years. The age group in the range of 40-50 years constitute maximum number of study patients. Mean age was found to be in normal patient is 45.10 and S.D 13.20, prediabetic patient is 44.10 and S.D 11.70. As per ADA 2002 recommendation, patients with BMI ≥ 25 are considered obese. In this study, Prediabetic patients were considered obese and normal patients were considered non- obese as measured by BMI. So, it is inferred from the study that obesity plays an important role in the development of insulin resistance.

Insulin secretory function: By measuring C-peptide levels in the fasting state, insulin secretion from the β cells of pancreas was measured in this study. Because C- peptide is secreted from β cells of pancreas along with insulin in equal amounts and it undergoes only negligible liver extraction and its level in the peripheral blood equals to that of in the portal blood, C- peptide is used as a measure of insulin secretion in the body. In this study, Fasting serum C- peptide and serum insulin level was found to be a high in Prediabetic patient as compared to normal patient was significant (p=0.0001) Mean C-Peptide level in this study was Prediabetic 1.91 ± 0.10, Normal.1.44 ±0.22, Mean serum insulin level in this study was Prediabetic 190.6 ± 9.51, Normal.158.14 ±9.77.

In this study, obese patients had mean C- peptide level of 1.91 ng/ml while non- obese patients had 1.44 ng/ml, indicating that obese patients had higher mean C- peptide levels compared to non-obese group, this association shows positive

correlation as measured by P value which is significant (P = 0.00010).

In obese patients resistance to insulin action occurs resulting in elevated insulin levels as evidenced by increased C- peptide levels. Study conducted by Snehalatha, A. Ramachandran et al [9] also showed that the insulin secretion was lesser in non-obese compared to obese individuals. Andrea Tura et al [10] in his study measured insulin and C- peptide levels during a 3 hour oral glucose tolerance tests. S.W. Park et al [11] in his study noticed that there is an association between BMI and serum C-peptide levels which were positively correlated. Banerjee et al in his study showed that Asian Indians have high body fat relative to muscle mass and BMI; they have increased resistance to insulin action at cellular level resulting in elevated serum insulin levels. Clare, Jones O et al [12] in their study noticed that the obese patients had elevated serum insulin, C- peptide and blood glucose levels than non- obese patients.

BMI, FBS and HbA1c levels: In this study it is noticed that there is a BMI, fasting plasma glucose and HbA1c levels. They were positively correlated as indicated by the P value which was found to be significant (P = 0.0001). So, it is inferred that FBS, HbA1c level increases in pre diabetic than normal patient with increase in BMI, indicating the increased resistance to insulin action in obese individuals.

Conclusion

- Early screening of subjects with risk factor of prediabetes,
- C-peptide and serum insulin testing should be done in patients with poor blood glucose control to decide treatment modalities and to create awareness about lifestyle modifications and education to Prevent obesity and encourage to physical activity.

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