Original Research Article

Treadmill stress testing in asymptomatic subjects with coronary risk factors

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Abstract

Background: Coronary artery disease (CAD) is the commonest form of clinical heart disease beyond the age of 40 years. Maximal treadmill stress testing has been used by some investigators to detect latent subclinical myocardial ischemia due to CAD. **Aim:** To find out the incidence of latent coronary artery disease in asymptomatic subjects over the age of 40 years with coronary risk factors by treadmill stress test. **Material and Methods:** The present study included 70 asymptomatic subjects over the age of 40 years with different coronary risk factors like hypertension, diabetes mellitus, obesity, hypercholesterolemia and heavy smoking, were studied for the presence of latent coronary artery (CAD) by treadmill stress test. **Results:** The incidence of positive treadmill stress test in subjects having single risk factor was 15.38%, while it was 25% with two risk factors and it was 48.27% with more than two risk factors. Out of 23 subjects whose treadmill stress test was positive, the maximum number of cases i.e. 43.47% had changes of ischemic response appearing in stage 11 (6 min) of exercise while 26.10% had changes appearing in stage I (3 min).**Conclusion:** Treadmill stress test can pick up coronary artery disease when resting ECG is normal. It is a non-invasive, reliable and a very safe method for detection of latent CAD.

Key Word: Coronary artery disease, Asymptomatic, Risk factors, Treadmill stress test,

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INTRODUCTION

Coronary artery disease (CAD) accounts for large number of cardiac deaths in developed as well developing countries. It is a disease that affects not only old people, it is also important as a cause of premature death and disability in middle age.[1] Coronary artery disease is the commonest form of clinical heart disease beyond the age of 40 years.[2] Detection of its presence at an early stage is essential in order to slow the evolution of the disease. Multiple inter-related factors have been demonstrated to be associated with increased risk of development of CAD. Prospective studies demonstrated a consistent association of characteristics observed in apparently healthy individuals with subsequent incidence of CAD in the same individuals.[3] Data accumulated from various epidemiological studies have shown that factors such as hypertension, diabetes mellitus, high cholesterol level, heavy smoking and obesity are associated with an increased risk of CAD.[2] Detection of latent CAD remains one of the most important and difficult problems of modem medicine. Maximal treadmill exercise electrocardiography has emerged as a useful tool for screening and diagnosis of CAD. The treadmill exercise electrocardiography has been used to screen those asymptomatic individuals who are considered high risk for CAD.[4] The development of techniques capable of identifying persons with latent CAD is important both for directing preventive efforts to these persons and for evaluating the condition of those whose sudden illness could compromise public safety.[5] Maximal treadmill stress testing has been used by some investigators to detect latent subclinical myocardial ischemia due to CAD.[6] The present study was undertaken to find out the incidence of latent coronary artery disease in asymptomatic subjects over the age of 40 years with coronary risk factors by treadmill stress test.

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MATERIAL AND METHODS

The present study included 70 asymptomatic subjects over the age of 40 years with different coronary risk factors like hypertension, diabetes mellitus, obesity, hypercholesterolemia and heavy smoking, were studied for the presence of latent coronary artery (CAD) by treadmill stress test.

Inclusion criteria

- Fasting blood sugar level of 140 mg% or more and post prandial blood sugar level of 200 mg % or more.
- Serum cholesterol level of 260 mg% or more.
- Smoking more than 20 cigarettes or bidies per day.
- Blood pressure 150/90 mm of Hg or higher.
- Persons who are obese (BMI >25).

Exclusion criteria

- History of angina pectoris and myocardial infarction
- Abnormal baseline E.C.G.
- Severe anemia (Haemoglobin level<7gm%)
- The Pathophysiology of Exercise Induced Ischemia.
- Physically handicapped

A detailed history and clinical examination was carried out in the selected individuals. Routine investigations like haemogram, urine analysis, blood sugar, blood urea, serum creatinine, serum cholesterol, X-ray chest, and routine 12 lead ECG were done in all subjects.

Treadmill stress testing: Patients were instructed not to eat or smoke for 2 or 3 hours before test. Patients were instructed to avoid any strenuous physical efforts for at least 12 hours before testing. Patients were asked to stop all drugs for at least 48 hours before treadmill Stress test. Consent was taken in writing after explaining the procedure of the test with risk and possible complications. A 12-lead ECG was taken prior to treadmill stress test. After explaining the procedure to the patient, the ECG recording was taken in supine position, standing position, and after hyperventilation to eliminate false positive results because of hyperventilation and posture. The subjects were subjected to treadmill stress test according to Bruce protocol. ECG tracings were taken for 10 seconds at the end of every 3 minutes of exercise (i.e. completion of one stage) and at the maximum exercise. Blood pressure readings were taken at the end of each stage. ECG tracing were taken every 2 minutes for 8 minutes in the post exercise period along with HP readings.

