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Angiographic Profile and Treadmill Test Relationship of Women with Chest Pain Suggestive of Coronary Artery Disease

Stanley George

Department of Cardiology, Pariyaram Medical College, Kannur, India
Email: s4stanley@gmail.com

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Abstract

Aim: The aim of present study was to analyze the prevalence and pattern of coronary artery disease (CAD) among women who underwent coronary angiography (CAG) and Treadmill Test (TMT). **Methods:** A total of 100 consecutive women patients for coronary angiogram were studied at Department of Cardiology, Government Medical College, Kottayam, Kerala, India on over a period of 6 months from February 2008. Total 65 women completed TMT stress test. The patients were subjected to CAG and TMT. Data were analyzed by using SPSS 20.0 software. **Results:** A total of 100 women patients were included. Among that 66% patients had hypertension and 47% patients had diabetes mellitus. The CAG revealed the presence of 17%, 13% and 15% of single vessel disease, double vessel disease, and triple vessel disease respectively. Vessel involvements were notably higher in positive TMT values during stress test. The sensitivity and specificity of TMT for detecting coronary artery disease in women were 61% and 69% respectively. **Conclusion:** It is concluded that, the findings of the present study effectively demonstrated higher predictive value of TMT in women with chest pain suggestive of CAD.

Keywords

Coronary Angiography, Coronary Artery Disease, Treadmill Test

1. Introduction

Coronary artery disease (CAD) is a leading cause of morbidity and mortality in human beings. Previously it was considered as a disease of Western Nations, but now it is equally prevalent in developed and developing nations [1]. Globally, there has been a significant rise in the proportion of women suffer from CAD

over the last few decades. The causes for this evolutionary change may be genetic or environmental factors. The preliminary step was to identify these changes using angiographic profiles of women suffering from CAD. In addition, exercise stress test or "Treadmill Test" (TMT) remains a cost-effective and widely applicable approach for assessing myocardial ischemia, but has a relatively low specificity and sensitivity, mainly in single and double vessel disease [2] [3]. The prevalence and pattern of CAD in women who underwent coronary angiography (CAG) and TMT was very less.

When symptoms are atypical or non-specific, TMT in women has a relatively low analytical tools yield for CAD compared with men. Therefore, there was need of angiographic prevalence and pattern of CAD in women. The earlier researcher reported that 70% of sensitivity and 61% of specificity of TMT for detection of CAD in women [4]. Stenosis of the left main coronary artery (LMCA) is a comparatively rare but significant cause of augmented morbidity and mortality among patients with CAD. Left anterior descending (LAD) is the most commonly affected vessel, followed by LCX and RCA, and LMCA was the least involved vessel [5].

During exercise, catecholamine was released predominantly in women, which could potentiate coronary vasospasm and enhance the frequency of abnormal exercise. False positive results have been represented commonly during menses and pre-ovulation. The previous finding from a meta-analysis elucidated that a specificity of 70% suggests false positivity of approximately 30% in TMT positive patients [4].

The aim of the present study was to analyze the coronary artery profile using coronary angiography and treadmill test in CAD and/or chest pain women patients.

2. Material and Method

This study was conducted on one hundred consecutive women patients who have chest pain conducted for coronary angiogram at Department of Cardiology, Government Medical College, Kottayam, Kerala, India over a period of 6 months from February 2008.

In this study, we have included women patients with chest pain were at least 30 years of age, who had a history of either diabetes mellitus and/or hypertension. Patients were excluded if they had pervious coronary artery bypass graft, PTCA and valvular heart disease. Detailed history of patients was recorded on basis of nature of chest pain. Pulse, blood pressure and JVP (jugular venous pressure) examination was done. Anemia, jaundice, Cyanosis, Pedal edema, approximate fat and palpable heart sounds or murmurs were examined. The Bruce protocol was used for stress testing. In resting 12 lead ECG was performed and each lead placed on the body records the electrical activity of the heart. There are three leads that are connected to the Treadmill monitor. During the stress test, the patient's blood pressure was recorded at the second minute in every stage.

