Exercise-induced ischemia in newly diagnosed asymptomatic type 2 diabetes mellitus patients: a prospective observational study

Dr. Lakshmi Spandana Potluri[1*] and Dr. Sri Sowmya Pediredla[2]

[1] Senior Resident, Department of Cardiology, Rajarajeswari Medical College and Hospital, Bangalore, Karnataka, India

[2] Senior Resident, Department of Cardiology, GSL Medical College and General Hospital Rajahmundry, Andhra Pradesh, India

*Corresponding author: Dr. Lakshmi Spandana Potluri

Received 17 March 2026; Accepted 01 May 2026; Published 12 May 2026

DOI: https://doi.org/10.64171/JAMS.2026.6.2.7-11

Abstract

Background: Cardiovascular disease remains the leading cause of morbidity and mortality in patients with type 2 diabetes mellitus (T2DM). Coronary artery disease in diabetes may remain clinically silent until advanced stages because of autonomic dysfunction, altered pain perception, and diffuse atherosclerosis. Early recognition of occult ischemia may permit timely preventive intervention.

Objective: To determine the prevalence of exercise-induced ischemia using treadmill exercise testing in newly diagnosed asymptomatic T2DM patients and to identify associated clinical predictors.

Methods: This prospective observational study enrolled 200 newly diagnosed asymptomatic T2DM patients with normal resting electrocardiograms and no known coronary artery disease. All patients underwent detailed clinical evaluation, biochemical investigations, lipid profile assessment, and treadmill stress testing using the Bruce protocol.

Results: Of the 100 participants, 63% were male and 37% were female. The majority belonged to the 41–50 year age group. Mean body mass index was 24.71 ± 3.42 kg/m². Mean fasting blood glucose was 181.74 ± 33.80 mg/dL, postprandial blood glucose 229.35 ± 57.92 mg/dL, and HbA1c 8.63 ± 1.22%. Positive treadmill stress testing suggestive of exercise-induced ischemia was observed in 2% patients. HbA1c was significantly higher in treadmill-positive patients compared with treadmill-negative patients.

Conclusion: Exercise-induced ischemia was uncommon in newly diagnosed asymptomatic T2DM patients. Poor glycemic control was significantly associated with positive stress testing. Selective rather than universal screening may be more appropriate in this population.

Keywords: Type 2 diabetes mellitus, Silent ischemia, Treadmill test, HbA1c, Coronary artery disease, Asymptomatic diabetes

Introduction

Type 2 diabetes mellitus is one of the most important global health challenges and is strongly associated with premature cardiovascular morbidity and mortality. Cardiovascular disease remains the leading cause of death among individuals with diabetes [1, 2]. Patients with T2DM have accelerated atherosclerosis, endothelial dysfunction, chronic inflammation, platelet activation, and metabolic abnormalities that increase the risk of coronary artery disease (CAD) [3].

A major challenge in diabetic cardiovascular care is the occurrence of silent myocardial ischemia. Due to autonomic neuropathy and altered nociception, significant coronary disease may progress without classical anginal symptoms [4]. Consequently, some patients first present with myocardial infarction, heart failure, arrhythmia, or sudden cardiac death [9]. Exercise treadmill testing (TMT) is an inexpensive, accessible, and non-invasive modality used to detect inducible ischemia. However, recent guidelines do not recommend routine universal screening of all asymptomatic diabetic individuals, particularly those at low or intermediate risk [1, 7, 10]. Instead, a risk-based selective approach is increasingly favored.

Most available studies have evaluated long-standing diabetes. Data on newly diagnosed asymptomatic T2DM patients remain limited [11]. Therefore, this study aimed to determine the prevalence of exercise-induced ischemia in newly diagnosed asymptomatic T2DM patients and identify associated clinical predictors.

Materials and Methods

Study design and setting

This prospective observational study was conducted in the Department of Cardiology at tertiary care teaching hospitals in South India over a 1 year period.

Study population

A total of 100 newly diagnosed patients with type 2 diabetes mellitus were enrolled consecutively.

Inclusion criteria

- Newly diagnosed T2DM
- Age >18 years
- No symptoms suggestive of coronary artery disease
- Normal resting electrocardiogram
- Provided informed consent

Exclusion criteria

- Known coronary artery disease

- Prior myocardial infarction
- Typical angina or anginal equivalent symptoms
- Heart failure
- Significant valvular heart disease
- Uncontrolled hypertension
- Severe renal dysfunction
- Peripheral vascular disease
- Cardiomyopathy
- Contraindication to exercise stress testing

All participants underwent: Detailed medical history, Physical examination, Anthropometric measurements, Blood pressure recording, Fasting blood glucose, Postprandial blood glucose, HbA1c estimation, Lipid profile.

