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Correlation between Glycated Hemoglobin (HbA1c) Levels and Positive Tread Mill Test in Patients of Type 2 Diabetes Mellitus

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Introduction

Type 2 diabetes mellitus (DM) has got a distinct association with coronary artery disease (CAD) . Diabetes mellitus is a metabolic disorder characterized by hyperglycemia resulting from defect in insulin secretion, insulin action or both. It may be accompanied by other biochemical disturbances and the presence of progressive diabetic tissue damage with micro and macrovascular complications.

Aims and Objectives

- To assess correlation between HbA1c levels in Type 2 diabetics and a positive Tread Mill Test

Spectrum of Diabetes Mellitus

Table 1: Spectrum of Diabetes Mellitus

Types of Diabetes	Normal Glucose Tolerance	Pre-diabetes/ impaired fasting glucose/ impaired glucose Tolerance	Diabetes Mellitus
FPG	<5.6 mmol/L (100 mg/dL)	5.6-6.9 mmol/L (100-125 mg/dL)	≥ 7 mmol/L (126 mg/dL)
2-h-PPG	<7.8 mmol/L (140 mg/dL)	7.8-11 mmol/L (140-199 mg/dL)	≥ 11.1 mmol/L (200 mg/dL)
HbA1c	<5.6 %	5.7-6.4 %	≥ 6.5 %

Glycated Hemoglobin: HbA1c

Glycated hemoglobin (HbA1c) is derived from the non-enzymatic addition of glucose to amino groups of hemoglobin. HbA1c is a specific glycated hemoglobin that results from the attachment of glucose to the N-terminal valine of the hemoglobin β-chain[66].

HbA1c As A Diagnostic Tool For Diabetes

Glycation depends on the life span of RBC which is normally 120 days. ADA recommends the use of HbA1c as a diagnostic marker for diabetes and categories for increased risk of diabetes. Persons with HbA1c of 6.5% and above (≥ 6.5% or 48 mmol/mol) are to be diagnosed as diabetes and

HbA1c between 5.7-6.4 are considered to have pre-diabetes. The A1C test should be performed using a method that is certified by the NGSP (www.ngsp.org) and standardized or traceable to the Diabetes Control and Complications Trial (DCCT) reference assay.

HbA1c Testing: ADA 2016 Recommendations

- Perform the A1C test at least two times a year in patients who are meeting treatment goals (and who have stable glycemic control)
- Perform the A1C test quarterly in patients whose therapy has changed or who are not meeting glycemic goals.

Treadmill
Bruce Protocol

This is the most widely used protocol. It consists of 7 stages in which speed and grade are increased every 3 minutes. Bruce protocol has the advantage of being relatively short in duration. It also has many disadvantages. It's high workloads may not be suitable for most cardiac patients or elderly sedentary individuals. The large increments in work make the estimation of maximal oxygen consumption less accurate. The fourth stage can either be run or worked, which results in differing oxygen costs.

Modified Bruce Protocol

This protocol to an extent overcomes the disadvantages of the Bruce protocol. Here the first two stages are run at 1.7 mph at 0% and 5% grades. The third stage of modified Bruce corresponds to 1st stage of Bruce. The remaining stages correspond to that of Bruce protocol

Method and Materials

The present study was done to assess correlation between HbA1c levels in Type 2 diabetics and a positive Tread Mill Test.

It was carried out in Sri Venkateshwaraa medical college hospital and research centre which a 750 bedded multi disciplinary centre is serving the rural population. The study was carried out in the department of General Medicine in association with department of cardiology.

Type of Study: Cross-sectional study

Period of study: From July 2018 to June 2019 – one year period

Study Population: Type 2 Diabetes Mellitus without established clinical diagnosis of coronary artery disease selected by random sampling from those admitted in medical wards and those who present to Medicine OPD.

Sample Size: 75 Patients.

