

## ORIGINAL RESEARCH

# To detect silent myocardial ischemia in patients with type 2 diabetes mellitus by a treadmill test

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### **Abstract**

**Background:** The present study was conducted for detecting silent myocardial ischemia in patients with type 2 diabetes mellitus by a treadmill test. **Materials & methods:** A total of 100 consecutive middle aged asymptomatic diabetics and 100 healthy controls were enrolled. All the diabetics and controls were subjected to treadmill test and 24-hour ambulatory electrocardiographic monitoring. Coronary angiography was done in those who were positive in treadmill test or 24-hour ambulatory electrocardiographic monitoring. A baseline 12-lead resting ECG was performed to assess for infarction. Only patients without ECG changes of myocardial infarction underwent the exercise stress test. **Results:** A total of 100 consecutive middle aged asymptomatic diabetics and 100 healthy controls were enrolled. Out of 100 diabetic subjects, ST segment depression indicating silent myocardial ischemia was seen in 39 percent of the diabetic subjects and in 7 percent of the controls on treadmill test. On comparing statistically, the results were found to be statistically significant. **Conclusion:** For detection of silent myocardial ischaemia in diabetic patients TMT has a significant role.

**Key words:** Diabetes, Treadmill, Myocardial

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### **INTRODUCTION**

Numerous distinct pathophysiologic abnormalities have been associated with type 2 diabetes mellitus (T2DM). It is well established that decreased peripheral glucose uptake (mainly muscle) combined with augmented endogenous glucose production are characteristic features of insulin resistance. Increased lipolysis, elevated free fatty acid levels, along with accumulation of intermediary lipid metabolites contributes to further increase glucose output, reduce peripheral glucose utilization, and impair beta-cell function.<sup>1-3</sup>

The aging of the human population is another contributor, as diabetes tends to affect older individuals. The cost of diabetes care is at least 3.2 times greater than the average per capita healthcare expenditure, rising to 9.4 times in presence of complications. Control of blood glucose, blood pressure, and other targets remains suboptimal for many patients. This has been partly attributed to the lack of awareness and health promotion needed for diabetes control.<sup>4-6</sup>

Treadmill stress testing is a form of cardiovascular stress testing that uses exercise with electrocardiography (ECG) and blood pressure monitoring. This form of stress testing is usually performed with exercise protocols using either a treadmill or bicycle. In addition, patients who are

unable to exercise may benefit from the administration of a pharmacologic agent that stimulates the heart's activity, simulating exercise-induced changes. With treadmill stress testing, providers can determine a patient's functional capacity, assess the probability and extent of coronary artery disease (CAD), and assess the risks, prognosis, and effects of therapy.<sup>6-8</sup> Hence; the present study was conducted for detecting silent myocardial ischemia in patients with type 2 diabetes mellitus by a treadmill test.

### **MATERIALS & METHODS**

The present study was conducted for detecting silent myocardial ischemia in patients with type 2 diabetes mellitus by a treadmill test. A total of 100 consecutive middle aged asymptomatic diabetics and 100 healthy controls were enrolled. All the diabetics and controls were subjected to treadmill test and 24-hour ambulatory electrocardiographic monitoring. Coronary angiography was done in those who were positive in treadmill test or 24-hour ambulatory electrocardiographic monitoring. A baseline 12-lead resting ECG was performed to assess for infarction. Only patients without ECG changes of myocardial infarction (pathologic Q waves in 2 concomitant leads) underwent the exercise stress test. All the results were recorded in Microsoft excel sheet

followed by statistical analysis using SPSS software. Chi-square test will be used for evaluation of level of significance.

## RESULTS

A total of 100 consecutive middle aged asymptomatic diabetics and 100 healthy controls were enrolled. Mean age of the diabetic subjects and controls was 51.2 years and 55.3 years respectively. 68 percent of

the diabetics and 63 percent of the controls were males. Majority of the subjects were of urban residence. Out of 100 diabetic subjects, ST segment depression indicating silent myocardial ischaemia was seen in 39 percent of the diabetic subjects and in 7 percent of the controls on treadmill test. On comparing statistically, the results were found to be statistically significant.

