ROLE OF EXERCISE STRESS TESTING IN EVALUATION OF PATIENTS PRESENTING WITH CHEST PAIN

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ABSTRACT

Objective: *To evaluate and assess the accuracy of the clinical diagnosis of ischemic heart disease (IHD) with exercise stress testing in patients presenting with chest pain.*

Material and Methods: *All patients referred from outdoor and emergency department were sent to exercise tolerance test (ETT) room, after undergoing full clinical assessment including history, examination and resting ECG. The patients underwent exercise testing according to Bruce Protocol.*

Results: *One hundred and twenty patients underwent exercise stress testing between December 2002 and June 2003. Among these 86 (71.7 %) were males and 34 (28.3 %) were females. The mean age of males was 45.19±9.49 years and females 44±10.9 years. Out of 120 patients, 50(41.6%) and 70 (58.3%) patients had positive and negative stress testing results respectively. Out of 50 positive cases, 33 (66%) were males and 17 (44%) were females. The mean age of patients with positive test was 51.3±8.3 years and negative test was 40.4±8.5 years. Hypertension was the most prevalent risk factor 42(35%) followed by family history 36(30%). Out of total diabetics (18/120) twelve (66%) had positive test. A significant number of patients (n=30/38, (79%) with no risk factors were negative on stress testing.*

Conclusion: *This study concludes that exercise stress test is a cost effective tool to evaluate patients presenting with chest pain in out-patients department suggestive of ischemic heart disease, both typical / definite angina as well as atypical / probable angina. This also helps to stratify those with increased likelihood of IHD into high-risk group needing referral for invasive tests and low risk group that can be observed.*

Key Words: *Ischemic Heart Disease, Exercise Stress Test, Chest Pain, Angina Pectoris.*

INTRODUCTION

Coronary artery disease remains amongst the leading causes of mortality and morbidity until recently.[1] Only in America, more than two million patients are admitted annually in hospitals with clinical suspicion of ischemic heart disease.[2] Coronary artery disease imposes physical, social and economical burden.

Standard care for patients presenting to emergency room with chest pain, even now, is admission to coronary care unit.[3] This results in fairly large number of unnecessary admissions because only one third of these are found to have coronary artery disease.

Exercise stress testing being a non-invasive and comparatively economical test can provide useful information to establish diagnosis and estimate prognosis in patients with coronary artery disease.[4] It is particularly helpful in patients with chest pain syndrome who are considered to have a moderate probability of coronary artery disease on the basis of age, gender and symptoms.

Exercise testing has excellent safety record. Mortality is less than 0.01% and morbidity is less than 0.05%. Risk is less for low risk patients who are seen in emergency and undergo exercise testing for risk stratification.[1] The predictive value according to American Heart Association for detection of coronary artery disease is 90% if typical chest discomfort occurs during exercise with horizontal or down sloping ST segment depression of up to 1 mm or more.[1] Sensitivity of exercise testing in patients with coronary artery disease is 68% and specificity is 77%.[3] In multivessel disease, the sensitivity is

AGE & SEX DISTRIBUTION (n = 120)

	Frequency n=120	Mean age in years (±SD)
Male	86(71.7%)	45.19±9.49
Females	34(28.3%)	44±10.9

Table 1

81%.[5] Recent approach is based on the evidence that low risk patients with suspected coronary event could be identified clinically by gender, age, symptoms, past history of coronary artery disease and electrocardiography.[6,7]

This study was conducted to evaluate and assess the accuracy of the clinical diagnosis of ischemic heart disease with exercise stress testing in patients presenting with chest pain.

MATERIAL AND METHODS

This descriptive study was conducted at Department of Cardiology, Mayo Hospital, Lahore, from Dec 2002 June 2003. This study enrolled 120 patients.

