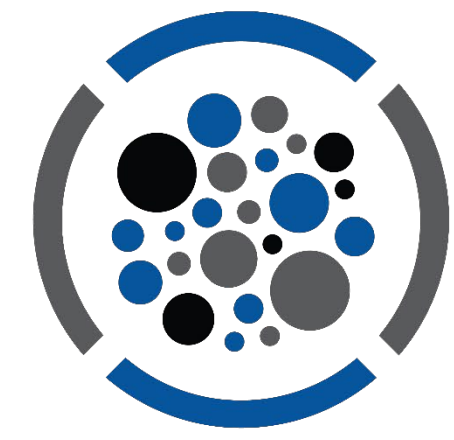


# Infections in VADers: a True Villain of the Force



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## Abstract

**Background:** Ventricular assist devices (VADs) are increasingly used for the management of end-stage heart failure, but infection is a complication that has not been thoroughly studied. The purpose of our study was to compare patients who had surgical debridement versus medical therapy alone for VAD-related/specific infections.

**Methods:** We performed a retrospective chart review on patients at Duke University Hospital (DUH) from 2015 to 2017. Patients with VAD-related/specific infections were included, per 2011 ISHLT definitions. We reviewed electronic medical records for demographics, VAD implantation data, infectious episodes, surgical debridements and mortality. Descriptive statistics compared patients with and without debridement and compared with and without relapse.

**Results:** We found 94 infections in 72 patients. Descriptive statistics of the cohort and comparisons with and without debridement. Sixty-one cases (65%) included debridement and 5 (5%) required pump exchange. Notably, patients with fever or bacteremia were more likely to undergo debridement. Of the patients that had a preoperative CT, sensitivity for deep infection (pump, pocket, or deep to the muscle) was 38%, yet specificity was 95%. For superficial infections (involving the driveline or superficial to the muscle), preoperative CT sensitivity was 95%; specificity 65%. When the preoperative driveline culture grew staphylococcus species or *Pseudomonas aeruginosa* there was strong correlation with intraoperative organism (matched in > 75% of cases). Relapse rates appeared the same if patients received 2, 4, or ≥ 6 weeks of intravenous antibiotics.

**Conclusions:** We present a large single-center cohort examining VAD-related/specific infections. While patients chosen for debridement may be sicker, these patients had a longer hospital stay and relapsed more often. Preoperative CT should be used with caution as it underestimates the extent of disease. However, preoperative driveline cultures correlated strongly with intraoperative cultures for most common pathogens. There was no association between initial intravenous therapy duration and infection relapse.

## Background

- Drive Line (DL) infections are a common complication for LVAD patients, and can lead to pump replacement
- Surgical wound debridement is morbid and costly with unclear efficacy.
- No standard algorithm for evaluating which patients should undergo debridement.
- The performance of CT scans and superficial wound cultures for diagnosing DL infections is unknown.

**Purpose: to determine if surgical debridement decreases infection relapse rates and the ultimate need for pump replacement**

## Methods

- Retrospective chart review on LVAD patients with a diagnosed DL infection at Duke University Hospital (DUH) between January 2015 to December 2017.
- Descriptive statistics compared 2 cohorts: patients with and without debridement and compared patients with and without infection relapse.
- Unadjusted Kaplan-Meier analysis assessed the impact of driveline debridement on LVAD patient survival

## Results

Table 1. Demographic characteristics of total cohort and comparisons among patients who underwent debridement for treatment of infection and patients who did not undergo debridement for treatment of infection

