

2 fitness-related variables—exercise capacity and heart rate recovery—predicted mortality in asymptomatic women

Mora S, Redberg RF, Cui Y, et al. Ability of exercise testing to predict cardiovascular and all-cause death in asymptomatic women: a 20-year follow-up of the Lipid Research Clinics Prevalence Study. *JAMA*. 2003;290:1600-7.

QUESTION

Do exercise-test variables related to ischemia, fitness, and autonomic function predict risk for cardiovascular and all-cause mortality in asymptomatic women?

DESIGN

Population-based cohort study (Lipid Research Clinics Prevalence Study) with a mean follow-up of 20.3 years.

SETTING

10 centers in North America.

PARTICIPANTS

2994 asymptomatic women who were 30 to 80 years of age, had no known cardiovascular disease, and were eligible for exercise testing (mean age 47 y, 95% white; based on 2985 women).

ASSESSMENT OF RISK FACTORS

Exercise test variables (based on a Bruce treadmill protocol, which was terminated when a target heart rate \geq 90% of maximal predicted heart rate for age and physical activity level was attained) were peak exercise capacity, heart rate recovery (HRR), nonattainment of target heart rate, exercise-induced ventricular arrhythmia, and ST-segment depression. Clinical variables included hypertension, diabetes, obesity, elevated total

cholesterol, smoking status, family history of premature coronary heart disease (CHD), postmenopausal status, medication use, and physical activity level.

MAIN OUTCOME MEASURES

Cardiovascular and all-cause mortality.

MAIN RESULTS

Of 427 women (14%) who died during the study period, 147 (34%) died from cardiovascular causes. After adjustment for age and cardiovascular risk factors, the following factors were associated with an increased risk for cardiovascular mortality: exercise capacity, HRR, nonattainment of target heart rate, and ventricular arrhythmia; ST-segment depression was not associated with increased

risk (Table). Similar results were found for all-cause mortality, except ventricular arrhythmia was not associated with an increased risk.

CONCLUSION

2 fitness-related variables (exercise capacity and heart-rate recovery) independently predicted risk for cardiovascular and all-cause mortality in asymptomatic women undergoing stress testing, but electrocardiographic ischemic changes did not.

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Risk for all-cause and cardiovascular mortality according to exercise-test variables in asymptomatic women*

| Exercise test variables | Hazard ratio (95% CI) | |
|--------------------------------------|--------------------------|----------------------|
| | Cardiovascular mortality | All-cause mortality |
| Exercise capacity (\leq median) | 1.90 (1.18 to 3.04) | 1.60 (1.24 to 2.05) |
| Heart rate recovery (\leq median) | 2.16 (1.38 to 3.36) | 1.50 (1.20 to 1.87) |
| Target heart rate not attained | 1.45 (1.00 to 2.11) | 1.24 (1.01 to 1.53) |
| Ventricular arrhythmia | 1.69 (1.11 to 2.58) | 1.19 (0.90 to 1.58)† |
| ST-segment depression \geq 1.0 mm | 0.88 (0.48 to 1.61)† | 0.69 (0.45 to 1.04)† |

*CI defined in Glossary. Based on multivariate Cox proportional-hazards models that included 1 exercise test variable at a time, adjusted for age, current smoking, diabetes, family history of premature coronary heart disease, obesity, high low-density lipoprotein cholesterol, low high-density lipoprotein cholesterol, high triglycerides, and hypertension.

†Not significant.

COMMENTARY

Cardiovascular mortality has declined steadily in most demographic groups in the United States over the past 20 years. However, some public health experts are concerned that these declines may be waning because of increasing levels of cardiovascular risk factors related to the increasing prevalence of obesity. In response to this concern, many experts are calling for efforts to increase levels of physical activity in the general population.

The results of the study by Mora and colleagues offer strong support to these calls. Measures of cardiovascular fitness, particularly exercise capacity and rate of normalization of heart rate after exercise, predicted cardiovascular and all-cause mortality even after controlling for diabetes, hypertension, hyperlipidemia, smoking, age, and obesity in a relatively large cohort of women followed for > 20 years. The magnitude of the risk associated with the exercise test variables was similar to the magnitude of risk associated with other well-known risk factors. It is reasonable to expect that improving these measures of fitness will decrease the risk for cardiovascular death, particularly in light of epidemiologic evidence that becoming more active is associated with a decrease in risk (1). Risk-reduction programs might consider adding

exercise prescription and follow-up based on formal testing to current guidelines for the management of hyperlipidemia, hypertension, and smoking.

Mora and colleagues' findings also serve as a caution to those who would use exercise testing in asymptomatic women to diagnose preclinical CHD rather than to quantify risk for CHD. The study suggests that ST-segment depression with exercise in asymptomatic women has little predictive value. This finding is entirely consistent with the well-known clinical observation that exercise electrocardiography has poor positive predictive value in middle-aged women. Finding and acting on ST-depression in asymptomatic women might therefore result in unnecessary follow-up testing and morbidity and mortality associated with interventions that have no effect on outcome.

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Reference

1. Blair SN, Kohl HW 3rd, Barlow CE, et al. Changes in physical fitness and all-cause mortality. A prospective study of healthy and unhealthy men. *JAMA*. 1995;273:1093-8.