Left Ventricular Assist Devices and Predictors of Infection and Mortality

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Introduction

Left ventricular assist devices (LVADs) have proven over the past decade to be a viable temporary option for patients suffering from end stage heart failure when less invasive measures have failed. Today these devices are implanted in various clinical settings either as a potential bridges to cardiac transplantation or for destination therapy.

Recent studies conducted seem to favor a strong association between the development of infection among LVAD recipients and mortality. Certain complications such as blood stream infections have been thought to be associated with increased mortality. There are few studies among this particular patient population that identify predictors of mortality. There are an even fewer number of studies dedicated to identifying factors that predict infectious complications among these patients.

The objective of this study was to describe the various infections observed among a population of patients with LVADs and then to the identify what factors may be predictors of these infections. We determined both infectious and non-infectious predictors of mortality in these patients. The ultimate goal was to identify these predictors and then, if possible, suggest modifications to see if we could impact the development of infection and decrease mortality after LVAD.

Materials/Methods

Paper and electronic medical records of 69 patients who underwent LVAD placement were reviewed. Inclusion criteria: any adult patient that had a LVAD from 1/2007-12/2010 at Montefiore Medical Center. Follow up time ranged from 6mo-3yrs. Data collection ceased 4/2011. Infectious and non-infectious outcomes were obtained from the chart review.

Parameters Reviewed

Gender
Age
Device type
Reason for LVAD (cardiogenic shock)
Reason for LVAD (BTT, BTD, DT)
Diabetes
Days from admission to LVAD
Days from LVAD to discharge or death
Duration entire hospital stay
ECD (extra-corporeal device, tandem VAD or IABP) prior to LVAD
Days intubated
Renal replacement therapy (RRT)
Transfer from an outside hospital (OSH)
Duration of tandem devices
Re-do sternotomy performed
Other cardiac surgeries done at time of LVAD
Bypass time
Chest closed after LVAD implanted
Re-exploration of mediastinum after original chest closure
An exchange ever performed

Definitions

Driveline infection: Localized purulent drainage from abdominal wall exit site and isolation of 1 or more pathogens

LVAD endocarditis: Isolation of the same microorganism from >1 blood culture and histopathological evidence of infection involving inflow/outflow conduits or porcine valves at time of transplant or autopsy

Device related infected BSI: Isolation of same microorganism (based on species and antibiogram) from >1 blood culture and from samples from the driveline exit site and/or LVAD pocket and/or from the explanted device in the absence of histopathologic evidence of device infection

Device pocket infection: Localized purulence in the subcutaneous space in which the LVAD was placed and the isolation of one or more pathogens

Pneumonia: Clinically patient had one of the following,: cough, sputum, fever, chills, pleuritic chest pain with physical findings such as crackles or rales in the lung or dullness to percussion, increased tactile and vocal fremitus, bronchial breathing, and a pleural friction rub, the presence of leukocytosis and or patients had to have evidence of parenchymal abnormality, consolidation and/or infiltrates on chest radiograph

Results

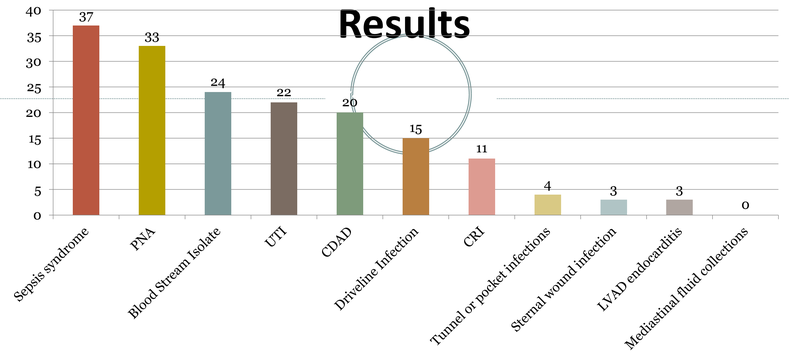

Figure 1. Case numbers of the different infectious disease outcomes among 69 LVAD recipients

Non-Infectious Characteristic	N (%)
Required ECD prior to LVAD	33 (48)
Prolonged bypass time > 100 mins	30 (43)
Simultaneous cardiac surgery	38 (55)

Infectious Outcome	N (%)
Any Infection	48 (70)
Blood stream infection (BSI)	24 (35)
CDAD	20 (29)
Pneumonia	33 (48)
Catheter related infection (CRI)	1 1 (16)
Sepsis Syndrome	37 (54)

Organisms causing Blood stream infections (BSI)	N (%)
Staphylococcus epidermidis	4 (6)
Klebsiella pneumoniae	4 (6)
KPC	2 (3)
ESBL	1 (1)
Sensitive	1 (1)
Enterococcus faecalis (all sensitive)	2 (3)
E. Coli	2 (3)
ESBL	1 (1)
Sensitive	1 (1)
Streptococcus sanguis	2 (3)
Pseudomonas aeruginosa (sensitive)	1 (1)
Enterobacter cloacae (sensitive)	1 (1)
Streptococcus mutans	1 (1)
Streptococcus bovis	1 (1)
Staphylococcus aureus (MRSA)	1 (1)
Listeria monocytogenes	1 (1)
Torulopsis glabrata	1 (1)

Polymicrobial BSI	N (%)
Staphylococcus epidermidis + *E. faecalis* (S)	1 (1)
Staphylococcus epidermidis + MRSA	1 (1)

Organism causing Driveline Infections	N (%)
MRSA	3 (4)
MSSA	3 (4)
Serratia	2 (3)
CONS	1 (1)
Enterococcus faecalis	1 (1)
Stenotrophomonas	1 (1)
Pseudomonas	1 (1)
Alcaligenes xylosoxidans	1 (1)

Polymicrobial Driveline Infections	N (%)
Staphylococcus epidermidis + *E. faecalis* (S)	1 (1)
Staphylococcus epidermidis + MRSA	1 (1)

Exposure	Outcome	OR_{ADJ} (95% C.I.)	p value
ECD	BSI	3.37 (1.16-9.84)	0.026
ECD	CDAD	7.50 (2.1-26.1)	0.001
Prolonged bypass time	CRI	4.31 (1.04-17.9)	0.045
Simultaneous cardiac surgery	CRI	0.018 (0.001-0.30)	0.005
Pneumonia	Mortality	5.83 (1.60-21.1)	0.007

Conclusions

- Our study suggests that an ECD prior to LVAD placement and prolonged bypass times are predictive of infectious complications.
- Post operative pneumonia was associated with increased mortality.
- Larger prospective studies are needed to further characterize predictors of infection and mortality with the ultimate goal of minimizing these complications.

References

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