

ROLE OF EXERCISE STRESS TEST IN DETECTING UNDERLYING MYOCARDIAL ISCHEMIASachin N. Solanke¹, Nandkumar D. Kulkarni²**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: BACKGROUND: Ischemic heart disease (IHD) is the leading cause of death and disability in industrialized countries. In India also there is increasing trends of death and disability due to IHD. The prevalence of IHD in India is 96.7/1000 in urban and 27.1/1000 in rural areas. Main risk factors for IHD are diabetes mellitus, hypertension, obesity, smoking and hyperlipidemia. **AIM:** The present study aims at early detection of IHD which can prevent death and disability in persons with risk factors. **DESIGN:** The present study is cross sectional observational study carried out in the govt. medical college of rural Indian set-up. **MATERIALS AND METHODS:** The present study was carried out on 70 asymptomatic patients of age group 30-70 years with any of the above mentioned risk factors for IHD. The treadmill test was performed in these patients. **STATISTICAL ANALYSIS:** The analysis was done using MS office excel 2007 software. **RESULTS:** 24.22% patients showed positive treadmill test. This means 24.22% of patients were having underlying IHD though they were asymptomatic. **CONCLUSION:** Thus treadmill test is a valuable, non-invasive tool for early detection of myocardial ischemia among the asymptomatic patients with risk factors for coronary artery disease.

KEYWORDS: Asymptomatic patients, Ischemic heart diseases, risk factors, Stress test.

INTRODUCTION: IHD remains the leading cause of death and disability in the populations of most industrialized countries.⁽¹⁾ WHO has drawn attention to the fact that IHD is our modern epidemic that affects population, not an unavoidable attribute of ageing. In today's world, most of the deaths are attributable to non-communicable disease and just over half of these are as a result of IHD. In India, the situation is no different from other part of the world. In one study, the prevalence of IHD among adults (Based on clinical and ECG criteria) was estimated as 96.7 per 1000 population in urban and 27.1% in rural areas.⁽²⁾ Indian population is more prone for IHDs and many times the first episode is the fatal one.

The risk factors for the development of IHD include diabetes, smoking, obesity, hypertension, hyperlipidemia etc. The patients with these risk factors are at increasing risk of developing IHD.

Tread Mill testing of patients with known or suspected coronary artery disease is an important part of patient management. The resting state frequently does not provide complete evaluation. Therefore introduction of stressful condition may be necessary to detect underlying ischemia.⁽³⁾ Electrocardiographic changes in response to stress testing have been accepted widely as means to detect underlying coronary heart disease.⁽⁴⁾

Graded Treadmill stress test is now utilized to detect asymptomatic patients at increase risk and yields a significantly higher percentage of positive ST segment responses than more conventional Master's two step test.⁽⁵⁾

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Very few studies have been carried out in India to find the incidence of the IHD in asymptomatic individuals with risk factors for coronary artery disease using treadmill test. Keeping in mind the severity of the condition and lack of data in Indian setting, this study has been carried out with the objectives to find out the incidence of the IHD in asymptomatic individuals with risk factors for coronary artery disease by treadmill test and to find out any correlation between multiple coronary artery disease risk factors and incidence of IHD in asymptomatic individuals.

MATERIALS AND METHODS: Our study is cross sectional observational study in the rural Indian set-up. Present study was undertaken in Swami Ramanand Teerth Rural Government Medical College, Ambajogai from July 2004 to January 2007. Present study included asymptomatic patients with important risk factors for coronary artery disease between 30 to 65 years of age, attending outpatient department in SRTR Government Medical College, Ambajogai.

Thus the study population includes asymptomatic patients with important risk factors for IHD like type 2 DM, hypertension, chronic cigarette smoking, obesity and dyslipidemia without ECG evidence of IHD. Patients were selected randomly to avoid selection bias. Patients with the history of angina pectoris, myocardial infarction, significant electrographic abnormalities, type 1 DM, morbid medical conditions like COPD, osteoarthritis, rheumatoid arthritis, severe anemia, thyrotoxicosis and those patients unwilling to complete exercise test were excluded from the study.

