Adventures in Advanced Heart Failure: Aggressive Palliation

Tiffany Richter, DO
Nancy Hart Wicker, MD
Jordan Barham, NP

Innovation and Excellence in Advanced Illness at End of Life
43rd Annual Hospice & Palliative Care Conference – September 2019 – Greenville, SC
Objectives

• Describe palliative use of medications and cardiac infusions in advanced HF
• Describe LVAD use
• Discuss components of a pre-LVAD palliative care consultation
• Review considerations surround about LVAD deactivation and hospice
• Describe CardioMEMS use in advanced HF
Disclosures

We are boring and have no financial disclosures.
# NYHA Classification

## The New York Heart Association (NYHA) Definition

<table>
<thead>
<tr>
<th>Classification</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYHA Class 1</td>
<td>No limitations of physical activity. No heart failure symptoms</td>
</tr>
<tr>
<td>NYHA Class 2</td>
<td>Mild limitation of physical activity. Heart Failure symptoms with significant exertion; comfortable at rest or with mild activity</td>
</tr>
<tr>
<td>NYHA Class 3</td>
<td>Marked limitation of physical Activity. Heart Failure symptoms with mild exertion; only comfortable at rest</td>
</tr>
<tr>
<td>NYHA Class 4</td>
<td>Discomfort with any activity</td>
</tr>
</tbody>
</table>
## American College of Cardiology Foundation/American Heart Association Staging System

<table>
<thead>
<tr>
<th>HF Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Patients at high risk for developing HF in the future but no functional or structural heart disorder</td>
</tr>
<tr>
<td>B</td>
<td>A structural heart disorder but no symptoms at this stage</td>
</tr>
<tr>
<td>C</td>
<td>Previous or current symptoms of heart failure in the context of an underlying structural heart problem, but managed with medical treatment</td>
</tr>
<tr>
<td>D</td>
<td>Advanced disease requiring hospital-based support, a heart transplant or palliative care</td>
</tr>
</tbody>
</table>
Poor Heart Failure Prognosis

• Cardiac Hospitalizations
  – 3x 1 year mortality
• Intolerance to beta blockers/ACE-Inhibitors
  – High 4 month mortality
• Elevated BUN +/- creatinine ≥ 1.4mg/dl
• SBP <100mmHg +/- HR >100 bpm
  – 2x 1 year mortality)
• Decreased LVEF ≤ 45%
Symptoms of Heart Failure

- **Pain**
  - Peripheral edema, arthritis, diabetic neuropathy, post-herpetic neuralgia, angina

- **Dyspnea**
  - Fluid retention, pleural/pericardial effusions, dysrhythmias, COPD exacerbation

- **Depression**
  - SSRI drug of choice – preserves EF, lack of hypotensive/dysrhythmia effects/few drug interactions
  - Psychostimulants possibly not safe
Symptoms of Heart Failure

• Fatigue
  – Energy conservation
  – Drug side effect (B-Blockers)
• Insomnia
  – Orthopnea
• Anxiety
• Constipation
• Nausea/vomiting
Diuretics

- Relieve symptoms of fluid overload
- Start with loop diuretics
  - Furosemide, torsemide, bumetanide
  - Optimize dose
  - Can change to IV or SC (furosemide)
    - Gut edema can decrease absorption of PO diuretics
    - IV bolus or continuous infusion
- Addition of Thiazide diuretic in loop-resistant patient
  - Metolazone or hydrochlorothiazide
- Potassium sparing diuretics
  - Spironolactone
Inotropic Agents

• Increase contractility by increasing available calcium levels within myocardial tissue via cAMP regulation

• Help achieve diuresis by increasing cardiac output and symptom relief

• Heart Failure with reduced ejection fraction (HFrEF) (Systolic HF)
  – IV phosphodiesterase (PDE)-3 inhibitors (Milrinone)
  – IV Beta Adrenergic Receptor agonists (Dobutamine)
  – IV or Oral Digoxin (Oral Digoxin only PO positive inotropic agent available for long term ambulatory use in US)
Indications for Inotropic Agents

• Only for decreased cardiac contractility
  – EFrHF (systolic) NOT EFpHF (diastolic)

• Short Term Hemodynamic Support
  – 2013 American College of Cardiology/AHA HF Guidelines
  – 2016 European Society of Cardiology HF Guidelines
  – Decompensated HFrEF with low cardiac output
    AND
  – Hypotension or evidence of end-organ perfusion
    • Limited to these indications due to increased mortality and side effect risk
Indications for Inotropic Agents

- NYHA class IV
- Maximal medical therapy with refractory symptoms
- Failed weaning of inotrope in inpatient setting or too ill to wean
- Willing to have outpatient access
- Accept risk of life threatening arrhythmia / hypotension
Indications for Inotropic Agents

• Long-Term IV Hemodynamic support
  – May be harmful and generally not recommended
    • Risk of sudden death secondary to ventricular arrhythmia
      – Risk mitigated with ICD +/- antiarrhythmic such as amiodarone
    • Catheter infections
  – Can serve as a bridge to definitive therapy
    • Coronary revascularization (Ischemic cardiomyopathy)
    • Mechanical circulatory support (LVAD)
    • Cardiac transplantation
  – Palliation in end stage heart failure refractory to standard medical therapy
Medicare Coverage (Not on Hospice)

