



Intrinsic Myocardial Function and Relationship with Left Ventricular Unloading in Patients Supported on CF-LVAD Therapy

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Relevant Financial Relationship Disclosure Statement

Intrinsic Myocardial Function and Relationship with Left Ventricular Unloading in Patients Supported on CF-LVAD Therapy

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I will not discuss off label use and/or investigational use

The following relevant financial relationships exist related to this presentation:

Authors ANR, AS, JMS, and ALC: No relationships to disclose

Author AB: No relevant disclosures. Co-founder of Rion, LLC and RioCOR, Inc.

Background

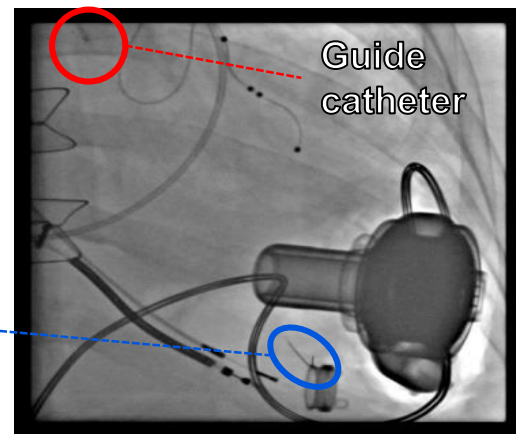
- Improved outcomes of LVAD therapy relative to medical therapy continues to be demonstrated¹
- Speed optimization facilitates modulating “dose” of LVAD support applied
 - However, optimal dose with respect to native heart-LVAD interaction still incompletely understood despite prior invasive data.²
- Expanding interest in recovery facilitated by improved recognition of explant candidates.³⁻⁵
 - Few patients will be explanted
 - Intrinsic myocardial recovery may be beneficial on LVAD therapy

Study Aim

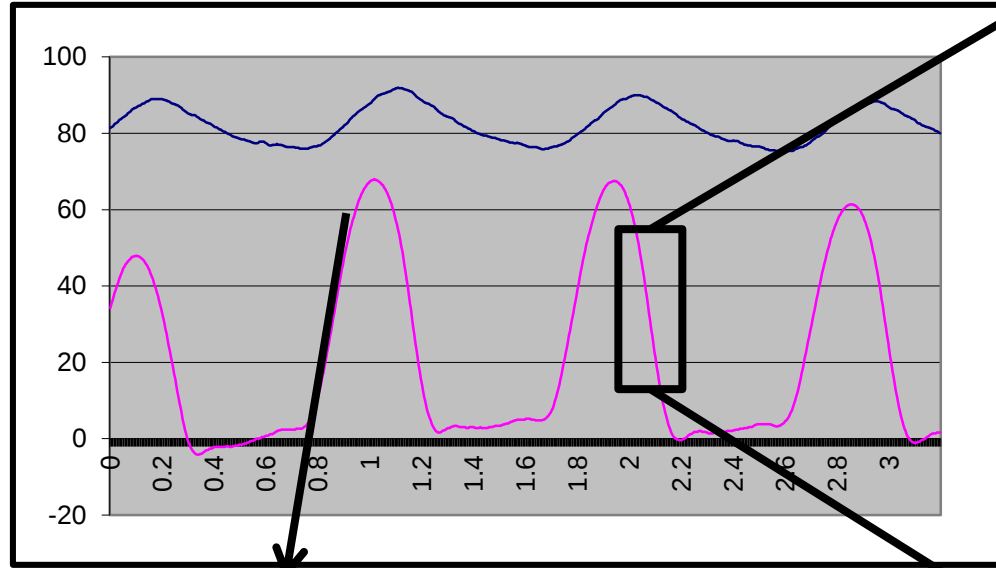
1. Evaluate how “recovery” correlates with intrinsic myocardial function hemodynamically
2. Evaluate how improved intrinsic myocardial function is associated with ability to optimize hemodynamics

Methods

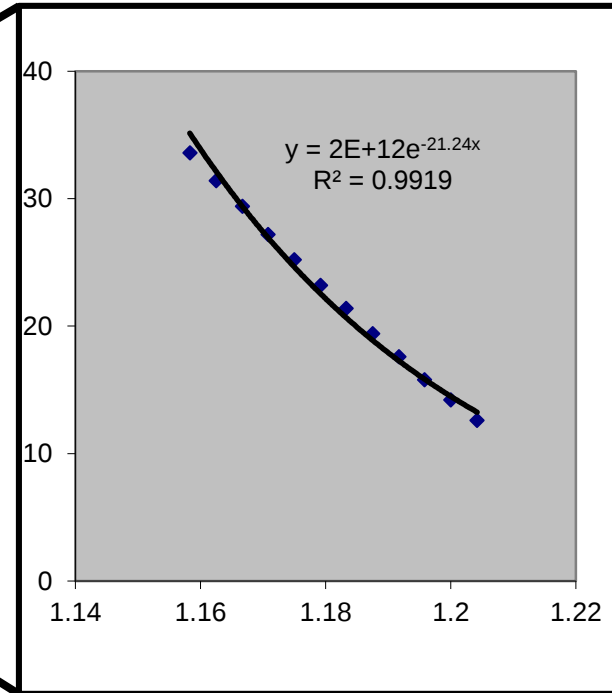
- Inclusion: RHC/LHC for speed optimization
- Exclusion: RV failure requiring inotropes; > mild AI on TTE, $\geq$ mod MR on TTE; and inability to optimize (final CI < 1.8 or LVEDP > 20 mmHg)
- n = 25; stratified by LV recovery (LVEF >24% or $\leq$ 24%)
- Utilized an invasive LHC ramp protocol
 - Feasible, safe¹
 - Left ventricular cannulation
 - Native heart-LVAD interaction
 - High-fidelity micromanometer wire in LV



