

Multi-beat right ventricular pulmonary arterial coupling predicts clinical worsening in PAH

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Rationale: Right ventricular (RV) dysfunction drives morbidity and mortality in pulmonary arterial hypertension (PAH). RV dysfunction in PAH is ideally measured by the ratio of RV to pulmonary arterial (RV-PA) coupling, though its ability to predict clinically significant outcomes is unknown.

Objective: To assess the predictive power of multi-beat (MB) RV-PA coupling, as determined by the ratio of MB-derived end-systolic elastance (Ees) to effective arterial elastance (Ea). Single-beat (SB)-derived Ees/Ea and other metrics were also assessed.

Methods: Twenty-six subjects with PAH underwent same-day cardiac magnetic resonance imaging, right heart catheterization, and RV pressure-volume assessment (Millar, Houston, TX) with both MB and SB determination of Ees/Ea. Patients were treated with standard of care therapies and followed prospectively until they met criteria of clinical worsening (CW), as defined by >10% decline in 6-minute walk distance (6MWD), worsening New York Heart Association (NYHA) class, escalation of PAH therapy, RV failure hospitalization, or transplant/death.

Measurements and Main Results: Subjects were 57 ± 14 years of age; predominantly women (84%) with connective tissue disease (CTD) (69%); and largely NYHA class III (50%) at enrollment. Median follow-up was 38 months (range 9.6-60). Sixteen (62%) patients met the definition of CW, with some meeting multiple criteria: declining 6MWD (n=6), NYHA class (n=4), therapy escalation (n=8), RV failure hospitalization (n=6). MB Ees/Ea was significantly lower in CW patients (0.7 ± 0.5 vs. 1.3 ± 0.8 , $p=0.02$). In Cox proportional hazard modeling, decreasing MB Ees/Ea was associated with increased risk of CW (HR 3.8, $p=0.04$). The optimal Ees/Ea cut-point predictive of CW was 0.65, defined by ROC (AUC 0.78, $p=0.01$). MB Ees/Ea below this cut-point was significantly associated with adverse events (HR 5.1, $p=0.001$) (Figure 1). RV ejection fraction and stroke volume/end-systolic volume also predicted CW, whereas SB Ees/Ea did not (Figure 2).

Conclusions: RV-PA coupling as measured by MB Ees/Ea has prognostic significance in PAH.

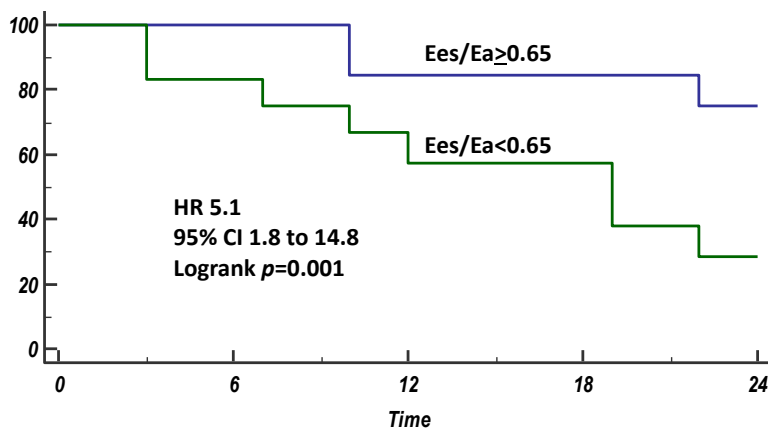


Figure 1. Kaplan Meier curve for MB Ees/Ea and CW

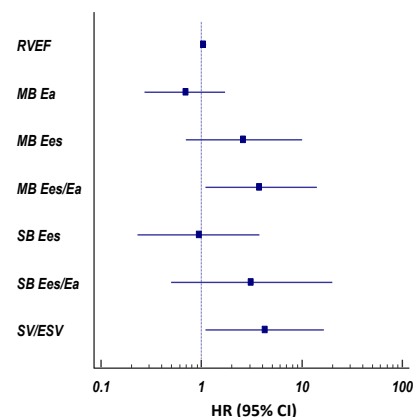


Figure 2. Forest plot