• Uncontrolled dyspnea at rest despite max medical treatment

• Hemodynamic studies within 6 months
  – Cardiac index of 2.2 L/min/m² (max) and/or pulmonary capillary wedge pressure of 20mmHg prior to infusion
  – 20% increase in cardiac index and/or 20% decrease in pulmonary capillary wedge pressure during infusion

• Controlled arrhythmias prior to discharge – possible addition of amiodarone

• Range of covered doses with effort documented to maintain on lowest practical dose
Medicare Coverage
(Not on Hospice)

• Documentation of improvement with infusion
  – Decreased dyspnea
  – Absence dyspnea at rest
  – Improved diuresis
  – Improved renal function
  – Reduction weight
Hospice Coverage

- Can be thousands of dollars monthly
- Need for advanced training of staff to manage
- Many hospices will not accept inotrope dependent patients
- Many home health agencies have programs
Choice of Inotrope

• Hypotension
  – Dobutamine
    • Beta-receptor agonist
    • Does not have prominent vasodilator effects

• Renal Insufficiency
  – Dobutamine
  – If milrinone used needs dose adjustments to avoid accumulation and hypotension

• Recent Beta-Blocker Use
  – B-Blockers typically discontinued in those who need ionotrophic support
  – Milrinone preferred
    • PDE-3 inhibitor
• Main beta adrenergic agent for inotropic support
• Racemic mixture of mixed alpha-1 effect and minimal -2 effects
  – Minimal effect on peripheral vascular resistance
    • Unlike isoproterenol, high-dose dopamine, norepinephrine, epinephrine
• Symptomatic improvement in advanced HF with dobutamine infusion for 3-5 days
  – Benefit can last for 30 days = Dobutamine Holiday
Dobutamine

- No data showing improved survival from intermittent or continuous dobutamine
- Hypersensitivity myocarditis = eosinophilic hypersensitivity myocarditis in 2.4-23% of patients on dobutamine infusion, particularly prolonged
- High-dose levels (>1-3 mcg/kg/min)
  - Beta-1 adrenergic effects = increased inotropy
  - Alpha- adrenergic effects = arterial and venous constriction
Milrinone

• Intravenous phosphodiesterase-3 inhibitor
  – ↓ the rate of cyclic adenosine monophosphate (AMP) degradation
    • Increased cyclic AMP concentration
      – ↑ calcium influx into the cell
        » ↑ contractility
  – Cause systemic arterial and venous dilation via inhibition of vascular PDE
  – Acute hemodynamic and symptomatic benefit in advanced EFrHF
  – Associated with significant increases in hypotension and atrial arrhythmias
Summary of Inotropes

• Short term IV inotrope therapy can be used in decompensated heart failure with HFrEF
  – If there is also hypotension or evidence of end-organ hypoperfusion
  – Increased risk of mortality and side effects

• Intermediate to Long-term IV inotrope infusions
  – Refractory heart failure as bridge to definitive therapy
  – For palliative care in end-stage EFrHF

• If patient has been on B-Blocker recently and may have residual B-blocker effects contributing to hypoperfusion, use PDE-3 inhibitor (Milrinone)
46 year old male presented to PHR as a transfer from GHS for worsening cardiogenic shock. He had been there for two weeks with worsening cardiogenic shock despite BiVICD placement, IABP, and inotropic support.
Case presentation #1

- Seen by advanced heart failure team
- Considered LVAD placement
- Palliative Care consulted
What is an LVAD?

• **Left Ventricular Assist Device**
  
  • **Indications:**
    - NYHA Class IV
    - Ejection Fraction <25%
    - \( \text{MVO}_2 \leq 14 \text{mL/kg/min} \)

• Mechanical circulatory assist device to replace the function of a failing ventricle

• Provides continuous blood flow from the left ventricle to the aorta
How does it work?
Device Options

HeartMate II  
HeartMate 3  
HeartWare
Equipment

- Wall Power
- Battery Charger
- Batteries

HeartWare Equipment

HeartMate Equipment
Goals of Treatment

• Help patients live longer
  – Survival to heart transplant (Bridge-to-transplant)
  – Indefinitely on support (Destination therapy)

• Improve quality of life
  – Living normal lives with minimal restrictions
  – Improved exercise tolerance
  – Improved end-organ function
  – Improved neuro-cognitive function
Special Considerations for VAD Patients

• Cannot have MRI
  – CT scans and Xrays are ok
• Must be on either batteries or wall power at all times to power the pump
• Cannot swim or take tub baths
• Almost always on anticoagulation
  – Exception for patients that have had bleeding complications
• Their families complete education before being discharged from the hospital (before surgery if possible)
• Require sterile dressing changes to their driveline
  – Initially, must be a daily change
  – After site is properly healed, may go to weekly
New Research

MOMENTUM 3 Full Cohort Results
The Largest Randomized Controlled Trial Ever Conducted for an LVAD* (N=1028)

Results from the MOMENTUM 3 full cohort at 2 years show that HeartMate 3 LVAD continues to have:

- The highest survival rate for any LVAD in a randomized controlled trial§
- The lowest hemocompatibility-related adverse event rates of any LVAD¶,§,§,1-5

Immediate, significant, and sustained improvements in functional capacity and quality of life†

*Ongoing evaluation of over 2000 patients (1028 alive, 9.0% BTT, 37% DTT, 19% DTT and 1500 CAP).
†For a continuous flow LVAD in a randomized controlled trial.
§Key adverse events include pump thrombosis, stroke and GI bleeding.

