

Study to Determine the Diagnostic Utility of Treadmill Test in Asymptomatic Coronary Artery Disease Patients with Type 2 Diabetes Mellitus.

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ABSTRACT

Background: Coronary Artery Disease being the leading cause of death in patients with Type 2 Diabetes Mellitus often may remain asymptomatic due to silent Myocardial ischemia. People suffering from diabetes mellitus have 2-4 times higher risk of developing coronary artery disease. In such patients periodical clinical examinations and resting ECG may not detect the impending coronary artery disease. Therefore, we analysed the diagnostic utility of Treadmill Test in predicting Silent cases of Myocardial Ischemia. **Methods:** Our study was conducted as an Observational study over a period of 1.5 years including 50 patients of Type 2 Diabetes Mellitus. This study was conducted at a tertiary care centre of Western Uttar Pradesh. **Results:** The results of Treadmill test demonstrated that amongst the studied cases of Type 2 diabetes mellitus approximately one-third of the cases showed positive association whereas the rest were negative. These positive TMT cases were associated with longer duration of Type 2 Diabetes Mellitus. In this study we also evaluated possible association between Autonomic Dysfunction with Positive Treadmill Test. **Conclusion:** Our study concluded that Screening for Coronary Artery Disease should be done in all Type 2 Diabetes Mellitus patients with prolong duration of Diabetes and with Autonomic Neuropathy. As it will lead to early detection of Coronary Artery Disease and its management will reduce the morbidity and mortality due to the same.

Keywords: TMT, Type2 DM, Autonomic Neuropathy, Silent MI.

INTRODUCTION

Diabetes Mellitus (DM) is a heterogenous chronic metabolic disorder principally characterized by persistent hyperglycemia resulting from defect in insulin secretion, insulin action or both.^[1] The diabetes mellitus is an “iceberg disease” affecting 382 million people worldwide and set to increase to 592 million by the year 2035. Diabetes Mellitus may be accompanied by other biochemical disturbances and the presence of progressive diabetic tissue damage with microvascular complications including retinopathy, neuropathy and nephropathy and macrovascular complications including cardiovascular, cerebrovascular and peripheral vascular diseases.^[1]

Coronary artery disease (CAD) is one of the macrovascular complications and leading cause of cause of death and disability in the developed countries and is increasing rapidly in the developing world.^[2] The cardiovascular disease accounts for

80% of death in diabetic patients, furthermore the prevalence of silent myocardial ischemia among the individuals with DM is high ranging from 20% - >50%.^[3] Cardiovascular disease (CVD) accounts for 65 – 75% of deaths in people with diabetes.^[4,5]

It is generally accepted that the incidence of both asymptomatic and symptomatic coronary artery disease is increased in diabetic patients. CAD in diabetics is often symptomless due to occurrence of silent myocardial ischemia. The cause of these Silent Myocardial Ischemia may be cardiac denervation due to the consequence of diabetic autonomic neuropathy, which establish CAD as a major reason of disability and death in Diabetes mellitus.

Routine clinical check up & Electrocardiogram during rest may be incompetent for detection of CAD. Henceforth timely detection of asymptomatic CAD may be achieved by non-invasive test in these patients. Therefore, non-invasive test like Treadmill Test for detection of early CAD can be done in out patient basis.⁶ Cardiac abnormalities that are usually not detected while resting can be evoked by a simple physiological strain like exercise, to ascertain the appropriateness of cardiac function.^[7]

Identification of most of the patients who have the probability of significant ischaemia while

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performing routine activities can be done by Treadmill Test which is considered as a reliable screening & specific test. Myerburg RJ in his study showed the approximate sensitivity and specificity of exercise TMT as ~68 % and ~77 % respectively in people with CAD.^[8]

Aims Of The Study

This study attempts to demonstrate the diagnostic utility of Treadmill Test in Asymptomatic coronary artery disease patients with Type 2 Diabetes Mellitus.

1. Assessment of Autonomic Neuropathy by Clinical Examination.
2. Assessment of asymptomatic CAD by Exercise TMT.

MATERIALS AND METHODS

Study Setting

The study was conducted on patients attending or admitted in the General Medicine, TMMC & RC, TMU, Moradabad, UP, India & on patients who met the inclusion criteria during the study period of 1.5 year(s). The data for the study was recorded from the history, examination & investigations of the patients including the previous medical records.

Study Design: Observational Study.

Sample Size: 50 cases.

Selection of Subjects: Patients were selected on the basis of inclusion & exclusion criteria.

