

FREQUENCY OF POSITIVE EXERCISE TOLERANCE TEST FOR SILENT MYOCARDIAL ISCHEMIA IN ASYMPTOMATIC UNCOMPLICATED TYPE 2 DIABETIC PATIENTS

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ABSTRACT

Objective: To determine the frequency of positive exercise tolerance test (ETT) for silent myocardial ischemia in asymptomatic uncomplicated type 2 diabetic patients.

Study Design: Descriptive- cross sectional study.

Place and Duration of Study: Department of medicine, Pakistan Navalship (PNS) Shifa Karachi from November 2011 to May 2012.

Material and Methods: A total of 135 patients with type 2 diabetes mellitus of more than five years duration were included in the study without any history of chest pain and having no evidence of complications (neuropathy, nephropathy, retinopathy) using non probability-consecutive sampling technique. Relevant history and investigations were done to exclude other risk factors for ischemic heart disease such as smoking, obesity, hyperlipidemia and hypertension. ETT was used as the main tool to detect silent myocardial ischemia. Data was collected through a pre-designed proforma and analyzed using SPSS version 11.

Results: The study revealed that frequency of positive ETT for silent myocardial ischemia in uncomplicated asymptomatic type 2 diabetic patients was 35.56% (n=48) while 64.44% (n=87) had no findings of silent myocardial ischemia.

Conclusion: The frequency of positive ETT for silent myocardial ischemia in our study was 35.56%. Thus, ETT being non-invasive should be performed as a preliminary investigation for detection of silent myocardial ischemia in every patient of type 2 DM of more than 5 years duration.

Keywords: Asymptomatic type 2 diabetes, ECG, ETT, Silent ischemic heart disease.

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INTRODUCTION

This century brings a pandemic of diabetes mellitus, with marked increase in early accelerated atherosclerosis¹. Current estimates of the number of people with diabetes include 171 million worldwide and these numbers are projected to double by the year 2030². The prevalence of diabetes in Pakistan in the urban versus the rural areas is 6.0% in men and 3.5% in women against 6.9% in men and 2.5% in women, respectively³. Ischemic heart disease is the leading cause of death in patients with diabetes, accounting for 75% of mortality in type 2 diabetics². Coronary artery disease is generally detected at an advanced stage in type 2 diabetics, whereas an asymptomatic stage is commonly missed. According to different studies conducted internationally and

nationally, the prevalence of silent ischemic heart disease in type 2 diabetic patients varies from 22% to almost 52%^{5,6}.

Silent myocardial ischemia is a relatively common, yet poorly understood, clinical entity⁷. Decreased sensitivity to painful stimuli and coronary microvascular dysfunction play an important role in developing silent myocardial ischemia. Another area of investigation suggests that silent ischemia may be due to cerebral cortical dysfunction, rather than peripheral nerve dysfunction⁸. In a meta-analysis of 12 published studies, Vinik et al. reported a consistent association between cardiac autonomic neuropathy and the presence of silent myocardial ischemia, measured by exercise stress testing, with point estimates for the prevalence rate ratios from 0.85 to 15.53⁹. In the absence of symptomatic ischemic heart disease, clinical features that help to identify patients with an increased risk for myocardial infarction or cardiac death include evidence of other atherosclerotic vascular disease, micro

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albuminuria and chronic kidney disease, autonomic neuropathy, retinopathy, hyperglycemia, abnormal resting ECGs, age, sex, and both traditional and novel cardiac risk factors¹⁰.

Various studies have signified the importance of screening certain high risk groups with complications for silent myocardial ischemia. But these studies have not highlighted the presence of silent myocardial ischemia in asymptomatic uncomplicated type 2 diabetic patients. Hence the causal association between diabetic complications and silent MI has been challenged by some authors as delay in the identification of silent myocardial ischemia in such diabetic patients

ischemia or left bundle branch block (LBBB). Patients having supporting evidence of diabetic complications on physical examination and lab investigations were also excluded from the study. The presence of micro albuminuria was ruled out by checking spot urine test for albumin creatinine ratio. Ophthalmologist was consulted to rule out the presence of diabetic retinopathy. Other risk factors for ischemic heart disease which may act as confounders such as smoking, obesity, hypertension and hyperlipidemia were excluded with relevant history and investigations including serum levels of glucose, creatinine, triglycerides and cholesterol. All patients with type 2 diabetes mellitus of more than or equal to five years

Table-1 Age distribution of the patients (n=135).

Age(in years)	No. of patients	Percentage
20-30	11	8.15
31-40	27	20
41-50	43	31.85
51-60	32	23.70
>60	22	16.30
Total	135	100
Mean and sd	43.54 +7.35	

Table-2: Frequency of positive ETT for silent myocardial ischemia in asymptomatic uncomplicated type 2 diabetic patients (n=135).

ETT positive	No. of patients	Percentage
Yes	48	35.56
No	87	64.44
Total	135	100

unquestionably worsens their prognoses. This highlights the clear need for early identification of silent ischemic heart disease in asymptomatic uncomplicated type 2 diabetic patients.

