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## RESEARCH ARTICLE

# GENDER DIFFERENCE IN POSITIVE TREADMILL TEST AND CORONARY ANGIOGRAM PROFILE CORRELATION IN PATIENT WITH SUSPECTED CORONARY ARTERY DISEASE AT CHITWAN MEDICAL COLLEGE, NEPAL

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### ABSTRACT

**Background:** Tread mill stress test (TMT) is the most commonly performed stress test for diagnosis of coronary artery disease (CAD) in outpatient setting. Tread mill test is often employed for an initial assessment in patients with suspected coronary artery disease serving as a gatekeeper for cardiac catheterization. **Methods:** We have included all the patients who had tread mill test positive and underwent coronary angiography and subsequently analyzed for the presence of coronary artery disease. TMT test was done using Bruce protocol and results were classified as positive and negative upon ECG changes. **Results:** Out of 122 participants, 72 (59%) participants were male and 50 (41%) participants were female. Mean age was  $63.06 \pm 8.78$  years and  $56.52 \pm 9.66$  years in male and female group respectively. Smoking (50%) was the number one risk factor in male group and overweight (72%) in female group. The coronary angiogram showed normal coronaries in 36% and 30.5% in female and male participants respectively. Significant coronary artery disease seen in male participants was 61% and in female participants was 54%. The most common coronary artery involved having significant disease during coronary angiogram was LAD 72.7% and 74.1% respectively in male and female group followed by RCA (59.1% and 44.4%) and LCX (31.8% and 22.2%) in male and female participants respectively. **Conclusion:** There was significant correlation between positive TMT results and coronary angiogram findings in both male and female participants.

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## INTRODUCTION

Coronary artery disease (CAD) is a leading cause of morbidity and mortality in the world. Previously, it was considered as a disease of western nations but now it is equally prevalent in developed and developing nations (Celermajer et al., 2012). The assessment of patients with suspected coronary artery disease (CAD) places an enormous and increasing burden on our health care system (Heidenreich et al., 2011). Because effective treatment is available to reduce the risk of CAD associated adverse events. Stress testing has been used since the late 1920s as a convenient, non-invasive way to assess for exercise induced myocardial ischemia (Master, 1929). The accuracy of the tread mill stress test (TMT) in predicting significant coronary heart disease is variable. In a person at high risk for coronary heart disease (e.g. advanced age, multiple coronary risk factors), an abnormal TMT is very predictive of the presence of coronary heart disease

(> 90% accurate) (Ben-Shlomo et al., 2013). The diagnostic rate of coronary artery disease (CAD) has been dramatically increasing with the development of interventional technique which makes coronary angiography the "gold standard" tool for CAD diagnosis (Armin Arbab-Zadeh, 2012). However, limited by its invasive property, exercise tread mill test is still used as an economic and simple method to screen and assist in diagnosis of patient with known or suspected CAD (Amany, 2007). Another factor is evaluation of ECG changes specifically ST segment depression during exercise or during recovery phase. However, with chances of false positive and negative tests, especially in patients with atypical or no angina pectoris is one of the problem of test being not highly specific (Gibbons, 2002). This study is thus prospectively performed to look at coronary angiographic findings in whom tread mill test status was positive to predict CAD and factors affecting the accuracy of diagnosis.

## METHODS

This is a prospective observational hospital based study carried out in the department of cardiology at Chitwan Medical College, Bharatpur, Chitwan from June 2019 to December 2020 after approval from institutional ethical committee. Informed consent was taken from each participated patient with positive treadmill test and were admitted for coronary angiography at this center.

**Inclusion Criteria:** Patient with chest pain with normal or abnormal ECG are included, who had single or multiple risk factors like hypertension, diabetes, smoking and other risk factors. All patients with treadmill test positive (based on AA/AHA 2002 guideline),<sup>8</sup> undergoing coronary angiography to rule out CAD. The following results will be interpreted as positive.

### During Exercise

- ) Horizontal or downsloping ST segment depression of 0.1 mV (1 mm) in magnitude lasting 80 msec in one or more leads after the J point specially in leads V4, V5 and V6 or V5 alone.
- ) ST segment elevation of 0.1mV (1mm) in leads without pre-existing Q waves.
- ) ST segment elevation in aVR.
- ) Exertional hypotension
- ) Inability to achieve 3 METS workload
- ) Exercise induced angina which leads to limit exercise or occurs at a low workload.
- ) Failure to achieve 85% of the age predicted maximum heart rate in the absence of medication like Beta blockers and non dihydropyridine calcium channel blockers.