Inclusion Criteria

- Type 2 DM patients without clinical evidence of CAD.
- Normal resting 12 lead ECG.

Exclusion Criteria

Patients suffering from:

- Confirmed IHD (Stable Angina, Unstable Angina & Myocardial Infarction)
- Hypertension & CVA.
- Abnormal resting ECG including Bundle Branch Block.
- Severe Osteoarthritis.
- Chronic Kidney Disease.
- Thyroid disorders.
- Any other disease which may not allow him/her to undergo Treadmill Test. & Patients not giving consent.

RESULTS

Table 1: Table showing demographic profile of study group

Age Group	Male	Female	Total
35-45	17	06	23
46-55	13	07	20
56-65	05	02	07
Mean±SD	47.5±7.7	46.8±8.4	47.3±7.8

In this Observational study, conducted at TMMC & RC, Moradabad, we included 50 asymptomatic diabetic patients during study period. Out of which 35 (70%) were Males and 15 (30%) were females. The Mean Age of total study population is 47.3 ± 7.8.

In this Study, we stratified study population according to duration of Diabetes Mellitus in which 14 (28%) participants had duration of illness less than 5 years which included 9 Males and 5 Females. 12 (24%) participants had duration of Diabetes between 6 to 10 years. It included 9 Males and 3 Females. There were 11 (22%) participants who had duration of Diabetes between 11 to 15 years out of which 8 were Males and 3 were Females. Remaining 13 (26%) participants had duration of Diabetes between 16 to 20 years which included 9 Males and 4 Females.

Table 2: Table showing Duration of Diabetes Mellitus in study population.

Duration (Years)	Male	Female	Total
<5	09	05	14
06-10	09	03	12
11-15	08	03	11
16-20	09	04	13

In our Study we performed Exercise Treadmill Test on participants. We found that 15 (30 %) of the Total participants had Positive Treadmill Test results which consist of 10 Male participants and 5 Female participants while remaining 35 (70%) of the study group had negative Treadmill Test results which included 25 Male participants and 10 Female participants.

During Treadmill test on Diabetic study participants, we found positive results in 15 (30%) of the study participants suggestive of Coronary Artery Disease. Hence in our study we found 30% prevalence of Asymptomatic Coronary Artery disease based on TMT results.

Table 3: Table showing TMT results in study group.

Sex	Positive	Negative
Male	10	25
Female	05	10
Total	15 (30%)	35 (70%)

In our study, we had extrapolated results of Exercise Treadmill test with duration of diabetes amongst the

study population. We found that among 14 participants who had duration of Diabetes Mellitus less than 5 years, only 1 participant had positive Exercise Treadmill Test results while remaining 13 had negative Exercise Treadmill Test results. There were 12 participants having duration of Diabetes Mellitus between 6 to 10 years out of which 2 participants had positive Exercise Treadmill Test results while 10 participants had negative Exercise Treadmill Test results.

Participants, who had duration of Diabetes mellitus between 11 to 15 years, were 11. Out of those 11 participants 5 had Positive Exercise Treadmill Test results while 6 of them had negative Exercise Treadmill Test.

Remaining 13 participants who had the duration of Diabetes Mellitus between 16 to 20 years consisted 7 participants with positive Exercise Treadmill Test and 6 participants with negative Exercise Treadmill Test.

In our study we found significant statistical association between Duration of Diabetes Mellitus and Exercise Treadmill Test results with p value of 0.025907 and Chi2 coefficient 9.2701

We found that there is increased prevalence of positive Exercise treadmill Test amongst participants with prolonged Duration of Diabetes mellitus. Therefore, in our study we found that Prevalence of Asymptomatic Coronary Artery disease increases with Duration of Diabetes mellitus.

Table 4: Table showing correlation between duration of Diabetes Mellitus and TMT results.

Duration Of Diabetes Mellitus	Number Of Patients	TMT Positive	TMT Negative
<5	14	1	13
6-10	12	2	10
11-15	11	5	6
16-20	13	7	6

P = 0.025907, Chi2 coefficient – 9.2701

In our Study we also assessed study participants for presence of Autonomic Neuropathy. We found that 11(22%) of study participants had Autonomic Neuropathy and 39 (78%) study participants did not have Autonomic Neuropathy.

We extrapolated results of Autonomic Nervous system examination results with Exercise Treadmill Test results in which we found that out of 11 participants who had Autonomic Neuropathy, 7 participants had positive Exercise Treadmill Test and 4 participants had negative exercise Treadmill Test.

Remaining 39 participants without Autonomic Neuropathy had 8 participants with positive exercise Treadmill Test results and 31 participants had negative Exercise treadmill Test results.

