INTRODUCTION

Coronary Artery Disease (CAD) is the most common form of heart disease and the leading cause of premature death in the world. Depending on the severity of the underlying lesions and biologic triggers, a spectrum of clinical syndromes ranging from stable angina pectoris to acute coronary syndromes and sudden death may be observed. Previously, CAD was considered to be the disease of elderly. Nowadays, the onset of disease is observed in the younger age group making it important to screen the younger persons for presence of risk factors of CAD.

ETT (exercise tolerance test) is a useful tool for this screening purpose. In patients selected for coronary angiography, the sensitivity of the exercise ECG (ETT) in patients with CAD is approximately 68%, and specificity is 77%. In patients with single-vessel disease, the sensitivity ranges from 25-71%, with exercise-induced ST displacement most frequent in patients with left anterior descending CAD, following by those with right CAD and those with isolated left circumflex CAD. The sensitivity and specificity for left main or three-vessel CAD are approximately 86% and 53%, respectively. The exercise ECG tends to be less sensitive in patients with extensive anterior wall myocardial infarction and when a limited exercise ECG lead set is used. Approximately, 75-80% percent of the diagnostic information on exercise-induced ST segment depression in patients with a normal resting ECG is contained in leads V4 to V6. Exercise ECG is less specific when patients in whom false-positive results are more common are included, such as those with valvular heart disease, left ventricular hypertrophy, marked resting ST segment depression, or digitalis therapy. Thallium Stress Test (TST) is expected to produce more reliable results. Myocardial perfusion imaging augments the results of ETT.

Army soldiers are expected to be otherwise physically fit and less likely to have coronary artery disease when compared to the other population groups because of their age group, fitness level and continuous physical activity.

ABSTRACT

Objective: To determine the role of Exercise Tolerance Test (ETT) and Thallium Stress Test (TST) in the detection of Coronary Artery Disease (CAD) among soldiers.

Study Design: Descriptive study.

Place and Duration of Study: This study was conducted at Combined Military Hospital (CMH), Multan, Pakistan, from 2002 to 2004.

Methodology: There were 291 male soldiers between ages 30 and 45 years who presented with chest pain and had normal resting ECG. All patients were subjected to ETT. Positive ETT cases had Coronary Angiogram (CA) as the gold standard. Negative cases were subjected to TST. Normal CA cases also had TST to rule out microvascular disease. Those with normal ETT and positive CAD risk factors also had TST. Those with negative TST had CA as service requirement.

Results: All 291 cases had ETT, 130 cases were found positive, 161 had negative ETT. When CA was done on 130 positive cases, 95 had CAD (true positive, TP) and 35 had normal coronaries (false positive, FP). Out of the 161 negative ETT cases, 128 had normal coronaries (true negative, TN) and 33 had CAD (false negative, FN). TST was conducted on 196 cases, out of which 78 cases were found positive and 118 had negative TST. When subjected to CA, out of 78 positive cases, 30 had CAD (TP) and 48 had normal coronaries (FP). Out of 118 negative TST cases, 115 had normal coronaries (TN) and 3 had CAD (FN), ETT was found to have sensitivity of 74.2%, specificity of 78.5%, Positive Predictive Value (PPV) of 73.1%, Negative Predictive Value (NPV) of 79.5% and test accuracy of 76.6%. TST had sensitivity of 90.9%, specificity of 70.6%, PPV of 38.5%, NPV of 97.5% and accuracy of 74.0%.

Conclusion: TST was found to be more sensitive and less specific than ETT in the diagnosis of CAD.

Key words: Coronary disease. Coronary angiography. Exercise test. Thallium stress test.

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Received May 17, 2007; accepted May 5, 2009.
exertion during their training process. Their risk stratification is mandatory whenever they present with chest pain as their exact cause of chest pain has to be established. They are exposed to very high altitudes, which has low oxygen in atmosphere and extreme of low temperature, which can adversely affect their pulmonary, cardiac and cerebral physiology.

The aim of this study was to compare ETT and Thallium stress test in evaluating the soldiers who were at high risk for CAD.