### During Recovery

- ) ST segment depression 0.1mV (1mm) horizontal or downsloping
- ) Difference of heart rate at peak exercise and at one minute after cessation of exercise of 12 beats/min or less
- ) Non-sustained VT, Ventricular bigeminy/ trigeminy or frequent Ventricular ectopy (e.g. >7 per minute or >10% of beats in a 30-second period).

### Exclusion Criteria

- ) All patients with contraindication to treadmill test, which includes-
- ) Absolute
- ) Acute Myocardial infarction (within 2 days)
- ) High risk unstable angina
- ) uncontrolled cardiac arrhythmia causing symptoms or haemodynamic compromise
- ) Uncontrolled symptomatic heart failure
- ) Acute pulmonary embolism
- ) Acute myocarditis/ pericarditis
- ) Acute Aortic dissection

### Relative

- ) Moderate stenotic valvular heart disease

- ) Electrolytes abnormalities
- ) High blood pressure > 200/110mmHg
- ) Tachyarrhythmias or Bradyarrhythmias
- ) HOCM
- ) high degree AV block
- ) Mental or physical impairment leading to inability to exercise adequately

All patients unable to perform exercise treadmill test

**Study Assessment:** Detailed history about risk factor of coronary artery disease (like Age, Sex, diabetes, hypertension, dyslipidaemia, cigarette smoking, family history of CAD and measured height and weight for the calculation of BMI) were asked to all the patients whose treadmill test came positive. All patients with exercise treadmill test positive underwent coronary angiographic evaluation at Chitwan Medical College CATH LAB by Cardio fellow resident or cardiology faculty. Interpretation of coronary angiogram for coronary artery disease was performed. Coronary lesion quantification was done in at least two orthogonal views. The criterion for Significant Coronary artery disease (CAD) was defined as >50% stenosis of the left main stem, >70% stenosis in a major coronary vessel {Left Anterior Descending (LAD), Left Circumflex (LCX) or Right Coronary Artery (RCA)} in coronary angiography; Borderline significant as 50-70% Stenosis and minor or insignificant coronary artery disease as <50% stenosis. Patients with significant coronary lesions were further classified depending on the number of major coronary vessel lesion involved as having single vessel disease (SVD), Double Vessel Disease (DVD) or Triple Vessel Disease (TVD).

## RESULTS

This study included 122 participants with age ranging from 40 to 78 years of age. Out of 122 participants, 72 (59%) participants were male and 50 (41%) participants were female. Mean age in the male participants group was 63.06±8.78 years and in the female group was 56.52±9.66 years.

**Table 1. Baseline clinical characteristics of the participants**

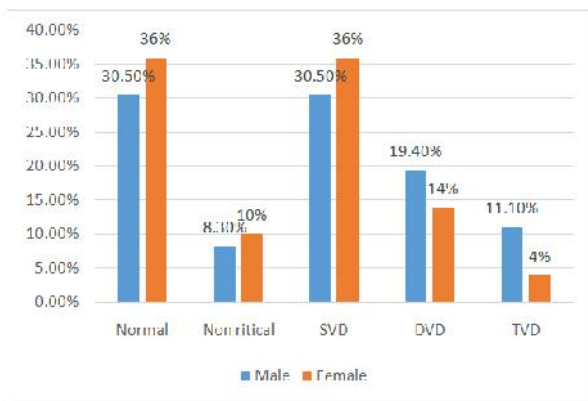
Characteristics	Male (n=36)	Female (n=25)	P-value
Age of the participants	63.06±8.78	56.52±9.66	0.469
Hypertension	32 (44.4%)	24 (48%)	0.018
Diabetes Mellitus	24 (33.3%)	12 (16.7%)	0.002
Dyslipidaemia	0 (0%)	4 (8%)	0.023
Smoking	36 (50%)	16 (32%)	0.010
Body Mass Index (BMI)			
Normal BMI (18.5-24.9kg/m <sup>2</sup> )	40 (55.6%)	14 (28%)	0.015
Overweight (BMI: 25-29.9kg/m <sup>2</sup> )	30 (41.7%)	30 (60%)	0.050
Obese (BMI: 30 kg/m <sup>2</sup> and above)	2 (2.8%)	6 (12%)	0.126
Family History of CAD	0 (0%)	2 (4%)	0.016

