Worsening Creatinine Trend in the Year Prior to LVAD Implantation Is Associated with Lower Pectoralis Muscle Measures and Increased Post LVAD Mortality

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BACKGROUND

- The association between renal function at the time of left ventricular assist device (LVAD) implantation and post LVAD mortality has been previously established
- Cardiorenal syndrome secondary to poor organ perfusion pressure is associated with poor outcomes

PURPOSE

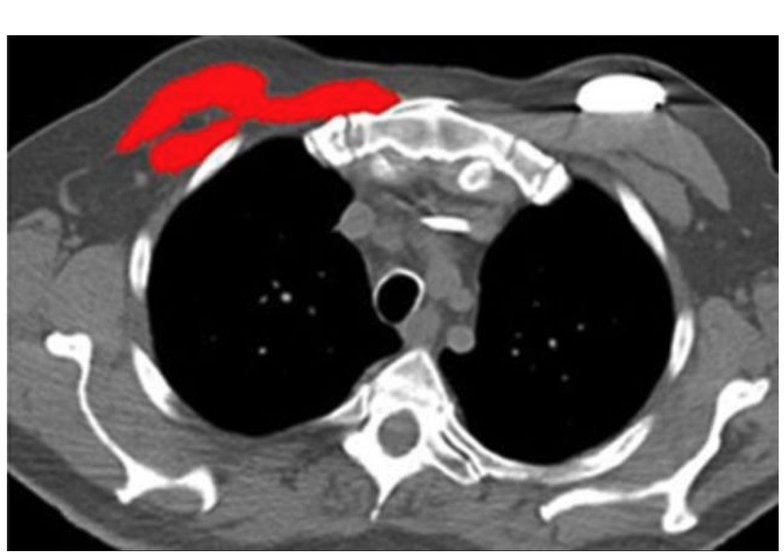
- To test the association between the RATE of change in renal function in the year prior to LVAD implantation and post LVAD mortality
- To test the association between the RATE of change in renal function and pre LVAD sarcopenia measures quantified by CT scan

METHODS

- Single center CF-LVAD cohort
- Inclusion criteria were patients with chest CT scans performed ≤ 3 months prior to LVAD implantation with renal function trend available for a year prior to LVAD (n=102)
- Renal function was smoothed using mixed effects modeling from 365 to 60 days prior to LVAD and a slope was calculated for each patient
- The slope of the renal function was assessed as a predictor of post LVAD mortality using multivariable cox regression

FIGURE 1: Axial computed tomographic (CT) image demonstrating measurement of unilateral pectoralis muscle

Axial CT images of the pectoralis major and minor at a level directly above the aortic arch. The image has been manually shaded using a Hounsfield unit range of −29 to 150. The program used to analyze the image produced measures of cross-sectional area in cm2 and mean Hounsfield units of the shaded area (Cogswell, Circ Heart Failure 2017).



RESULTS

TABLE 1: Patient baseline characteristics

	Trend of Renal Function Slopes by Tertiles			
	Lowest Slope	Intermediate Slope	Highest Slope	
	n=34	n=34	n=34	
Renal function - 365 days (mg/dL)	1.5 +/- 0.6	1.2 +/- 0.4	1.3 +/- 0.35	0.022
Renal function - 60 days (mg/dL)	1.3 +/- 0.5	1.3 +/- 0.4	1.8 +/- 0.4	<0.001
Creatinine at implant (mg/dL)	1.16 +/- 0.4	1.2 +/- 0.5	2.0 +/- 0.6	0.001
Age (years)	57 +/- 11	56 +/- 16	61 +/- 10	0.206
Male	25 (81)	23 (77)	29 (85)	0.678
White	22 (76)	26 (90)	28(90)	
Bridge to transplant	21 (62)	25 (74)	17 (50)	0.136
Device type				0.351
HeartMate 2	22 (71)	25 (83)	21 (61)	
HVAD	2 (7)	2 (7)	5 (15)	
HeartMate 3	7 (23)	3 (10)	8 (24)	
Ischemic cardiomyopathy	17 (55)	16 (53)	24 (71)	0.288
INTERMACS Profile				0.005
1	1 (3)	2 (7)	6 (18)	
2	1 (3)	3 (10)	10 (29)	
3	13 (42)	7 (23)	5 (15)	
4+	16 (52)	18 (60)	13 (38)	
Diabetes	13 (42)	8 (27)	19 (56)	0.061
Body Mass Index (kg/m2)	27 +/- 6	29 +/- 5	30 +/- 6	0.05
Albumin (g/dL)	3.5 +/- 0.4	3.6 +/- 0.6	3.6 +/- 0.6	0.717
NT pro BNP (pg/mL)	6,075 [2,514, 9,416]	3,195 [1,912, 5,159]	8,048 [4,450, 12,550]	0.005
Fick cardiac index (L/min/m2)	2.08 +/- 0.64	1.93 +/- 0.61	2.09 +/- 0.46	0.502
Right atrial pressure (mmHg)	11.4 +/- 4.2	10.5 +/- 6.2	13.6 +/- 6.5	0.115
Pectoralis Muscle Mass Indexed (cm2/m2)	5.8 +/- 1.9	6.6 +/- 1.6	6.1 +/- 1.9	0.48
Pectoralis Hounsfield Units Mean	44.2 +/- 32.8	31.4 +/- 8.5	28.1 +/- 9.2	0.047

TABLE 1: Baseline characteristics of the full cohort, stratified by rate of change of renal function over 1 year prior to LVAD implantation. There was no difference in baseline age, sex, diagnosis.