Methods: tau (τ) and LV dP/dt



Peak positive dP/dt



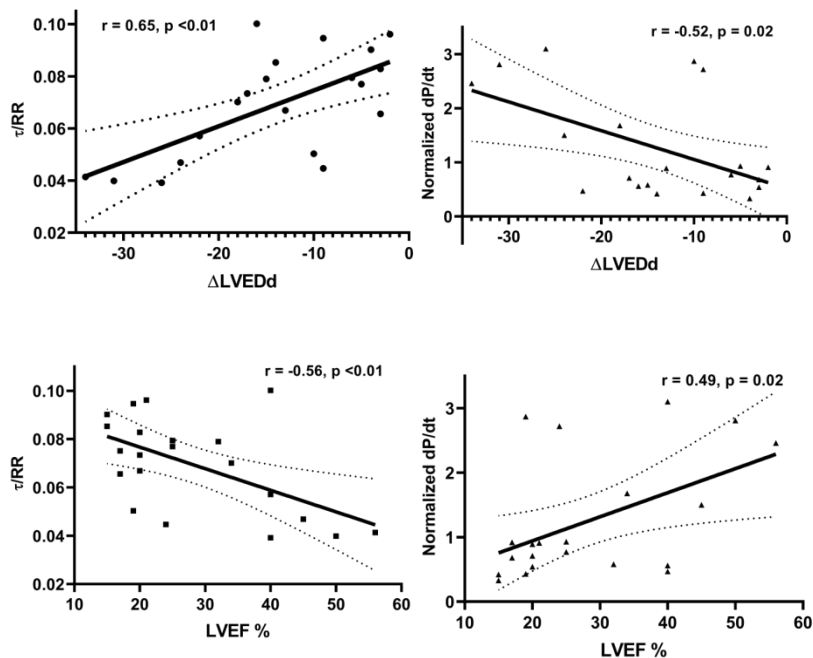
- dP/dt normalized to LVEDP and HR; Normalized to R-R interval (τ/RR)

Results

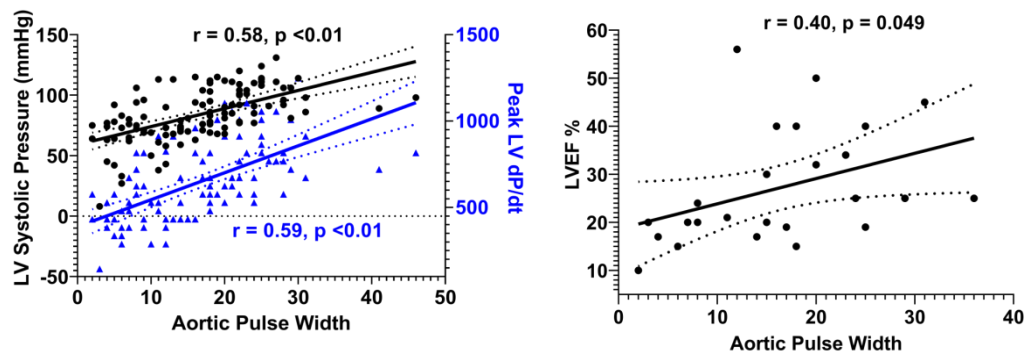
Baseline Value	Whole Cohort	LVEF% >24	LVEF% ≤ 24	p-value
<u>Demographics</u>	N = 25	N = 12	N = 13	
Age	55 ± 12	56 ± 10	54 ± 13	0.67
Gender (female)	9 (36%)	4 (33%)	5 (38%)	0.79
Ischemic etiology	9 (36%)	6 (50%)	3 (23%)	0.16
INTERMACS	2.6 ± 0.9	2.6 ± 0.8	2.6 ± 1.0	0.93
BMI	30 ± 7	29 ± 6	30 ± 9	0.63
Implant Indication (RTT)	14 (56%)	4 (33%)	10 (77%)	0.03
LVAD distribution	HM2 11(44%); HM3 2(8%); HW 12 (48%)	HM2 8 (67%); HM3 1 (8%); HW 3 (25%)	HM2 3 (23%); HM3 1 (8%); HW 9 (69%)	0.07
Pre-LHC Flow	4.6 ± 1.1	4.5 ± 0.9	4.7 ± 1.2	0.60
Pre LHC Power	4.6 ± 1.1	4.8 ± 0.7	4.5 ± 1.4	0.56
Days Since Implant		400 ± 284	617 ± 581	0.24
<u>Medications</u>				
Beta-blocker	23 (92%)	11 (92%)	12(92%)	0.95
ACEi/ARB/ARNI	10 (40%)	8 (67%)	2 (15%)	0.02
MRA	8 (32%)	4 (33%)	4 (31%)	0.89
Vasodilator	3 (12%)	1 (8%)	2 (15%)	0.59
Digoxin	3 (12%)	1 (8%)	2 (15%)	0.59
Dihydropyridine CCB	9 (36%)	6 (50%)	3 (23%)	0.23
<u>Exercise Capacity</u>				
6MWT	351 ± 111	305 ± 108	398 ± 98	0.06
Peak VO ₂	13.1 ± 2.7	13.7 ± 3.2	12 ± 1.9	0.40
<u>Pre-LHC Echocardiographic Data</u>				
LVIDd (mm)	58 ± 11	49 ± 9	65 ± 6	0.0001
Delta LVIDd from pre-implant	-13 ± 10	-18 ± 10	-9 ± 7	0.02
LVEF%	27 ± 12	37 ± 10	18 ± 3	<0.0001
Aortic Valve opening	12 (52%)	6 (50%)	7 (54%)	0.85
AI grade – mild	9 (36%)	2 (17%)	7 (54%)	0.05
MR grade – mild or mild-mod	7 (28%)	3 (25%)	4 (31%)	0.62
RV dysfunction – mod-severe to severe	10 (40%)	3 (25%)	7 (54%)	0.09

