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Research Article

FACTORS ASSOCIATED WITH SILENT ISCHEMIA IN TYPE 2 DIABETIC PATIENTS

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ABSTRACT

Objective: The present study was conducted to study the role of treadmill testing (TMT) in identifying silent ischemia in diabetic patients and to assess factors associated with silent ischemia in them.

Methods: The study was a hospital-based cross-sectional study where 60 patients with type 2 diabetes between the age 40 and 60 years without an established clinical diagnosis of coronary artery disease attending medical OPD were included in the study. The TMT was done using a computerized CTMT machine with built-in protocols. Continuous electrocardiogram (ECG) recordings were taken.

Results: The prevalence of silent myocardial ischemia in type 2 asymptomatic diabetes mellitus in this study was found to be 28.3%. Smoking, higher age, alcohol intake, and duration of DM were found to be significantly associated with silent myocardial ischemia.

Conclusion: Thus, we conclude that the prevalence of silent myocardial ischemia is more common in diabetics. Early screening of asymptomatic patients with type 2 diabetes mellitus with the help of TMT for evidence of silent myocardial ischemia may prevent catastrophic cardiac events.

Keywords: Treadmill testing, Silent myocardial ischemia, Type 2 diabetes mellitus.

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INTRODUCTION

Coronary artery disease (CAD), the primary cause of death in patients with type 2 diabetes, typically goes undiagnosed as a result of silent myocardial ischemia. The frequency of CAD in our country ranged between 15 and 65/1000 individuals before recent increases of 80–120/1000, making it a substantial cause of sickness and mortality [1]. CAD includes a complex etiology and other important risk factors, including diabetes, which is one of the key modifiable risk factors. The prognosis is poor and diabetes raises the likelihood of developing heart disease, according to data from the Framingham Heart Study. Cardiovascular disease (CVD)-related mortality increases 4 times more in diabetic women than in males with diabetes [2].

By connecting hyperglycemia to the likelihood and severity of these problems, clinical data demonstrate that lowering hyperglycemia lowers the risk of microvascular and macrovascular complications in diabetes. Thus, the "DEADLY TRIANGLE" of CAD, cerebrovascular disease, and peripheral vascular disease is the major contributor to morbidity and death in the diabetic population. As their initial symptoms, diabetes individuals with CAD may have sudden death, myocardial infarction, arrhythmias, silent myocardial ischemia, or heart failure. The association between diabetes and asymptomatic CAD has been attributed to autonomic neuropathy [3]. Early detection of asymptomatic CAD in type 2 diabetes may help prevent catastrophic cardiac events. However, regular, thorough clinical examinations and resting electrocardiograms (ECGs) may fail to detect CAD symptoms.

Therefore, it should be recommended that these individuals undergo sophisticated cardiovascular non-invasive testing for the early diagnosis of CAD. The majority of patients who are likely to experience considerable ischemia while engaging in routine activities can be identified by exercise electrocardiography, which continues to be the most important screening test for serious CAD [4-6]. The current study was carried out in a tertiary care facility in South Gujarat to investigate the role of treadmill testing in the diagnosis of silent ischemia in diabetic patients and to evaluate variables related to silent ischemia in them.

METHODS

Study design, settings, and participants

It was a hospital-based descriptive study conducted over a period of 1 year from January to December 2015 in a tertiary care teaching hospital in Gujarat, India. Sixty patients with type 2 diabetes between age 40 and 60 years without an established clinical diagnosis of CAD attending medical OPD were included in the study. Not included are patients with known myocardial infarction, unstable angina, left bundle branch block, severe left ventricular hypertrophy, valvular heart disease, cardiomyopathy, uncontrolled hypertension, hemodynamic instability, and those who have had angioplasty or coronary artery bypass surgery. Patients with severe osteoarthritis or other disabilities (who are unable to perform the test), advanced diabetes with unstable complications, anemia, additional known absolute and relative contraindications to treadmill testing (TMT), inconclusive test results for TMT, and patients unwilling to give consent are excluded.