The positive predictive value was determined according to the following formula: PPV = True Positive/(True Positive + False Positive). Written informed consent was obtained from all patients before enrolment, and the study was approved by the local ethical committee.

Statistical Analysis

Categorical variables were expressed as percentages. The SPSS 20.0 software (SPSS Inc., Chicago, IL, USA) was used to analyze the data.

3. Results

3.1. Baseline, Lesion and Procedural Characteristics

The baseline demographics of the patients are outlined in Table 1. A total of 100 women data were collected and analyzed in this study. Out of 100 women, 47% had diabetes, 66% had hypertensive and 36% had both diabetes and hypertension. Among 100 patients, 55% and 24% patients were treated with stable angina and unstable angina/non-ST-elevation myocardial infarction. A total of 16% patients had previous MI and 15% silent ischemia. Details of the lesion and procedural characteristics are outlined in Table 2. Among the 100 patients under assessment, single vessel disease (SVD) was the most common (17%) followed by 15% of triple vessel disease (TVD) and 13% of double-vessel disease (DVD). Left anterior descending (LAD) artery disease was seen in 38% followed by right coronary artery (RCA) 29%, left circumflex artery (LCx) 23%, and left main coronary artery (LMCA) in 5%. Minor coronary artery disease was present in 26% of

Table 1. Baseline demographic data of the patients.

Variable	N = 100 Patients
Age years	
30 - 40	9 (9%)
41 - 50	24 (24%)
51 - 60	43 (43%)
61 - 70	17 (17%)
>70	7 (7%)
Diabetes mellitus, n (%)	47 (47%)
Hypertension, n (%)	66 (66%)
Both diabetes mellitus and hypertension, n (%)	36 (36%)
Clinical presentation	
Stable angina, n (%)	55 (55%)
Unstable angina/NSTEMI, n (%)	24 (24%)
Previous MI, n (%)	16 (16%)
Atypical chest pain, n (%)	05 (5%)
Silent ischemia, n (%)	15 (15%)

NSTEMI: Non-ST-elevation myocardial infarction; MI: Myocardial infarction.

Table 2. Lesion and angiographic characteristics.

Variables	n = 116 Lesions
Lesion location, n (%)	
LAD, n (%)	38 (38%)
RCA, n (%)	29 (29%)
LCx, n (%)	23 (23%)
LMCA, n (%)	5 (5%)
Number of diseases vessels	
Single vessel disease, n (%)	17 (17%)
Double vessel disease, n (%)	13 (13%)
Triple vessel disease, n (%)	15 (15%)
Minor CAD	26 (26%)
Normal coronary artery	(24%)

LMCA: Left main coronary artery; LAD: Left anterior descending artery; LCx: Left circumflex artery; RCA: Right coronary artery; CAD: Coronary artery disease.

cases and 24% of patients had normal coronaries.

3.2. Stress Test (TMT) and Coronary Angiography Findings

A total of 100 patients underwent TMT test, of which 65% of patients completed stress test (Figure 1). Out of 65 patients, 33 patients had a positive test and 32 patients had a negative/inconclusive test. From this study, it was found that 18.2% of diabetes patients had negative TMT test and 15.1% had a positive test. Similarly, 21.2% of hypertensive patients had a negative TMT test and 27.3% had a positive TMT. In those patients having both diabetes and hypertension 21.2% had a negative TMT and 36% had a positive TMT (Figure 2).

Table 3 depicts the correlation between vessel involvement and TMT value. It was found that higher level of positive stress test *i.e.* 27.1%, 15.1% and 36% of patients were positive TMT with SVD, DVD and TVD respectively as compared to negative TMT. However, those who were having normal coronaries, 31.3% were having a negative TMT and 15% had positive TMT. The present study revealed significant correlation between single vessel involvement and TMT positivity ($Z = 2.75$; $p < 0.01$). Similarly, comparing DVD and TVD with TMT showed significant correlation ($Z = 2.99$; $p < 0.01$). The positive predictive value, sensitivity of TMT for detecting coronary artery disease in women was 61% and specificity was found to be 69% in the present study (Figure 3).