The patient with moderate probability on the basis of age, gender, symptoms with no previous history of ischemic heart disease and appropriate for exercise testing according to latest American Heart Association guide lines[8] were examined separately by two clinicians including researcher. Patients were included in the study on the basis of following criteria:

a) All patients with clinical suspicion of ischemic heart disease

b) Previously not known patients of ischemic heart disease

c) Patient with electrocardiogram not diagnostic of myocardial infarction or angina.

Patients were excluded if any of these was present:

a) Age less than 20 years and more than 60 years.

b) Very old and disabled patients who were unable to perform exercise testing.

STRESS TEST RESULTS AND AGE AND SEX DISTRIBUTION (n = 120)

	Positive	Negative
Total (n= 120)	50 (41.6%)	70 (58.3%)
Males	33 (66%)	52 (74.3%)
Females	17 (44%)	18 (25.7%)
Mean age (years)	51.3±8.3	40.4±8.5

Table 2

c) Diseases, which are contraindications to exercise testing i.e. pre-existing LBBB, pre-excitation syndrome.

All patients referred from outdoor and emergency department were sent to ETT room after undergoing full clinical assessment including history, examination and resting ECG. The patients underwent exercise testing according to Bruce Protocol. Findings were recorded on the pre-designed proforma.

Statistical analysis:

The data was analyzed by SPSS version 10. Categorical variables were analysed by using Chi Square test and continuous variables were analyzed by using student t test. All tests applied were two tailed. A p value of less than 0.05 was taken as significant.

RESULTS

Patient characteristics:

One hundred and twenty patients underwent exercise stress between December 2002 and June 2003. Out of these, 86(71.7%) patients were males and 34 (28.3%) were female. (Table 1) The mean age of males was 45.19±9.49 years and females was 44±10.9 years. Out of 120 patients, 50 (41.6%) had positive stress testing and 70(58.3%) patients and negative results (Table 2). The number of patients presenting with typical/definite angina clinically was 52(43.3%) and out of these 37/52 (71.1%) were positive on exercise stress testing. (Table 3) The distribution of positive results among male and female patients was 33/50(66%) and 17/50(44%) respectively. (Table 2) The number of patients presenting with atypical or probable angina was 64/120(53.3%)

DISTRIBUTION OF POSITIVE STRESS RESULTS IN DIFFERENT CLINICAL GROUPS (n = 120)

	Typical Angina	Atypical Angina	Non-anginal Pain
Positive cases	37/52(71.1%)	13/64(20.3%)	0/4(0.00%)
Negative cases	15/52(28.84%)	51/64(79.68%)	4/4(100%)
Total cases	52/120(43.3%)	64/120(53.3%)	4/120(3.3%)

Table 3

DISTRIBUTION OF RISK FACTORS

Risk factor	Male (n=86)	Female (n=34)	Total (n=120)
Hypertension	24(35%)	18(42.8%)	42(35%)
Diabetes Mellitus	14(77%)	4(22%)	18(15%)
Smoking	20(100%)	0(00.0%)	20(16.7%)
Family history	24(66.6%)	12(33.3%)	36(30%)
Hyperlipidemia	12(85.7%)	2(14.3%)	14(11.7%)
Patients with no risk factors	17(14%)	21(17.5%)	38(31.6%)

Table 4

and out of these 13(20.3%) were positive and 51(79.7%) were negative on stress testing. (Table 3) The patients presenting with non-anginal chest pain were 4(3.3%) in number, all being negative on stress testing. (Table 3) The mean age of patients with positive stress test was 51.3±8.3 years and negative stress test was 40.4±8.5 years (Table 2). The mean age of male and female patients among these positive results was almost equal i.e. 51.47 and 51 years respectively. Hypertension was the most prevalent risk factor 42(35%) followed by family history 36(30%) in males and females individually and in all positive cases collectively (Table 4). Out of total diabetics (18/120) twelve (66%) had positive test. Most of females belonged to atypical/probable clinical group (65%), signifying decreased stress test sensitivity in females. A significant number of patients 30/38 (79.5%) with no risk factor were negative on stress testing (Table 5). Ischemic ECG changes occurred at a significantly lower percentage of age predicted submaximal heart rate in positive cases as compared to negative cases both in males and females.

