Section: Cardiology

Original Research Article

A STUDY ON THE PREVALENCE OF ASYMPTOMATIC ISCHEMIC HEART DISEASE IN DIABETIC WOMEN

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Abstract

Background: Women with diabetes lose cardiovascular protection associated with sex; asymptomatic ischemic heart disease is common in this population. Asymptomatic IHD is common in patients with diabetes and can be effectively detected using the treadmill stress test (TMT). This study aimed to determine the prevalence of asymptomatic IHD in women with diabetes using the TMT as a diagnostic tool. **Materials and Methods:** This cross-sectional study was conducted at the Madras Medical College, Chennai. Among 107 women with diabetes attending the outpatient clinic, 30 were selected based on specific inclusion criteria, including type 2 diabetes, absence of known CAD, and normal echocardiography. Patients underwent TMT, and their demographic and clinical characteristics were analysed. **Result:** Of the 30 female diabetic patients evaluated for asymptomatic ischemic heart disease using TMT, 9 (30%) tested positive. The mean age in the TMT-positive group was 49.78 ± 8.11 years, compared to 45.21 ± 7.66 years in the TMT-negative group (p=0.16). The prevalence of systemic hypertension was 55.55% in the TMT-positive group and 42.10% in the TMT-negative group, with no significant difference (p=0.48). The mean duration of diabetes in the TMT-positive group was 5.78 ± 3.31 years, compared to 4.32 ± 2.81 years in the TMT-negative group, with no significant difference (p=0.27). No statistical differences were noted between the TMT-positive and TMT-negative groups in terms of BMI (p=0.84) or menopause (p=0.69). **Conclusion:** TMT is a cost-effective, non-invasive tool for the early detection of asymptomatic ischemic heart disease in women with diabetes, identifying approximately one-third as TMT-positive.

INTRODUCTION

CAD refers to the narrowing or blocking of the coronary arteries, mainly due to atherosclerosis, which can trigger myocardial infarction as well as many other cardiovascular conditions. It is very common in patients with diabetes mellitus because the enhanced inflammatory processes within diabetes mellitus increase the destructive action on arteries and plaque generation. The presence of CAD in diabetic patients is associated with worse clinical outcomes, including increased risks of myocardial infarction and mortality, pointing out the critical interplay between these two conditions.[1]

CAD affects an estimated 30 million people in India, with an estimated prevalence rate of approximately 3%, based on the 2000 report. It is a major cause of morbidity and mortality worldwide. The epidemiological transition in India has placed an increasing burden of non-communicable diseases, including CAD, in younger populations.[2,3] Diabetes mellitus also poses a serious problem, although its prevalence varies significantly across regions. For example, epidemiological research suggests that the prevalence of diabetes ranges from 2.02% in rural Madhya Pradesh up to as high as 40.3% in Tamil Nadu.[4]

Women with type 2 diabetes are more likely to have heart failure than their male counterparts, especially when they lose the comparative protection that females generally have against cardiovascular disease in the absence of CAD. As a result, it might be that diabetes accelerates the progression of CAD in women and thus leads to worse outcomes.[5] Patients with diabetes have a 2-4-fold increased risk of developing CAD. Better implementation of therapies that reduce cardiovascular risk in patients with diabetes will require moving beyond the traditional primary focus on glycemic control. Working knowledge of the effects of diabetes mellitus on the heart and blood vessels will aid physicians in caring for these patients.[6] In the

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general population, women experience relative protection from myocardial infarction and usually develop CAD approximately 10 years later than men do. However, diabetes blunts the cardiovascular benefits of the female sex.[7]

In the first National Health and Nutrition Examination Survey (NHANES) and the NHANES epidemiologic follow-up survey conducted 10 years apart, age-adjusted mortality decreased in non-diabetic men and women but less so in diabetic men and increased by 23% in diabetic women.[8] In the Gruppo Italiano per 10 studio della sopravvivenza bell Infarto miocardio - 2 (GISSI-2) study of thrombolytic therapy in patients with myocardial infarction, diabetes increased the death rate by 40% in men and by 90% in women.[9]

In the Finnish contribution to the WHO Multinational Monitoring of Trends and Determinants of Cardiovascular Disease), 1-year mortality was 38% higher in men with diabetes and 86% higher in women with diabetes. Silent myocardial ischemia, which is common in patients with diabetes, can be detected using treadmill tests. Therefore, in developing nations such as India, the treadmill test, which is cost-effective, can be used as an investigation modality for diagnosing CAD in high-risk populations such as women with diabetes.[10]

Aim

This study aimed to investigate the prevalence of asymptomatic ischemic heart disease in women with diabetes by using an exercise stress test.

