International Journal of Research in Health and Allied Sciences

Journal home page: www.ijrhas.com

Official Publication of "Society for Scientific Research and Studies" [Regd.]

ISSN: 2455-7803

Original Research

To evaluate the ECG anomalies and treadmill test results in type 2 diabetes mellitus patients

[1]Sumaina Thummala, [2]Shah Suchi Devang, [3]Mohammad Hazique, [4]Sahil Garg, [5]Amro Musa Mohamed Elamin Alam Alhouda, [6]Ali Abdalla Ali Osman, [7]Abdul Muqtadir, [8]Mohamed Faisal Elawad Altahir

[1]MBBS, Karpaga Vinayaga Institute of Medical Sciences and Research Center, India;
[2]MBBS, AMC MET Medical College, Ahmedabad, Gujrat, India;
[3]MBBS, Nilratan Sircar Medical College and Hospital, Kolkata, West Bengal, India;
[4]MBBS, Sri Guru Ram Dass Institute of Medical Sciences and Research, India;
[5,6,8]University of Khartoum, Faculty of Medicine, Sudan;
[7]MBBS, Shadan Institute of Medical Sciences, Hyderabad, Telangana, India

ABSTRACT:

Aim: To evaluate the ECG anomalies and treadmill test results in type 2 diabetes mellitus patients. **Methods:** Following ethical approval from management, an observational, cross-sectional study was conducted. The study included 100 patients with Type 2 Diabetes Mellitus and 100 age and gender matched healthy controls who were diagnosed using ADA criteria (FBS > 126 mg/dl, PPBS > 200 mg/dl). Patients who were taking their normal dose of insulin or oral hypoglycemic medications were also included in the study. Following a 12-hour overnight fast, all individuals were given a standardised meal containing 600 kilo calories, 60 percent carbs, 20-25 percent proteins, and 15-20 percent fats. For lipid profile measures, blood was drawn while fasting and 4 hours after a meal. Fasting and postprandial blood sugar, glycosylated haemoglobin (HbA1c), lipid profile (fasting and postprandial), ECG, and TMT were all measured in all participants. **Results:** In the current study, the majority of diabetes patients (50 percent) were between the ages of 50 and 60, followed by 40-50 years (22 percent) and 60-70 years (28 percent). Similarly, the bulk of non-diabetes patients are between the ages of 50 and 60 (40 percent), followed by 41-50 years (28 percent) and 60-70 years (22 percent). ST depression and T wave inversion were identified in 25 (25%) of 100 diabetic patients who had ECG abnormalities, 21 (21%) had LAE, 7 (7%) had LVH, 3 (3%) had RBBB, and 3 (3%) had LBBB. There is no ST elevation in any of the patients. When the lipid profile was compared to the TMT findings, it was shown that the majority of patients with aberrant postprandial lipid profiles exhibited positive TMT. With $p<0.001$, 0.001, and 0.006, respectively, a positive connection was found between smoking, dyslipidemia, and TMT positivity. With $p=0.17$ and 0.66, respectively, the correlation between alcohol abuse, hypertension, and TMT positive was not significant. **Conclusion:** Based on the findings of this investigation, it is possible to conclude that patients with T2DM had a greater prevalence of ECG abnormalities. T2DM patients are also more likely to have TMT. We propose that T2DM patients be screened for CVD using ECG and TMT.

Keywords: ECG anomalies, treadmill, type 2 diabetes mellitus

Received: 12 January, 2022 Accepted: 15 February, 2022

Corresponding author Ali Abdalla Ali Osman, University of Khartoum, Faculty of Medicine, Sudan **Email:** aliabdalla10@hotmail.com

This article may be cited as: Thummala S, Devang SS, Hazique M, Garg S, Alhouda AMMEA, Osman AAA, Muqtadir A, Altahir MFE. To evaluate the ECG anomalies and treadmill test results in type 2 diabetes mellitus patients. Int J Res Health Allied Sci 2022; 8(2):73-76.

