

Work-rate affects cardiopulmonary exercise test results in heart failure

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Received 17 December 2003; received in revised form 30 April 2004; accepted 10 June 2004
Available online 8 December 2004

Abstract

Aims: Cardiopulmonary exercise test (CPET) is used to evaluate patients with chronic heart failure (HF) usually by means of a personalized ramp exercise protocol. Our aim was to evaluate if exercise duration or ramp rate influences the results. **Methods and results:** Ninety HF patients were studied (peak $\dot{V}O_2 > 20$ ml/min/kg, n=28, 15–20 ml/min/kg, n=39 and <15 ml/min/kg, n=23). Each patient did four CPET studies. The initial study was used to separate the subjects into three groups, according to their exercise capacity. In the remaining studies, work-rate was increased at three different rates designed to have the subjects reach peak exercise in 5, 10 and 15 min from the start of the ramp increase in work-rate, respectively. The order was randomized. The work-rate applied for the total population averaged 22.7 ± 8.0 , 11.6 ± 3.7 , 7.5 ± 2.9 W/min with effective loaded exercise duration of 5 min and 16 ± 29 s, 9 min and 43 ± 49 s and 14 min and 32 ± 1 min and 12 s for the 5-, 10- and 15-min tests, respectively. Peak $\dot{V}O_2$ averaged $16.9 \pm 4.3^*$, 18.0 ± 4.4 and 18.0 ± 5.4 ml/min/kg for the 5-, 10- and 15-min tests, (*= $p < 0.001$ vs. 10 min). The shortest test had the lowest peak heart rate and ventilation and highest peak work-rate. Peak $\dot{V}O_2$ and heart rate were lowest in 5-min tests regardless of HF severity. The $\Delta\dot{V}O_2 / \Delta\text{work-rate}$ was lowest in 5-min tests and highest in 15-min tests. At all ramp rates, $\Delta\dot{V}O_2 / \Delta\text{work-rate}$ was lower for the subjects with the lower peak $\dot{V}O_2$. The $\dot{V}_E / \dot{V}CO_2$ slope and $\dot{V}O_2$ at anaerobic threshold were not affected by the protocol for any grade of HF.

Conclusions: In chronic HF, exercise protocol has a small effect on peak $\dot{V}O_2$ and $\Delta\dot{V}O_2 / \Delta\text{work}$ but does not affect $\dot{V}O_2$ at anaerobic threshold and $\dot{V}_E / \dot{V}CO_2$ slope.

Keywords: Exercise; Oxygen consumption; Heart failure

Europ J of Heart Failure 2005; 7: 498-504.

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