

ORIGINAL ARTICLE

A Study of ECG and TMT Changes in Asymptomatic Type-2 Diabetes mellitus

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ABSTRACT

Introduction: Coronary Artery Disease (CAD) has a high prevalence in Asian Indians. 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 ischaemia. For these reasons, there is an increasingly recognized need to document the prevalence of cardiovascular diseases in a diabetic population. Early detection of asymptomatic CAD in diabetics may prevent catastrophic cardiac events.

Material and method: The present study is a cross sectional study on the patients of type 2 diabetes mellitus without clinical and electrocardiographic evidence of coronary artery disease.

Result: In 102 of our patients, TMT was positive in 32 patients (31.37%) and was negative in 70 patients (68.6%) . Among TMT positive patients 19 (26.03%) were males and 13 (44.83%) were females.

Conclusion: 21 out of 32 TMT positive patients underwent coronary angiography and 19 were found to have significant coronary artery disease (11 triple vessel & 8 double vessel disease). All 19 patients were treated successfully by coronary artery bypass grafting.

Keywords: Coronary Artery Disease, myocardial ischemia, ECG

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INTRODUCTION

Diabetes mellitus is an 'Iceberg disease'. Coronary artery disease (CAD) is more common in diabetics and is the leading

cause of death in patients with type 2 diabetes and is often asymptomatic because of silent myocardial ischemia. CAD can be asymptomatic in diabetes and may present with sudden death, myocardial infarction, arrhythmia, silent myocardial ischemia or heart failure. However, periodical thorough clinical examination and resting E.C.G may fail to detect coronary artery disease. Hence sophisticated cardiovascular non invasive tests should then be proposed for early detection of CAD in these patients. Exercise electrocardiograph can identify the majority of patients likely to have significant ischemia during their daily activities and remains the most important screening test for significant CAD. This study will help add to the growing literature on evaluation of the prevalence of ischemic changes in selected asymptomatic type 2 Diabetic patients by exercise treadmill test. The objectives of the present study were to assess the prevalence of ischemic cardiac changes in asymptomatic Type 2 Diabetic patients and to study and evaluate Asymptomatic Type 2 Diabetes Mellitus with normal ECG by Treadmill Test.

MATERIAL AND METHOD

The present study was conducted in the Andhra Medical College and K.G.Hospital, Visakhapatnam. Study Design: The present study is a cross sectional study on the patients of type 2 diabetes mellitus without clinical and electrocardiographic evidence of coronary artery disease.

Source of data - The patients of type 2 diabetes mellitus without clinical evidence of coronary artery disease attending diabetic clinic, cardiology and medicine OPD, Andhra medical college and K.G.Hospital, Visakhapatnam were enrolled in the present study. Sample Size. Total of 102 patients were included in the study.

Sample size calculation - The sample was calculated considering 80% of the average number of patients of type 2 diabetes mellitus without clinical evidence of coronary artery disease attending diabetic clinic, cardiology and medicine OPD, Andhra Medical college and K.G.Hospital, Visakhapatnam over last three years.

Selection Criteria

1. Patients of type 2 Diabetes mellitus with out clinical evidence of coronary artery disease.
2. Normal resting 12 lead electrocardiogram.

No past history of Ischemic heart disease, CVA and hypertension. A detailed history was elicited from all patients with emphasis on symptomatology of diabetes mellitus, duration of diabetes mellitus, and its various microangiopathic complications.

Body mass index (BMI) was calculated according to Quetelet's formula and subjects were accordingly categorized. Normal (18.5-24.9), overweight (25-29.9), obesity (30-39.9), morbid obesity (>40).

INVESTIGATION

All patients were subjected to the following investigation at the time of inclusion into the study i.e. Routine hemogram, Glycosylated hemoglobin, Fasting and post prandial blood sugar, Lipid profile (total cholesterol, triglycerides, LDL, HDL), Blood urea and serum Creatinine, Urine routine and microscopic examination, Resting Electrocardiogram and Tread mill testing.

RESULTS

We studied a total number of 102 cases of type 2 diabetes mellitus without clinical and electrocardiography evidence of ischemic heart disease in Andhra Medical College and K.G. Hospital, Visakhapatnam.

