PRIORITIZING PATIENTS FOR CORONARY ANGIOGRAPHY USING SIMPLIFIED TREADMILL SCORE IN HIGH RISK ASIAN SUBJECTS IN SAUDI ARABIA

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ABSTRACT

***Objective*:** Our aim was to prioritize & identify patients for coronary angiography using simplified treadmill score in high risk Asian subjects.

***Methods*:** Consecutive patients referred for chest pain were evaluated based on clinical history and Treadmill Exercise Stress tests and Duke treadmill score and The Simplified treadmill score were plotted into risk categories and high risk patients were referred for coronary angiography.

***Results*:** A total of 212 subjects with 95% males underwent Treadmill Stress test of whom 51(24%) were designated as high risk group with a Simplified treadmill score of >60, who were advised Coronary angiography but only 22% of the high risk group underwent Coronary angiography and almost all were found to have two or three vessel disease.

Conclusion: The Simplified treadmill score can prioritize patients for coronary angiography using the high risk probability ratio of Simplified treadmill score in Asian subjects.

KEY WORDS*:* Stress ECG Test, Exercise Tolerance test, Simplified Treadmill score, Duke treadmill score, Ischemic heart disease, Coronary artery disease, Asian subjects.

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INTRODUCTION

Saudi Arabia is home to a large expatriate population hailing mainly from South Asia, South East Asia and Africa. Exercise has been the most common physiologic stress and it places a major demand on cardiopulmonary system. Exercise ECG is the cheapest and cost-effective first diagnostic test recommended by the American Heart association,[1] though some investigators have questions regarding the sensitivity of Exercise ECG which is 45% though specificity is 85%.[2] That is why various scores have been recommended to increase the sensitivity of ETT in screening IHD.[3-11] We analyzed patients who presented with chest pain by performing non-invasive Exercise Tolerance Test and prioritizing them before coronary artery angiography by using Duke treadmill score[5] and Simplified Treadmill score[3] before recommending them to go for coronary angiography, All the high risks patient in both the scores were referred for coronary angiography. The recommendations for women may be different from the male population, which states that they should be able to walk and baseline ECG should be within normal limits, on the contrary if baseline ECG is abnormal or they have Diabetes they should go for Stress Echocardiographgy.[12]

Study Setting: A case control, observational study. All patients underwent Exercise Treadmill testing at Jeddah National Hospital between January 2003 and March 2005.

Inclusion Criteria: Any patient referred for evaluation of chest pain excluding NSTEMI & STEMI acute coronary syndromes by resting ECG & cardiac enzyme markers regardless of age & sex and ethnic background.

Exclusion criteria:

1. Previous cardiac surgery or angiography.
2. Valvular heart disease.

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3. Left bundle branch block pattern on ECG.
4. Paced rhythm.
5. WPW syndrome on baseline ECG.
6. History of previous MI.
7. Acute Coronary Syndromes (STEMI & NSTEMI).

PATIENTS AND METHODS

First of all a computerized database (MS Excel) regarding the previous History of patient signifying Diabetes mellitus, Dyslipedemia (Hypercholesterolemia &/or Hypertrigly- ceridemia), Family History of IHD, current smoking status, and medications was obtained.

Exercise Testing: The patients were exercised on a Treadmill machine loaded with computerized software RAM 2001 Stress ECG system; Italy Full Bruce protocol and modified Bruce protocol were used for the symptom limited stress tests. Visual ST Segment depression was measured at the J junction and corrected for pre-exercise ST segment depression; ST-segment slope was measured over the following 80 ms and classified as up sloping, horizontal, or down sloping the treadmill test was always supervised by the physician.

Score Calculation:

1. Duke treadmill score was calculated by the RAM 2001 software as follows[5]:- DTS=Exercise time*- 5×(ST segment derivation)#- 4×(Angina index)$

* Exercise time is based on standard Bruce protocol.

* ST segment derivation is measured 80msec after the J point. if the amount of excercie-induced ST segment deviation is less than 1mm, the value entered into the score for ST segment is 0.

Angina index is 0 if no exercise angina occurs, 1 if exercise angina occurs, 2 if the reason the patient stopped excercising.

