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Original Research Article

Study of Invasive Coronary Angiography in Patients with Suspected Coronary Artery Disease by Treadmill Test in Ethnic and Non-Ethnic People of Tripura: A Cross Sectional Study

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Abstract

Background: coronary artery disease (CAD) is still one of the main causes of death around the world, and it is becoming more common in developing countries like India. Coronary angiography (CAG) is the best way to make a diagnosis, but non-invasive tests like the treadmill test (TMT) are often used to screen. However, the variability in the diagnostic accuracy and predictive value of TMT necessitates evaluation specific to each region.

Objectives: To ascertain the prevalence and distribution of coronary artery abnormalities in patients exhibiting positive TMT and to assess the correlation between demographic and clinical risk factors and CAD severity.

Methods: A cross-sectional observational study was performed involving 125 patients with positive TMT undergoing CAG. Clinical, demographic, and risk factor data were gathered and analyzed utilizing SPSS v27. The chi-square test and the t-test were used. A p-value of less than 0.05 was deemed statistically significant.

Results: Of the 125 patients, 85 (68%) exhibited abnormal coronary angiographic results. Single-vessel disease (SVD) was the most common (40.8%), followed by double-vessel disease (17.6%) and triple-vessel disease (9.6%). The highest rate of LAD involvement was 37.6%. There were strong links between the severity of CAD and diabetes (p=0.022), dyslipidemia (p=0.034), smoking (p=0.043), and a lack of physical activity (p=0.046). There was no significant link between age, sex, race, or high blood pressure.

Conclusion: TMT is a useful screening tool, but it doesn't always give accurate predictions. Risk factor profiling greatly improves its usefulness in the clinic. Coronary angiography is still necessary for a definitive diagnosis.

Keywords: CAD, Treadmill Test, Angiography, Risk Factors, India.

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Introduction

Coronary artery disease (CAD) is a big problem for public health all over the world. It causes a lot of heart-related illnesses and deaths. It is marked by the gradual narrowing of coronary arteries due to atherosclerosis, which leads to decreased myocardial perfusion. CAD is responsible for almost 17.8 million deaths each year around the world, which shows how serious the disease is [1].

India is going through a quick epidemiological transition, and non-communicable diseases are becoming more common. CAD is responsible for around 28% of total fatalities in India, with ischemic heart disease as the primary cause [2]. The burden is made worse by the fact that some areas, especially the northeastern states, have a higher rate of disease, more severe cases, and less access to advanced healthcare. The rise in CAD cases in India is mostly due to urbanization, changes in diet, a sedentary lifestyle, smoking, and the growing number of people with diabetes and high blood pressure [3]. These risk factors work together to speed up atherosclerosis and make people more likely to have heart problems.

The diagnosis of CAD requires a combination of clinical evaluation, biochemical markers, and imaging techniques. Electrocardiography (ECG)

and echocardiography yield initial data but are inadequate in sensitivity for early detection. Stress testing, especially the treadmill test (TMT), has become a popular non-invasive way to find out if someone has myocardial ischemia [4].

The TMT tests how the heart and blood vessels react to different levels of exercise, usually using the Bruce protocol. It finds ischemia by looking at changes in the ECG, symptoms, and hemodynamic responses. Even though TMT has some good points, it has problems with sensitivity and specificity that make it hard to diagnose.

Coronary angiography (CAG) is still the best way to diagnose CAD because it lets you see the coronary anatomy directly and measure stenosis [5]. Nonetheless, owing to its invasive characteristics and inherent risks, it is inappropriate for routine screening.

Many people have talked about how TMT results and angiographic results don't match up. If TMT results are false-positive, they could lead to unnecessary invasive procedures. If they are false-negative, they could delay diagnosis. Consequently, assessing the relationship between TMT and CAG results is crucial for enhancing diagnostic approaches.

Most research on CAD in India has been carried out in metropolitan areas, yielding insufficient data from northeastern states. Due to the ethnic diversity, lifestyle variations, and healthcare inequalities in this region, it is essential to produce region-specific evidence.

This study's goal is to look at the relationship between TMT and coronary angiography results in a tertiary care setting in Northeast India and to look at how demographic and clinical risk factors affect the severity of CAD.

A Review of the Literature:

Pathophysiology of CAD: CAD is caused by the formation of atherosclerotic plaques in coronary arteries, which narrows the lumen and slows blood flow. The process includes problems with the endothelium, fat build up, inflammation, and plaque rupture [6]. Acute events like myocardial infarction frequently arise from plaque instability rather than solely from the extent of stenosis.

Categorization

CAD is generally divided into:

- Ischemic heart disease that doesn't change
- Acute coronary syndrome (ACS), encompassing unstable angina, NSTEMI, and STEMI [7]

Methods of Diagnosis

1. Electrocardiography (ECG)

Gives a basic assessment but isn't very sensitive.

2. Echocardiography: Helpful for finding problems with wall motion, but it depends on the operator.

3. Test on the treadmill (TMT): TMT is still an important part of screening for CAD. It finds ischemia by looking at changes in the ST segment during exercise. Sensitivity is between 70% and 90%, and specificity is between 60% and 80% [8].

