Exercise Stress Testing In Diabetics with Asymptomatic Coronary Artery Disease

Pankaj Panchal *, Jasmin Parmar, Vishaldeep Gohel ***, Maulik Padalia******

*Tutor, **Assistant Professor, *** Tutor, ****Tutor Department of Physiology, Shree M.P. Shah Government Medical College, Jamnagar -361008

Abstracts: Background: Coronary artery disease (CAD) is a common cause of premature morbidity and mortality in diabetics and is often asymptomatic because of silent myocardial ischemia. Early detection of silent myocardial ischemia may prevent catastrophic cardiac events. **Objectives**: to study the prevalence of latent coronary artery disease in diabetics by maximal treadmill exercise testing and to correlate CAD with severity and duration of diabetes. **Materials and methods**: The present one year observational cross sectional study was conducted at Gurugobind Singh hospital, Jamnagar in 100 diabetic patients without clinical evidence of coronary artery disease. All participants undergone exercise stress testing using Bruce protocol to detect silent myocardial ischemia. **Results**: Out of 100 patients, TMT was positive in 32(32%) and negative in 68(68%) patients. TMT was positive in 10/56(17.85%), 8/24(33.33%), 8/12(66.66%) and 6/8(75%) patients with duration of diabetes ≤5, 6 to 10, 11 to 15 and 16 to 20 years respectively. **Conclusion and interpretation**: The prevalence of asymptomatic coronary artery disease in diabetes mellitus without past history of ischemic heart disease or hypertension is 32%. Longer the duration and poor control of diabetes, greater the risk of asymptomatic coronary artery disease. [Panchal P NJIRM 2014; 5(6):56-59]

Key Words: coronary artery disease, diabetes mellitus, treadmill test

Author for correspondence: Dr. Pankaj Panchal, Department of physiology, M.P. Shah Government medical college, Jamnagar-361008. **Email:** drpankajbpanchal@gmail.com

Introduction: Diabetes mellitus is the commonest endocrine disease affecting mankind. Diabetes is accepted as a worldwide epidemic with an estimated increasing number of diabetics from 382 million in 2013 to 592 million by 2035[1]. India is presently estimated to have 65.1 million people affected by this deadly disease[1]. The incidence of this disease continues to be on the rise all over the world. The magnitude of problem is further compounded by various catastrophic macro and microvascular complications targeting the vital organs in the body.

Coronary artery disease (CAD) is the leading cause of death in patients with type 2 diabetes and is often asymptomatic due to silent myocardial ischemia. The prevalence of CAD in our country earlier varied from 15-65/1000 population, but now it has increased about 80-120/1000 making it a major cause of morbidity and mortality[2].

Coronary artery disease is multifactorial in etiology and has several important risk factors, out of which diabetes is one of the important modifiable risk factor.

Data from Framingham heart study demonstrate the increased and poor prognosis of cardiac disease in diabetes. Mortality related to heart disease is doubled in diabetic men and quadrupled in diabetic women over that in their non-diabetic counterparts[3].

CAD is the leading cause of morbidity and mortality in diabetes and frequently manifests itself silently and prematurely. Thus a classical cardiovascular risk factor is 'HYPERGLYCEMIA'. Clinical evidence demonstrates that hyperglycemia in diabetes correlates well with risk and severity of microvascular & macrovascular complications and improving hyperglycemia reduces this risk. Thus 'DEADLY TRIANGLE' of the coronary artery disease, cerebrovascular disease and peripheral vascular disease is the major cause of morbidity & mortality in diabetic population.

CAD can be asymptomatic in diabetes and may present with sudden death, myocardial infarction, arrhythmias, silent myocardial ischemia or heart failure. Early detection of CAD in diabetic patients may prevent catastrophic cardiac events. However, periodic thorough clinical examination may fail to detect latent CAD. Hence , sophisticated non-invasive cardio-vascular tests should be proposed in these patients.

Exercise electrocardiograph can identify majority of patients with Significant CAD during their daily activities and remain the most important screening test for detecting significant CAD4.