Results

Intrinsic LV markers and Recovery on VAD



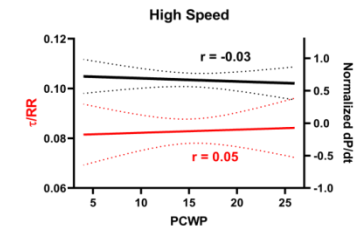
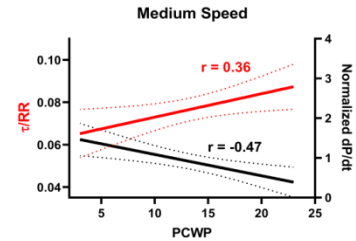
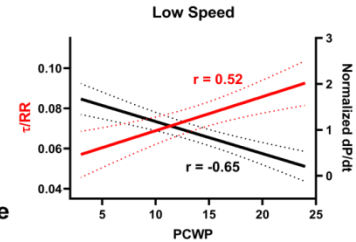
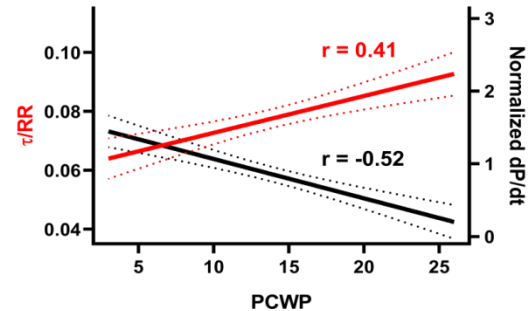
Detecting LV recovery



Results

Baseline Hemodynamics	Whole Cohort	LVEF% >24	LVEF% ≤ 24	p-value
	N = 25	N = 12	N = 13	
RA (mmHg)	10 ± 5	8 ± 3	11 ± 5	0.09
mPA (mmHg)	22 ± 8	21 ± 7	23 ± 8	0.47
PCWP (mmHg)	12 ± 5	11 ± 6	14 ± 5	0.18
MAP (mmHg)	84 ± 12	86 ± 11	82 ± 13	0.44
Aortic Pulse Width (mmHg)	16 ± 9	22 ± 7	11 ± 7	0.0003
PVR (WU)	1.9 ± 1.0	2.1 ± 1.0	1.8 ± 1.0	0.48
RVSWI (mmHg*mL/m ²)	447 ± 170	474 ± 174	414 ± 167	0.42
CI (L/min/m ²)	2.6 ± 0.6	2.4 ± 0.5	2.7 ± 0.6	0.19
LV Hemodynamics				
SVRI (dyn*s/cm ⁵ *m ²)	2400 ± 500	2400 ± 400	2300 ± 500	0.49
LVEDP (mmHg)	11 ± 6	10 ± 5	12 ± 6	0.55
LVSP (mmHg)	84 ± 18	88 ± 18	81 ± 19	0.44
LVSWI (mmHg*mL/m ²)	2800 ± 700	2700 ± 600	2900 ± 800	0.47
tau (ms)	58 ± 13	53 ± 10	63 ± 14	0.06
Peak LV dP/dt (mmHg/s)	690 ± 220	802 ± 234	590 ± 155	0.03
Peak LV dP/dt normalized	1.25 ± 0.95	1.48 ± 0.99	1.04 ± 0.89	0.29

Markers of Intrinsic LV Function vs. Filling Pressure



Conclusions

- Traditional markers of LV recovery (LVEF, LVIDd) mirror improvement in contractility and relaxation
- Aortic pulse width associated with improved LV systolic function— both invasive and non-invasive measurements
- Reliance on LVAD for LA unloading is greater at higher speeds with less LV contribution