Original Article

Role of Exercise Tolerance Test in the Screening of Suspected Myocardial Ischemia in Bangladeshi Patients

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Abstract:

Background: Ischemic Heart Disease (IHD) is preventable and reversible if early screening and elimination of the risk factors like life style modification and dietary intervention can be done. Exercise Tolerant Test (ETT) has become an important diagnostic tool to evaluate patient with suspected or known case of ischemic heart disease.

Objective: To determine the frequency of IHD among subjects who presented with chest pain and to identify the common indications for ETT.

Methodology: It was a cross-sectional study; the data was collected from ETT Unit of Mugda Medical College Hospital, Dhaka, Bangladesh using standard Bruce protocol.

Result: Out of 200 patients, there were 124(61%) male and 78(39%) female who presented in the cardiology department for ETT. Common indications for ETT were evaluation of chest pain 180(90%), followed by general check-up 14(7%), post-PCI evaluations 4(2%) and post-CABG evaluation 2(1%).Presenting complaints were typical angina 12(6%), shortness of breath 56(28%), non-specific chest pain 82(41%), chest compression 46(23%) and others 4(2%). Exercise ECG showed no ST changes in 138(69%) patients. The most common risk factors were hypertension, diabetes, smoking and obesity. Majority of the subjects 136(68%) were test negative whereas 42 (21%) were test positive and 22(11%) were test equivocal.

Conclusions: It is concluded that most of the subjects presenting with the suspected symptoms of myocardial ischemia were negative for IHD, and so why we advocate the use of ETT as a screening tool in patients who presents with features simulating angina. This will prevent unnecessary hospital admission.

Key Words: Exercise tolerance test, myocardial ischemia, and angina.

(Bangladesh Heart Journal 2019; 34(2): 122-126)

Introduction:

Coronary artery disease (CAD) is a global health problem reaching an epidemic in both developed and developing countries and is the leading cause of mortality and morbidity world- wide[1,2]. The South Asian countries have among the highest incidence of coronary artery disease globally[3]. The prevalence of IHD is 6.8% in Pakistan and United States of America[4]. In the last three decades, the prevalence of CAD has increased from 1.1% to about 7.5% in urban population of Delhi, India and from 2.1% to 3.7% in rural population[5]. Data related to different

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DOI: https://doi.org/10.3329/bhj.v34i2.44443

aspect of CAD in Bangladesh are inadequate but it is highly prevalent in Bangladesh[6].The IHD is preventable and reversible if early screening and elimination of risk factors like life style modification and dietary intervention can be done[7]. ETT has become an important diagnostic tool to evaluate patient with suspected or known cases of heart disease[8].It is one of the least costly of all non-invasive investigation for the screening of IHD[9]. However, because of low sensitivity and specificity, it just provides a basis for further planning and clinical decision making regarding coronary angiography. The aim of this study was to determine the indications for ETT and to find out the frequency of subject with positive test for ischemia and angina.

Methodology:

This prospective observational study was carried out in the Department of Cardiology, Mugda Medical College Hospital, Dhaka, Bangladesh. Total 200 subjects were enrolled for the study from 1st January 2018 to 31st December 2018. The standard Bruce protocol was used to evaluation of ischemia and angina. The result was considered positive if horizontal or descending ST-segment depression was >=1mm or ST-segment elevation or inotropic failure appeared i.e fall of systolic arterial blood pressure>10mmHg. Similarly, test was considered negative if the sub- maximum heart rate (85% of the maximum expected rate for age) was achieved without angina or definite ischemic changes. The test result was considered equivocal when there was only minimum T-inversion without ST changes and no definite angina. Data were analyzed using SPSS software V17. Descriptive analysis was carried out for both continuous and discrete data. Basic clinical and procedural characteristics were analyzed.