Characteristic	Debridement (N=61) N (%)	No debridement (N=33) N (%)	p-value
Age (mean, std)	58.2 (12.1)	56.0 (15.7)	0.48 <sup>†</sup>
Female	18 (29.5)	10 (30.3)	0.94 <sup>†</sup>
BMI (IQR 25-75)	31 (27-40)	33 (26-41.5)	0.45 <sup>†</sup>
Etiology			0.13 <sup>†</sup>
Ischemic	22 (36.1)	18 (54.6)	
Non-ischemic	39 (72.2)	15 (45.4)	
Device Type			0.02 <sup>†</sup>
Heartware	9 (14.75)	1 (3.03)	
HM2	49 (80.33)	31 (93.94)	
HM3	3 (4.92)	1 (3.03)	
Diabetes	27 (44.3)	16 (48.5)	0.69 <sup>†</sup>
Hypertension	55 (90.2)	30 (90.9)	0.91 <sup>†</sup>
COPD	18 (29.5)	6 (18.2)	0.32 <sup>†</sup>
Prior sternotomy	25 (41.0)	14 (42.4)	0.89 <sup>†</sup>
Prior valve replacement	19 (31.2)	9 (27.3)	0.81 <sup>†</sup>
Days from LVAD until infection (median, Q25-Q75)	528 (245-903)	551 (300-1,082)	0.25 <sup>‡</sup>
VAD-specific infections			
Pump	3 (5.4%)		
Pocket	2 (3.6%)		
Driveline	48 (85.7%)		
VAD-related infections	9 (14.8%)	4 (12.1%)	0.08 <sup>*</sup>
Fever at diagnosis	21 (34.4)	3 (9.1)	0.007 <sup>†</sup>
Mortality (only out of 72 unique patients)	25 (50%)	11 (42.3%)	0.31 <sup>†</sup>
Hospital LOS (days)	11 (8-17)	4 (1-14)	0.0007 <sup>†</sup>
Number of admits within 6 months	0 (0-1)	0 (1-0)	0.41 <sup>†</sup>
Relapse	41 (67.2%)	15 (26.8%)	0.04 <sup>†</sup>

\*unpaired T-test, † Fisher's exact test, ‡ Wilcoxon rank-sum test

Table 2. Organisms found intraoperatively and the number of organisms found preoperatively that are the same as the intraoperative cultures

Intraoperative Culture Organism	Number of Intraoperative Cultures	Preoperative Cultures that identify the same Organism as Intraoperative Cultures
MSSA	22 (36%)	17 (77.3%)
MRSA	6 (10%)	6 (100%)
CoNS	4 (7%)	3 (75%)
Pseudomonas aeruginosa	6 (10%)	5 (83%)
Non-Pseudomonal GNR's	5 (8%)	
Other (fungi, mycobacterium)	4 (7%)	
Polymicrobial	6 (10%)	
No Culture Done	2 (3%)	
Negative	6 (10%)	

\*A total of 38 preoperative cultures identified the same organism as the intraoperative cultures

Figure 1. Kaplan-Meier survival analysis between patients who underwent debridement and those that did not for treatment of infection.