Treadmill stress testing

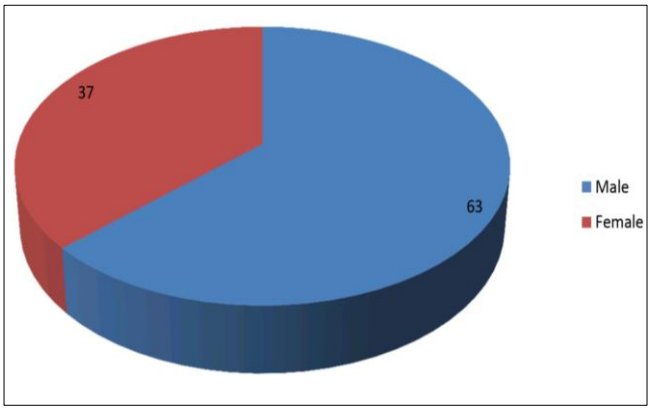
Exercise treadmill testing was performed using the Bruce protocol. Test positivity was defined by ischemic ST-segment changes and/or symptom-limited findings suggestive of inducible myocardial ischemia [5, 12].

Statistical analysis

Continuous variables were expressed as mean ± standard deviation, and categorical variables as percentages. Comparative analysis between treadmill-positive and treadmill-negative groups was performed. A *p*-value <0.05 was considered statistically significant.

Results

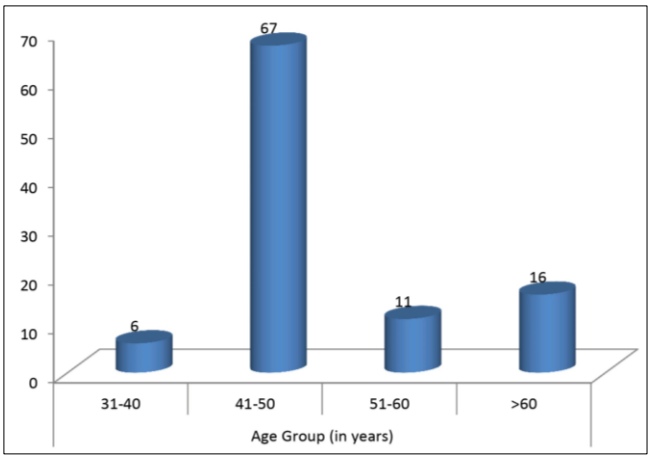
Baseline characteristics



Graph 1: Gender distribution among the study subjects

Table 1: Gender distribution among the study subjects

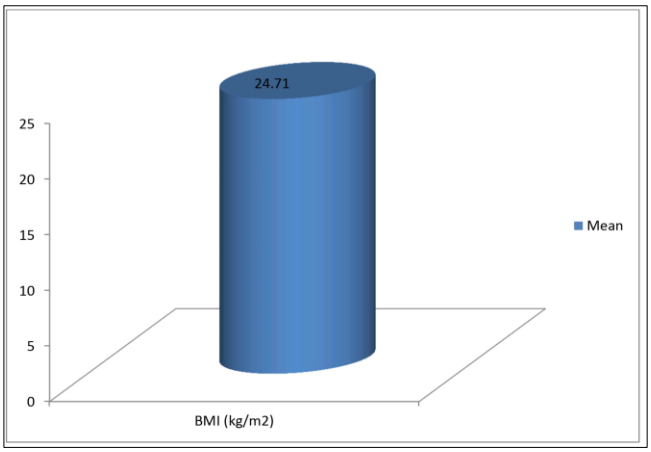
Gender	N	%
Male	63	63
Female	37	37
Total	100	100



Graph 2: Age distribution among the study subjects

Table 2: Age distribution among the study subjects

Age Group (in years)	N	%
31-40	6	6
41-50	67	67
51-60	11	11
>60	16	16
Total	100	100



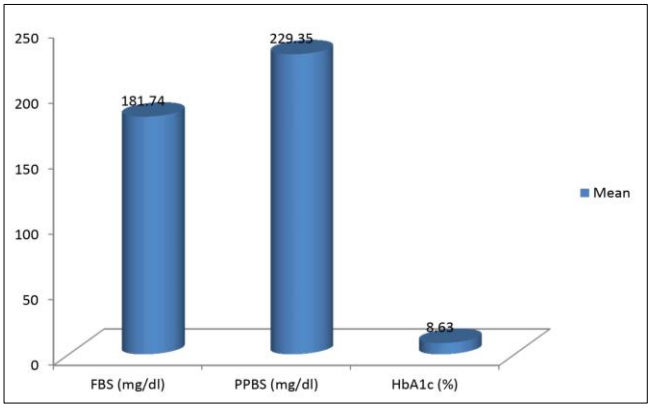
Graph 3: Mean BMI (kg/m^2) among the study subjects

