ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 08 | August - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

CORONARY ANGIOGRAPHIC PROFILE WITH POSITIVE EXERCISE TREADMILL TEST IN PATIENTS WITH DIABETES AND NON-DIABETES. - A COMPARATIVE STUDY

Cardiology

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ABSTRACT

Introduction: Cardiovascular diseases account for approximately 75% of the deaths that occur in patients with diabetes. People with diabetes have an increased prevalence of atherosclerosis and coronary arterydisease and experience higher morbidity and mortality after acute coronary syndrome and myocardial infarction. The aim of this paper to compare the diagnostic accuracy of exercise treadmill test in the detection of significant and severe coronary artery disease as determined by coronary angiography between diabetics and non-diabetics. **Materials And Methods:** This comparative study had been carried out in the department of Cardiology, SSIMS Hospital, Davanagere in patients with 50 number of CAD with diabetes and 50 number of CAD without diabetes during the period of August 2024 to May 2025. **Results:** Based on the study protocol of study patients were divided as more significant coronary artery lesion and positive exercise treadmill test in diabetic patients were grouped as Group A(N=50) and those without diabetes were grouped as Group B (N=50) for statistical analysis. There is close relationship between the METS, ST Segment Shifts, TMT respondents and CAG with respect to the diabetic patients. **Conclusion:** In the present study, there is strong correlation between positive exercise treadmill test and coronary angiographic profile in patients with diabetes and non-diabetes. It is shown that in our study that there is positive treadmill test in METS less than 5 predicts an increased likelihood of TVD (18%) and LMS (3%) LMCA disease involvement, Complex lesion, lesion like Bifurcation (14%) and Calcification (33%) was significantly higher in diabetics.

KEYWORDS

INTRODUCTION:

Coronary artery disease remains the leading cause of mortality and morbidity[1]. Diabetes mellitus (DM) is a global health issue and burden. The population of DM patient is rapidly increasing in India, following the westernization of life the Indian style. Diabetes is the 7th leading cause of death in India, with much of that mortality a result of cardiovascular disease[2]. Ultimately atherosclerosis accounts for 65-80 % of all deaths among south Indian patients with diabetes[3].

Because the clinical signs of coronary artery disease in diabetic patients are hard to detect and routine screening is costly, it would be of great benefit to try to either prevent CAD from occurring or to detect it early and provide optimal care by using a resting 12 lead ECG, exercise Treadmill test and Coronary angiography.

Exercise Treadmill test is non-invasive relatively inexpensive and widely used in the clinical setting. Four major clinical uses of exercise testing relating to diagnosis, prognosis and functional assessment and therapeutic prescription Coronary angiography (CAG) is presently the gold standard investigation in the evaluation of coronary artery disease. In our study, its correlation with positive exercise Treadmill test in patients with diabetes and without diabetes is assessed.

MATERIALS AND METHODS:

We have selected 50 number of CAD patients with diabetes were randomly selected for study (Group A) and results were compared with control of 50 CAD patients without diabetes (Group B). They were men and women ranging in the age from 30 to 65 years with a mean of 48 years. All patients were evaluated with detailed history, examination and laboratory investigation including fasting blood sugar, post prandial blood sugar, lipid profile, 12 leads ECG exercise treadmill test with Bruce protocol and coronary angiography. They were included in the study after adhering to study protocol.

We have taken the blood pressure, height and weight of each patient. All the blood tests were done after 12 hours of overnight fasting by Calorimetry Diabetes mellitus was diagnosed to be present if a patient had a definite history of diabetes with records of treatment or fasting plasma glucose more or equal to 126 mg/dl or also two hours past load glucose more or equal to 200 mg/dl, based on the guidelines of the American Diabetes Association 2015. Angina class of each patient was defined according to CCB classification[1].

All the patients were exercised in the Treadmill according to the Bruce and modified Bruce protocol under Cardiologist's supervision. The exercise test procedure was explained to them and each patient's consent was obtained. The patients were exercised according protocol using the graded multistage treadmill test. Patients were encouraged to their maximum. Those who are in decompensated heart failure, advanced AV block and high-risk unstable Angina are excluded from the study. Metabolic equivalents, (METS) was used to express the estimated work load1.

The positive exercise ECG was determined by conventional criteria more or equal to 1 mm of horizontal or down slopping ST segment depression at 80 m sec after the end of the QRS complex (from J point) in three consecutive beats.

The Coronary angiograms were done in Toshiba standalone cath lab in our hospital. Coronary angiograms were done through (R) radial (or) right femoral artery approach after getting patient's consent. CAD was defined as the presence of more or equal to 50% stenosis in the Coronary arteries.