Data collection

Study participants were selected in accordance with the inclusion criteria, and their informed consent was obtained in writing. After carefully reviewing the patients' histories, a comprehensive physical examination and cardiovascular assessment were conducted. The following routine laboratory examinations were carried out: CBC, ESR, routine urine testing for qualitative micro/macro albuminuria, fasting and postprandial plasma glucose estimations, serum creatinine, blood urea, and a complete lipid profile. Each subject completed a 12-lead resting ECG before the TMT. Another ECG was recorded during the first 20–30 s of hyperventilation because this treatment has the potential to modify the ECG in ways similar to those seen in ischemic patients. Such changes could increase the possibility of falsely positive test results. Risk factors for HTN were obesity,

dyslipidemia, smoking, microalbuminuria, macroalbuminuria, and creatinine.

Every patient was questioned regarding their medical history, including the duration of their diabetes. Body mass index (BMI), which was calculated using height and weight measurements and the Quetelet method, was used to categorize the subjects (normal=18.5–24.9, overweight=25–29.9, and obese=30–39.9). The TMT was completed using a computerized CTMT machine with built-in protocols. A continuous ECG recording was made. Exercise testing was discontinued in all patients after the target heart rate was reached, any arrhythmia, or an abnormal ischemia response that appeared as three consecutive beats with a stable baseline and relatively flat or downward-sloping ST segment depression (2 mV/s) after the J point. In addition, if a patient had chest pain, fatigue, or dyspnea in addition to hypertension, the exercise test was halted.

Statistical analysis

Data were analyzed and statistically evaluated using SPSS software, version 20 (Chicago II, USA). Quantitative data were expressed in mean, standard deviation, and the difference between two comparable groups were tested by the Mann–Whitney "U" test whereas qualitative data were expressed in percentage, and the difference between proportions was tested by the Chi-square test or Fisher exact test. "p" < 0.05 was considered statistically significant.

Ethical issues

All caregivers were explained about the purpose of the study. Confidentiality was assured to them along with informed written consent. The study was approved by the Institutional Ethical Committee.

OBSERVATION AND RESULTS

The average age of the study participants was 50.6–6.38. The majority of the study participants were between the ages of 40 and 45. There were 60 study participants, of which 20 were female and 40 were male. There were two men for every one woman, 35 (58.3%) had a normal BMI, 17 (28.3%) were overweight, and just 8 (13.4%) were obese. Thirteen (21.7%) of the 60 study participants were alcoholics, and 20 (33.3%) were smokers. In the study population, more than 30 patients (i.e. 50%) had diabetes for 5 years or less, followed by 16 patients (26.7%) with diabetes for 6–10 years, 9 patients (15%) with diabetes for 11–15 years, and only 5 patients (8.4%) with diabetes for more than 15 years.

It was found that there was a statistically significant difference in TMT positive cases and TMT negative cases with reference to the average age (p=0.02), average duration of diabetes (p=0.001), average HbA1C levels (p=0.001), and triglycerides levels (p=0.001). There was a statistically significant association between smoking and alcohol intake with TMT-positive subjects (Table 1).

Table 1: Association of TMT findings with different parameters

Parameters	TMT Negative (n=43)	TMT Positive (n=17)	p-value
Age (in years)	49.35±6.44	53.71±5.04	0.02
BMI (kg/m^2)	24.57±3.67	24.74±4.13	0.87
T. Cholesterol (mg/dl)	182.07±28.98	177.12±25.39	0.52
TG (mg/dl)	121.24±26.78	154.12±25.49	<0.001
LDL(mg/dl)	119.57±23.65	117.47±23.3	0.78
HDL (mg/dl)	35.93±3.18	35.47±3.26	0.62
HbA1C	8.15±1.09	9.80±1.26	<0.001
Duration of DM (in years)	6.12±3.48	11.71±4.54	<0.001
Smoker	7 (35%)	13 (65%)	<0.001
Alcohol intake	3 (23.1%)	10 (76.9%)	<0.001