Table 3: Mean BMI (kg/m^2) among the study subjects

Variables	Value
Mean	24.71
SD	3.42

Among the 100 study participants, 63 were male and 37 were female. Most patients were between 41 and 50 years of age. Mean body mass index was 24.71 ± 3.42 kg/m².

Glycemic and lipid Parameters

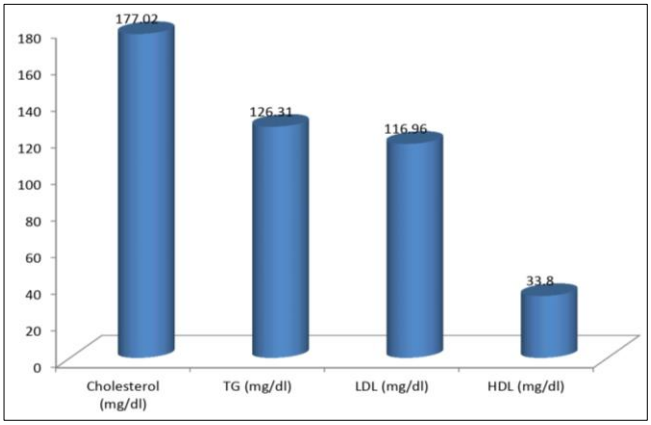


Graph 4: Diabetic profile among the study subject

Table 4: Diabetic profile among the study subjects

Variables	Mean	SD
FBS (mg/dl)	181.74	33.80
PPBS (mg/dl)	229.35	57.92
HbA1c (%)	8.63	1.22

All the diabetic parameters viz. FBS (mg/dl), PPBS (mg/dl) and HbA1c (%) were found to be in higher range i.e. mean FBS (mg/dl), PPBS (mg/dl) and HbA1c (%) was 181.74±33.80, 229.35±57.92 and 8.63±1.22 respectively.



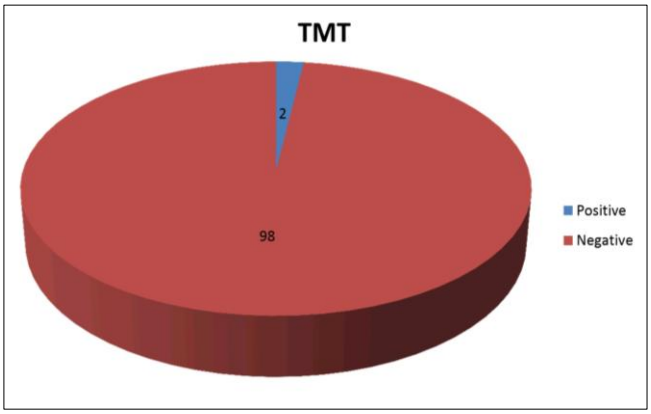
Graph 5: Lipid profile among the study subjects

Table 5: Lipid profile among the study subjects

Variables	Mean	SD
Cholesterol (mg/dl)	177.02	26.85
TG (mg/dl)	126.31	29.62
LDL (mg/dl)	116.96	29
HDL (mg/dl)	33.8	1.27

Analysis of Lipid Profile showed Mean cholesterol (mg/dl), TG (mg/dl), LDL (mg/dl) and HDL (mg/dl) among the study subjects was 177.02±26.85, 126.31±29.62, 116.96±29 and 33.8±1.27 respectively.