Duke Treadmill score:

Score of >5 =Low risk consistent with excellent survival

Score of 10 to 4 = Intermediate risk

Less than 10 = High Risk

2. Simplified Treadmill score(STS)[13] was calculated as follows on a flashcard/MS Exel and total scores were summed up as follows:-

Risk Factor	*Circle one response*	*Score*
	Male	*Female*
Maximal Hear rate	<100bpm=30 100 to 129=24 130 to 159=18 160 to 189=12 190 to 220=6	<100bpm=20 100 to 129=16 130 to 159=12 160 to 189=8 190 to 220=4
Exercise ST depression	1-2 mm=15 >2mm=25	1-2 mm=6 >2mm=10
Age	 >55 yrs=20 40-55 yrs=12	 >65 yrs=25 50-65 yrs=15
Angina History	Definite/ Typical=5 Probable/ Atypical=3 Non-cardiac pain=1	Definite/ Typical=10 Probable/ Atypical=6 Non-cardiac pain=2
Hypercholesterolemia?	Yes=5	Yes=10
Diabetes?	Yes=5	Yes=10
Exercise test induced angina	Occurred=3 Reason for stopping=5	Occurred=9 Reason for stopping=15
Smoking? Estrogen status	NA NA	Yes=10 Positive=-5, Negative=+5
	Total Score:	

Interpretation:

<40: low probability of IHD

40-60: intermediate probability of IHD

>60; High probability of IHD

Following paradigm[3] were used as clinical reaction to estimated probability of IHD:-

Low probability: Reassurance to the patient that symptoms are most likely not due to IHD.

Intermediate Probability:Require other test such as Stress Echocardiography or nuclear angiography to clarify diagnosis; antianginal medicine used.

High Probability: Angiography required.

Statistical Analysis: Statistical analysis was done using SPSS (Statistical package for social sciences) version 10. All data of patients was converted from MS Excel to SPSS database and analysed using means with standard deviation and percentages.

RESULTS

In total 212 cases were analyzed with a preponderance for males (95%), The mean age for exercise test was 43years (Sd 8.28), which clearly dictates the working class or prime age group when IHD strikes. The 93% of the subjects belonged to the Indo-Pak subcontinent where IHD has a very high prevalence. Chest pain was used as symptom limiting endpoint for terminating the test. We classified the subjects into three different groups according to risk assessment following Treadmill score, Less than 40 were designated as Low probability of IHD, and 40 to 60 Treadmill score were designated as medium risk group with intermediate probability of IHD, High risk group was having a Treadmill score of > 60 who were advised to undergo coronary angiography. About 22% of the high risk group underwent Coronary angiography at various centres within three months and reports were analyzed, In total 72% of the high risk group had 2 to 3 vessel disease and undergone coronary angioplasty ± stenting and 27% had undergone Coronary artery bypass surgery.

DISCUSSION

Classic criteria of 1mm of ST depression has low sensitivity and specificity, furthermore exercise ST depression has not been prognostic in all studies. Functional capacity is the strongest predictor of prognosis and heart rate recovery adds to it,[1] Maximum heart rate has been an important part of diagnostic scores. Use of ST depression as a sole criterion in exercise stress testing should be avoided.[14] Scores increase accuracy by enhancing the odds that any decision will be correct. Standard exercise test has a predictive accuracy of 73% shown by at least 147 studies and 24,047 patients. The score strategy has a predictive accuracy of 88% in >1000 patients, This is comparable to Thallium scintigraphy (predictive accuracy 85%), SPECT (pa 80%) Adenosine SPECT (pa 85%),Exercise Echo (pa 80%) and EBCT(65%), Score accuracy outnumber all of these modalities by a predictive accuracy of 88%& sensitivity of 85% and specificity of 92%,[2,9] Therefore scores, ST/HR index and heart rate recovery should be part of every standard ECG exercise test. Various complicated scores and experienced physician/Cardiologist assessment has been recommended to screen patients for coronary artery disease but use of simplified Treadmill score, ST depression, METS, ST*HR index, Duke treadmill score and Borg scale has been found to be important for diagnostic and prognostic significance,[2] Until recently DTS was used as prognostic score and then studies recommended its use in diagnosis of IHD.[10,13,15,16] We found simplified treadmill score encompassing the clinical variables including a history of diabetes mellitus, a history of dyslipedemia and a history of angina pectoris and Stress ECG criteria including maximum heart rate, Exercise ST depression and exercise induced angina as part of assessment, though other criteria which are important in prognosis of IHD include no. of METS, double product, and ST*HR index and a machine calculated DTS are also useful parameters because no of METS consistently decreased with our high risk subjects (classified according to STS (simplified treadmill score).Mean ST*HR index also showed an upward trend with high risk subjects which signifies a high percentage of IHD with a high index. Double product also decreased progressively with our high risk