Age - The mean age of the study subjects was 50.11 years; standard deviation (SD) of 7.95 years with a range of 26 – 65 years. Most of the patients belonged to the age group 36 – 55 years.

Sex - Out of 102 cases, 73 were males and 29 were females.

Statistically, no significant difference was seen between the sexes as far as their mean Age, Systolic blood pressure, Diastolic blood pressure, Total cholesterol, Triglycerides, LDL, HDL, FBS and PPBS was concerned. Statistically, significant difference was seen between the sexes in aspect of their average BMI (P value=0.021) and average HbA1C (P value=0.01) was concerned. Average Age in males was 50.89 yrs & in females was 49.34 yrs. Average BMI in males and females was 29.46 kg/m² & 25.53 kg/m² respectively. Average HbA1C in males and females was 7.98% & 8.50% respectively.

Duration of Diabetes Mellitus - In the study population, more number of patients (61 i.e. 59.8%) were having diabetes equal to or less than 5 years, followed by 27 patients (26.4%) with the duration of 6 to 10 years, next 10 patients (9.8%) between 11 to 15 years and only 4 patients (3.9%) between 16 to 20 years.

In our 102 patients, 2 (1.96%) was on diet control alone, 59 (57.8%) were on one or the other OHA's, 10 (9.8%) were on one or the other form of insulin while 31 (30.39%) were receiving both oral hypoglycemic agents and insulin.

The observations made with tread mill testing were as follows with reference to average age, (p=0.0001), duration of diabetes (p=0.0001), BMI (p=0.0001), total cholesterol (p=0.001), triglyceride levels (p=0.0001), and LDL levels (p=0.0001), was found to have statistically significant difference in TMT positive cases and TMT negative cases. Average age in TMT positive and negative cases was 53.84 and 42.43 yrs respectively. Average BMI in TMT positive and negative cases was 30.41 and 25.01 kg/m² respectively. Average Total cholesterol in TMT positive and negative cases was 189.81 and 169.59 mg% respectively. Average triglyceride levels in TMT positive and negative cases was 135.19

Parameters	TMT	Mean	Std. Deviation	P Value	Inference
Avg Age (Yrs)	Positive	53.84	7.35	0.0001	Significant
	Negative	42.43	7.55		
	Positive	8.87	4.61		
Avg Duration of DM (Years)	Negative	5.01	3.14	0.0001	Significant
	Positive	30.41	5.13		
Avg BMI (Kg/m ²)	Negative	25.01	3.68	0.0001	Significant
	Positive	8.20	1.20		
Avg HbA1C(%)	Negative	8.10	0.78	0.623	Not Significant
	Positive	159.84	23.63		
Avg FBS (mg%)	Negative	164.42	21.09	0.331	Not Significant
	Positive	208.13	58.56		
Avg PPBS (mg%)	Negative	213.67	55.90	0.649	Not Significant
	Positive	189.81	25.28		
Avg Total Cholesterol (mg%)	Negative	169.59	27.82	0.001	Significant
	Positive	135.19	27.67		
Total Triglyceride (mg)	Negative	112.71	22.31	0.0001	Significant
	Positive	116.28	22.88		
Avg LDL (mg%)	Negative	97.41	16.31	0.0001	Significant
	Positive	38.19	2.80		
Avg HDL (mg%)	Negative	38.51	2.84	0.598	Not Significant

Table-3: Comparison of diabetic subjects with and without asymptomatic coronary artery disease

Parameters	Male (n=73)		Female (n=29)		Total		P Value	Inference
	S D	Mean	S D	Mean	S D	Mean		
Age (yrs)	7.13	50.89	8.78	49.34	7.95	50.11	0.61	NS
BMI (kg/m ²)	5.12	29.46	4.37	25.53	5.03	27.49	0.02	S
SBP (mmHg)	7.60	124.00	7.53	126.07	7.63	124.59	0.218	NS
DBP (mmHg)	5.77	81.51	5.77	81.52	4.60	81.00	0.555	NS
HbA1C (%)	0.87	7.98	0.98	8.50	0.93	8.13	0.01	S
T.Chol (mg%)	28.55	173.84	28.55	173.85	28.53	176.00	0.234	NS
TGL (mg%)	25.54	120.61	25.54	120.61	26.20	119.83	0.64	NS
LDL(mg%)	20.39	103.96	20.39	103.96	20.52	103.39	0.661	NS
HDL (mg%)	2.83	38.67	2.83	38.67	2.81	38.41	0.143	NS
FBS (mg%)	21.71	165.13	21.87	157.62	21.91	162.97	0.12	NS
PPBS (mg%)	57.43	214.32	54.71	205.93	56.52	211.90	0.503	NS