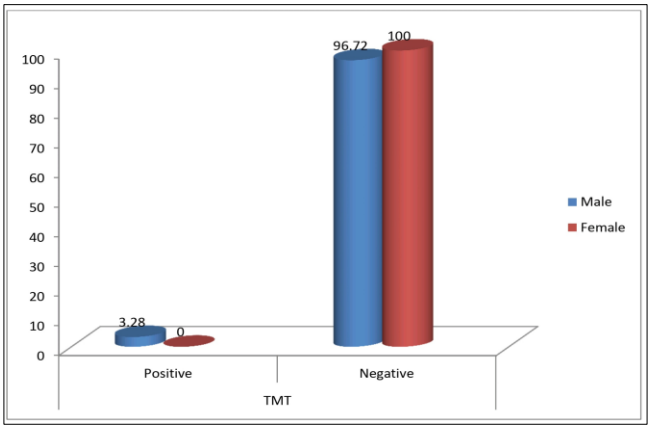
Treadmill test outcomes



Graph 6: TMT outcomes among the study subjects

Table 6: TMT outcomes among the study subjects

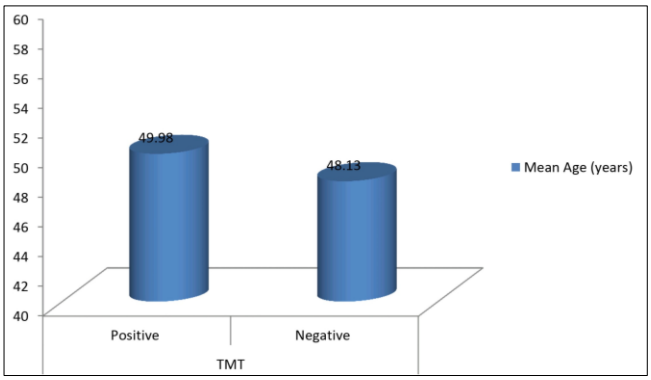
TMT	N	%
Positive	2	2
Negative	98	98



Graph 7: TMT outcomes among the study subjects according to gender

Table 7: TMT outcomes among the study subjects according to gender

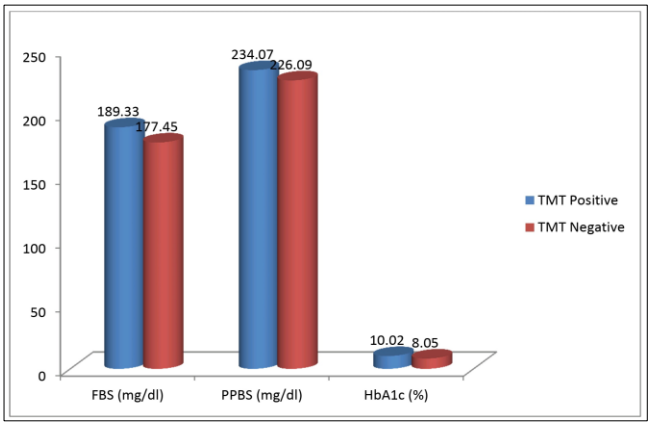
Gender	TMT				Chi Square	p value
	Positive		Negative			
	N=2	%	N=98	%		
Male	2	3.28	61	96.72	0.09	0.94
Female	0	0	37	100		



Graph 8: Mean age among the study subjects according to TMT outcomes

Table 8: Mean age among the study subjects according to TMT outcomes

TMT	Mean Age (years)	SD	t test	p value
Positive	49.98	7.02	1.37	0.42
Negative	48.13	5.19		



Graph 9: Mean diabetic profile among the study subjects according to gender

Table 9: Mean diabetic profile among the study subjects according to gender

Variables	TMT				t test	p value
	Positive		Negative			
	Mean	SD	Mean	SD		
FBS (mg/dl)	189.33	31.66	177.45	34.67	1.68	0.22
PPBS (mg/dl)	234.07	51.42	226.09	58.74	1.38	0.35
HbA1c (%)	10.02	1.38	8.05	1.14	7.54	<0.01*

Positive treadmill stress testing was observed in 2 patients (2%), while 98 patients (98%) had negative tests. No statistically significant association was observed with age, BMI, fasting glucose or postprandial glucose.

Patients with positive treadmill tests had significantly higher HbA1c values (10.02 ± 1.38%) compared with TMT-negative individuals (8.05 ± 1.14%), suggesting an association between poor glycemic control and inducible ischemia [6, 13].

Discussion

This study demonstrated a low prevalence (2%) of exercise-induced ischemia among newly diagnosed asymptomatic T2DM patients. These findings suggest that occult obstructive coronary disease may be less common at the time of diagnosis compared with patients with longer disease duration.

Earlier studies such as the DIAD trial reported a higher prevalence of silent ischemia in established diabetes populations [14, 15]. The difference may be explained by longer cumulative exposure to hyperglycemia, endothelial dysfunction, vascular inflammation, and progressive atherosclerosis in chronic diabetes.

The significant association between elevated HbA1c and positive treadmill testing in the present study is clinically relevant. Poor glycemic control has been linked to adverse vascular remodeling, oxidative stress, and increased cardiovascular risk [6, 13]. Thus, HbA1c may help identify newly diagnosed diabetic patients who merit closer cardiovascular assessment.