Inclusion Criteria

➢ Age above 40 years
➢ Both gender (Male and Female)
➢ All type 2 diabetic patients
➢ Type 2 diabetic patients without any pre-existing coronary artery disease.
➢ Subjects with Normal resting ECG
➢ Smoker and alcoholic patients

Exclusion Criteria

➢ Established case of CAD
➢ Age <40 years
➢ Physically disable who cannot perform TMT
➢ Osteoarthritis knee
➢ Chronic kidney disease
➢ Severe Anemia
➢ ECG evidence of Q wave MI, Ischemic ST segment or T wave changes or Complete LBBB / RBBB
➢ Severe Aortic stenosis, HOCM
➢ Liver disease / malignancy
➢ Peripheral Vascular disease
➢ Patients with history of CVA
➢ Patients on drugs affecting the heart

Method of Data Collection

All type 2 diabetic patients attending to medical and cardiology department in Sri Venkateshwaraa medical college hospital and research centre were included in the study after obtaining informed consent and description of the procedure. After documenting the demographic data of the patients a details clinical history and details of diabetes was obtained from the patients. A thorough general physical examination and a detailed

systemic examination was obtained and documented as in Proforma.

Interventions/Investigations Needed

ECG

HbA1c

Treadmill test

Statistical Analysis

Patient's demographic data and results will be analyzed using descriptive statistics like mean and standard deviation. The data during the study will be collected and tabulated in Microsoft Excel. The data thus obtained will be analyzed by statistical package for social service (SPSS) version 23.

Results

Table 3: Gender Distribution of Study Population

GENDER	No. of Patients	%
MALE	45	60
FEMALE	30	40
TOTAL	75	100%

Table 7: HbA1c Distribution of the Study Population

HbA1c LEVEL	No. of subjects
<7 %	36
7.1-8%	13
8.1-10%	19
>10%	07
Total	75

Table 10: TMT Pattern among Subjects

TMT results	Male	Female	Total
Positive	08 (17.78%)	06 (20%)	14 (18.67%)
Negative	37 (82.22%)	24 (80%)	61 (81.33%)
Total	45 (100%)	30 (100%)	75 (100%)

Table 13: TMT in Relation with HbA1c

HbA1c	TMT RESULTS		p VALUE
	Positive	Negative	
<7 %	01	35	p=0.015
7.1-8%	02	11	p=0.495
8.1-10%	07	12	p=0.589
>10%	04	03	p=0.295

Discussion

Our observation in the study as follows:

In the present study of 75 cases 45(60%) were males and 30(40%) were females.

In the present study HbA1c level were found ≤7%

(36 Patients), 7.1-8.0 (13 Patients), 8.1-10 (19 Patients) and ≥10 (7 Patients) respectively (**Fig.Table-5**).

In the present study, we found 50% (7 Patients) with HbA1c 8.1-10%, 28.6% (4 Patients) with HbA1c >10%, 14.3% (2 Patients) with HbA1c 7.1-8% and 7% (1 Patient) with HbA1c <7% had positive TMT. **(Table-11)** Swaminathan et al[21] had shown statistically significant positive TMT in asymptomatic T2DM patients with HbA1C more than 9.7%.

Conclusion

In the present study done to assess correlation between HbA1c levels in Type 2 diabetics and positive Tread Mill Test.

was done in Sri Venkateshwaraa medical college and hospital. Our study outcomes were

➢ In our study we observed that 18.67% of patients had a positive TMT.

➢ Glycosylated hemoglobin levels were found to be more in Diabetics, who had greater prevalence of inducible ischemia in asymptomatic type 2 DM.

Summary

- In my study out of 75 cases 45 were males and 30 were females.

- In the study population, more number of patients (26 i.e., 52%) were having diabetes with duration of 6-10 years were more and was not statistically significant with inducible ischemia.

Out of 75 DM cases in my study, Treadmill test positive cases were 15 (18.67%) and negative cases were 60(>80%) patients .

In the present study we found HbA1C (%) is directly proportional to positive Treadmill test.

In summary, type 2 DM had a increased risk of coronary artery disease if they were longer duration of DM, and elevated HbA1C levels even though they are asymptomatic. Based on our study, a routine screening test to detect inducible ischemia in asymptomatic type 2 DM patients.

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