Prognostic value of the cardiorespiratory optimal point during submaximal exercise testing

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Background: Peak oxygen consumption (pVO2) is a key parameter in assessing the prognosis of heart failure with reduced ejection fraction (HFrEF) patients (pts). However, it is a less reliable parameter when the cardiopulmonary exercise test (CPET) is not maximal. It is crucial to identify the submaximal exercise variables with the best prognostic power (PP), in order to improve the management of pts that cannot attain a maximal CPET.

Purpose: The aim of this study was to evaluate and compare the PP of several exercise parameters in submaximal CPET for risk stratification in pts with HFrEF.

Methods: Prospective evaluation of adult pts with HFrEF submitted to CPET in a tertiary center. A submaximal CPET was defined by a respiratory exchange ratio (RER) $\leq$1.10. Pts were followed up for at least 1 year for the primary endpoint of cardiac death and urgent heart transplantation/ventricular assist device implantation. Several CPET parameters were analyzed as potential predictors of the combined endpoint and their PP (area under the curve - AUC) was compared to that of pVO2, using the Hanley and McNeil test.

Results: CPET was performed in 487 HF pts, of which 317 (66%) performed a submaximal CPET. Pts averaged 57±12 years of age, 77% were male, 45.7% had ischemic cardiomyopathy, with a mean LVEF of 30.4±7.6%, a mean heart failure survival score of 8.6±1.1. The mean pVO2 was 17.1±5.5 ml/kg/min and the mean RER 1.01±0.08. During a mean follow-up (FU) time of 11±1 months, 18 pts (6%) met the primary endpoint. Cardiorespiratory optimal point (OP - VE/VO2) had the highest AUC value (0.915, p=0.001), followed by the partial pressure of end-tidal CO2 at the anaerobic threshold - PETCO2L (0.814, p<0.001). pVO2 presented an AUC of 0.730 (p=0.001). OP$\geq$31 and PETCO2L $\leq$37mmHg had a sensitivity of 100 and 76.9% and a specificity of 71.1 and 67%, respectively, for the primary outcome. OP presented a significantly higher PP than pVO2 (p=0.048), whether PETCO2L didn't achieve any statistical significance (p=0.164). Pts with anOP$\geq$31 presented a significantly lower survival free of HT during FU (log rank p=0.002).

Conclusion: OP had the highest PP for HF events of all parameters analyzed for a submaximal CPET. This parameter can help stratify the HF pts physiologically unable to reach a peak level of exercise.