The study has been approved by the institutional ethical committee of SRTR Government Rural Medical College, Ambajogai, Maharashtra, India. As per Helsinki declaration, written informed consent was taken from each subject participating in the study. Every patient selected for this treadmill was evaluated with detailed history and physical examination pertaining to coronary artery disease risk factors. They were subjected to investigations like complete hemogram, urine analysis, liver function test, kidney function test, BSL, fundus examination, 12 lead ECG. Twelve hours fasting blood sample was collected from each individual, to perform biochemical analysis and levels of fasting blood glucose and lipid profile were determined.

Instructions were given to patients regarding overnight fasting, discontinuation of smoking and drugs one day before the test.

PROCEDURE: Treadmill was performed according to 'Bruce' protocol. 12 lead ECG was taken just prior to test and pulse, blood pressure were recorded in supine and standing position. Height and weight were recorded. The entire procedure was explained to the patient in detailed and for anxious patients a brief demonstration of the procedure was given. Patients were instructed to report immediately when they experience unusual or significant symptoms (e.g. chest pain, dizziness etc.) during exercise. In addition the patients were also assured that they may request termination of exercise prematurely, whenever necessary.⁽⁶⁾

Results in the form of total exercise time, maximum heart rate, percentage of maximum heart rate achieved, work done in METS, reasons for the termination of the test, exercise tolerance, arrhythmias, hemodynamic response and chronotropic response were noted.

Interpretation was done as per guidelines of Mark D. Darrow (1999)⁽⁴⁾:

Statistical Analysis: The analysis was done using MS office excel 2007 software.

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RESULTS: Seventy asymptomatic patients with important risk factors for coronary artery disease were subjected to treadmill stress test in Swami Ramanand Teerth Rural Government Medical College, Ambajogai.

64.28 % patients were in the age group of 50 years and above, and 35.7 % were below 50 years.

Distribution of cases according to risk factors as shown in Table No.1.

The treadmill test was done in all patients showing any of the above mentioned risk factors.

The age-wise distribution results of the treadmill test were as shown in Table no.2.

In total 17(24.22%) patients had shown positive treadmill stress test from the study group (70 patients). Out of 17 positive treadmill test, 12 patients (70%) were above the age group 50 years.

Risk factor-wise distribution of treadmill test results shown in Table no. 3.

Table 3 shows that maximum number of patients having diabetes mellitus as a sole risk factor (26.31%) showed positive treadmill test results followed by hypertensive patients (19.04%). Also From above table it seems very clear that treadmill test was positive in more number of patients having multiple risk factors as comparable to that of only one risk factor. This means there are more chances of having underlying IHD in asymptomatic patients with multiple risk factors for coronary heart disease as comparable to that of single risk factor for the same.

DISCUSSION: Silent coronary artery disease is an important cause of premature death. Sudden death is the first and only manifestation of disease in 18% of patients with coronary artery disease. The resting state frequently does not provide a complete evaluation so the introduction of a stressful condition (like treadmill test) may be necessary to detect underlying or latent ischemia.⁽³⁾

Smoking, hypertension, diabetes mellitus, obesity and hyperlipidemia are the main risk factors for IHD. A unique human habit of smoking has been identified as a major IHD risk factor with several possible mechanism as carbon monoxide induced atherogenesis, nicotine stimulation of adrenergic drive raising both blood pressure and myocardial oxygen demand fall in protective high density lipoprotein.⁽²⁾

In diabetes abnormalities relating to platelet function, coagulation, fibrinolysis and endothelial function have been described. Elevated blood sugar levels in diabetes induce vascular damage and promote atherosclerosis which favors intraluminal thrombus formation.⁽⁷⁾

Obesity especially abdominal obesity is associated with atherogenic lipid profile with increased LDL-C, VLDL and triglyceride and decreased HDL- C.⁽⁸⁾

Hypertension accelerates atherosclerotic process especially if hyperlipidemia is present. Increased blood pressure causes injury to endothelium which favors atherosclerosis and thrombus formation.⁽⁷⁾

Thus, all the above mentioned risk factors directly or indirectly lead to atherosclerosis which further leads to increased peripheral resistance and hypertension. Thus increased workload of myocardium leads to concentric left ventricular hypertrophy and this increased muscle mass leads increased oxygen requirement.