4. Discussion

The risk of morbidity and mortality from coronary artery disease increased rapidly among men and women. Even though significant research efforts have advanced diagnosis and treatment strategies for patients at risk, but the detection of CAD in women can be challenging. The predictive value of risk factors was different in women than men because atypical chest pain is more prevalent

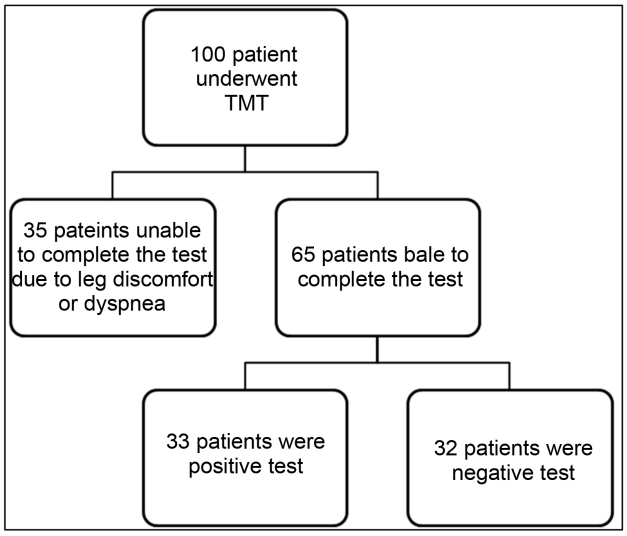

Figure 1. Flowchart of patients who underwent the exercise treadmill test (TMT).

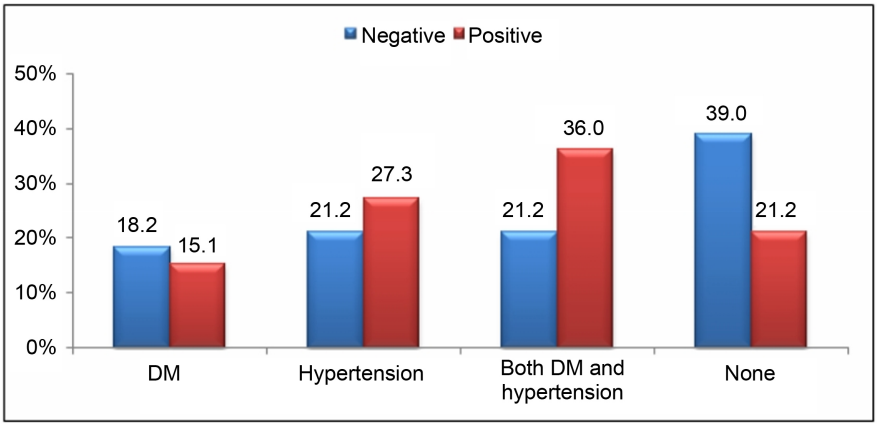

Figure 2. Correlation between TMT test and risk factors of complexity of diseases.

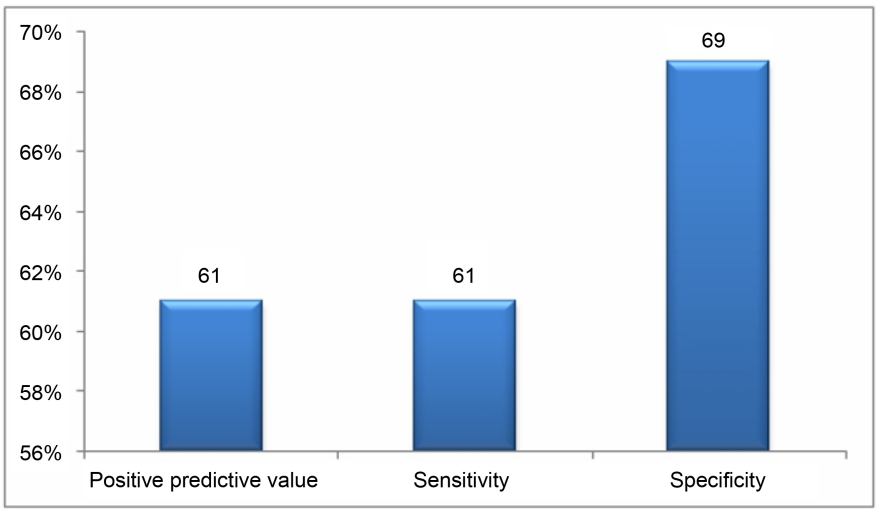

Figure 3. Predictive value, sensitivity and specificity of TMT in coronary artery disease patients.