MATERIAL AND METHODS

This descriptive- cross sectional study was conducted at the department of Medicine Pakistan Navalship (PNS) Shifa Hospital Karachi from November 2011 to May 2012. Patients were taken from medical OPD of the hospital. The exclusion criteria were type 1 or secondary diabetes, previous cardiovascular disease, typical angina or chest pain and resting electrocardiogram (ECG) signs of myocardial

duration were included in the study without any history of chest pain, having no evidence of complications (neuropathy, nephropathy, retinopathy) and with normal resting ECG. Informed written consent was taken from all patients by explaining the risks and benefits of the study, use of data for research and publication and details of exercise tolerance test. Diabetic status and duration of disease was confirmed with the help of history and preliminary investigations. Physical examination was carried out to assess the complications of diabetes. Symptom-limited treadmill exercise tolerance test (ETT) was performed on all selected patients according to the standard

Bruce protocol. A 12-lead ECG was used and continuously monitored during the test, and blood pressure was recorded at rest and every 2 minutes during exercise and recovery. The ETT was considered positive when a horizontal or down sloping ST-segment with a depression ≥ 1 mm occurred 0.08 seconds after the J point. The test was considered equivocal when a ST segment depression < 1 mm was observed, or when a left bundle branch block or premature ventricular beats > 6 beats/min were seen. The test was considered inconclusive if the patient failed to reach 85% of the predicted maximal heart rate for his or her age. We defined silent myocardial ischemia as objective evidence of ischemia occurring in an asymptomatic patient during the ETT.

Data was collected through a pre-designed proforma. Exclusion criteria were followed to control confounders and thus preventing the introduction of bias in the study results. Confidentiality of the patient's record was maintained. Data was entered and analyzed into statistical package for social sciences (SPSS version 11). Descriptive statistics were used to analyze and describe the data. Frequency and percentages were calculated for categorical variables like presence of silent ischemic heart disease on ETT.

RESULTS

A total of 135 subjects fulfilling the inclusion/exclusion criteria were enrolled to determine the frequency of positive ETT for silent myocardial ischemia in asymptomatic uncomplicated type 2 diabetic patients presenting at Out Patient Department (OPD) of PNS Shifa Hospital Karachi.

Age distribution showed a mean of 43.54 ± 7.35 years with most patients ($n=43$) 31.85% in age group of 41-50 years and least ($n=11$) 8.15% in age group of 20-30 years. (table-1).

Frequency of positive ETT for silent myocardial ischemia in asymptomatic uncomplicated type 2 diabetic patients was found to be 35.56% ($n=48$) while 64.44% ($n=87$) had no findings of silent ischemic heart disease. (Table-2).

DISCUSSION

Coronary artery disease is the leading cause of morbidity and mortality in patients with type 2 diabetes and is often asymptomatic because of silent myocardial ischemia. Silent ischemic heart disease represents only the tip of the iceberg of the ischemic spectrum. Early recognition and diagnosis of silent ischemic heart disease will lead to a more effective therapy and will decrease cardiovascular complications and mortality. In our study the frequency of silent myocardial ischemia in asymptomatic uncomplicated type 2 diabetic patients was recorded to be 35.56% which is in agreement to different studies conducted internationally and nationally^{5,6}. A study from Peshawar showed that 44% of asymptomatic diabetics had positive ETT for silent myocardial ischemia⁵. A study conducted at Liaquat University Hospital Hyderabad revealed positive ETT in 37% asymptomatic diabetic patients¹¹. Proportion of silent ischemia in type 2 DM patients from rural population of Central India was estimated to be 21.11% based on treadmill ETT.

We planned this study to help in developing a suitable rationale involving utilization of easily accessible and cost effective investigations for early recognition of silent myocardial ischemia in asymptomatic uncomplicated type 2 diabetics. The treadmill exercise test can be performed at a much lower cost when compared with other imaging procedures such as coronary computed tomography (CT), echocardiography, and stress single photon emission computed tomography myocardial perfusion imaging. The ETT is preferable to a pharmacological stress test because it depicts the heart's actual workload and better simulates everyday cardiac strain¹³. Furthermore; patients are not exposed to ionizing radiation and contrast. The more recently developed noninvasive, multi-slice CT angiography is recommended for exclusion of coronary heart disease, but has the associated disadvantages of high radiation exposure and cost¹⁴. An estimated 1 in 270 women who underwent CT coronary angiography at age 40 will develop cancer from that CT scan,

compared with an estimated 1 in 8,100 women who had a routine head CT scan at the same age¹⁵. Moreover, a completely normal ETT has been reported to be a marker for a good prognosis in patients with diabetes¹⁴. Therefore, initially performing an ETT in patients who are able to exercise is recommended. For these reasons, we chose the ETT as a preliminary investigating tool for detecting silent myocardial ischemia in asymptomatic patients with type 2 DM. Further studies will guide us with respect to which modality is most appropriate.

CONCLUSION

The ETT being non-invasive should be performed as a preliminary investigation for detection of silent myocardial ischemia in every patient of type 2 DM of more than 5 years duration. Moreover, every set-up should have a high index of suspicion to diagnose silent myocardial ischemia in asymptomatic uncomplicated type 2 diabetic patients.

CONFLICT OF INTEREST

The authors of this study reported no conflict of interest.

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