INTRODUCTION

When compared to the general population, those with type 2 diabetes have a twofold increased risk of cardiovascular disease (CVD). Resting electrocardiogram (ECG) abnormalities such as pathological Q-waves, bundle branch block, tall R-wave/left ventricular hypertrophy, abnormal QRS-axis, and ST-segment abnormalities are associated with an increased risk of CVD morbidity or mortality in the general population, independent of known cardiovascular risk factors, with a reported prevalence of a few percent. According to a survey conducted by the Diabetic Society of India, 1.22 billion individuals in India suffer from diabetes. Type

2 diabetes is the most common type of diabetes. Type 2 diabetes mellitus has become a global epidemic, with the poor world bearing the brunt of the burden. [1-4]

Diabetes may cause myocardial involvement sooner, affecting early diastolic relaxation. Coronary artery disease and its complications are the leading causes of death in type 2 diabetes. [5] According to the Framingham Heart Study, diabetes males die twice as often as non-diabetic men, while diabetic women die four times as often as non-diabetic women. Exercise is a typical physiological stimulus used to trigger circulatory anomalies that are not present at rest and to assess heart function adequacy. It has shown to be the most feasible and non-invasive method of detecting latent ischemic heart disease. When used to a group where the diagnosis is most ambiguous, the stress test has the greatest diagnostic value. Even when there is no history of chest pain, there exists a strong possibility of significant narrowing in the coronary tree in patients with appropriate risk factors, especially diabetes mellitus. An attempt will be made through this study to detect early disease and offer treatment modalities to asymptomatic patients having diabetes mellitus.

MATERIAL AND METHODS

Following ethical approval from management, an observational, cross-sectional study was conducted. The study included 100 patients with Type 2 Diabetes Mellitus and 100 age and gender matched healthy controls who were diagnosed using ADA criteria (FBS > 126 mg/dl, PPBS > 200 mg/dl). Patients who were taking their normal dose of insulin or oral hypoglycemic medications were also included in the study. Those with familial hyperlipidaemia, nephropathy, hepatic illness, hypothyroidism, alcoholism, patients on lipid-altering medicines (antihyperlipidaemic agents, beta blockers, thiazide diuretics) and fasting triglycerides more than 250 mg/dl were excluded.

Following a 12-hour overnight fast, all individuals were given a standardised meal containing 600 kilo calories, 60 percent carbs, 20-25 percent proteins, and 15-20 percent fats. For lipid profile measures, blood was drawn while fasting and 4 hours after a meal. Fasting and postprandial blood sugar, glycosylated haemoglobin (HbA1c), lipid profile (fasting and postprandial), ECG, and TMT were all measured in all participants.

DATA EXAMINATION

The IBM SPSS 25.0 programme was used for all data analysis. To create the tables, frequency distribution and cross tabulation were used. The tables were created using PRISM and Microsoft Excel. Quantitative data was expressed as mean and standard deviation whereas categorical data was expressed as numberand percentage.

RESULTS

In the current study, the majority of diabetes patients (50 percent) were between the ages of 50 and 60, followed by 40-50 years (22 percent) and 60-70 years (28 percent).

Similarly, the bulk of non-diabetes patients are between the ages of 50 and 60 (40 percent), followed by 41-50 years (28 percent) and 60-70 years (22 percent).

ST depression and T wave inversion were identified in 25 (25%) of 100 diabetic patients who had ECG abnormalities, 21 (21%) had LAE, 7 (7%) had LVH, 3 (3%) had RBBB, and 3 (3%) had LBBB. There is no ST elevation in any of the patients.

When the lipid profile was compared to the TMT findings, it was shown that the majority of patients with aberrant postprandial lipid profiles exhibited positive TMT. With $p<0.001$, 0.001, and 0.006, respectively, a positive connection was found between smoking, dyslipidemia, and TMT positivity. With $p=0.17$ and 0.66, respectively, the correlation between alcohol abuse, hypertension, and TMT positive was not significant.

Table 1 Age and gender distribution of patients

Gender	Diabetic patients	Non diabetic patients
Male	50	50
Female	50	50
Age in years		
Below 50	28	28
50-60	50	50
60-70	22	22

Table 2 Comparing post prandial lipid levels with TMT findings in diabetes patients

Lipid		TMT		Total
		Negative	Positive	
TG	Abnormal	36 (48%)	39(52%)	75
	Normal	25 (100%)	0 (0%)	25
TC	Abnormal	30 (48.39%)	32 (51.61%)	62
	Normal	38 (100%)	0 (0%)	38

HDL	Abnormal	12(42.86%)	16 (57.14%)	28
	Normal	72 (100%)	0 (0%)	72
LDL	Abnormal	26 (47.27%)	29 (52.73%)	55
	Normal	45 (100%)	0 (0%)	45

Table 3 Comparing post smoking, alcohol, hypertension levels with TMT findings in diabetes patients

Parameter	TMT		P value
	Positive	Negative	
Smoking	58	42	<0.001
Alcohol	29	71	0.17
Hypertension	22	78	0.66

DISCUSSION

In recent years, the prevalence of coronary artery disease has increased. As a result, there is a need not only to treat the disease on time, but also to forecast the disease early and thereby reduce morbidity and mortality by commencing therapy in the early stages of the disease.