Positive treadmill stress test[7]: The positive treadmill stress tests were coded as Type IA, IB, II in accordance with the criteria of Goldschlager et al. Type I A: Down sloping ST segment depression of 1mm or more. Type 1 B: Horizontal ST segment depression of 1mm or more. Type II: Slowly up sloping ST segment depression during exercise or afterwards is defined as ST segment depression greater than or equal to 1.5 mm, 80 m sec. after J Point (the junction of QRS complex with the ST segment) or ST segment depression greater than or equal to 1 mm with ST segment slope not exceeding 1 mv/sec, or both Arrhythmias, heart block or T-wave changes were not considered indicators of a positive treadmill stress test in the present study.

RESULTS

In the present study, out of 70 asymptomatic subjects with coronary risk factors, 50 subjects (71.43%) were males while 20 subjects (28.57%) were females. The male to female ratio in the present study was 2.5:1. The maximum number of subjects were in the age group of 40 to 49 years i.e. 42.85%, out of which 34.28% were males and 8.57% were females. 23 subjects (32.85%) were owned in the age group of 50 to 59 years and among those 21.42% were males while 11.43% were females. 16 subjects(22.85%) were observed in the age group of 60 to 69 years and among those 14.28% were males and 8.57% were females. 53 subjects (75.70%) were observed between the age group of 40 to 59 years, out of which 50.70% were males and 20 % were females. In the age group of 70 and above only one male subject (1.45%) was observed.

Table 1: Incidence of various coronary risk factors in the present study

Risk factors	Alone		With other risk factors		Total (n=70)	
	No	Percentage	No	Percentage	No	Percentage
Hypertension	6	8.57%	44	62.48%	50	71%
Diabetes	5	7.14%	25	35.5 %	30	42.6%
Hypercholesterolemia	-	-	28	39.76 %	28	39.76%
Obesity	-	-	22	31.24%	22	31.24%
Heavy smoking	2	2.85%	24	34.08%	26	36.92%

Out of 70 subjects, 13 cases (18.53%) were having only one risk factor while 57 cases (81.43%) had more than one risk factor. Out of 13 cases with one risk factor, the maximum number of cases i.e. 46.5% were hypertensive followed by diabetics (38.46%) and heavy smokers (15.39%). in the present study there was not a single subject who had either hypercholesterolemia or obesity alone as a risk factor. Out of 70 cases, 50 subjects (71.42%) were hypertensive, out of

which 8.57% were having hypertension alone as risk factor while 62.85% were having other associated risk factors. Among study group, 30 subjects (42.85%) were diabetics, out of which 5 subjects (7.14%) were having diabetes mellitus alone as risk factor and 25 subjects (35.71%) were having other associated risk factors. Whereas, 28 subjects (40%) had blood cholesterol levels >260 mg% and all subjects were having other associated risk factors. Moreover, 22 subjects (31.42%) were obese individuals and all had other associated risk factors. In regard to smoking, 26 subjects (37.14%) were heavy smokers out of which 2 subjects (2.85%) had heavy smoking alone as a risk factor while 24 subjects (34.29%) had other associated risk factors.

Table 3: Distribution of positive stress test as per risk factors

Risk factors	Alone		With other risk factors		Total	
	No.	Positive	No.	Positive	No.	Positive
Hypertension	6	1 (16.66%)	44	15 (34.09%)	50	16 (32%)
Diabetes	5	1 (20%)	25	10 (40%)	30	11 (36.66%)
Hypercholesterolemia	-	-	28	12 (42.85%)	28	12 (42.85%)
Obesity	-	-	22	7 (31.81%)	22	11 (50%)
Heavy smoking	2	-	24	8 (50%)	26	8 (30.76%)

