Combining low-intensity and maximal exercise test results improves prognostic prediction in chronic heart failure

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OBJECTIVES: This study investigated the combination of maximal and low-intensity exercise testing in predicting prognosis in chronic heart failure (CHF), using one single exercise test (two-step protocol). BACKGROUND: Risk assessment based on any single factor has limited accuracy and reproducibility. METHODS: Treadmill exercise testing was performed in 202 consecutive CHF patients (174 male; mean age 52 +/- 11 years) using "breath-by-breath" gas exchange monitoring. Oxygen uptake (VO(2)) kinetics were defined as oxygen deficit (DeltaVO(2) x time [rest to steady state] - Sigma VO(2) [rest to steady state]) and mean response time (MRT = oxygen-deficit/DeltaVO(2)). Peak VO(2) (VO(2)max) was defined as the highest VO(2). Mean follow-up was 873 +/- 628 days. The primary end point was cardiac mortality and the need for urgent heart transplantation. RESULTS: Forty-four patients (22%) died and 15 (7%) were urgently transplanted. In both univariate and multivariate analyses, MRT >50 s was the most powerful predictor of the primary end point (hazard ratio [HR] 4.44), followed by predicted VO(2)max <50% (HR 3.50) and resting systolic blood pressure <105 mm Hg (HR 2.49, all p < 0.001). A majority (n = 130 [64%]) had one or none of these risk factors, with a one-year event rate of only 3%. Patients with two risk factors (n = 45 [22%]) were at medium risk (one-year event rate of 33%). Twenty-seven patients (13%) had all three risk factors, with a one-year event rate of 59%. The area under the curve, using the number of risk factors, was 0.86 +/- 0.04 for the primary end point at one year. These results were independent of medication, in particular, beta-blockade. CONCLUSIONS: A combination of low-intensity and maximal exercise test results improves assessment of prognosis in patients with CHF.