**Table 1: Demographic data**

Variable		Diabetic group	Control group
Mean age (years)		51.2	55.3
Gender	Males	68	63
	Females	32	37
Residence	Rural	28	36
	Urban	72	66

**Table 2: Presence of silence**

Silent myocardial ischemia	Diabetic group	Control group	p-value
Present	39	7	0.004 (Significant)
Absent	61	93	
Total	100	100	

## DISCUSSION

Type 2 diabetes is a common metabolic disorder characterized by chronic hyperglycaemia. It is associated with a reduced life expectancy owing to a greater risk of heart disease, stroke, peripheral neuropathy, renal disease, blindness and amputation. The mechanisms by which people with impaired fasting glucose and/or abnormal glucose tolerance 'progress' to overt type 2 diabetes are not completely understood. Moreover, type 2 diabetes is defined in a 'negative' sense (hyperglycaemia occurring in the absence of evidence of autoimmune destruction of islet cells). This has two consequences – one is the heterogeneity of the disease, the other is that the disease is identified purely in terms of hyperglycaemia, to a certain extent ignoring the underlying mechanisms that lead to the disease.<sup>9</sup>In a scientific statement published in *Circulation* on April 13, 2020, the American Heart Association (AHA) noted that compared with CAD in patients without T2DM, CAD in patients with T2DM needs to be treated more aggressively to reduce the risk of MI. Although cardiologists have been treating patients with CAD and associated T2DM for a long time, T2DM has traditionally been considered a comorbidity that only affects the development and progression of the CAD. In the past decade, many factors have changed, forcing the cardiology community to reconsider the important role of T2DM in the development and progression of CAD.<sup>10</sup>Exercise stress testing has been used for decades as a noninvasive test to diagnose and risk stratify coronary artery disease (CAD). However, it lacks adequate sensitivity, which nevertheless depends on the pretest probability of CAD in the population tested. The overall sensitivity has ranged from 60% to

70% with a specificity of 85%. Due to the innumerable criteria set for the EKG stress test interpretation and reporting, a lot of confusion arises between institutions.<sup>11, 12</sup>Hence; the present study was conducted for detecting silent myocardial ischemia in patients with type 2 diabetes mellitus by a treadmill test.

A total of 100 consecutive middle aged asymptomatic diabetics and 100 healthy controls were enrolled. Mean age of the diabetic subjects and controls was 51.2 years and 55.3 years respectively. Out of 100 diabetic subjects, ST segment depression indicating silent myocardial ischaemia was seen in 39 percent of the diabetic subjects and in 7 percent of the controls on treadmill test. On comparing statistically, the results were found to be statistically significant. Mfeukeu-Kuate, L et al, in a previous study determined the prevalence and determinants of silent myocardial ischemia in a population of people with type 2 diabetes using exercise stress electrocardiography. Patients with type 2 diabetes underwent a complete clinical evaluation, blood test, resting electrocardiogram (ECG), and exercise stress ECG according to the Bruce protocol. A total of 112 patients with diabetes (63 males and 49 females) were screened. The median age was 58 (IQR: 51 - 64) years. Sixty-five (58%) patients had a positive exercise stress ECG test. Factors independently associated with a positive stress test were abdominal obesity and Female sex. The prevalence of silent myocardial ischemia was high in a population of asymptomatic patients.<sup>13</sup>

In a study conducted by Gupta SB et al, authors evaluated silent myocardial ischaemia and cardiac autonomic neuropathy in diabetics. Treadmill exercise electrocardiography was performed in 47 patients of

diabetes to detect latent coronary artery disease. Eighteen patients (36.3%) were found positive on treadmill test. All forty seven subjects were evaluated for cardiac autonomic neuropathy. The incidence of cardiac autonomic neuropathy in treadmill positive group was 72.2% as compared to 31.0% in treadmill negative group, ( $p < 0.01$ ). Nine patients from the positive group and 4 patients from the negative group were subjected for coronary angiography, which revealed significant CAD in 8 and 1 subjects in both groups respectively. It is concluded that the incidence of silent myocardial ischaemia in diabetics is very high and cardiac autonomic neuropathy seems to be the most probable reason for absence of pain.<sup>14</sup> Sharda M et al, in a previous study, accessed utility of exercise treadmill test in type-2 diabetes mellitus patients for detecting silent myocardial ischaemia and associated risk factors.<sup>75</sup> DM-2 cases were enrolled in study of any age attending medical OPD. All cases were gone through detailed history and TMT procedure. There is higher prevalence of SMI in DM-2 patients. TMT positivity for inducible ischaemia in DM-2 patients were associated with increasing age, male sex, higher BMI, hypertension, smoking, alcoholism, microalbuminuria, macroalbuminuria and dyslipidemia. Duration of diabetes increases the development of CAD in diabetic patients. TMT is a safe procedure with no complication. Prevalence of silent myocardial ischaemia in DM-2 patients is 37.3%. There is significant correlation between risk factors of CVD and evidence of ischaemia on TMT in diabetic patients. Duration of diabetic state has a strong correlation for inducible ischaemia on TMT.<sup>15</sup>

## CONCLUSION

From the above results, authors concluded that for detection of silent myocardial ischaemia in diabetic patients TMT has a significant role.

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