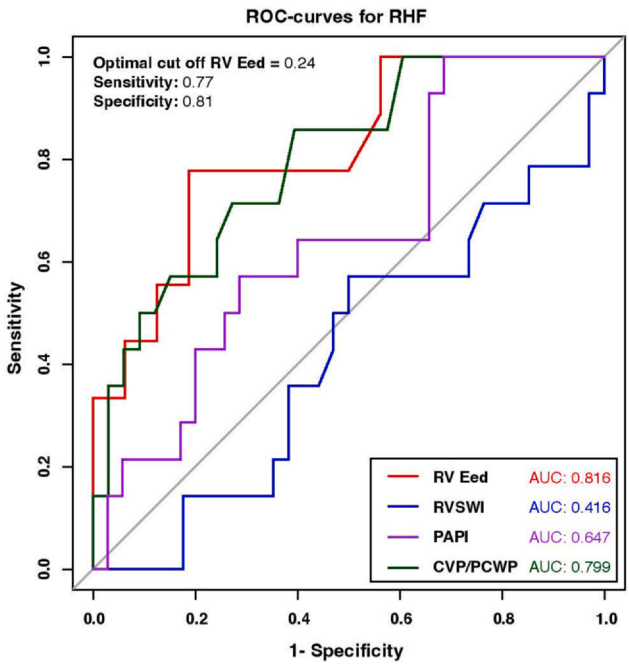


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### Incremental Value of Hemodynamics during Vasodilator Challenge to Predict Right Heart Failure After Left Ventricular Assist Device Implantation

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**Purpose:** Vasodilator challenge during right heart catheterization (RHC), by optimizing right ventricular (RV) loading conditions, could allow to better assess RV functional reserve. Whether hemodynamics during vasodilator challenge may improve risk stratification for right ventricular failure (RVF) following left ventricular assist device (LVAD) implantation is unclear.

**Methods:** We performed an observational retrospective study including all consecutive patients undergoing RHC with vasodilator challenge for the clinical work-up of LVAD implantation at 5 european advanced heart failure centers between January 2016 and January 2024. Vasodilator challenge was administered by intravenous nitroprusside (NTP) infusion. All hemodynamic measurements were performed at baseline and after NTP. We studied the association of baseline and post-NTP hemodynamics with early severe RVF, as defined by the need for right ventricular assist device within 30 days from LVAD implant.

**Results:** Of 155 patients analyzed (median age 57 years, INTERMACS ≤3 72.4%), 22 (14.2%) developed early severe RVF and had higher in-hospital mortality (36.4% vs. 10.9%, p=0.005). Patients experiencing early severe RVF had lower baseline pulmonary artery pulsatility index (PAPi, 2.1, IQR 1.3-5.3 vs. 3.4, IQR 2.4-4.9, p=0.022), baseline right ventricular stroke work index (RVSWi, 7.3 cJ/m$^2$, IQR 5.9-11.8 vs. 10.2 cJ/m$^2$, IQR 7.2-12.8, p=0.050) and post-NTP PAPi (2.7, IQR 1.7-4.4 vs. 4.4, IQR 2.7-8.0). Best cut-points according to the Youden's index were the following: baseline PAPi 2.0, post-NTP PAPi 3.0, RVSWi 8.0 cJ/m$^2$. At multivariate analysis, adjusting for the EUROMACS-RHF risk score, baseline PAPi ≤2 (adj-OR 3.3, 95%CI 1.1-10.1, p=0.038) and post-NTP PAPi ≤3 (adj-OR 3.2, 95%CI 1.2-9.0, p=0.026) emerged as independent predictors of early severe RVF. A graded increase in early severe RVF risk was observed according to the combination of baseline and post-NTP PAPi: both normal 7.7%, reduced/normal 8.3%, normal/reduced 11.4%, reduced/reduced 52.9% (p < 0.001).

**Conclusion:** In a multicenter cohort of patients undergoing LVAD implantation, baseline and post-NTP PAPi were independent predictors of early severe RVF. Vasodilator challenge could provide incremental predictive value over baseline hemodynamics by unveiling RV functional reserve.

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### Right Ventricular-Pulmonary Arterial Coupling Predicts Late Right Heart Failure in LVAD Recipients

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**Purpose:** Standard hemodynamic indices of right ventricular (RV) function exhibit poor sensitivity in detecting late right heart failure (LRHF) post LVAD. RV-pulmonary arterial (RV-PA) coupling measured by invasive pressure-volume loop (PVL) more sensitively captures RV dysfunction and may better capture LRHF. We evaluated the association between RV-PA coupling and LRHF among LVAD recipients.

**Methods:** Patients who underwent right heart catheterization (RHC) ≥1-month post-LVAD implantation underwent prospective RV PVL assessment and outcome adjudication. RV-PA coupling, or Ees/Ea, was measured as the ratio between RV end-systolic elastance (Ees, contractility) and pulmonary arterial elastance (Ea, afterload). LRHF was defined by the 2020 Mechanical Circulatory Support Academic Research Consortium guidelines. Receiver operating curve analyses compared the ability of Ees/Ea to predict LRHF versus pulmonary artery pulsatility index (PAPi), right atrial-to-wedge pressure ratio (RA/PCWP), and RV stroke work index (RVSWI). Fisher's exact test assessed the association between low (< 0.35) and high (> 0.35) Ees/Ea with outcomes (LRHF, inotrope initiation). Kaplan-Meier analysis compared time from RHC to LRHF between low and high Ees/Ea groups.

**Results:** Thirteen LVAD recipients underwent PVL assessment between July 2021 and July 2022 (85% men, mean age 54 years, mean Ees/Ea 0.37). Patients with low Ees/Ea (n=7) were significantly more likely to develop LRHF by year-3 follow-up versus the high Ees/Ea group (p=0.01, Figure 1). Ees/Ea best predicted LRHF (Area under curve (AUC)=0.80; p=0.079) compared with PAPi (AUC=0.5; p=0.99), RA/PCWP (AUC 0.77; p=0.10), and RVSWI (AUC 0.58; p=0.66). Low Ees/Ea was associated with inotrope initiation (p=0.03) and trended with LRHF (p=0.09).

**Conclusion:** RV Ees/Ea predicts time to LRHF among LVAD recipients and may predict LRHF better than standard RHC indices. RV-PA uncoupling may be a reliable metric of RV dysfunction in LVAD patients.