FIGURE 2: Rate of change of renal function in the year prior to LVAD implantation

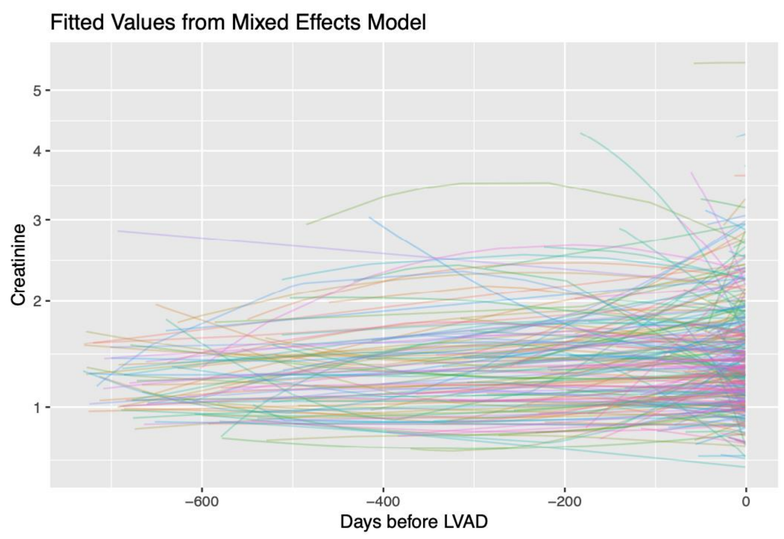


FIGURE 2: Rate of change of renal function. Creatinine values were plotted and smoothed for each patient. Data was included for final analysis from 12 months up to 2 months prior to LVAD implantation.

FIGURE 3: Kaplan Meier survival: post LVAD mortality by pre LVAD renal trend tertile

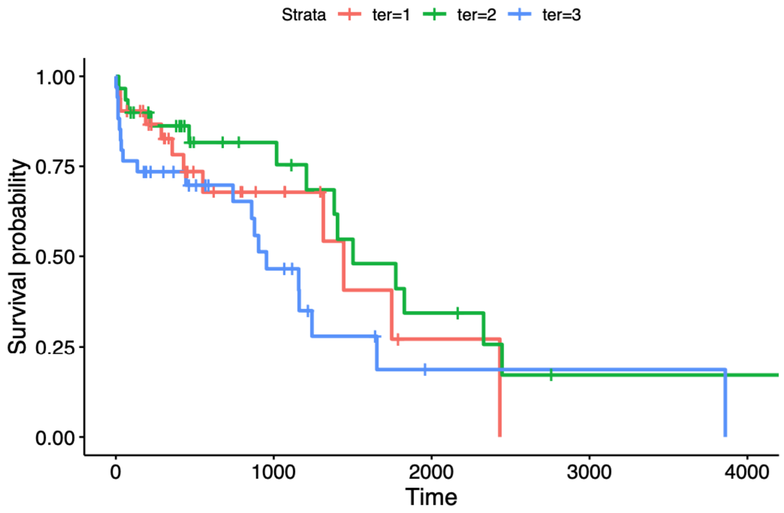


FIGURE 3: Kaplan Meier survival curve plotted for each stratified tertile. Tertile 3, representing the poorest renal function, showed an early decrease in survival that remained up to 5 years post LVAD implantation, when compared to the other two tertiles.

- Patients with the largest deterioration in renal function in the year prior to LVAD were more likely to be INTERMACS 1 and 2 at the time of surgery (Table)
- Each 1 mg/dl increase in creatinine between -365 days and -60 days increased the hazards rate of death after LVAD by a factor of 2.6 (adjusted HR 2.6, 95 % CI 1.03-6.7, p = 0.04)
- Patients with the largest decline in renal function had lower pectoralis muscle tissue attenuation by CT imaging in the 3 months prior to LVAD (Table)

CONCLUSIONS

- Renal function deterioration over the course of the year prior to LVAD was associated with pectoralis muscle sarcopenia and higher post LVAD mortality, even after adjustment for other variables
- The change in renal function paired with muscle tissue attenuation by CT scan may further define ideal implantation timing