This study was designed to evaluate silent myocardial ischemia in selected asymptomatic diabetics by exercise stress test.

Material and Methods: the present study was conducted in medicine department of the Guru Gobind Singh hospital, Jamnagar. The study was approved by institutional ethical committee.

Study Design: The present study is one year observational cross sectional study on patients of asymptomatic diabetes without clinical and electrocardiographic evidence of coronary artery disease

Source of Data: The patients of asymptomatic diabetes mellitus without clinical evidence of CAD were selected from the diabetic clinic and medicine OPD that had duration of diabetes varied from 3 months to 20 years. These patients were enrolled for the study.

Sample Size: Total of 100 asymptomatic diabetic patients were taken

Selection Criteria

- **Inclusion Criteria:**

•Patients having type 1 or 2 diabetes who had no symptoms or signs suggestive of CAD were selected for the study.

•Only diabetics who were free of congenital or valvular heart disease, hypertension, myocardial infarction, chest pain, dyspnoea, palpitation or syncope were selected.

- **Exclusion Criteria:** Diabetics who had

1. Severe anemia
2. Renal disease
3. Abnormal resting electrocardiograms were excluded from the study.

Methods and Collection of Data:
Data collection

All the patients attending medicine OPD, diabetic clinic were screened for eligibility. The eligible patients were administered an informed consent. The consented participants were taken in the present study. Detailed data of participants like name, age, sex, past history, personal history, occupation were obtained by interviewing the patients as per predesigned Performa. They underwent thorough physical examination. All of them had normal 12 lead ECG and underwent treadmill test.

A detailed history was elicited from all the patients with emphasis on cardiovascular system, duration of diabetes.

Exercise Stress Testing: Pretest preparation: All the patients enrolled in the study gave a written informed consent after having explained about procedure and possible risks involved in exercise stress testing. The patient was instructed not to eat or drink caffeinated beverages three hours prior to testing and to wear comfortable shoes and loose fitting clothes. Shaving of chest was done in case of hairy person. Patients on beta blockers, nitrates, CCBs were advised to omit these drugs 48 hours before the test. Patients were instructed to avoid smoking and alcohol consumption atleast 12 hours prior to test. Reassurance was given about the procedure and method of termination of test if he or she feels inability to complete the test. Emergency drugs and defibrillator were kept at hand.

Method: Baseline pulse, blood pressure and resting ECG were recorded. Then all patients selected for exercise testing were subjected to multistage maximal exercise treadmill test using Bruce protocol, started at speed of 1.7 mph at 10 degrees. The pulse, blood pressure and ECG were recorded at the end of each stage of exercise, immediately before and after stopping exercise. Clinical parameters like auscultation for appearance of murmurs, gallop rhythm, crepitations and symptoms like chest pain, fatigue & syncope were observed continuously. Exercise test was terminated in all patients following the achievement of target heart rate or an abnormal ischemic response. After completion of exercise test subject was made to sit in a chair for

relaxation. Clinical parameters were recorded at every 2 minute for atleast 5 to 10 minutes and ECG monitoring was done continuously during recovery phase.

The Exercise Testing Was Evaluated Using Following Criteria:

The test is terminated prematurely if:

(1) The patient developed extreme fatigue, breathlessness or anginal pain.
(2) Declining heart rate and fall in blood pressure response to progressive workload.
(3) Appearance of Serious ventricular arrhythmias and advanced degree of heart block
(4) Excessive ST segment depression
(5) Vertigo or visual disturbances
(6) Ataxia or gait disturbances

ST-T wave changes interpretation : horizontal or down sloping ST segment depression of more than or equal to 1.5 mm or more occurring 0.08 sec after J point of QRS complex during or after the exercise was taken as positive response.

Result:

Table 1: TMT Results

TMT results	Male	Female	Total
Positive	26(31.7%)	6(33.3%)	32(32%)
Negative	56(68.3%)	12(66.7%)	68(68%)
Total	82(100%)	18(100%)	100(100%)

Table -1 shows prevalence of silent myocardial ischemia in the study population. Among 100 patients, TMT was positive in 32(32%) patients and negative in 68(68%) patients.