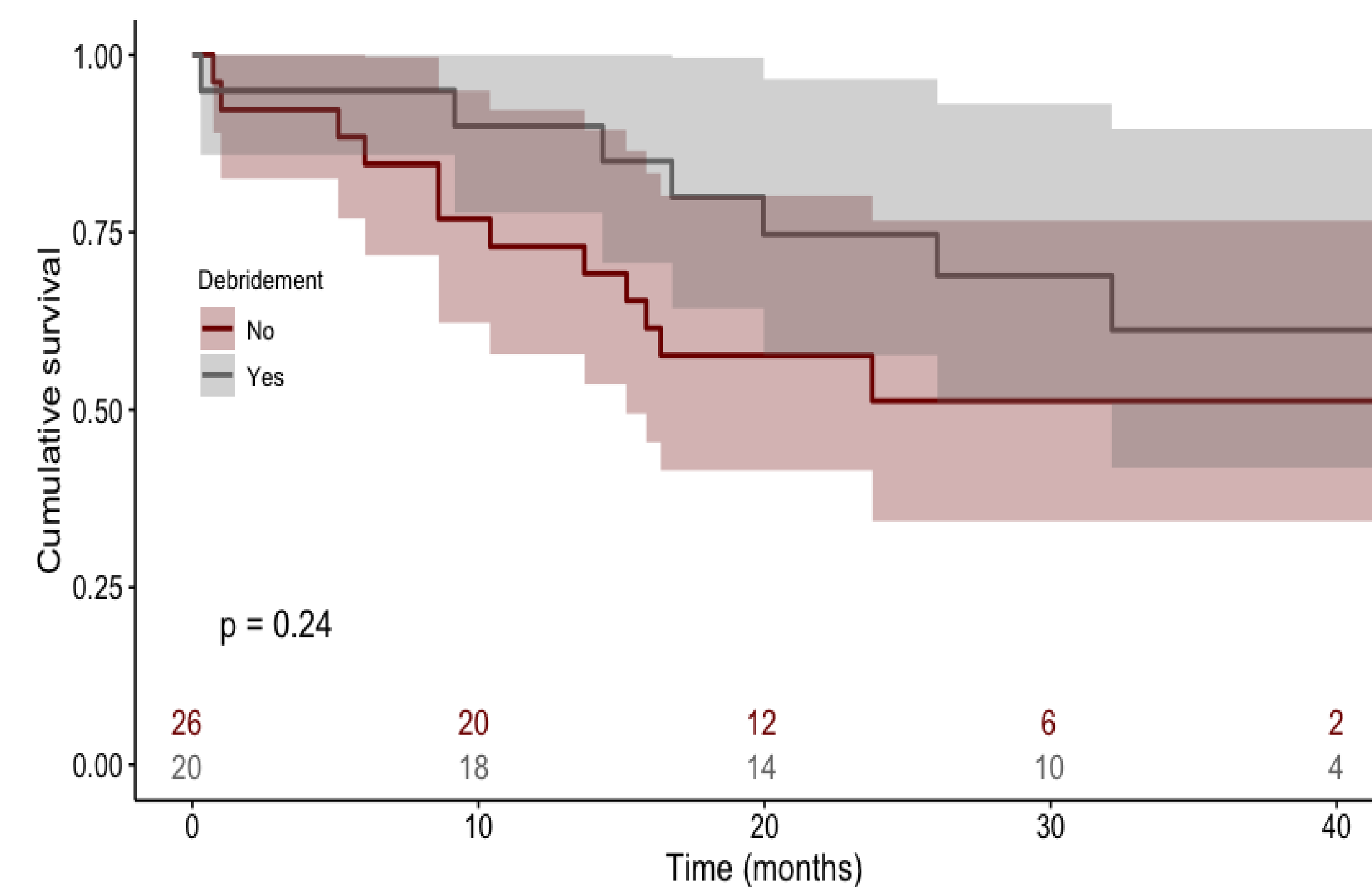


Table 3. Comparing treatment and cultures in patients who suffered an infection relapse

Treatment	Relapse (N=56)	No Relapse (N=38)	p-value
Debrided	41 (73.2%)	20 (52.6%)	0.04 <sup>*</sup>
Debrided + Pre-hospital antibiotics	18 (43.9%)	6 (30.0%)	0.4 <sup>*</sup>
Debrided + IV antibiotics			0.23 <sup>*</sup>
2 weeks	1 (2.4%)	3 (15.0%)	
4 weeks	8 (19.5%)	3 (15.0%)	
≥6 weeks	32 (78.1%)	14 (70%)	
Oral long-term suppressive antibiotics	32 (57.1%)	9 (23.7%)	0.001 <sup>*</sup>
Intraoperative Culture			0.19 <sup>*</sup>
MSSA	15 (26.8%)	7 (18.4%)	
MRSA	5 (8.9%)	1 (2.6%)	
Coagulase negative staphylococcus species	3 (5.4%)	1 (2.6%)	
Pseudomonas	3 (5.4%)	3 (7.9%)	

\*Fisher's exact Test

## Conclusions

- Pre-operative DL cultures matched intraoperative cultures with staphylococcus species or *Pseudomonas aeruginosa* in greater than 75% of cases.
- Preoperative CT scans may underestimate the extent of disease.
- While patients chosen for debridement may be sicker, these patients relapsed more often, and had longer hospital stays.
- The group without debridement had a trend for lower survival
- Future randomized studies are needed in order to set the gold standard way of treatment for these patients.