Complications: There were no complications during exercise stress testing except in one patient who had a run of ventricular tachycardia in recovery period that reverted spontaneously.

DISCUSSION

Our study demonstrates that exercise stress testing in selected patients is a cost effective tool to evaluate patients presenting with chest pain suggestive of ischemic heart disease in outpatient department. It helps to stratify those with intermediate probability of CAD into a high risk group needing referral for further invasive tests and a low risk group that can be observed[6,9] All of our patients were referred from outdoor and emergency with chest pain suggestive of ischemic heart disease. They were first clinically evaluated to know the pretest probability of IHD on the basis of age, sex and description of pain and other risk profile with normal ECG or only minimal changes. Our approach was based on the evidence that the diagnostic power of ETT is maximal when pretest probability of CAD is intermediate (30 to 70%).[8] This idea is also supported by our study that a clinician can estimate the likelihood of CAD by clinically available data, as 71.1% of clinically definite/typical angina patients were positive on stress testing in our study.[6,9,10] Our study supports pretest probability of CAD as given in ACC/AHA guidelines.[8,10]

ETT in selected patients utilizing a modified Bruce protocol is safe even though there is a possibility of adverse cardiac events as

DISTRIBUTION OF RISK FACTORS IN STUDIED PATIENTS

No of Risk factor	+ive ETT (n=50)	-ive ETT (n=70)	Total (n=120)
Patients with no risk factors	8 (16%) (21%)	30 (42.9%) (79%)	38 (31.6%) (100%)
Patients with one risk factor	24 (48%) (48%)	26 (37.1%) (52%)	50 (41.6%) (100%)
Patients with two risk factors	12 (24%) (50%)	12 (17.1%) (50%)	24 (20%) (100%)
Patients with more than two risk factors	6 (12%) (75%)	2 (2.9%) (25%)	8 (6.6%) (100%)

Table 5

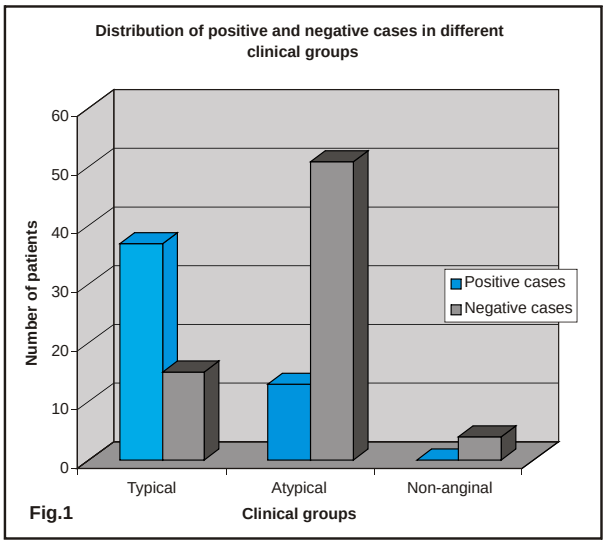

Fig.1

CONCLUSIONS

REFERENCES

1. Chaitman BR. Exercise stress testing. In: Braunwald E, Zipes DP, Libby P. editors. Heart diseases, a textbook of cardiovascular medicine. 6th ed. New York: WB Saunders, 2001:139-59.

2. Lewis WR, Amsterdam EA. Utility and safety of immediate exercise testing of low risk patient admitted to the hospital for suspected acute myocardial infarction. Am J Cardiol 1994;74:987-90.

3. Sarullo FM, Di Pasquale P, Orlando G, Buffa G, Cicero S, Schillaci AM et al. Utility and safety of immediate exercise testing of low-

risk patients admitted to the hospital with acute chest pain. Int J Cardiol 2000 ; 75(2-3): 239-43.