MATERIALS AND METHODS

This cross-sectional observational study included 107 women with diabetes who visited the outpatient clinic in the Department of Cardiology of the Institute of Internal Medicine, Madras Medical College, and the Government General Hospital, Chennai, in 2006. This study was approved by the Institutional Ethics Committee before initiation, and informed consent was obtained from all patients.

Inclusion criteria

Known diabetic women on treatment (OHA and insulin therapy), diabetic women not on treatment for CAD, patients not on the beta-blocker duration of diabetes within 10 years, and those with normal echocardiography were included.

Exclusion criteria

Patients with peripheral vascular disease, type 1 diabetes mellitus, known CAD, signs of left ventricular failure, uncontrolled systemic hypertension, high-risk unstable angina, age >65 years, and other absolute contraindications to exercise stress testing were excluded.

Methods

The prevalence of asymptomatic ischemic heart disease was calculated using an exercise stress test. Asymptomatic ischemic heart disease was defined as positive inducible ischemia during the treadmill test without angina at rest. Fasting plasma glucose levels were measured using the glucose oxidase and pyruvate oxidase methods from overnight fasting samples, whereas postprandial blood sugar was assessed two hours after breakfast.

The Body Mass Index (BMI) was calculated using the following formula: BMI= Weight kg/height m2. Patients were categorised into three groups based on their BMI: < 25, 25–30, and > 30. Treadmill test positivity was analysed in these groups.

The treadmill test used the standard Bruce protocol because of its extensive diagnostic and prognostic data. Patients were instructed to refrain from eating or consuming caffeinated beverages for three hours before testing and to wear comfortable clothing. Adequate skin preparation was performed to ensure high-quality recordings. Heart rate, blood pressure, and electrocardiography findings were recorded during each exercise stage and recovery.

Statistical analysis

Statistical analysis was performed on the data of the 30 patients using Microsoft Excel 2003 and SPSS version 13.0. Variables such as age, duration of diabetes, BMI, systemic hypertension, and menopausal status in the TMT-positive and TMT-negative groups were analysed. The significance of the differences in means was calculated using z-tests for means and chi-square tests for proportions, with statistical significance set at ($p < 0.05$).

RESULTS

Of the 30 female diabetic patients who underwent TMT to assess for asymptomatic ischemic heart disease, 9 tested positive, accounting for 30% of the total.

The study population was divided into TMT-positive (n=9) and TMT-negative (n = 19) groups. They were matched for age, BMI, mean duration of diabetes, systemic hypertension, and menopause. The mean age in the TMT-positive group was 49.78 ± 8.11 years, compared to 45.21 ± 7.66 years in the TMT-negative group, with no significant difference ($p = 0.16$). The mean BMI in the TMT-positive group was 27.39 ± 3.91, compared to 27.01 ± 4.10 in the TMT-negative group, with no significant difference ($p = 0.84$).

Table 1: Comparison of clinical and demographic characteristics between TMT positive and TMT negative groups

	TMT Positive	TMT Negative	P value
Number	9	19	-
Age	49.78 ± 8.11	45.21 ± 7.66	0.16
BMI	27.39 ± 3.91	27.01 ± 4.10	0.84
The mean duration of diabetes	5.78 ± 3.31	4.32 ± 2.81	0.27
SHT	55.55%	42.10%	0.48

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Menopause	22.22%	15.78%	0.69

The mean duration of diabetes in the TMT-positive group was 5.78 ± 3.31 years, compared to 4.32 ± 2.81 years in the TMT-negative group, with no significant difference (p = 0.27). The prevalence of systemic hypertension was 55.55% and 42.10% in the TMT-positive and TMT-negative groups, respectively, with no significant difference (p = 0.48). The proportion of postmenopausal patients was 22.22% in the TMT-positive group and 15.78% in the TMT-negative group, with no significant difference (p = 0.69) [Table 1].