Table-1: Parameters

Duration of diabetes (yrs)	TMT Positive	%	TMT Negative	%	Total
> 5	13	21.31	48	78.69	61(100%)
6-10	9	33.33	18	66.67	27(100%)
11-15	7	70.00	3	30.00	10(100%)
16-20	3	75.00	1	25.00	4 (100%)
Total	32	31.37	70	68.63	102(100%)

Table-2: Duration of diabetes & TMT results

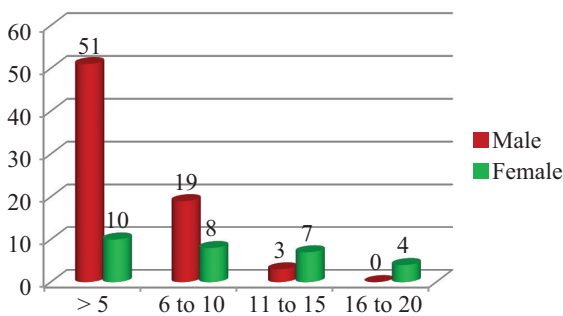


Figure-1: Duration of diabetes mellitus

[In the population, more number of patients (61 i.e 59.8%) were having diabetes equal to or less than 5 years, followed by 27 patients (26.4%) with the duration of 6 to 10 years, next 10 patients(9.8%) between 11 to 15 years and only 4 patients(3.9%) between 16 to 20 years]

and 112.75 mg% respectively. Average LDL in TMT positive and negative cases was 116.28 and 97.41 mg% respectively. Average duration of diabetes in TMT positive and negative cases was 8.87 and 5.01 years respectively.

DISCUSSION:

The present study was aimed at the asymptomatic presentation of coronary artery disease in diabetes mellitus patients. It consist of assessing the prevalence of asymptomatic coronary artery disease with normal resting ECG in diabetes mellitus, by seeking the TMT changes (positivity). This study consisted of 102 known diabetics without clinical and electrocardiographic evidence of CAD and were evaluated for

the prevalence of asymptomatic coronary artery disease by using exercise Tread mill testing.

In this study, 73 were males and 29 were females with mean age of 50.11 years. Of the total, 32 patients (31.37%) were overweight, 38 patients (37.25%) were obese and remaining were with normal BMI. Thus 'to be in obese' group was commonly seen. In our study population, more number of patients (61 i.e 59.8%) were having diabetes equal to or less than 5 years, followed by 27 patients (26.4%) with the duration of 6 to 10 years, next 10 patients(9.8%) between 11 to 15 years and only 4 patients(3.9%) between 16 to 20 years. In our 102 patients, 2(1.96%) was on diet control alone, 59 (57.8%) were on one or the other OHA's, 10 (9.8%) were on one or the other form of insulin while 31 (30.39%) were receiving both oral hypoglycemic agents and insulin.

Among 102 patients, TMT was positive in 32 (31.37%) and was negative in 70 patients(68.63%). Out of 32 positive, 19 were males and 13 were females. The prevalence of asymptomatic coronary artery disease in type 2 diabetes mellitus was found to be 31.37%(32/102). This study concurs with other studies done before. One study¹ found 31% diabetics without prior evidence of coronary artery disease had treadmill test positive and silent myocardial ischemia was 2.2 times more common in diabetics as compared with non diabetics. A study² in India found that 38.3% of diabetics without prior coronary artery disease had silent myocardial ischemia on exercise test. Another study³ from India, reported 50% incidence of silent myocardial ischemia in diabetics on exercise electrocardiogram and 35% on ambulatory monitoring. Another group⁴ found that 29% diabetics who were asymptomatic for coronary artery disease had silent myocardial ischemia on 24 hour ambulatory monitoring exercise electrocardiogram. A similar study⁵ had shown higher prevalence of silent myocardial ischemia in diabetics as compared to non diabetics. The other group⁶ found 12.1% of diabetics free of coronary artery disease to have silent myocardial ischemia on exercise electrocardiogram testing. One study⁷, found that silent myocardial ischemia was seen in 14 (46.7%) out of 30 diabetics by using tread mill test. One of the study⁸ concluded that the prevalence of silent myocardial ischemia by using exercise ECG was 17% and angiographic coronary artery disease was