4. Gibbon RJ, Chatterjee K, Daly J, Douglas JS, Fihn SD, Garden JM et al. ACC/AHA/ACP-Asim Guidelines for management of patient with chronic stable angina: a report of American College of Cardiology/American Heart Association task force on practice guideline (committee on management of patient with chronic stable angina. J Am Coll Cardiol 1999;33:2092-7.
5. Fletcher GF, Flipse TR, Kligfield P, Malouf JR. Current status of ECG stress testing. Curr Probl Cardiol 1998;23(7):383-90.
6. Sharief S, Zaman KS. Exercise tolerance test in patients presenting with chest pain and normal electrocardiogram. J Coll Physicians Surg Pak 2002; 12: 348-52.
7. Amsterdam EA, Kirk JD, Dierks DB, Lewis WD, Tumpsedd SA. Immediate exercise testing to evaluate low risk patients presenting to emergency department with chest pain. J Am Coll Cardiol 2002;40:251-6.
8. Gibbons RJ, Balady GJ, Beasley JW. ACC/AHA guidelines for exercise testing. A report of the American College of Cardiology/American Heart Association Task Force on practice guidelines (Committee on exercise testing). J Am Coll Cardiol 1997;30:260.
9. Ishtiaq O, Ahmed M, Aman F, Khalil MA, Mehmood A. An evaluation of exercise stress test for coronary artery disease and outcome. J Coll Physicians Surg Pak 2002; 12: 721-9.
10. Diamond GA, Forrester JS. Analysis of probability as an aid in the clinical diagnosis of coronary-artery disease. N Eng J Med 1979; 300:13508.
11. Farkouh ME, Smars PA, Reeder GS. A clinical trial comparing a chest pain observation unit with routine admission in patients with unstable angina. N Eng J Med 1999; 339:1882.
12. Amsterdam EA, Lewis WR, Yadlapalli S. Evaluation of low-risk patients with chest pain in the emergency department: value and limitations of recent methods. Cardiol Rev 1999;7:17-26.
13. Lee TH, Cook EF, Weisberg M, Sargent RK. Wilson C, Goldman L. Acute chest pain in the emergency room. Identification and examination of low-risk patients. Arch Intern Med 1985;145:65-9.
14. Young DZ, Lampert S, Graboys TB, Lown B. Safety of maximal exercise testing in patients at high risk for ventricular arrhythmia. Circulation 1984; 70:184.
15. Polanczyk CA, Johnson PA, Hartley H. Clinical correlates and prognostic significance of early negative exercise tolerance test in patients with acute chest pain seen in the hospital emergency department. Am J Cardiol 1998; 81:288-92.
16. Sox HC, Hickam DH, Marton KI. Using the patient's history to estimate the probability of coronary artery disease: A comparison of primary care and referral practices. Am J Med 1990; 89:714.
17. Alexander KP, Shaw LJ, Delong ER. Value of exercise treadmill testing in women. J Am Coll Cardiol 1998; 32:1657.
18. Pryor DB, Harrell FE, Lee KL. Estimating the likelihood of significant coronary artery disease. Am J Med 1983; 75:771-80.
19. Pryor DB, Shaw L, McCants CB. Value of the history and physical in identifying patients at increased risk for coronary artery disease. Ann Intern Med 1993; 118:81-90.
20. Cassin M, Macor F, Cappelletti P, Rubin D, Deganuto L, Tropeano P. Management of patients with low-risk chest pain at the time of admission: a prospective study on a non-selected population from the Emergency Department. Ital Heart J 2002; 3: 399-405.
21. Macor F, Cassin M, Pitzorno C, Dall'Armellina E, Carniel E, Marciano F. Usefulness of exercise test in selected patients coming to the emergency department for acute chest pain. Ital Heart J 2003 ;4:92-8.
22. Buchsbaum M, Marshall E, Levine B, Bennett M, DiSabatino A, O'Connor R et al. Emergency department evaluation of chest pain using exercise stress echocardiography. Acad Emerg Med 2001;8:196-9.

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