Results:

Among total 200 patients, there were 122(61%) males and 78(39%) were females with age range from 28 to 85years (mean-46.84±10.56). Chest pain was the commonest indications (Table-1) and obesity was the commonest risk factor (Table-2). Baseline ECG was mostly normal with sinus rhythm (Table-3) and study of ECG changes during exercise reveal, no ST-changes in 90(45%) and acute ST-changes seen in 50(25%) (Table-4). Result of the ETT are summarized as following, ETT negative 136(68%), ETT positive 42(21%), ETT equivocal 22(11%) (Fig.2). Limiting factors during ETT performance mostly were THR achievement or SOB (Fig: 1). Most ST-changes are seen in lead II, III, aVf & V4-V6 (Table-IV) and no significant arrhythmia seen other than few premature atrial 20(10%) and ventricular 10(5%) ectopic. All the ETT positive cases 42(21%) underwent for coronary angiography. Among them 32(16%) had significant coronary artery disease involving left main stem or left anterior descending artery whereas 10(5%) had normal coronary angiogram.

Table-I
Indications of ETT

Indications	Number	Percentages
Evaluation of chest pain	180	90%
Post-PCI evaluation	04	02%
Post-CABG evaluation	02	01%
General check-up	14	07%
	Total-200	Total-100%

Table-II
Known Risk factors

Risk factors	Number	Percentages
Hypertension	74	37%
Diabetes	60	30%
Dyslipidemia	40	20%
Smoking	50	25%
Obesity	104	52%
Family history	48	24%

Table-III
Resting ECG findings

Variables	Frequency	Percentages
Normal ECG	130	65%
Nonspecific T-changes	32	16%
T-inversion in leads II, III, aVf and V4-V6	04	02%
T-inversion in leads V1-V6	02	01%
RBBB	06	03%
PVCs	16	08%
PACs	08	04%
Others	02	01%
	Total-200	Total-100%

Table-IV

ECG changes during exercise

Variables	Frequency	Percentages
No ST changes	90	45%
Acute changes	50	25%
STchanges(significant/borderline):		
In lead II,III,aVf and V4-V6	28	14%
In lead I,aVl and V4-V6	10	05%
In lead V4-V6	06	03%
In lead I, aVl, V1-V6	06	03%
In lead I,aVl,II,III,aVf and V4-V6	10	05%
	Total- 200	Total-100%

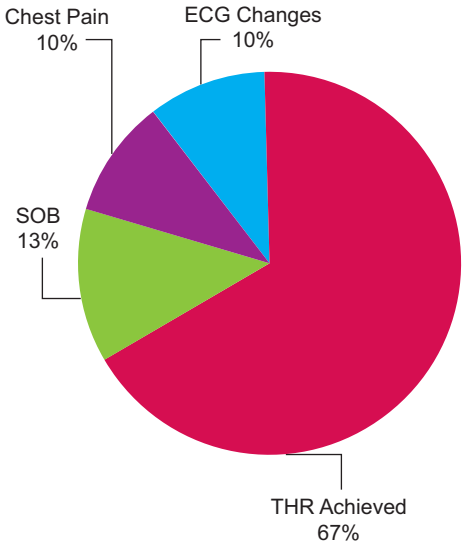

Fig.-1: *Criteria for Termination of Tests (Limiting Factors)*

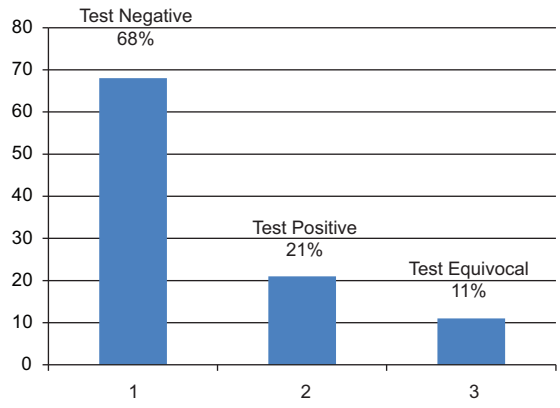

Fig.-2: *Impression of ETT*

Discussion:

Stress testing has been used since late 1920s as a convenient, non-invasive way to asses for exercise induced myocardial ischemia[10]. Stress testing with exercise or imaging has the greatest value in patient with a pretest intermediate risk for CAD. Stress testing can be performed with several modalities that can provide different type of information regarding diagnosis and prognosis. Several studies may be considered, including coronary calcium calcification (CAC) scoring, coronary computed tomography angiogram (CCTA), stress testing with and without an imaging modality, and catheterization (not usually the initial screening test).An ETT can be used to assess tolerance of increased activity with continuous ECG monitoring, as well as hemodynamic response and symptoms. This test is well established, inexpensive, and easily available. In addition to providing information regarding exercise-induced ischemia, ETT also offer information regarding exercise capacity and functional status. The stress portion of the test can be conducted with exercise or medical therapy, and imaging modality may be appropriate for some patients. Exercise testing has a sensitivity of 78% and specificity of 70% for coronary artery disease detection and cannot be therefore be used to rule in and rule out IHD unless the probability of coronary artery disease is taken into account. In a low risk population, like men less than aged 30years and women less than 40,a positive test result probably is a false positive than true negative and add little new information. In a high risk population, like those aged over 50 years with typical angina symptoms, a negative result cannot rule out IHD, though the results could also be of some prognostic value[11].Exercise induced chest discomfort without associated ECG changes may be the only signal that obstructive coronary artery disease is present[12]. It was noticed that changes in ECG like ST-segment depression or T wave inversion also affect the test result. A completely normal ETT has been reported to be a good prognostic indicator in diabetic patients[13]. The leading cause of mortality in patients with diabetes is cardiovascular disease (CVD), when it does occur, CVD in diabetic patients is more severe, more complex, and results in higher complication rate than in patients without diabetes[14]. In our study, diabetes was present in 60(30%) patients. Compared with such imaging procedures as CCTA, echocardiography, and stress single photon emission computed tomography (SPECT) myocardial perfusion imaging, the ETT is very cost effective. Although it remains controversial to screen asymptomatic patents, screening patients with limited functional status is

probably a reasonable approach for people moderate to high risk of underlying CAD. An ETT can be safe and effective initial screening test in patients who can exercise and have a normal baseline ECG. The ETT is preferable to a pharmacological stress test because it represents better cardiac strain with daily cardiac activity and thus depicts the heart's actual workload. Also patients have the advantage not to get exposed to ionizing radiation and contrast. The more recently developed non-invasive, multi-slice CT-angiography is still recommended to rule out coronary artery disease, but has the associated risk of high radiation exposure and is not cost effective[15]. An estimated 1 in 270 women who underwent CT coronary angiography at age 40 will develop cancer from radiation exposure during that CT, compared with an estimated 1 in 8100 women who had a routine head CT scan at the same age[16]. This was the reason, we chose the ETT as a screening tool in our study. It is also very popular as a screening test for IHD in the other countries of this sub-continent. In a study done in Pakistan by Imran Khan et al [19] showed that out of 200 patients majority of the subjects 148 (74%) were test negative for IHD and angina, whereas 36 (18%) had test positive for ischemia and angina. The finding is very similar to the result of our study. In 1988 ADA Consensus Development Conference on the diagnosis of coronary artery disease in people with diabetes recommended performing stress screening for coronary disease in asymptomatic patients with 2 or more cardiovascular risk factors (smoking, arterial hypertension, hypercholesterolemia, family history of premature CAD, microalbuminuria)[17]. However, recent studies have shown that the presence of traditional risk factors did not help to identify asymptomatic with a higher prevalence of coronary artery disease[18]. We did ETT in all patients regardless of age and risk factors that can be a limiting factor in our study.

Conclusion :

An exercise stress test would help to better assess exercise tolerance, a strong predictor of mortality, as well as hemodynamic response to activity. Our study concludes that most of the subjects presenting with symptoms simulating myocardial ischemia were negative for ischemic heart disease and angina. So our recommendation is that, to prevent unnecessary hospital admission, ETT must be done on patients presenting with signs and symptoms simulating angina.

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