Table 3. Correlation between TMT test and vessel involvement.

Vessel involvement	TMT positive	TMT negative
SVD	27.1%	3.1%
DVD	15.1%	9.3%
TVD	36%	21.2%
LMCA	20%	-
Minor coronary artery disease	24.2%	37.5%

SVD: Single vessel disease; DVD: Double vessel disease; TVD: Triple vessel disease; LMCA: Left main coronary artery.

among women. Hence, women in this study were classified according to different ages from 30 to >70 years. There has been a varying trend in the number of young and middle-aged women (41 to 60 years) undergoing coronary angiography and the reason for this is the onset of risk factors for CAD at younger and middle age. The complexity of diseases condition like diabetes mellitus and hypertension or presence of both varies between different age groups. Modifications of dietary habit and lifestyle improve the incidence of CAD patients.

The TMT was performed using treadmill bicycle exercise with ECG, blood pressure and heart rate monitoring. 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. The diagnostic accuracy of exercise testing varies depending on the age, clinical characteristics of the patient and modality of test used [6]. Similar to the diagnostic data, there have been voluminous amount of single-centre studies outcome demonstrated the stress test as diagnostic tool in women with CAD [7] [8] [9] [10].

The meta-analyses data in the published literature elucidated the analytical accuracy of stress testing for the presence of obstructive CAD, identified as 50% diameter or more stenosis by quantitative coronary angiography (QCA) [11] [12] [13]. Exercise stress test has been represented to have a sensitivity of 61% and specificity of 69% for the detection of CAD in women. In our study, 65 patients completed stress test out of 100 patients. Of these 65 patients, positive TMT were 36% cases of both hypertension and diabetes mellitus, while 27.3% and 15.1% women with hypertension and diabetes mellitus condition have positive TMT respectively. Hence, the presence of complexity of disease leads to more risk of CAD. Moreover, discussion on the correlation between diabetes and CAD continues, and numerous current studies have reported a positive relationship [14] [15].

In our study, 35 patients (35%) were unable to complete the TMT test, mostly due to leg discomfort or dyspnea. The TMT is often not feasible for diabetic and hypertensive patients because their exercise capability may be impaired. In addition, the presence of lesions in a number of disease vessels is an important risk factor to correlate with TMT test. Our result showed that 27.1%, 15.1% and 36% of patients were positive stress test with SVD, DVD and TVD respectively. LAD

is the most commonly affected vessel, followed by involvement of LCx and RCA, and LMCA is the least involved vessel. However, atypical chest pain with normal coronaries patients has 31.3% negative TMT test. Similarly, minor CAD patients have 24.2% and 37.5% of positive and negative TMT respectively. In the absence of symptomatic CAD, clinical characteristics that assist to classify patients with an elevated risk for myocardial infarction or cardiac death include evidence of other atherosclerosis, abnormal resting ECGs, autonomic neuropathy, retinopathy, chronic kidney disease, age, sex, hyperglycemia and novel cardiac risk factors [16].

The positive predictive value of the TMT for predicting angiographic coronary disease was 61%. It is therefore concluded that the magnitude of exercise definitely improves the predictive value of treadmill tests and helps in the identification of patients with more severe coronary heart disease.

5. Limitations

First limitation is the small number of subjects recruited in our study. Second limitation is unavailability of information on conventional cardiovascular disease risk factors, such as a history of premature CAD, retinopathy and autonomic neuropathy.

6. Conclusion

In conclusion, associations of vessels involvement were considerably correlated with positive TMT values. These finding have shown that the higher predictive value of TMT with chest pain indicative of CAD in women patients. Further research is needed to ascertain the effectiveness of schedule screening for asymptomatic CAD and chest pain in a different patient subgroup.

Conflict of Interest

All authors have no conflicts of interest to declare.

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