Early diagnosis of subclinical disease, as well as diligent following supervision and follow-up, is one method to the prevention and reduction of coronary artery disease-related consequences.

Diabetic individuals are frequently hyperlipidaemic, putting them at high risk for coronary heart disease. The significant cardiovascular mortality linked with Type 2 diabetes is the result of a protracted, exacerbated postprandial state.

In Type 2 diabetics, an aberrant lipid profile in the postprandial state is more important than an abnormal lipid profile in the fasting state in generating atherosclerotic problems. [6]

In the current study, the majority of diabetes patients (50 percent) were between the ages of 50 and 60, followed by 40-50 years (22 percent) and 60-70 years (28 percent). For this investigation, an equal number of age and gender matched controls were used. Our findings were consistent with those of Raghavendra et al, who found that the age group 51-60 years had the highest prevalence of diabetes (45 percent), followed by age 41-50 years (30 percent), and patients aged 30-40 years had the lowest prevalence (21 percent). Similarly, the bulk of non-diabetes patients (41%) are between the ages of 51 and 60, with 41-50 years (34%) coming in second.

Elisabeth et al evaluated 14 type 2 diabetes patients and 12 healthy controls aged 35 to 60 years. Both diabetes and control participants were around the same age (49.9± 8.5 versus 48.9±8.1 years). 8 The mean age of diabetes patients in Kumar JG et al's research was 60.32± 5.2, whereas non-diabetic patients were 50.5± 34 years. 9 Gender distribution was comparable in both the diabetes and non-diabetic groups in the current investigation. Similarly, Gandiah et al discovered that diabetes patients were 68 percent male and 32 percent female, whereas nondiabetic patients were 68 percent male and 32 percent female. This suggests that the gender distribution was comparable throughout the groups. 6.In the Raghavendra et al research, 58 percent of non-diabetic controls were males and 42 percent were females, whereas 52 percent of diabetes patients were males and 48 percent were females. [7]

In contrast, all 26 diabetic and non-diabetic patients in the Elisabeth et al trial were men. [8] In the Kumar JG et al research, diabetes patients were 62.99 percent male and 37.01 percent female, whereas nondiabetic patients were 67.93 percent male and 32.07 percent female. [9] T2DM is regarded as a risk factor for cardiovascular disease (CVD). Its macrovascular consequences are linked to a twofold increase in the incidence of atherosclerotic CVD. The majority of diabetics with cardiovascular disease are asymptomatic. In asymptomatic people, electrocardiogram (ECG) abnormalities have been demonstrated to be predictive of silent ischaemia. Atypical ECG responses are related with a statistically significant increased risk of cardiac death and morbidity.

In the current investigation, ST depression and T wave inversion were detected in 25 (25 percent) of 100 diabetic patients who had ECG abnormalities, 21 (21 percent) had LAE, 7 (7 percent) had LVH, 3 (3 percent) had RBBB, and 3 (3 percent) had LBBB. There is no ST elevation in any of the patients. Gupta et al examined ECG alterations in 100 asymptomatic Type 2 DM patients and discovered that 13% had ST depression + T wave inversion, 6% had LAE, 4% had LVH, and 2% each had RBBB and LBBB. There was no evidence of ST elevation in any of the individuals. [10,11]

According to a study conducted in the United States involving 635 African American-Diabetes Heart Study (AA-DHS) participants, the prevalence of ECG abnormalities in diabetes patients was prolonged QTc (25.5 percent), T wave changes (22 percent), LVH (18.5 percent), sinus tachycardia (15.5 percent), ischaemic heart disease (IHD) (9 percent), conduction defects (7 percent), and ectopic beats (4 percent). [12,13] Both investigations are consistent with the current study. Patients' histories, physical examinations, and non-invasive procedures such as ECG, holter monitoring, stress test (TMT), stress echocardiography, and stress thallium imaging are useful in establishing the diagnosis of diabetic myocardial ischemia.