Results And Data Analysis:

Data are expressed as mean value plus or minus standard deviation (SD). Statistically significant analysis defined as $P<0.05$. Statistical analysis was done using SPSS software system based on the study protocol. 100 study patients were divided as those significant Coronary artery lesion and positive exercise treadmill test in diabetic patients were grouped as Group A (N=50) and those without diabetes were grouped as Group B (N=50) for statistical analysis.

They were thoroughly evaluated by 12 leads ECG, Exercise treadmill test, 2 D Mode Doppler and Tissue Doppler Echocardiography and Coronary Angiography. The results of the study were as follows.

The association between TMT,CAG with diabetes patients were analyzed and the results were given in the following bivariate table.

TMT And Diabetes Mellitus

	DM Type			Total
		Non-Diabetic	Diabetic	
TMT	Mild	28	21	49
		28.00%	21.00%	49.00%
	Moderate	16	19	35
		16.00%	19.00%	35.00%
	Severe	6	10	16
		6.00%	10.00%	16.00%
	Total	50	50	100 0.0%
			50	100.00%

PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

CAG* Diabetes Mellitus

		DM Type		Total
		Non-Diabetic	Diabetic	
CAG	N	9	5	14
		9.00%	5.00%	14.00%
	SVD	12	9	21
		12.00%	9.00%	21.00%
	DVD	20	14	34
		20.00%	14.00%	34.00%
	TVD	9	19	28
		9.00%	19.00%	28.00%
	Left Main	0	5	5
		0.00%	5.00%	5.00%
	Total	50	50	100
		50.00%	50.00%	100.00%

In order to find the relationship between the TMT and CAG of the respondents and Diabetes Mellitus, a Chi-Squre test was used and result of the test is shown in the following table:

Chi-Square Test				
	Value	df	P Value	Remark
TMT	8.652	2	0.013	Significant
CAG	10.326	4	0.035	Significant

It is observed from the above table that the P value is less than 0.05 or and hence, the result is significant at 5% level. From the analysis, it is concluded that there is close relationship between the TMT and CAG of the respondents and Diabetes Melitus.

The association between TMT and CAG in diabetics and nondiabetics is analyzed and the results were given in the following table.

TMT- CAG* Diabetics						
Diabetic	CAG					Total
	N	SVD	DVD	TVD	Left Main	
Mild	4	9	4	5	0	22
	8.00%	18.00%	8%	10.00%	0.00%	44.00%
Moderate	0	0	9	9	1	19
	0.00%	0.00%	18.00%	18.00%	2.00%	38.00%
Severe	0	0	3	5	1	9
	0.00%	0.00%	6.00%	10.00%	2.00%	18.00%
Total	4	9	16	19	2	50
	8.00%	18.00%	32.00%	38.00%	4.00%	100.00%

TMT- CAG* Non-Diabetics

TMT-CAG* Non-Diabetics						
Non -Diabetic		CAG				
		N	SVD	DVD	TVD	Total
TMT	Mild	6	7	12	7	
		8.00%	14.00%	24.00%	14.00%	60.00%
	Moderate	1	5	8	3	15
		2.00%	10.00%	16.00%	6.00%	34.00%
	Severe	0	3	0	0	3
		0.00%	6.00%	0.00%	0.00%	6.00%
	Total	7	30..0%	18	10	50
		10.00%	30.00%	40.00%	20.00%	100.00%

In order to find the relationship between the TMT of the respondents and CAG, a Chi-Square test was used and result of the test is shown in the following table:

TMT CAG Diabetes -Chi-Square Test

	Value	Df	P Value	Remarks
Diabetic	16.715	8	0.033	Significant
Non -Diabetic	6.81	6	0.339	Not Significant

From the analysis it is concluded that there is close relationship between the TMT of the respondents and CAG with respect to the diabetic patients

DISCUSSION:

Coronary artery disease in patients with diabetes is a rising scourge in developing and underdeveloped countries. It remains the most common single cause of mortality and morbidity in men below 65 years of age6. For early diagnosis of CAD, before the occurrence of major mishap like myocardial infarction, treadmill stress test remains a chief, cost effective and widely available and applicable approach. The advent of selective coronary arteriograpy has enabled the clinician to correlate in vivo coronary artery anatomy with such non-invasive tests as exercise electrocardiography.

In this study, we included all the patients with the positive exercise treadmill test to determine how will the existences of three vessel or LMS can be predicted among patients referred for a treadmill exercise test with suspected CAD.