DISCUSSION

In our study, 30 female patients with diabetes underwent treadmill testing to evaluate the presence of asymptomatic ischemic heart disease, a condition often associated with type 2 diabetes mellitus. Of the total patients, 9 tested positive for TMT, with a prevalence rate of 30% for asymptomatic ischemic heart disease in our study. The mean age of the patients in the TMT-positive group was found to be 49.78 ± 8.11 years, with relatively middle-aged at-risk demographics. The mean body mass index among these TMT-positive patients was 27.39 ± 3.91, presenting a tendency for overweight or even obesity as a risk factor.

Our study's results follow Shah et al., where among 50 patients examined, 19 patients (36%) tested positive for TMT, and 32 patients (64%) tested negative, underlining that there is a comparable prevalence of ischemic heart disease among diabetic populations.[11] Similarly, Handargal and Shetty conducted a study for 162 patients and made a TMT-positive rate of 38.9%, and during the investigation, 63 patients came out to be inducible ischemia. This underscores the considerable burden of cardiovascular risk factors in the diabetic population. They also reported that TMT positivity was positively correlated with increasing age, higher BMI, and other metabolic risk factors. The mean BMI of their study group was 29.69 ± 3.58 kg/m².[12] Similar results were found by Lavekar and Salkar, who stated that among 161 patients, 34 (21.1%) had exercise-induced ischemia.[13] In a similar direction, Panchal et al. have shown that among 100 patients, 32 (32%) were TMT-positive, while the remaining 68 (68%) were TMT-negative.[14]

Our study showed that the mean duration of diabetes in the TMT-positive group was 5.78 ± 3.31 years compared to 4.32 ± 2.81 years in the TMT-negative group. Although this difference was not significant (p = 0.27), it suggests a possible trend for longer diabetes duration correlating with ischemic outcomes. Kumar et al. reported a baseline mean diabetes duration of 4.87 ± 4.04 years among the patients in their study, with mean HbA1c levels of 7.96 ± 1.02%, suggesting poor glycaemic control as an underlying factor.[15] Panchal et al. reported that the risk for ischemia also correlated with the duration of diabetes, with TMT positivity rates of 17.85%, 33.33%, 66.66%, and 75% in the patients with diabetes durations of ≤5, 6–10, 11–15, and 16–20 years.[14]

In our study, the prevalence of systemic hypertension was 55.55% in the TMT-positive group and 42.10% in the TMT-negative group, although the difference was not statistically significant (p = 0.48). Mahmood SE also mentioned that 44.46% of T2DM patients were hypertensive, and its prevalence increased with advancing age.[16] Gupta et al. have also emphasised an age-associated increase in many metabolic and cardiovascular risk factors such as BMI, waist circumference, systolic blood pressure, fasting cholesterol, and triglyceride levels, particularly among females at a significant level (p < 0.01).[17]

Our study also examined the role of menopause as a risk factor for ischemic heart disease. We considered 22.22% of patients in the TMT-positive group to be postmenopausal, while only 15.78% in the TMT-negative group were postmenopausal; the difference was not significant (p = 0.69). Similar findings have been reported by Tandon et al. Of the 68 patients advised to undergo electrocardiography, 23 showed ischemic changes. Among the 12 women exposed to TMT, 4 were positive for IHD. They observed that 96% of women in their study had menopause-related problems, and 11% had a risk factor count of more than four, thus having a high burden of cardiovascular risk in postmenopausal women.[18]

It is important to determine how menopause contributes to the risk of cardiovascular disease in women with diabetes. Hormonal alterations, especially decreased oestrogen levels, can promote endothelial dysfunction and accelerate atherosclerosis progression. Zhao et al. reported that an independent higher total testosterone/oestradiol ratio is associated with increased incident CVD, CHD, and HF risk.[19]

CONCLUSION

The prevalence of asymptomatic ischemic heart disease was higher in women with diabetes than in those without. Approximately one-third of women with diabetes have asymptomatic ischemic heart disease, which can be detected by simple treadmill tests, comparison of age, BMI, duration of diabetes, systemic hypertension, and menopause, and no significant differences in these parameters were observed between the TMT-positive and TMT-negative groups.

These findings emphasise the utility of TMT as a cost-effective, non-invasive diagnostic tool for the early detection of silent myocardial ischemia in high-risk populations, such as women with diabetes. Routine screening with TMT can enable timely intervention and reduce cardiovascular morbidity and

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mortality in this vulnerable population. These results support the combination of routine cardiac evaluation with diabetes management protocols, particularly for women, to address sex-specific cardiovascular risks associated with diabetes.

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