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Role of Exercise Tolerance Test (ETT) in the Screening of Ischaemic Heart Disease

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ABSTRACT

Introduction: *Ischemic Heart Disease (IHD) is a common health problem now a day. It is preventable and reversible if early screening and elimination of the risk factors can be done. Exercise Tolerance Test (ETT) has become an important diagnostic tool to evaluate patient with suspected or known case of IHD. This study was aimed to determine the role of ETT as a screening test for IHD.* ***Methods:*** *This observational study was conducted in cardiology department of North Bengal Medical College Hospital, Sirajganj, Bangladesh over a period of one year, from 1st January 2021 to 31st December 2021. Total numbers of 200 patients were enrolled for this study and relevant data was collected from the study subjects using standard Bruce protocol. The standard Bruce protocol was used to evaluation of ischemia and angina.* ***Results:*** *Out of 200 patients, majority (124, 62%) were male. Chest pain (170, 85%) was the commonest indication of ETT and obesity (78, 39%) was the commonest risk factor of IHD. Baseline ECG was mostly nonspecific T-change with sinus rhythm and study of ECG changes during exercise reveal, no ST-changes in 96 (48%) and acute ST-changes seen in 40 (20%). Majority of the subjects 116 (58%) were test negative whereas 42 (21%) were test positive and 62 (31%) were test equivocal.* ***Conclusion:*** *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.*

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INTRODUCTION

Coronary artery disease (CAD) is a global health problem in both developed and developing countries and is the leading cause of mortality and morbidity world-wide.[1,2] The South Asian countries have the highest incidence of coronary artery disease.[3] The prevalence of Ischemic Heart Disease (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 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] Exercise Tolerance Test (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. So, the objective of this study was to evaluate the role of ETT in the screening of IHD.

METHODS

This observational study was carried out in the Department of Cardiology, North Bengal Medical College Hospital, Sirajganj, Bangladesh. Total 200 subjects were enrolled for the study from 1st January, 2021 to 31st December, 2021. During this period patients with the symptoms of stable angina came to out patients department (OPD) of cardiology, north Bengal medical college were included. The standard Bruce protocol was used for evaluation of ischemia and angina. The result was considered positive if horizontal or descending ST-segment depression was ≥1 mm or ST-segment elevation or inotropic failure appeared i.e. fall of systolic arterial blood pressure >10 mmHg. 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. Frequency and percentage were calculated manually.

RESULTS

Among total 200 patients, there were 124 (62%) males and 76 (38%) were females with age range from 28 to 85 years (mean-46.84±10.56). Chest pain was the commonest indications (Table I) of ETT and obesity was the commonest risk factor (Table II) of IHD. Baseline ECG was mostly nonspecific T-change with sinus rhythm and study of ECG changes during exercise reveal, no ST-changes in 96 (48%) and acute ST-changes seen in 40 (20%) (Table III). Result of the ETT among 200 patients were summarized as following, ETT negative 116 (58%), ETT positive 62 (31%), ETT equivocal 22 (11%) (Figure1). All the ETT positive cases 62 (31%) underwent for coronary angiography. Among them 46 (23%) had significant coronary artery disease involving left main stem or left anterior descending artery.

Table I: Indications of ETT

Indications	Number	Percentage
Evaluation of chest pain	170	85%
Post-PCI evaluation	08	04%
Post-CABG evaluation	04	02%
General check-up	18	09%
Total	**200**	**100%**

Table II: Risk factors for IHD

Risk factors	Number	Percentages
Obesity	78	39%
Hypertension	72	36%
Smoking	70	35%
Dyslipidemia	60	30%
Diabetes	56	28%
Family history	42	21%

Table-III: ECG changes during exercise

Variables	Frequency	Percentage
No ST changes	96	48%
Acute changes	40	20%
ST changes (Significant/borderline):		

In lead II,III,aVf and V4-V6	32	16%
In lead I,aVl and V4-V6	12	06%
In lead V4-V6	06	03%
In lead I, aVl, V1-V6	04	02%
In lead I,aVl,II,III,aVf and V4-V6	10	05%
Total	**200**	**100%**

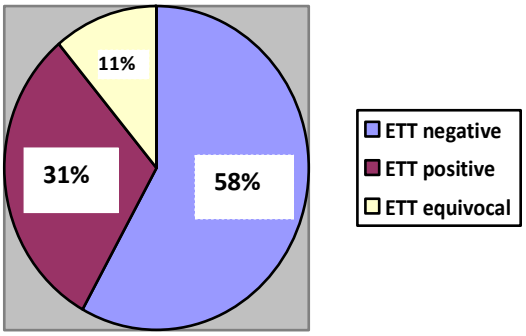

Figure 1: Interpretations of ETT

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 Coronary artery disease (CAD). It 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 Exercise Tolerance Test (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. Exercise testing has a sensitivity of 78% and specificity of 70% for coronary artery disease detection. So, it cannot be used to rule in and rule out IHD unless the probability of CAD is taken into account. In a low risk population, like men <30 years and women <40 years, a positive test result may be false positive. In a high risk population, like those aged over 50 years with typical angina symptoms, a negative result cannot rule out IHD.[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. In this study, diabetes was present in 56 (28%) patients. The ETT is very cost effective in compared with CCTA, echocardiography and stress single photon emission computed tomography (SPECT) myocardial perfusion imaging. 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. Also patients have the advantage not to get exposed to ionizing radiation and contrast media. The more recently developed non-invasive, multi-slice CT-angiography is still recommended to rule out CAD, but has the associated risk of high radiation exposure and is not cost effective.[14] An estimated 1 in 270 women who underwent CT coronary angiography at age 40 years 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.[15] For these reasons, ETT can be used as a screening test for early diagnosis of IHD.

Limitation: This was a single centre study.

CONCLUSION

Most of the subjects presenting with symptoms simulating myocardial ischemia were ETT negative for ischemic heart disease. So this study suggests that, for the prevention of unnecessary hospital admission, ETT should be done on patients presenting with signs and symptoms simulating IHD.

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Conflicts of interest: Not declared

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