found in 13% of middle aged subjects with type 2 diabetes mellitus without other cardiovascular risk factor. The other study⁹ from India, found that 51 (42.5%) had evidence of silent ischemia on treadmill testing. Of these 18 underwent coronary angiography and found to have significant CAD in 15 (83.7%). One study¹⁰ found that a total of 113/522 patients (22%) had silent ischemia using stress testing in asymptomatic patients with type 2 diabetes mellitus. Hence, the present study is in agreement with that diabetics have a higher prevalence of asymptomatic coronary artery disease.

Asymptomatic CAD in Type 2 Diabetics and Obesity

Average BMI in males and females was 29.46 kg/m² & 25.53kg/m² respectively with a statistically significant P value of 0.021. Average BMI in TMT positive and negative cases was 30.41 and 25.01 kg/m² respectively with a statistically significant P value of 0.0001. Must et al¹¹ conducted a study and found that Obesity was associated with type 2 diabetes and CAD. Another study¹² found that Obesity (either central/visceral or generalised) was found in 452 (48.7%) diabetics, of which 282 (62.4 %) had ischaemic heart disease as compared to only 234 (49.1%) of 476 non obese diabetics with coronary artery disease ($p < 0.0001$). A study¹³ carried out by Jung et al found out that Obesity was important risk factor for Diabetes mellitus.

In 102 of our patients, TMT was positive in 32 (31.37%) and was negative in 70 patients (68.63%). 61 patients with diabetes of duration equal to or less than 5 years, TMT positive in 13 (21.31%). 27 patients with diabetes of duration between 6 to 10 years, TMT was positive in 9 (33.33%). 10 patients with duration of diabetes between 11 and 15 years, TMT was positive in 7 (70%). 4 patients with diabetes of duration between 16 and 20 years, TMT was found to be positive in 3 (75%). Our results are similar to one study¹⁴ who found that 70% subjects (7/10) with diabetes of more than 5 years duration had associated silent myocardial ischemia while only 30% subjects (3/10) with diabetes of less than 5 years duration had associated silent myocardial ischemia. Another study¹⁵ including 500 patients with type 2 diabetes mellitus with normal resting ECG found that, 62 (12.4%) patients had asymptomatic coronary artery disease on exercise treadmill testing. The abnormalities of exercise test were associated with longer duration of diabetes ($p < 0.005$).

In our study, out of the 21 patients who underwent CAG, 11 of them had triple vessel and 8 patients had double vessel coronary artery disease. Many studies have identified a high prevalence of coronary atherosclerosis in patients with diabetes, even among those without clinical coronary heart disease (CHD). One of the many studies have found that Patients with diabetes mellitus (DM) are prone to a diffuse and rapidly progressive form of atherosclerosis.

CONCLUSION

In our 102 patients, 2(1.96%) was on diet control alone, 59

(57.8%) were on one or the other OHA's, 10 (9.8%) were on one or the other form of insulin while 31 (30.39%) were receiving both oral hypoglycemic agents and insulin. 61 patients (59.8%) were having diabetes equal to or less than 5 years, followed by 27 patients (26.4%) with the duration of 6 to 10 years, next 10 patients (9.8%) between 11 to 15 years and only 4 patients (3.9%) between 16 to 20 years. This was the observation in our study: During our study we observed peripheral neuropathy was present in 32 patients (31.37%) and autonomic neuropathy was seen in 20 patients (19.6%). On correlating asymptomatic coronary artery disease with neuropathy we found that, there was higher incidence of asymptomatic coronary artery disease with peripheral neuropathy and autonomic neuropathy. The characteristics of patients with treadmill positive and negative groups were compared and it was seen that the two groups varied significantly ($p < 0.05$) with respect to their average age, BMI, duration of diabetes, total cholesterol, triglyceride and LDL levels. Thus, we can conclude that the prevalence of asymptomatic coronary artery disease is common in diabetics.

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