In our study we found that there is Significant association between Autonomic Nervous involvement and Positive Exercise Treadmill Test

results suggestive of Coronary Artery Disease with p value of 0.005843 and chi2 coefficient 7.589.

In our study we found significant association between Autonomic Neuropathy and Asymptomatic Coronary Artery Disease.

Table 5: Table showing association of Autonomic Neuropathy with TMT results in study population.

Diabetic Patient	TMT Positive	TMT Negative	Total
With Autonomic Neuropathy	07	04	11 (22%)
Without Autonomic Neuropathy	8	31	39 (78%)

P = 0.005843, Chi2 coefficient – 7.589

DISCUSSION

The individuals living with Diabetes mellitus are more prone to Coronary artery disease which is a frequent reason of increased morbidity and mortality. Also in these Diabetes mellitus patients Asymptomatic CAD holds a crucial significance. Of the total ischemic episodes only 20-30% are symptomatic while 60-70% are asymptomatic. Therefore it is of utmost value that this silent CAD should be recognised timely in its course before any uncalled event. Assessment of such asymptomatic coronary artery disease in Type 2 Diabetes Mellitus has always been a challenge.

There are a lot of studies that occurred before in time and stated the greater frequency of Asymptomatic CAD in Diabetics.

In 1962, a study is conducted by Bradley RF et al which revealed that the patients with Diabetes Mellitus when presented with Myocardial Infarction displayed very minor or no pain at all when compared with patients without Diabetes Mellitus.^[9] In 1973 Margolis JR et al performed a study also known as Framingham study that was also first population based study and was followed up for 18 years. The study concluded that the quota of individuals with Silent MI was greater in people with Diabetes Mellitus and Hypertension.^[10] In 1967 a study was conducted by Rosenman RH et al also known as Western collaborative group study that also defended the inter-connection between Silent CAD & Diabetes.^[11]

Similarly association between diabetes and asymptomatic CAD has been ascribed to an Autonomic Neuropathy. Autonomic neuropathy may occur due to increased myocardial demand for oxygen and heart rate, by reducing myocardial blood flow by increasing coronary vascular tone at the site of the coronary stenosis and by reducing coronary perfusion pressure during orthostatic hypotension.^[12-14]

In our study, we found that among the 50 study participants 35 (70%) were Males and 15 (30%) were females; with mean age of study population were 47.3±7.8. In our study we extrapolated results of Exercise Treadmill Test with duration of Diabetes

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Mellitus among study population; we found that only 1 out of 14 (28%) participants with positive TMT who had duration of DM between 1-5 years; while 2 out of 12 (24%) participants had positive TMT with duration of Diabetes between 6-10 years; and 5 out of 11 (22%) participants had positive TMT with duration of Diabetes between 11-15 years while 7 participants out of remaining 13 (26%) participants had duration of Diabetes between 16-20 years. We found that there is increased prevalence of positive Exercise treadmill Test amongst participants with prolonged Duration of Diabetes mellitus. Therefore, in our study we found that Prevalence of Asymptomatic Coronary Artery disease increases with Duration of Diabetes mellitus. ($p=0.0259$; χ^2 coefficient = 9.270)

Our study has shown 30% prevalence of Coronary artery disease in asymptomatic Type 2 Diabetes Mellitus participants and has also demonstrated increased prevalence of Coronary Artery Disease in asymptomatic type 2 Diabetes Mellitus participants with increasing duration of Diabetes Mellitus. This study has also shown significant association between Autonomic Neuropathy and Coronary Artery Disease in Asymptomatic Type 2 Diabetic participants.

CONCLUSION

Screening for Coronary Artery Disease should be done in all Type 2 Diabetes Mellitus patients with prolonged duration of Diabetes and with Autonomic Neuropathy. As it will lead to early detection of Coronary Artery Disease and its management will reduce the morbidity and mortality due to the same. Patients with Type 2 Diabetes should be screened for Autonomic Neuropathy as it has significant association with Coronary Artery Disease in Asymptomatic Type 2 Diabetes Mellitus patients. All type 2 Diabetes Mellitus patients are high risk candidates for Coronary Artery Disease and those with prolong duration of Diabetes and Autonomic Neuropathy should undergo Exercise Treadmill Test irrespective of symptoms.

The limitation of our study was that it was a pilot study conducted at tertiary care center with small sample size. So, the results found in our study could not be extrapolated to the general population. More community based studies are required on large population to get prevalence of Coronary Artery Disease in Asymptomatic Type 2 Diabetes Mellitus patients.

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