Stoke Volume Reserve Is an Independent Predictor of Survival and Need for Advanced Therapies in HFrEF Patients

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Background
Risk stratification using cardiopulmonary exercise (CPET) measures is imperfect in patients with heart failure with reduced ejection fraction (HFrEF). We investigated whether stroke volume reserve (SVTR), a novel CPET parameter, would better specify risk of left-ventricular assist device (LVAD) implantation, heart transplantation (HTx), or death within 1 year in HFrEF-patients.

Methods
• This study is a retrospective analysis of 104 HFrEF patients who underwent consecutive cardiopulmonary exercise testing for transplant evaluation between January 2017-December 2018.
• Patients with LVEF ≤ 35% by echocardiography and New York Heart Association class II to IV HFrEF were included. Patients with congenital heart disease, planned coronary revascularization, or previous transplantation were excluded. Patients age < 18 years and those who failed to reach anaerobic threshold were also excluded.
• The primary composite outcome included death, HTx or LVAD implantation at 1 year.
• Univariate and multivariate logistic regression were used to correlate predictive ability of CPET parameters in predicting clinical outcomes and mortality.
• SVTR was calculated by multiplying the oxygen pulse by a previously validated constant that reflects the arteriovenous oxygen difference at anaerobic threshold.

Demographics
• Average Age: 59.2 ± 10.8, 88% Males
• Majority NYHA III, over 85% compliant with beta blockers, ACE or sacubitril-valsalban
• Average LVEF 22.6 ± 6.5, 7.6, 50% with an ischemic etiology
• Over 50% of patients received cardiac resynchronization therapy
• Resting Hemodynamic Data obtained on 82 out of the 104 patients

Results
• 39 outcomes (39.4%) were observed (16 HTx, 8 LVAD, and 15 deaths).
• As continuous variables, higher NYHA functional class, lower SVTR, higher VE VCO2 slope, lower VO2 AT, as well as baseline hemoglobin levels were found to be significantly associated with events.
• Multivariate logistic regression analysis revealed that VO2 P, VE VCO2, and SVTR were independently associated with risk for early clinical outcomes—the OR was notably highest in those with a diminished SVTR.
• The relative coefficients of each covariate in the multivariate logistic regression was used to guide a risk stratification model in which VO2 AT<11 and VO2 P<13 was weighted with 2 points.
• A cut-off at ± 3 demonstrated a 76.9% sensitivity and 83.3% specificity for 1-year events. Furthermore, a score ≥3 was more predictive of early clinical outcomes in this patient population (OR=16.7, p<0.001) when compared with the HFSS (OR=3.5, p=0.049).

Conclusion
• SVTR is a novel CPET parameter that predicts mortality and need for advanced therapies.
• Use of SVTR in a risk stratification model showed improved predicted accuracy over SHFM, HFSS, and a recently validated risk stratification tool that focused on liver dysfunction and rest hemodynamics to guide risk assessment.
• SVTR is a useful tool in assessing prognosis in HFrEF patients.
• SVTR provides valuable information on cardiac function. Further studies are needed to investigate the utility of this parameter in additional patient populations.

Disclosure
The authors have no financial conflicts to disclose.

References