Escalating Surgical Treatment for Left Ventricular Assist Device Infections is Associated with Decreased Expected Mortality: A Clinical Risk Prediction Score

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Hypothesis: A clinical risk prediction score for left ventricular assist device infections can be useful to identify high-risk patients that may benefit from surgical debridement and potential flap reconstruction.

Objective: Left ventricular assist devices (LVAD) greatly improve survival for patients with end-stage cardiac failure, but LVAD infections remain a significant challenge with overall incidence and predictive risk factors poorly understood. Furthermore, the indications and utility of escalating treatment from medical management to surgical debridement and potential flap reconstruction are not well-characterized.

Methods: A single-center retrospective review of 760 LVAD patients implanted between 2011-2021 was performed to identify those who developed LVAD infections. Outcomes included escalating management strategies, mortality after initial infection and surgical intervention, and readmission for infection. Cox proportional hazards regression was used to generate a calibrated risk-prediction score for mortality.

Results: In total, 255 (34%) patients developed an LVAD infection of whom 91 (36%) were definitively managed with medical therapy alone, 133 (52%) surgical debridement, and 31 (12%) with surgical debridement and flap reconstruction. One-year survival after infection was 85% with median survival of 2.40 years. Utilizing the risk prediction model **(Figure 1)**, significant decreases in survival were observed for each additional point with median survival of 5.67 years for scores 0-1, 3.62 years for a score of 2, and 1.48 years for scores ≥3 ($p<0.001$) **(Figure 2)**. Average risk scores increased significantly from patients receiving only medical management (1.3), to surgical debridement-alone (1.6), and flap reconstruction (2.3), with several-fold more high-risk patients (risk score ≥3) in the flap reconstruction group (42%) ($p<0.001$). There were no significant differences in survival between the various management groups ($p=0.902$). Methicillin-sensitive staph aureus and flap reconstruction were associated with decreased mortality.

Conclusions: A clinical risk tool for identifying patients at high-risk of developing LVAD infection is presented, and differential management strategies are characterized. Escalating surgical treatment was associated with improved expected mortality in high-risk patients. For patients able to undergo surgery, physicians may consider surgical debridement and potential flap reconstruction to alter their risk trajectory.

Figure 1. Risk Prediction Model

Infection Location	Points
Driveline only	0
Pump pocket or outflow cannula	1

MRSA Infection	Points
No	0
Yes	1

MSSA Infection	Points
No	0
Yes	-1

Diabetes	Points
No	0
Yes	1

ECMO after LVAD	Points
No	0
Yes	2

Summation of Points	
Infection Location	+_____
MRSA Infection	+_____
MSSA Infection	+_____
Diabetes	+_____
ECMO after LVAD	+_____
	+ 1
Total risk score =	_____

Total risk score	Predicted risk of 90-day mortality, %
0 or 1	<5
2	5-7
3	8-12
4	13-20
5	21-33
6	≥34

Figure 2. Kaplan-Meier Survival Curves by Risk Score