**Table 2. Difference in angiographic finding in male and female**

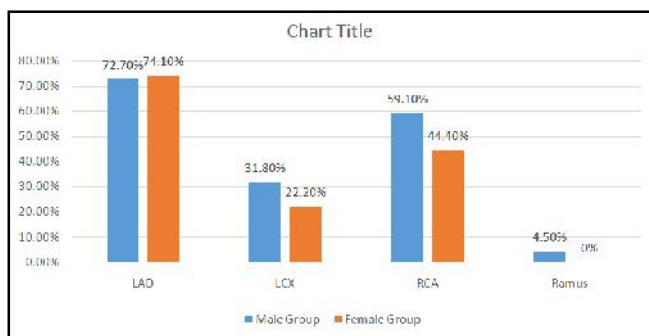
Gender	Normal	Non-critical	SVD	DVD	TVD
Male	22 (30.5%)	6 (8.3%)	22 (30.5%)	14 (19.4%)	8 (11.1%)
Female	18 (36%)	5 (10%)	18 (36%)	7 (14%)	2 (4%)

**Table 3. Coronary artery involved in significant lesion**

Coronary Artery Involved	Male Group	Female group
LAD	32 (72.7%)	20 (74.1%)
LCX	14 (31.8%)	6 (22.2%)
RCA	26 (59.1%)	12 (44.4%)
Ramus	2 (4.5%)	0 (0%)



**Figure 1. Difference in angiographic finding in male and female.**



**Figure 3. Coronary artery involved in significant lesion**

Smoking (50%) was the number one risk factor in this study in male participants followed by hypertension (44.4%), overweight (41%) and diabetes (33.3%) whereas in female participants overweight (72%) was the number one risk factor followed by hypertension (48%), smoking (32%) and then diabetes (16.7%) with family history of coronary artery disease being the least in both the groups. The coronary angiogram in female showed normal coronaries in 36% in comparison to male which was 30.5%. Significant lesion whether single vessel disease (30.5%), double vessel disease (19.4%) or triple vessel disease (11.1%) was seen in male participants whereas female participants had 36%, 14% and 4% respectively for single, double and triple vessel disease. The most common coronary artery involved having significant disease during coronary angiogram was LAD (72.7%) followed by RCA (59.1%) and LCX (31.8%) in male group whereas in female participants also LAD (74.1%) was the most common coronary artery involved in significant disease during coronary angiogram followed by RCA (44.4%) and LCX (22.2%).

## DISCUSSION

Accurate screening and diagnosis of suspected coronary artery disease is one of the most important mechanisms of timely intervention and prevention of mortality. Even though the TMT remains a cost-effective, easily available and widely applicable approach for early diagnosis of CAD especially if the resting electrocardiography is normal or non-diagnostic. This is described as poor man's angiogram. Person who are at high risk for coronary heart disease like advanced age, multiple coronary risk factors) and an abnormal TMT is highly suggestive of the presence of coronary heart disease However, a normal TMT may not reflect the absence of significant coronary artery disease in a person with the same risk factors. Abnormal tread mill test also may not reflect the true presence

of coronary heart disease (so-called "false-positive TMT"). According to Khanam *et al* from indoor, out of 50 TMT-positive female patients, 12 were having CAD on angiography (24%) indicating a low predictive value of TMT. The prevalence of CAD was 70% in high pretest probability group compared with 5% in low pretest probability group indicating high predictive value of TMT in high pretest probability group. SVD was most common (58%) followed by TVD (25%) and DVD (17%) (Khanam *et al.*, 2017). Similar findings were revealed by Ismai (Ismail, 2015) (Ismail *et al.*, 2015). Kim *et al*, in their study, suggested that in the interest of cost-effectiveness, screening for asymptomatic CAD could be limited to elderly patients with a duration of diabetes 10 years (Kim, 2011). Along with TMT positivity, if older age and diabetes also are present, the likelihood of CAD detection increases. Contraindications for TMT are symptomatic heart failure, acute myocardial infarction, symptomatic aortic stenosis, acute arrhythmia, accelerated hypertension (Blood pressure > 200/110), aortic dissection, and AV blocks. A coronary catheterization is a minimally invasive procedure to access the coronary circulation and blood-filled chambers of the heart using a catheter. It is performed for both diagnostic and therapeutic purposes.<sup>12</sup> Coronary catheterization is one of the several cardiology diagnostic tests and procedures (Bartel, 1974; Sharieff, 2002). This study showed that 30.5%, 19.4% and 11.1% of patients who had positive stress test had SVD, DVD and TVD respectively in male participant group whereas female participants group had single vessel disease in 36%, double vessel disease in 14% and triple vessel disease in 4%. LAD was the most commonly affected vessel in both male and female participants 72.7% and 74.1% respectively.

## Conclusion

There was significant correlation between positive TMT results and coronary angiogram findings in both male and female participants. So, the probability of positive tread mill test in predicting coronary artery disease was almost similar in both male and female participants.

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