Adding Exercise Testing to Framingham Score for Cardiovascular Risk Assessment


Study Overview

Objective. To evaluate if cardiovascular disease (CVD) risk prediction in asymptomatic men and women is improved using measures of heart rate recovery (HRR) and exercise capacity obtained during exercise testing.

Design. Prospective cohort study.

Setting and participants. Participants were recruited from 10 geographic regions in North America to undergo exercise stress testing. 40% had fasting lipid abnormalities. Patients were excluded if they had exercise duration < 1 minute, known CVD or symptoms suggestive of CVD, diabetes mellitus, or a Framingham Risk Score (FRS) (10-year risk of fatal heart disease or nonfatal myocardial infarction) of at least 20%; were age < 30 or > 70 years; failed to undergo a submaximal Bruce protocol exercise test; or were lost to follow-up. Patients were classified according to their FRS, HRR above or below the median, and exercise capacity above or below the median. The final cohort included 2797 women and 3329 men (mean age at enrollment, 44.6 years), and follow-up was approximately 20 years.

Main outcome measures. CVD death (determined from death certificates, next of kin, medical records, the National Death Index, and the Epidemiology Research Index) was the primary outcome. Secondary outcomes included noncardiovascular death, coronary heart disease death, and all-cause death. Cox proportional hazards models that included FRS as well as HRR and exercise capacity groups for these outcomes were analyzed.

Main results. FRS was a strong predictor of CVD death. After adjustment for FRS, at 10 years men and women with both HRR and exercise capacity below the median had higher risks of CVD death compared with patients with both measures above the median (hazard ratio [HR], 2.70 [95% confidence interval {CI}, 1.11–6.55] for men and 3.83 [95% CI, 2.03–7.41] for women). Women with either HRR or exercise capacity below the median had a significantly higher rate of CVD death at 20 years (HR, 3.08 [95% CI, 1.28–7.41]). Having both HRR and exercise capacity below the median was a strong predictor of 20-year CVD death (HR, 8.51 [95% CI, 3.65–19.8] for women and 3.53 [95% CI, 2.03–6.15] for men). Among men with FRS 10% to 19% and women with FRS 6% to 9%, low HRR and exercise capacity identified a high-risk group of patients. HRR and exercise capacity showed similar relationships to non-CVD and coronary heart disease death. Ischemic ST-segment depression was independently predictive of CVD death for men but not for women.

Conclusion. Measurement of HRR and exercise capacity may add supplemental prognostic information to the FRS for estimating cardiovascular risk in asymptomatic patients.

Commentary

Many adults are classified as being at intermediate risk for developing coronary heart disease when risk is estimated using traditional cardiac risk factors. Aggressively treating risk factors for the entire intermediate-risk group is a daunting task. Furthermore, some treatments to lower CVD risk (eg, aspirin) carry their own risk of important adverse effects. Thus, finding methods to better estimate risk is desirable.

Mora et al’s findings support prior studies that show that reduced exercise capacity or HRR predicts all-cause death [1–3]. While it seems that variables measured during exercise testing can help distinguish high- from low-risk persons with intermediate FRS, major relevant clinical questions remain unanswered. If additional testing is to be done for intermediate-risk asymptomatic patients, which tests should be chosen? In addition to exercise testing, additional risk stratification can be provided by measuring C-reactive protein, carotid intima-media thickness, coronary artery calcium, and the ankle. 
brachial index [4]. Second, obtaining better risk assessment by exercise testing or any other means is only useful if it leads to improved outcomes; evidence that this form of testing produces better outcomes is lacking. Furthermore, because exercise testing also includes measures of potential cardiac ischemia, increased testing could lead to an increase in coronary angiography and revascularization procedures among fairly low-risk asymptomatic patients, despite lack of evidence that invasive cardiac interventions benefit persons in this group. Mora et al found that ischemic changes on electrocardiography did not add significant prognostic information for predicting CVD death in women, and they did not discuss how many patients with abnormal ST segment changes went on to have invasive testing. A clinical trial comparing different management approaches is needed to help clinicians choose how to appropriately apply these tests to asymptomatic individuals.

There are several other limitations of this study. A large portion of the study population had dyslipidemia, and these findings may not apply as well to patients with high FRS from other risk factors. Lastly, Mora et al measured CVD mortality and did not address risk assessment for nonfatal but potentially disabling and costly CVD events.

Applications for Clinical Practice

Reduced HRR and exercise capacity predict CVD death beyond what can be determined by the FRS. However, major questions remain about whether adding exercise testing or other noninvasive measures of cardiac risk truly leads to more selective and effective use of primary prevention strategies and better outcomes in patients with intermediate CVD risk.

–Review by Stephen D. Persell, MD, MPH

References


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