**METHODODOLOGY**

This prospective study was conducted on 291 male soldiers at CMH, Multan, between 2002 and 2004. All male soldiers above 30 years of age were included who presented to the outpatient department or emergency with symptoms suggestive of CAD like discomfort or pain in the chest or arm. Patients with ECG evidence of acute Myocardial Infarction (MI) or previous history of myocardial infarction were excluded. All patients having any revascularization procedure in the past (coronary artery bypass surgery or coronary angioplasty), those with congenital heart disease, or left or right bundle branch blocks, pericarditis, myocarditis, cardiomyopathy, left ventricular hypertrophy or valvular heart disease were also excluded from the study.

All the patients were assessed with ETT, TST and CA at Armed Forces Institute of Cardiology, Rawalpindi. Outcome measures for stress ECG (ETT) included ST segment depression (down sloping or horizontal/flat ST depression of >1 mm), ST segment elevation (at least 1 mm, 80 mseconds from J point), number of leads showing persistence of ST changes, duration of ST deviation into recovery, time to the onset of ST deviation. Target Heart Rate (THR) was defined as HR= 220 – age in years. Maximum heart rate achieved, exercise systolic blood pressure response and the total exercise duration. Termination of ETT was done on achievement of target heart rate, symptoms like chest pain, dizziness, significant ST segment changes, fall in blood pressure (BP) >10 mmHg or rise in B.P >180 mmHg; or when patient himself requested to stop the test due to fatigue/ breathlessness. Exercise test was termed positive, if a horizontal or down sloping ST segment depression of >1 mm 80 mseconds from J point, ST segment elevation of 1 mm, 80 mseconds from J point or exercise induced arrhythmias (ventricular tachycardia, ventricular fibrillation) were detected.\(^6\)\(^,\)\(^7\)

The test was termed negative if the above-mentioned changes were absent and the patient achieved at least 90% of THR without any symptoms. The test was termed inconclusive, if the patient did not achieve at least 90% of the THR due to any reason. All the patients underwent ETT at CMH, Multan. Those patients with positive ETT underwent coronary angiography at AFIC-NIH, Rawalpindi, in a course of 1-2 weeks (group A). While those patients with negative ETT were subjected to TST for being symptomatic (group B). Among the group A, positive CA cases were treated accordingly and those with normal CA were subjected to TST later on. Among the group B (negative ETT group), all patients who were subjected to TST, later underwent coronary angiography due to TST being positive or due to service reasons and persistence of symptoms despite negative TST. Minor coronary artery disease on CA was defined as stenosis 30-49%, significant CAD was defined as stenosis >50% and critical stenosis was defined as > 70%.\(^8\)\(^,\)\(^9\)

The test sensitivity analysis for ETT and TST was done by taking CA as gold standard. Interpretation of ETT and TST results was made as True Positive (TP), if it showed specific changes suggestive of CAD (positive test) confirmed with CA. The test was declared False Positive (FP) if tests showed the specific changes suggestive of CAD but the CAD did not confirm the presence of CAD. True Negative (TN) test meant normal test in a person who did not have CAD on CA. The ETT was said to be false negative if the test was normal but the CA showed presence of CAD. That meant presence of CAD in cases with normal ETT and/or TST.

**RESULTS**

Out of a total 291 patients, 130 were found to have positive ETT and 161 had negative test. Distribution is given in Figure 1. Patients with positive ETT underwent CA. Out of those 130 patients, 95 were found to have CAD and 35 had normal coronary arteries. Thirty five patients with positive ETT and negative CA were investigated with TST to rule out microvascular disease. All of them were found to have negative TST. Those 35
Exercise ECG testing (ETT) has evolved during the past 50 years. It is a modality of considerable importance in the evaluation of patients with known or suspected ischemic heart disease. The exercise ECG and thallium stress test provide diagnostic information about the patients suffering from CAD, and also about category of patients who do not have typical features of CAD and present with atypical chest pain and have normal resting ECG. The purpose of this study was to establish the role of ETT and TST in the latter group.

For young soldiers reporting with chest pain at younger age, ETT and TST are the best screening tests to detect the presence of CAD so that remedial measures can be taken to modify the course of CAD. When compared with the results with international studies, Gianrossi et al. in a meta analysis calculated the mean sensitivity of ETT as 68% (range 23-100) and mean specificity of 77% (range 17-100), while it increased for thallium scan to 88% and 77% respectively, which is comparable with the results with international studies, Gianrossi et al., Fuster et al., and Zafar-ul-Islam, Jamal Waris and Zulfiqar Ali Kango.

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