

Painting Profiles of Ambulatory Advanced Heart Failure: A Report from the REVIVAL Registry

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Purpose: Ambulatory patients with advanced heart failure (HF) are increasingly being considered for mechanical circulatory support. INTERMACS patient profiles are a commonly used short-hand for HF disease severity and describe clinical trajectory, but have not been validated for use in ambulatory patients on oral medical therapy.

Methods: REVIVAL, a prospective, observational study, enrolled 400 outpatients from 21 VAD/transplant centers in 2015-16. Subjects had NYHA Class II-IV systolic HF despite optimal medical and electrical therapies, as well as a recent HF hospitalization, transplant listing, functional limitation, or evidence of high neurohormonal activation. Exclusion criteria included inotropes, dialysis or creatinine $\geq 3\text{mg/dL}$, or a non-cardiac disease limiting function or survival. Baseline characteristics, medications, and laboratories were evaluated according to INTERMACS profile assigned at enrollment by the treating physician. Continuous data were compared by one way ANOVA or Wilcoxon rank sum, categorical data using Chi-square test.

Results: Across INTERMACS patient profiles 4-7, there was no difference in age, gender, race, ejection fraction, blood pressure, jugular venous pressure, use of guideline-directed medical therapy, or most laboratories. However, lower INTERMACS profile was associated with progressively shorter 6-minute walk distance, higher uric acid level, and higher anticipated mortality by the Seattle HF Model Score. (TABLE)

Conclusion: Among ambulatory patients with advanced HF, lower INTERMACS profile was associated with increased disease severity as reflected by greater functional limitation and higher anticipated mortality. INTERMACS profiling is a convenient short-hand that encapsulates relevant prognostic information across multiple clinical domains. These profiles may assist in identifying ambulatory patients for consideration of advanced or investigational therapies.

Characteristics by INTERMACS Profile (*P < 0.05. Data displayed as median (IQR) or %.)

	4 (N = 33)	5 (N = 83)	6 (N = 155)	7 (N = 129)
Age, yrs	61 (12)	60 (14)	62 (14)	61 (12)
Female	21%	23%	27%	24%
LVEF, %	19 (5)	20 (9)	20 (9)	20 (8)
NYHA Class*				
I	0%	0%	3%	2%
II	3%	10%	27%	48%
III	73%	74%	59%	49%
IV	6%	6%	2%	0%
Six minute walk, m*	303 (134)	327 (109)	342 (111)	371 (130)
ACEI or ARB	70%	68%	73%	64%
Sacubitril/valsartan	52%	46%	45%	44%
Beta-blocker	91%	98%	95%	95%
Aldosterone antagonist	79%	70%	72%	76%
Hydralazine and nitrates	18%	13%	14%	18%
BiV pacing	55%	52%	42%	54%
Creatinine, mg/dL	1.27 (0.66)	1.30 (0.57)	1.33 (0.52)	1.30 (0.56)
Sodium, mmol/L	138 (5)	138 (4)	139 (5)	138 (4)
Uric acid, mg/dL*	9.0 (3.0)	7.8 (2.9)	8.2 (3.2)	7.6 (2.5)
Seattle HF Model Score*	1.28 \pm 0.97	0.84 \pm 0.84	0.59 \pm 0.98	0.23 \pm 0.96

Noninvasive Assessment of Lung Fluid Percentage in Heart Transplant Recipients Using Remote Dielectric Sensing

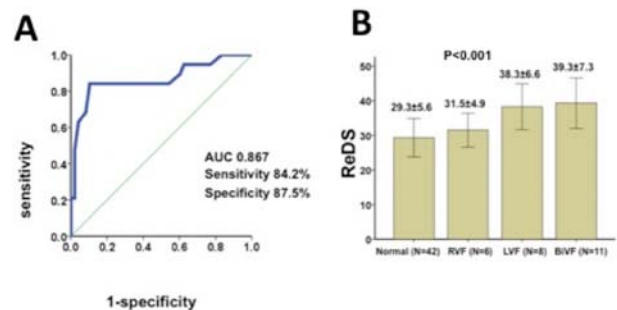
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Purpose: Remote dielectric sensing (ReDS) is a method for measuring lung fluid content, expressed as a percent of lung volume, that is being studied as a means of monitoring fluid status in heart failure patients. The ReDS monitor is a vest that obtains a reading of lung water percentage over 90 seconds. Heart transplant recipients undergo repeated invasive assessment of hemodynamics and fluid status to assess their graft function. This study aims to learn the correlation between ReDS values and intracardiac pressures in heart transplant recipients.

Methods: Heart transplant patients undergoing clinically indicated right heart catheterization were prospectively enrolled and assessed with concomitant ReDS readings. Correlations between ReDS readings, central venous pressure (CVP) and pulmonary capillary wedge pressures (PCWP) were assessed with Pearson coefficients. Sensitivity and specificity of determining elevated PCWP was assessed by ROC analysis.

Results: 40 patients were enrolled and had a total of 55 concomitant measurements. Average age was 53 \pm 14, 90% were male. Median time from heart transplantation was 355 days (IQR 123-689). A strong correlation was found between ReDS values and PCWP ($r=0.62$), CVP ($r=0.54$) and CVP+PCWP ($r=0.81$). ROC curve analysis revealed that a ReDS value $>34\%$ (the previously established upper limit of normal) predicted a PCWP ≥ 18 mmHg with an AUC of 0.87, sensitivity of 84% and specificity of 88% (Figure 1A). There were progressive increases in ReDS (Figure 1B) when only CVP was elevated (RVF), only PCWP was elevated (LVF) or both were elevated (BiVF) ($p<0.001$ for trend).

Conclusion: Lung fluid percentage measured by ReDS has a strong correlation with CVP and PCWP in heart transplant recipients. In conjunction with the clinical assessment, a noninvasive ReDS measurement post transplant can guide diuretic therapy and the need for invasive assessment, including biopsy.



Inert Gas Rebreathing - A Helpful Tool in LVAD Patient Management

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Purpose: In the special group of left-ventricular assist device (LVAD) patients, exercise capacity is a decisive factor regarding quality of life. When evaluating exercise capacity, precise information about the total cardiac output generated (LVAD flow plus residual function of left ventricle), both at rest and during exercise, is crucial. The inert gas rebreathing method facilitates non-invasive, direct and valid measurement of total cardiac output, as well as associated parameters. Despite its simplicity and low-risk reproducibility, this conclusive method is rarely used within the framework of LVAD patient management at the present time.

Methods: On the basis of previous spiroergometry results stepwise protocol (3 steps/each 4 minutes) according to the peak work load was fixed for inertgas rebreathing. In 18 LVAD patients (12 male, mean age 52.7 years, HeartWare n=8, HeartMate II n=3, HeartMate III n=1) CO was measured using inertgas rebreathing (Innocor[®]) at rest and during exercise at the end