Out of 50 total hypertensive subjects with or without other associated risk factors, the treadmill stress test was positive in 16 subjects (32%). Out of 6 subjects having hypertension alone as risk factor, the treadmill stress test was positive in one subject (16.66%) while out of 44 subjects having other associated risk factors, it was positive in 15 subjects (34.10%). Out of total 30 diabetics, the treadmill stress test was positive in 11 subjects (36.66%). Out of 5 subjects having diabetes mellitus alone as risk factor, the treadmill stress test was positive in one subject (20%) while out of 25 subjects having other associated risk factors it was positive in 10 subjects (40%). Out of 28 subjects who had serum cholesterol levels more than 260 mg% with other associated risk factors, the treadmill stress test was positive in 12 subjects (42.85%). Out of 22 subjects having obesity with other associated risk factors, the treadmill stress test was positive in 11 subjects (50%). Out of total 26 heavy smokers, the treadmill stress test was positive in 12 subjects (46.15%). Out of 2 subjects with heavy smoking alone as a risk factor none (0%) had positive stress test while out of 24 subjects having other associated risk factors, 12 subjects (50%) had positive treadmill stress test. Out of 22 subjects with single risk factor, 6 cases (27.27%) had positive treadmill stress test. Out of 28 subjects with two risk factors, 7 cases (25%) had positive treadmill stress test. Out of 29 subjects with more than two risk factors 14 cases (48.82%) had positive treadmill stress test. It was observed that 8.57% of subjects showing positive treadmill stress test had ECG abnormalities of Goldschlager et al 8.57% had Type 1A, 18.57% had type 1B, 5.71% had type II abnormality.[7] In Type IA, 8.57% of subjects had T-wave inversion with exercise. Among study group, 17.14% had occasional ventricular premature beats. But these were not considered indicators of a positive treadmill stress test in the present study. The maximum number of subjects showing positive treadmill mess test i.e. 10 cases (43.57%) had changes of ischemic response appearing in stage II of exercise. Out of 23 cases, 6 cases (26.1%) had changes of ischemic response appearing in stage I exercise while 5 cases (21.73%) had ischemic response appearing in stage III of exercise. 16 cases (69.57%) had changes of ischemic response appearing in stages of exercise between I & II. Two cases (8.7%) had changes in stage IV and above of exercise.

DISCUSSION

In the present study out of 70 asymptomatic subjects, maximum number of cases i.e. 30 subjects (42.85%) were observed in the age group of 40 to 49 years and only one subject (1.45%) was in the age group of 70 years and above. The number of risk factors are variable but in this study have been restricted to five in the present study i.e. hypertension, diabetes mellitus, hypercholesterolemia, obesity, and heavy smoking. In the present study out of 70 asymptomatic subjects with different coronary risk factors, hypertension was observed to be the commonest (71.42%) risk factor followed by diabetes mellitus, hypercholesterolemia, heavy smoking, and obesity in 42.85%, 40%, 37.14% and 31.42% of cases respectively. Agarwal BL et al observed diabetes mellitus to be the commonest (60%) risk factor followed by hypertension, obesity, hypercholesterolemia, and heavy smoking in 58%, 28%, 20% and 20 % respectively.[8] In the present study out of 70 asymptomatic subjects with different coronary risk factors, 13 cases (18.57%) were having only one risk factor while 57 cases (81.43%) had more than one risk factors. However, Agrawal BL et al observed 24% of cases with one risk factor and 76% of cases with more than one risk factors. Out of 13 cases with one risk factor, the maximum number of cases i.e. 46.15% were hypertensive followed by diabetes mellitus (38.46%) and heavy smokers (15.39%). Hypercholesterolemia or obesity alone as a risk factor was not observed in the present study.[8] In the present study out of 70 asymptomatic subjects, 50 cases (71.42%) were hypertensive out of which 8.57% were having

hypertension alone as risk factor while 62.85% were having other associated risk factors. 30 subjects (42.85%) were diabetics out of which 7.14% were having diabetes mellitus alone as risk factor while 35.71% were having other associated risk factors. 28 subjects (40%) had serum cholesterol levels > 260mg% and all cases were having other associated risk factors. 22 subjects (31.42%) were obese individuals (BMI >25) and all had other associated risk factors.26 subjects (37.14%) were heavy smokers out of which 2.85% had heavy smoking alone as risk factor while 34.29% had other associated risk factors. In the present study out of 13 subjects with single risk factor, the treadmill stress test was positive in 15.38% of cases. Out of 28 subjects with two risk factors, the treadmill stress test was positive in 25% of cases while out of 29 subjects with more than two risk factors, the treadmill stress test was positive in 48.27% of cases. Agarwal BL et al observed the incidence of positive treadmill stress test as 8.3%, 16.7% and 35% in subjects with one, two and more than two risk factors respectively.[8] Thus, the incidence of positive treadmill stress test is directly proportional to the number of risk factors. By selecting groups of individuals with certain combinations of high risk characteristics, it is possible to describe a segment of the population which at excessively high risk of developing CAD. In the present study it was observed that 8.57% of subjects showing positive treadmill stress test had ECG abnormalities of Gold schlager *et al* Type IA, while 18.57% had Type IB and 5.71% had Type II abnormalities.[7] Agarwal BL et al observed the lower incidence of type IA and type I3 as 2% and 14% while similar incidence of type II response was 8.6%.[8]

CONCLUSION

Treadmill stress test can pick up coronary artery disease when resting ECG is normal. It is a non-invasive, reliable and a very safe method for detection of latent CAD. Thus, treadmill stress testing of subjects with coronary risk factors, even though asymptomatic, is important not only for detection of latent CAD but also for effective institution of measures to control, or eradicate if possible, the modifiable risk factors in the hope that future coronary events with high morbidity and mortality will be minimized.

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