4. Angiography of the coronary arteries: Considered the gold standard because it lets you see the coronary arteries directly [5].

Previous Studies

- Ismail et al. (2015): Found that TMT didn't work well for women, with only 25% showing CAD on angiography [9].
- Kumar et al. (2017) indicated a greater predictive value in males (83%) than in females (53%) [10].
- Shrestha et al. (2017): Noted that merely 32.2% of TMT-positive patients exhibited significant CAD [11].
- Gyawali et al. (2023) found that 33% of cases had significant CAD, with LAD being the most common type [12].

These studies underscore the inconsistency in TMT accuracy and the necessity for regional data.

Aims and Goals

1. To ascertain the percentage of patients exhibiting abnormal coronary angiography among those with a positive TMT.
2. To examine the pattern of coronary artery involvement.
3. To examine the correlation between demographic and clinical risk factors and the severity of CAD.

Materials and Methods

Study Design: Hospital-based cross-sectional observational study.

Study Setting: Department of General Medicine, Agartala Government Medical College and GB Pant Hospital.

Study Duration: 1.5 years (2024–2025).

Study Population: Patients with suspected CAD and positive TMT undergoing coronary angiography.

Sample Size:

Calculated using Kish and Leslie formula:

N = 125

Inclusion Criteria

- TMT-positive patients undergoing angiography
- No prior CAD
- No prior PCI/CABG

Exclusion Criteria

- Contraindications to TMT
- Known CAD
- Baseline ECG abnormalities

Data Collection

Clinical data included:

- Age, gender, BMI
- Risk factors (diabetes, hypertension, smoking, dyslipidemia)
- Lifestyle habits

Statistical Analysis

- Software: SPSS v27
- Tests: Chi-square, t-test
- Significance: $p < 0.05$

Discussion

1. Understanding TMT Accuracy

The current study shows that TMT is a common screening tool, but it doesn't always give accurate predictions.

About one-third of TMT-positive patients had normal coronary angiography, which means that a lot of them were wrong about having the disease.

This is consistent with prior research by Shrestha et al. [11], which also indicated a minimal correlation between TMT and angiographic results. The causes of false-positive TMT encompass:

- Disease of the microvasculature
- Problems with the endothelium
- Abnormalities in the baseline ECG
- Not being able to exercise well

Furthermore, in younger demographics, as evidenced by this study (mean age ~38 years), false positives occur more frequently due to reduced pre-test probability.

2. The pattern of coronary artery involvement

The high percentage of single-vessel disease (40.8%) indicates that most patients were in the early stages of CAD.

This finding aligns with epidemiological trends in developing nations, where coronary artery disease (CAD) is increasingly identified at earlier stages owing to enhanced screening methods.

LAD was the artery that was most often involved (37.6%). This is clinically important because LAD supplies a large part of the left ventricle. Lesions in the left anterior descending artery (LAD) are linked to increased morbidity and mortality.

The relatively low rate of triple-vessel disease (9.6%) shows that this group of people didn't have severe CAD as often. But the fact that younger people have TVD shows how aggressive CAD can be in some groups.

3. The role of risk factors

Diabetes Mellitus

There was a statistically significant link ($p=0.022$). Diabetes hastens atherosclerosis by:

- Problems with the endothelium
- More oxidative stress
- Dyslipidemia

People with diabetes often have diffuse and multi-vessel disease.

Dyslipidemia
Also showed a strong link ($p=0.034$). High LDL and low HDL levels help plaque form. Cigarette smoking

Smoking causes CAD by: • More platelets sticking together

- Vasoconstriction
- Stress from oxidation

The strong link ($p=0.043$) shows that it is a major risk factor that can be changed.

Living a sedentary life

Being inactive can cause obesity, insulin resistance, and dyslipidemia. The link ($p=0.046$) shows how important it is to change your lifestyle.

4. Factors That Don't Matter

Age, sex, ethnicity, and hypertension did not exhibit a significant association. Some possible reasons are:

- Small number of samples
- A younger group of people studied
- Variables that confuse things

Hypertension is a well-known risk factor, but its lack of significance in this group may mean that the disease is better controlled or shorter in duration.

5. A comparison with studies from around the world

Compared to people in the West, CAD is more common in Indian patients:

- Happen at a younger age
- Be more forceful
- Have a higher number of risk factors

This study corroborates these findings and underscores the necessity for early screening and intervention.

6. Clinical Consequences

- TMT should not be utilized as an independent diagnostic instrument.
- Assessing risk factors makes diagnoses more accurate
- Patients with more than one risk factor should have angiography done early.

7. A public health point of view

The high number of modifiable risk factors shows that preventive measures can greatly lower the burden of CAD. Raising public awareness, making changes to your lifestyle, and getting screened early are all very important.

Conclusion: This research illustrates that: TMT has a fair amount of predictive value. Most TMT-positive patients have significant CAD. The most common pattern is SVD. Risk factors are very important in how bad a disease is.

For the best care of patients, it is best to use both TMT and coronary angiography to make a diagnosis.

Limitations

- Study at one center
- A small number of samples
- No follow-up results

Suggestions

- More studies with multiple centers
- Utilization of advanced imaging (CT angiography)
- Programs for preventive cardiology

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