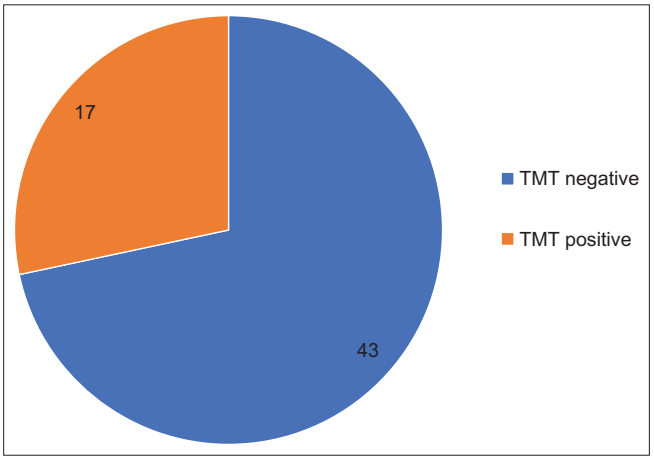

Fig. 1: Prevalence of silent myocardial ischemia based on TMT in DM type-2 patients

DISCUSSION

Coronary atherosclerosis is one of the most common and persistent effects of diabetes mellitus. Much emphasis has been paid to CAD's subtle and asymptomatic onset.

In the course of our research, we found that the prevalence of type 2 diabetes mellitus (T2DM) patients with asymptomatic myocardial ischemia was 28.3% (17/60). Our findings were in agreement with those of past studies. According to a study by Koistinen *et al*. [4], 29% of diabetics with silent myocardial ischemia on a 24-h ambulatory monitoring exercise ECG had no symptoms of CAD. In a comparable study, Achari *et al*. [5] discovered that diabetics were more likely than non-diabetics to experience silent myocardial ischemia.

Another study by Hume *et al*. [6] found that diabetics were 2.2 times more likely to have silent myocardial ischemia than non-diabetics and that 31% of diabetics with no history of CAD had positive treadmill test results. According to other research, the prevalence of silent myocardial ischemia in various regions of India ranged from 12.1 to 50% [4,7-11]. The current study's findings are consistent with the idea that diabetics are more likely to experience silent myocardial ischemia. This study found a positive and statistically significant correlation between age and the frequency of silent myocardial ischemia in type 2 DM patients. According to a study by Kuusisto *et al*. [12], the insulin resistance syndrome had a 1.71 hazard ratio for coronary heart disease (CHD) in the elderly.

Insulin resistance has been identified as a risk factor for CVD, which is associated with increases in acute phase protein response and inflammatory markers. According to a different study by Suastika *et al*. [13], T2DM and cardiovascular illnesses are closely related to aging. Another important study by Oki *et al*. [14] indicated that age 60 and older was one of the best indicators of poor myocardial perfusion (p=0.017; odds ratio [OR]=6.0).

Our analysis revealed smoking to be a risk factor for silent ischemia. According to a study by Turner *et al*. [15], smoking increases the risk of CAD in persons with type 2 diabetes. Data from 4540 people with T2DM who were tracked in the UKPDS revealed that smoking increased the risk of CHD in both males and females with T2DM. According to a different study by Kothari *et al*. [16], smoking is an independent and significant risk factor for stroke. In addition, the London cohort of the prospective (8-year follow-up) Multinational Study of Vascular Disease in Diabetics conducted by the World Health Organization showed that smoking is highly linked to a higher risk of CHD in T1 and T2DM patients [17].

Another risk factor identified by our research was alcohol. In spite of the fact that moderate alcohol use is linked to a lower risk of atherosclerotic disease in both the general population and diabetic patients, severe alcohol consumption, according to a study by Sakuta *et al*., only aids

diabetic patients in developing atherosclerosis [18]. According to a different study by Polsky *et al.* [19], light-to-moderate alcohol consumption among diabetic patients lowers the chances of CVDs and all-cause mortality, whereas heavy drinkers and binge drinkers are at increased risk.

Limitations

The amount of alcohol intake by the patient was not considered in our study while collecting patient information about alcohol consumption history. This remained one of the unexplained variables of our study. Due to a single-center-based study and a small sample size (n=60), extrapolation of the results into the general population is not always satisfactory.

CONCLUSION

Based on the results of our study, it can be said that type 2 diabetics have a higher prevalence of silent myocardial ischemia, and that triglyceride levels, aging, poor glycemic control (HbA1C levels), and smoking habits are significant clinical predictors of silent myocardial ischemia. Catastrophic cardiac events may be avoided by early detection of silent myocardial ischemia in T2DM patients who are asymptomatic using TMT.

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