When we analyzed the relationship of CAG with TMT, we found that there was statistically significant correlation between CAD and TMT. In diabetics and non-diabetics (P = 0.000 highly significant) from our study. TMT correlation with normal epicardial coronary arteries was 14%, whereas for single vessel disease, double vessel disease & TVD and left main disease were 21.0%, 34% 28% and 3% respectively.

Our findings were similar to that of Roitmanetal finding13, in their study, they found that strong correlation between positive exercise treadmill test and CAG. Proudfit etal21 reported METS in an independent predictor of the exercise of TVD or LMS When we analysedthe relationship between METS and diabetes mellitus, we found that METS <5 was 9.8% in diabetic and only 3% in nondiabetic, and we also noted that METS >7 was 18% in diabetic and 31.5% in non-diabetic. Our findings were similar to that of Bartel AG eal11 who reported a positive relationship between workload and existence of TVD or LMS in diabetics and non-diabetics. We also noted that METS <5 was 22.5% in TVD and 16% in DVD and 3% in LMS in diabetic patient but only 12% in TVD, 6% in DVD and 9.5% in SVD in non-diabetics.

Saeed Sadegan MD etal8 reported that workload equal to or less than 7 METS indicated on 8.3% chance of detecting LMS confirmed by angiographic findings. In our study, there is 5% chance of detecting LMS which was confirmed by CAG. In contrast, when the workload was raised to greater than 7 METS, this chance decreased to 0%.

When analyzing the relationship between ST shifts and CAG, we found that there is close relationship between ST segment shift of the respondents and CAG with respect to the diabetic group (P=0.004). From our study, we noted that ST segment > 2 mm in CAD patients with diabetes, was 11% in DVD, 8.5% in TVD and 6% in LMS.

Whereas in non-diabetics 5% in SVD, 6% in DVD, 7.5% in TVD and 0% in LMS. Our findings were similar to that of Alan G.Bartel etal11 who reported that the degree of ST Segment depression was related to the severity of CAG. They found the patients having ST Segment depression greater than 2.00 mm were much likely to have TVD, than those with less severe ST depression. These findings correlate with our study.

Among diabetic patients, 9(9.5%) had chronic total occlusion involving SVD and 12 (16%) had DVD, 19 (19.5%) had TVD chronic total occlusion. The corresponding values in non-diabetics was 15 (15.0%), 18 (20.0%) and 10 (10.0%) respectively (P=0.035). When we analyzing diffuse lesion in diabetic patients it was 36 (82%) and 26 (45%) in non-diabetics. Our findings correlated with that of Jaishankar etal findings5 in their study, they were observed diffuse lesion were present in 47% in diabetics and 24% in non-diabetics. Bagchi Saumati etal7 also demonstrated that significantly higher incidence of severe disease (DVD, TVD) was found in CAD patients with diabetes. (P <0.05).

From our study, we have observed that the pattern of vessel involvement was similar in both groups with mostly commonly involved was left anterior descending artery. Our findings correlate with Girish etal observation[19].

When we are analyzing LMCA involvement in patients with CAD with diabetes and non-diabetes, we found that LMCA involvement was higher in diabetes patient (3.0%) versus none in non-diabetics patients (P=0.000). This finding correlated with that of Girish etal study, in their

study they demonstrated that LMCA involvement was higher in diabetic patients (P<0.001).

When we are analyzing bifurcation lesion in both groups, we found that Bifurcation lesion was higher in diabetics (14%) and in non-diabetics, it was only 3%. We also noted that calcified lesions were 33% in diabetics and 14% in non-diabetics. Our findings correlates with that of Laxman Dubey etal study[23], in their study, they observed that calcified lesions were 56% in diabetics and 29% in non- diabetics.

CONCLUSION:

In the present study, there is strong correlations between positive exercise treadmill test and coronary angiographic profile in patients with diabetes and non-diabetes. METS is an independent predictor of the existence of the Three Vessel or Left Main Disease. It is shown that in our study that there is positive treadmill test in METS less than 5 predicts an increased likelihood of TVD (18%) and LMS (3%) in patient with diabetes. Our study confirmed that there is a positive relationship between workload and existence of TVD or LMS. This study shows that the degree of ST segment depression correlates well with the angiographic degree of the stenosis. ST segment depression >2.00 mm has significant correlation in predict TVD (8.5%) and LMS (6%). Diabetes Mellitus results in a higher incidence of chronic total occlusion and more proximal and more diffuse coronary lesion (80%). Chronic total occlusion involving TVD in diabetic (19.5%) is more than in patients without diabetes (10%). Complex lesion like Bifurcation (14%) and calcification (33%) was significantly higher in diabetics. It is shown that in our study that there is LMCA disease involvement was higher in diabetics, when compared with nondiabetics. i.e.3% in diabetics.

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