The majority of individuals with aberrant postprandial lipid profiles showed positive TMT ($p<0.001$), according to the current study comparing the lipid profile with TMT results. Similar findings were reported by Gupta RK et al, who found that TMT was positive in 32 (31.37 percent) of 102 diabetes patients, with higher in men (59.73 percent). TMT positive patients had substantially higher mean cholesterol (189.81 mg%), triglyceride (135.19 mg%), and LDL (116.28 mg%) values ($P<0.001$). 10 Another research by Khanapure et al found that 32.9 percent of 82 asymptomatic T2DM patients tested positive for TMT.[11] There were some limitations to our investigation. For all instances, information on a family history of premature CAD, autonomic neuropathy, and retinopathy was unavailable. The minimal number of research subjects may be a constraint in and of itself.

CONCLUSION

Based on the findings of this investigation, it is possible to conclude that patients with T2DM had a greater prevalence of ECG abnormalities. T2DM patients are also more likely to have TMT. We propose that T2DM patients be screened for CVD using ECG and TMT.

REFERENCES

1. Gregg EW, Cheng YJ, Srinivasan M, et al. Trends in cause-specific mortality among adults with and without diagnosed diabetes in the USA: an epidemiological analysis of linked national survey and vital statistics data. Lancet. 2018;391:2430-40.https://doi.org/10.1016/S0140-6736(18)30314-3.
2. Ashley EA, Raxwal VK, Froelicher VF. The prevalence and prognostic significance of electrocardiographic abnormalities. Curr Probl Cardiol 2000;25:1-72.
3. Joshi SR, Parikh RM. India-diabetes capital of the world: now heading towards hypertension. J Assoc Physicians India. 2007;55:323-4.
4. Kumar A, Goel MK, Jain RB, Khanna P, Chaudhary V. India towards diabetes control: Key issues. Australas Med J. 2013;6(10):524-31
5. Bacci S, Villela M, Villela A, Langialonga T, Grilli M, Rauseo A et al. Screening for silent myocardial ischaemia in type 2 diabetic patients with additional atherogenic risk factors: applicability and accuracy of the exercise stress test. Eur J Endocrinol. 2002;147:649-54.
6. Gandiah P, Nandyala V, Srinivas B, Reddy BRK, Farheen N, Reddy GY.A study to show postprandial hyper triglyceridemia as a risk factor for macrovascular complications in type 2 DM. International Journal of Contemporary Medical Research 2016;3(6):15871590.
7. Raghavendra S, Dutta TK, Tumbanatham A, Sethuraman KR, Jayasingh K, Pyadala N. Fasting and postprandial lipid profile in type 2 diabetes mellitus: a comparative study. International Journal of Contemporary Medicine Surgery and Radiology. 2018;3(1):161-5.
8. Cavallero E, Brites F, Delfly B, NicolaïewN ,Decossin C, De Geitere C et al. Abnormal Reverse Cholesterol Transport in Controlled Type II Diabetic Patients. Arteriosclerosis, Thrombosis, and Vascular Biology. 1995;15:2130-5.
9. Gupta RK, Gupta R, Chaudhary S, Bhatheja H, Pathak P. Assessment of Asymptomatic Coronary Heart Disease in Type 2 Diabetics with Treadmill Test and Framingham 10- Year CHD Risk Scoring System. Journal of Cardiovascular Disease Research 2015;16 (3):1-8.
10. Khanapure SP, Parmar D, Bajaj G, Mural RH. Prevalence of Silent Coronary Artery Disease(CAD) in Asymptomatic T2DM–A Prospective Study.International Journal of Contemporary Medical Research. 2017; 4 (11):1-8.
11. Gupta S, Gupta RK,Kulshrestha M,Chaudhary RR. Evaluation of ECG Abnormalities in Patients with Asymptomatic Type 2 Diabetes Mellitus. J Clin Diagn Res. 2017; 11(4):OC39-41.
12. Sellers MB, Divers J, Lu L, Xu J, Smith SC, Bowden DW et al. Prevalence and determinants of electrocardiographic abnormalities in African Americans with type 2 diabetes. J Epidemiol Glob Health. 2014;4(4):289-96.
13. Kumar V, Madhu SV, Singh G, Gambhir JK. Post-Prandial Hypertriglyceridemia in Patients with Type 2 Diabetes Mellitus with and without Macrovascular Disease. JAPI. 2010;58:603–07.