Mattingly (1962), Brody(1959) and Bellet et al (1967) have demonstrated that submaximal exercise testing with post exercise ECG analysis can identify person at high risk of coronary artery disease.⁽⁹⁾

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Agrawal et al (1981) studied 50 subjects with important coronary risk factors of age group 40-62 yrs. They found abnormal ECG findings only during exercise in 4 subjects and both during and after exercise in 7 subjects. Thus they noted positive stress test in 22% cases.⁽¹⁰⁾

Nagamani et al (1988) carried out their study over 100 subjects of age group 30-60yrs and noted positive test in 18% cases.⁽¹¹⁾

Frans J. H. Wackers et al (2004) carried out DLAD study over 1123 asymptomatic subjects with type II diabetes mellitus of age group 50-75 yrs with no known or suspected IHD. The subjects undergone either stress testing and clinical follow up or follow up only. They observed that total 113 patients (22%) were having silent ischemia including 83 with regional myocardial perfusion abnormalities. They have also concluded that strong predictors for abnormal stress test were abnormal valsalva (Odd's ratio 5.6), male sex (2.5) and diabetes duration (5.2).⁽¹²⁾

Mahmoud Abd El Wahab (2005) from his study stated that prevalence of IHD increase with advancing age. At any even age prevalence of IHD in men was higher than that in women. Diabetes is a strong risk factor for IHD. Hypertension substantially increases the risk of both micro-vascular and macro-vascular complications of diabetes. 10 mm of Hg decrease in mean systolic blood pressure was associated with reduction in risk of 12% for any complication related to diabetes, 15% related to death and 11% for myocardial infarction.⁽¹³⁾

In the present study, 70 asymptomatic patients with important risk factors for coronary artery disease were subjected to treadmill stress test. In the present study, 24.28% patients showed positive treadmill stress test which is nearly similar to that of Agrawal et al (22%) and Frans J. H. Wackers et al (22%).

In the present study, maximum patients of age group 60-69 yrs have shown positive treadmill stress test. Also there was increasing trend of positive test with age which was similar to that of Mahmoud Abd El Wahab's study. In the present study, maximum patients of Diabetes mellitus (35.48%) had positive treadmill stress test followed by hypertensive patients (29.09%). Also there was positive treadmill test in more no. of patients having multiple risk factors as comparable to that of only one risk factor.

As a limitation we have not compared the results with that of the gold standard method which in this case is angiography. In the rural set-up in spite of lack of resources the study has been conducted. From this, it is clear that diabetes mellitus is the most important risk factor for IHD followed by hypertension. Still further study is necessary in this context for evaluating the treadmill stress testing along with comparison with more advanced and definitive tests.

CONCLUSION: Treadmill testing represents valuable, non-invasive method for diagnosing myocardial ischemia early in asymptomatic patients with important risk factors for coronary artery disease like diabetes, hypertension, dyslipidemia, obesity and smoking so that patients can be detected at an early stage and can be properly treated and protected from the hazards of overt ischemic heart disease.

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Sr. No.	Risk Factors	Total No. of cases
1	Hypertension	31
2	Diabetes Mellitus	31
3	Obesity	10
4	Smoking	12
5	Hyperlipidemia	8

Table 1: Distribution of cases according to risk factors

Sr. no.	Age (Yrs)	Positive	Negative	Total
1	30-39	--	07	07
2	40-49	05	13	18
3	50-59	05	19	24
4	60-69	07	14	21
5	≥ 70	--	--	--
	Total	17	53	70

Table 2: Age-wise distribution of results of treadmill stress test

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Sr. No.	Risk factor		Positive	Negative	Total
1	Hypertension	Isolated	4(19.04%)	17	21
		≥1 risk factor	5(50%)	5	10
2	Diabetes mellitus	Isolated	5(26.31%)	14	19
		≥1 risk factor	6(50%)	6	12
3	Obesity	Isolated	0	5	5
		≥1 risk factor	2(40%)	3	5
4	Smoking	Isolated	1(16.16%)	5	6
		≥1 risk factor	1(16.16%)	5	6
5	Hyperlipidemia	Isolated	0	2	2
		≥1 risk factor	1(33%)	4	6

Table 3: Risk factor-wise distribution of treadmill test

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