Current international guidelines do not support indiscriminate screening of all asymptomatic diabetic patients [1, 7, 10]. Selective screening may be considered in individuals with multiple risk factors, abnormal resting ECG, reduced exercise tolerance, chronic kidney disease, peripheral artery disease, or markedly elevated coronary risk burden.

Our findings support a pragmatic approach: aggressive risk-factor modification at diagnosis, with targeted testing reserved for higher-risk subsets rather than universal treadmill screening.

Conclusion

Exercise-induced ischemia was uncommon in newly diagnosed asymptomatic type 2 diabetes mellitus patients. Elevated HbA1c was the principal variable associated with positive treadmill stress testing. Routine universal screening may not be justified in all newly diagnosed patients; instead, selective risk-based screening appears more rational [1, 7, 8].

References

1. American Diabetes Association Professional Practice Committee. Standards of care in diabetes 2026. Diabetes Care. 2026;49(Suppl 1):S216-S245. Available from: https://diabetesjournals.org/care/article/49/Supplement_1/S216
2. American Diabetes Association Professional Practice Committee. Standards of care in diabetes 2025. Diabetes Care. 2025;48(Suppl 1):S207-S238. Available from: https://diabetesjournals.org/care/article/48/Supplement_1/S207
3. Low Wang CC, Hess CN, Hiatt WR, Goldfine AB. Clinical update: cardiovascular disease in diabetes

mellitus. Circulation. 2016;133:2459-2502. Available from: https://www.ahajournals.org/doi/10.1161/CIR.0000000000000339

4. Cosson E, *et al*. Silent myocardial ischemia and cardiac autonomic neuropathy in diabetes. Diabetes Metab. 2005;31:31-37. Available from: https://pubmed.ncbi.nlm.nih.gov/15784167/
5. Fletcher GF, Ades PA, Kligfield P, *et al*. Exercise standards for testing and training: AHA statement. Circulation. 2013;128:873-934. Available from: https://www.ahajournals.org/doi/10.1161/CIR.0b013e31829b5b44
6. Khunti K, Kosiborod MN, Ray KK. Legacy benefits of glycemic control in diabetes with cardiovascular disease. Diabetes Care. 2025;48(Suppl 1):S207-S238. Available from: https://diabetesjournals.org/care/article/48/Supplement_1/S207
7. Cosentino F, Grant PJ, Aboyans V, *et al*. ESC Guidelines on diabetes, pre-diabetes and cardiovascular diseases. Eur Heart J. 2023;44:4043-4140. Available from: https://academic.oup.com/eurheartj/article/44/39/4043
8. Cardiovascular risk screening in asymptomatic diabetes mellitus. Cardiovasc Diabetol. 2025;24:266. Available from: https://cardiab.biomedcentral.com/articles/10.1186/s12933-025-0266
9. Norhammar A, *et al*. Diabetes mellitus and unstable coronary artery disease. Lancet. 2002;359:2140-2144. Available from: https://pubmed.ncbi.nlm.nih.gov/12057592/
10. Screening for asymptomatic coronary artery disease in diabetes: systematic review. BMC Cardiovasc Disord. 2016;16:90. Available from: https://bmccardiovascdisord.biomedcentral.com/articles/10.1186/s12872-016-0256-9
11. Faglia E, *et al*. Prevalence of silent myocardial ischemia in newly diagnosed type 2 diabetes. Acta Diabetol. 2002;39:113-117. Available from: https://pubmed.ncbi.nlm.nih.gov/12370724/
12. Gibbons RJ, Balady GJ, Bricker JT, *et al*. ACC/AHA guideline update for exercise testing. Circulation. 2002;106:1883-1892. Available from: https://www.ahajournals.org/doi/10.1161/01.CIR.0000034670.06526.15
13. Emerging role of HbA1c and cardiovascular risk in diabetes. Diabetes Care. 2024;47(Suppl 1):S179-S218. Available from: https://diabetesjournals.org/care/article/47/Supplement_1/S179
14. Young LH, Wackers FJT, Chyun DA, *et al*. Cardiac outcomes after screening for asymptomatic coronary artery disease in type 2 diabetes: DIAD follow-up study. JAMA. 2009;301:1547-1555. Available from: https://jamanetwork.com/journals/jama/fullarticle/183804
15. Wackers FJT, Young LH, Inzucchi SE, *et al*. Detection of silent myocardial ischemia in asymptomatic diabetic subjects: DIAD study. Diabetes Care. 2004;27:1954-1961. Available from: https://diabetesjournals.org/care/article/27/8/1954