Table 2: TMT Results & Duration of Diabetes Mellitus

Duration of DM(years)	TMT positive	TMT negative	Total
≤5	10(17.85%)	46(82.14%)	56(56%)
6-10	8(33.33%)	16(66.66%)	24(24%)
11-15	8(66.66)	4(33.33%)	12(12%)
16-20	6(75%)	2(25%)	8(8%)
Total	32(32%)	68(68%)	100(100%)

Table-2 shows 10(17.85%) out of 56, 8(33.33%) out of 24, 8(66.66%) out of 12, 6(75%) out of 8 diabetics were TMT positive with duration of DM ≤5, 6 to 10, 11 to 15 and 16 to 20 years respectively.

Table 3: Control of Diabetes In TMT Positive Patients

Control of DM	HbA1c (%)	TMT positive(N=32)
Good	6-8	6
Fair	8-10	10
Poor	10-12	16

Table-3 shows out of 16 TMT positive patients most of (i.e. 8) had poor control of DM, 10 patients had fair control while 6 patients had good control.

Discussion: In the present study among 100 patients, TMT was positive in 32(32%) patients and negative in 68(68%) patients. The prevalence of latent coronary artery disease in diabetes mellitus was found to be 32 %(32/100).

Our findings were similar to previous study done before. Koistinen MJ[5] found that 29% diabetics who were asymptomatic for coronary artery disease had silent myocardial ischemia on 24 hour ambulatory monitoring exercise electrocardiogram.

Another similar study done by Scheidt-Nave C et al[6] had shown higher prevalence of silent myocardial ischemia in diabetics as compared to non-diabetics.

Motoji N[7] found that 31% without prior coronary disease had treadmill test positive and silent myocardial ischemia was 2.2 times more in diabetics as compared to non-diabetics.

Another study conducted by Ahluwalia G et al[8] from India reported 50% incidence of silent myocardial ischemia in diabetics on exercise electrocardiogram and 35% on ambulatory monitoring.

In our study, we found that average Glycosylated haemoglobin (HbA1C %) levels in TMT positive and TMT negative patients were 9.63 and 8.12

respectively. Statistically significant value of p=0.001 was found in HbA1C levels between both the groups.

A Study done by DeLuca AJ et al [9] found that among those who had diabetes mellitus, silent myocardial ischemia was present in 27 of 54 patients (50%) who had HbA1C level> or = 7.6% and in 39 of 137 (28%) with HbA1c level (p<0.005).

In the present study, out of 100 cases

- 56 patients with duration of diabetes equal to or less than 5 years. TMT was positive in 10(17.85%)
- 24 patients with duration of diabetes 6 to 10 years. TMT was positive in 8 (33.33%)
- 12 patients with duration of diabetes 11 to 15 years. TMT was positive in 8(66.66%).
- 8 patients with duration of diabetes 16 to 20 years. TMT was positive in 6(75%).

Our results are similar to one study done by Ahuwalia V[10] that 70% subjects (7/10) with diabetes of more than 5 years duration had associated silent myocardial ischemia while only 30% subjects (3/10) with diabetes of less than 5 years duration had associated silent myocardial ischemia.

Limitaton of This Study and Future Research: Larger Sample size would be more conclusive. Other non-invasive screening tests for stress echocardiography, stress thallium scanning are available. Coronary angiography remain best invasive technique for detection silent CAD.

Conclusion:

1. Prevalence of asymptomatic coronary artery disease in diabetes mellitus without past history of ischemic heart disease or hypertension is 32%.
2. Longer the duration of diabetes higher the incidence of silent myocardial ischemia.
3. Glycosylated hemoglobin level was found more in diabetics who had greater prevalence of silent myocardial ischemia on TMT reflecting poor the control of diabetes higher the incidence of silent myocardial ischemia.

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