Dying with a Left Ventricular Assist Device as Destination Therapy

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Disclosures

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DT-LVAD is an Efficacious Therapy

- LVAD as Destination Therapy (DT-LVAD) increasingly utilized in patients with advanced heart failure
- On average, patients
  - Live longer compared with medical therapy
  - Have improved QOL
  - Individual benefit varies
- However, eventually everybody dies

Fang J NEJM 2009
Study Aim

- The goal of this study was to systematically examine the deaths in patients treated with DT-LVAD at a single academic center

- Inclusion/ exclusion
  - Patients DT-LVAD implanted Jan 2007- Sept 2014
  - Deaths through July 1, 2015
  - Died with LVAD *in situ*
  - Cause of death from autopsy reports, death certificates, clinical notes
Study Population

166 patients DT-LVAD 1/2007-9/2014

- 89 patients died with DT-LVAD and included in analysis
  - 84 HMII, 3 HW HVAD, 2 HM XVE
  - 11 heart transplant
  - 2 explanted
  - 64 alive 7/1/2015
## Pre-LVAD Characteristics of 89 Patients

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Age, years</strong></td>
<td>64.5 (10.7)</td>
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<tr>
<td><strong>Male, %</strong></td>
<td>80.7%</td>
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<tr>
<td><strong>Ischemic etiology of HF, %</strong></td>
<td>58.4%</td>
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<tr>
<td><strong>Prior sternotomy, %</strong></td>
<td>60.7%</td>
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<tr>
<td><strong>Comorbidities, %</strong></td>
<td></td>
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<tr>
<td>Hypertension</td>
<td>59.6%</td>
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<tr>
<td>Diabetes</td>
<td>46.1%</td>
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<tr>
<td>Peripheral vascular disease</td>
<td>28.1%</td>
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<tr>
<td>COPD</td>
<td>16.9%</td>
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<tr>
<td>Cerebrovascular disease</td>
<td>36.0%</td>
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<td>Obese (BMI≥30 kg/m²)</td>
<td>44.3%</td>
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### Laboratory Data, median (IQR)

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<table>
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<tbody>
<tr>
<td>Total bilirubin, mg/dL</td>
<td>1.0 (0.8, 1.7)</td>
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<tr>
<td>Creatinine, mg/dL</td>
<td>1.4 (1.1, 1.8)</td>
</tr>
<tr>
<td>INR</td>
<td>1.3 (1.1, 1.4)</td>
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<tr>
<td>&gt;Moderate RV dysfunction, %</td>
<td>26.4%</td>
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### Experiences Around the Time of Death

<table>
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<tr>
<th>Metric</th>
<th>Value</th>
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<tr>
<td>Age at death, years, mean (SD)</td>
<td>66.1 (10.7)</td>
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<tr>
<td>Time LVAD implant to death, years, mean (SD)</td>
<td>1.7 (1.7)</td>
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#### Line Graph

- **Axes:**
  - **Y-axis:** Patients (No.)
  - **X-axis:** Months After LVAD (No.)

The line graph illustrates the number of patients over time following LVAD implantation, showing fluctuations in the number of patients per month.
Cause of Death

- Multiorgan failure: 25.6%
- Hemorrhagic stroke: 24.4%
- Heart Failure: 20.9%
- Cancer: 7.2%
- Infection: 7.2%
- Ischemic stroke: 4.8%
- Bleeding: 4.8%
- Other stroke: 3.6%
- LVAD failure: 2.4%
<table>
<thead>
<tr>
<th>Where Did Patients Die?</th>
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<tr>
<td><strong>In hospital death, %</strong></td>
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<tr>
<td><strong>Time hospital admission to death, days, median (IQR)</strong></td>
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<tr>
<td><strong>ICU care during terminal hospitalization, %</strong></td>
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<tr>
<td><strong>Died in an ICU, %</strong></td>
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<td><strong>Resuscitation during terminal hospitalization, %</strong></td>
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<td><strong>Mechanical ventilation during terminal hospitalization, %</strong></td>
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<tr>
<td><strong>Hemodialysis in 48 hours prior to death, %</strong></td>
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<tr>
<td><strong>Transition to comfort care prior to death, %</strong></td>
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LVAD Deactivations

- Defined as deactivation prior to clinical death
- Information available on 81/89 patients
- 49 (60.5%) had LVAD deactivated prior to death
  - 3 at home, remainder in hospital
  - Final decision by family/clinical team 85.7%
  - Most patients died within minutes of deactivation, all within 26 hours
Hospice and Palliative Care

- 46.3% (37/80) of patients saw palliative care in last month
  - Standard for all to see palliative care prior to LVAD
- 15.5% (13/84) enrolled in hospice
  - Time hospice to death median 10.5 days (range 1-315)
  - Cause of death: 5 multiorgan failure, 4 cancer, 2 stroke, 2 heart failure
- 12/13 patients enrolled in hospice died at home or in hospice facility
DT-LVAD Deaths Compared with Heart Failure, COPD, Cancer

Dunlay SM Circ Heart Fail 2015; 8:489
Unroe KT Arch Intern Med 2011; 171:196
Teno JM JAMA 2013; 309:470
Limitations

• Single center study

• Some details were not available in patients that died in other hospitals
Summary

• Most patients dying with a DT-LVAD
  • Died in the hospital, most in an ICU
  • Most common causes of death were multiorgan failure, heart failure, hemorrhagic stroke
  • Over half had LVAD deactivated, final decision by family/hospital team
  • Half saw palliative care
  • Very few enrolled in hospice

Patients with a DT-LVAD die differently than other patients with heart failure
Why do DT-LVAD patients die differently?

- Patient preferences may differ
- Acute deaths less predictable
- Clinicians may not be engaging patients in goals of care discussions
  - Involving palliative care too late
- Challenging to find skilled nursing and hospice facilities to accept patients with LVAD
Next Steps

• Examine if findings differ at other centers
  • Explore variability

• Are decisions aligned with patient preferences?
  • Are clinicians discussing preferences with patients and family?
  • What are the barriers to hospice enrollment?
  • Should palliative care have a longitudinal role?
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