Table-I

		Total No.	%
No.		212	100
Male		203	95.8
Female		9	4.2
Age	25-30	14	6.6
	31-40	74	34.9
	41-50	96	45.2
	51-60	21	9.9
	>60	7	3.3
Ethnic distribution			
Pakistani		132	62.2
Indian		48	22.6
Bangladeshi		19	4.2
Other		13	6
FHx of IHD		31	14.6
DM		58	27.3
Smoker		112	52.8
Dyslipedemia		55	26

Table-II: *STS :* Simplified Treadmill Score

Variable	Low Risk STS n=70	Medium risk STS n=81	High Risk STS n=51
Clinical History			
male sex%	94.3%	96.6%	96.1%
mean age(years) + SD	41±6.79	41.2±7.57	47.43±9.58
mean height (m) + SD	1.70±0.7	1.69±0.05	1.67±0.05
mean Weight(kg) + SD	79.9±13.19	77.6±11.4	73.8±10.5
mean BMI + SD	27.7±4.30	26.7±4.69	26.3±3.5
Risk factors			
DM %	19%	27.5%	39.2%
Dyslipedemia %	11%	28.6%	41.2%
Smoker %	49%	46.2%	47.1%
Fx of IHD %	9%	19.8%	13.1%
Exercise test			
mean heart rate,bpm ± SD	153.3±18.52	147.7±17.32	121±18.96
mean syst BP, mmHg ± SD	170.6±22.32	166.7±21.11	163.8±24.03
mean , ST depression ± SD	-0.15±0.52	-1.0±1.05	-1.43±1.22
mean double product ± SD	25030±5124	23775±4374	19340±4921
mean ST*HR index + SD	3.3±3.18	4.5±3.07	6.5±4.68
mean METS + SD	10.3±2.36	9.4±2.40	6.8± 2.63
Angiography done%			22%
angioplasty ± stent %			72.7%
CABG %			27.2%
DTS, mean + SD	6.1±5.56	3.1±8.17	0.4±7.67
STS ,mean + SD	32.7±4.15	51.1±6.50	70.1±6.79

patients which signify a poor prognosis to longevity owing to increased incidence of IHD, Simplified Treadmill score ranged from 24 to 84 with a mean score of 70 in high risk subjects. It is unfortunate that only 22% of the patients underwent Coronary angiography and PCI/CABG and almost 99% had two to three vessel disease which confirms the accuracy of Simplified Treadmill as valuable tool in predicting ischemic heart disease. Though these scores cannot be recommended to replace physician judgment and they should be thought of as a readily available second consultation[1] Heart rate recovery in first two minutes is another important variable to be considered in interpreting exercise test.[15,16] Exercise testing has a very good future as a diagnostic & prognostic investigation despite multitude of other invasive and non-invasive tests available specially in a South Asian context or where the cost is a limiting factor in diagnosing coronary artery disease, True value of ETT is important in patients who have intermediate probability of IHD[17] But scores definitely help in identifying subjects for coronary angiography and Simplified Treadmill score should be an essential component of Exercise ECG softwares[18] designed for Exercise tests like Duke treadmill score. Further large scale studies are required to validate and develop new Treadmill scores in Pakistani versus Asian subjects in diagnosing ischemic heart disease.

Only 10 patients were found to be high risk subjects identified by the Duke treadmill score paradigm compared to 51 found to be high risk by the simplified Treadmill score using the paradigm mentioned above for Duke treadmill score, so we conclude that machine calculated Duke treadmill score was not found to be a useful score for Asian subjects in this study.

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