

# Commentary

## Treadmill testing – Where does it stand today?

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Exercise testing is a cardiovascular stress test that uses treadmill bicycle exercise with electrocardiography (ECG) and blood pressure monitoring. Five decades ago Robert Bruce introduced cardiac exercise testing. Thereafter, treadmill testing has been a cornerstone of diagnostic procedures for coronary artery disease. Exercise stress testing, which is now widely available at a relatively low cost, is currently used most frequently to estimate prognosis and determine functional capacity, to assess the probability and extent of coronary disease. Exercise stress testing along with ECG and symptoms has been established as a major tool in the diagnosis and prognosis of cardiovascular disease, specifically coronary artery disease (CAD).

Treadmill test is performed frequently in patients with intermediate pretest probability (based on age, gender and symptoms) of coronary artery disease. Patients, who are stabilized after an episode of acute coronary syndrome (unstable angina or Non ST elevation MI) or myocardial infarction, are advised exercise testing to prognosticate, to prescribe the level of activity and the timing of coronary intervention. It is also used to evaluate patients after revascularization (coronary angioplasty or Bypass surgery) for the presence or absence of ischemia and to assess the exercise tolerance and prescribe activity. Patients suspected to have arrhythmias during exercise are evaluated by exercise testing. Exercise testing is also useful in evaluating children and adolescents with congenital heart disease and valvular heart disease to assess the exercise capacity and abnormalities of cardiac rhythm.

The parameters usually assessed are ST segment depression or ST elevation in leads without Q waves, development of angina, hemodynamic responses ST changes in recovery phase (table 1) angina pectoris, ventricular arrhythmias and inadequate response of blood pressure or heart rate to exercise (the latter is termed chronotropic incompetence) are the other important markers.

Increasing importance to recovery phase is being given; especially ST depression in the recovery carries almost similar diagnostic significance as that during the exercise. A study from the Cleveland Clinic group stressed on the time taken for the slowing of the heart rate during recovery, which indicates the vagal tone of the individual. Delayed heart rate slowing predicted poor outcome. Hence, heart rate recovery should be carefully monitored which adds further value to the test.

**Table 1: Treadmill test variables**

### Diagnostic and prognostic treadmill test variables during exercise and recovery

#### Exercise variables

- Maximal exercise capacity
- ST-segment depression
- ST-segment elevation
- Angina pectoris
- Inadequate blood-pressure response
- Inadequate heart-rate response
- Ventricular arrhythmia

#### Recovery variables

- ST-segment depression
- Delayed slowing of heart rate
- Ventricular arrhythmia

Ventricular arrhythmia during the recovery phase carries more mortality risk than that during peak exercise. It also reflects the vagal tone as increased vagal activity during recovery is required to suppress the arrhythmia. Exercise duration, exercise hypotension, exercise hypertension, chronotropic incompetence, heart rate recovery are among the most important hemodynamic variables predicting future cardiac events even in the absence of ischemia<sup>3</sup>.

Contraindications to testing include active angina or ischemia, heart failure, critical valvular heart diseases, severe hypertension, acute myocarditis or pericarditis. Elderly patients and patients with musculoskeletal problems cannot perform the test. The test carries the sensitivity and specificity of 57% and 72%. Baseline ECG changes of LVH, digoxin effect, bundle branch blocks, preexcitations greatly affect the interpretation of the test.

Pharmacological echocardiographic and radionuclide stress testing are now widely available with better sensitivity and specificity<sup>4</sup>. These tests are definitely useful in patients who cannot exercise on

a treadmill and in those with precluding ECG changes as described, but are expensive and does not provide sufficient hemodynamic information compared to treadmill test. Despite the technical fallacies, treadmill test still holds its place in the current era as a diagnostic and prognostic tool.

## References

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### Swig a Little Wine, Keep Your Mind in Line

Drinking moderate amounts of alcohol (particularly red wine) is no longer frowned upon by the medical community. Several previous studies have shown that wine, when consumed in moderation, can reduce the risk of cardiovascular disease, prevent the damaging effects of sunburn and even, prevent cancer (due to the presence of resveratrol). Now in a new study published in *BMC Medicine* (Gea et al. *BMC Medicine* 2013, 11:192; <http://www.biomedcentral.com/1741-7015/11/192>), researchers from Spain, suggest that consumption of moderate amounts (2 to 7 small glasses per week) of wine significantly reduces the risk of depression. The study was carried out on 5005 individuals of both sexes between the ages of 35 and 80. The key word here is "moderation". All the benefits accrue only to those who practice moderation. Exceeding the limit of 7 small glasses per week may actually worsen the depression. Never overdo a good thing!

- Dr. K. Ramesh Rao