Primary Endpoint Met, and Clinical Superiority Demonstrated Event-Free Survival at 2 Years*

**Superiority Analysis**
HR = 0.60 (95% CI: 0.47-0.75)
P < 0.0001 by log-rank test

**No. at Risk:**
- HeartMate 3™ LVAD: 516, 438, 373, 313, 280
- HeartMate II™ LVAD: 512, 401, 321, 264, 223

*Survival at 2 years free of disabling stroke (>3 mRS) or reoperation to replace or remove a malfunctioning device
Survival at 2 Years

HeartMate 3™ LVAD continues to show the highest survival for a LVAD at 2 years in a randomized controlled clinical trial.

**Graph:**
- Survival rates for HeartMate 3™ LVAD (blue) and HeartMate II LVAD (red).
- At 2 years, 90.0% for HeartMate 3™ LVAD, 88.7% for HeartMate II LVAD.
- HR = 0.88 (95% CI: 0.67-1.16), P = 0.37 by log-rank test.

**Table:**

<table>
<thead>
<tr>
<th>Months After Implant</th>
<th>HeartMate 3™ LVAD</th>
<th>HeartMate II LVAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>515</td>
<td>505</td>
</tr>
<tr>
<td>6</td>
<td>447</td>
<td>414</td>
</tr>
<tr>
<td>12</td>
<td>383</td>
<td>339</td>
</tr>
<tr>
<td>18</td>
<td>322</td>
<td>285</td>
</tr>
<tr>
<td>24</td>
<td>289</td>
<td>248</td>
</tr>
</tbody>
</table>

Innovation and Excellence in Advanced Illness at End of Life
Potential Risks and Complications

• Infection
  – Driveline (power cord that comes out of the abdomen) is the most common source
  – Bacteremia

• Bleeding (Blood thinners)
  – GI bleeding
  – Nose bleeding

• Stroke
  – Hemorrhagic
  – Embolic
Potential Risks and Complications

• Pump Thrombosis
  – Essentially a blood clot within the pump

• Arrhythmias
  – Patient might not know they are in a “deadly” rhythm like VT or VF

• Organ Failure
  – Kidney
  – RV Failure
Risks and Complications

• Most Common
  – Bleeding (~35%)
  – Infection from driveline site (~20%)
  – Arrhythmia (~20%)

• Less Common
  – Stroke (~13%)
  – Thrombus (~10%)
Why Palliative Care is important?

• To establish obtainable goals for patients and their families
• To give further insight to the advanced heart failure diagnosis
• Advance care planning
• To facilitate open conversation among patients, families, and healthcare providers
• Now part of our evaluation for patients needing LVAD
Components of a pre-LVAD palliative care consultation

Palliative Care Assessment

- Decision to undergo LVAD
- Symptoms
- Limits/Unacceptable states/Hopes/Fears
- Medications
- Spiritual or religious practices
- ACP/POA/AD
Components of a pre-LVAD palliative care consultation

Medical Preparedness Planning

- Device failure
- Post-VAD health-related QOL
- Device complications
- Progressive comorbid conditions
Components of a pre-LVAD palliative care consultation

Personal Preparedness:

- Power source
- Carrying equipment
- Driveline care
- Medicine
- Water Precautions
- Cost
- Sex
- Emotions
Case presentation #1: HPI

- 46 year old male presented to PHR as a transfer from GHS for worsening cardiogenic shock. He had been there for two weeks with worsening cardiogenic shock despite BiVICD placement, IABP, and inotropic support.
Case presentation #1: PMx

Past medical history:
• Chronic pain after a motorcycle accident in 1993
• NICM: diagnosed in 2011; viral vs. familial

Surgical history: BiV ICD, IABP (placed at GHS)
Case presentation #1: SHx

• Active tobacco abuse, no drugs or EtOH
• Lives with girlfriend of 20 years
• Has three sons: 7, 13, and 22 years old
• Close relationship with his mother
Case presentation #1: SHx

• On disability since a motorcycle accident
• Lost to follow-up for several years from his NICM
• He lives in Seneca (1 hour from local cardiologist, 3 hours from Columbia)
Case presentation #1

• Seen by advanced heart failure team
• Considering LVAD placement
• Palliative Care consulted
Pre-LVAD consultation

Palliative Care Assessment

- Decision to undergo LVAD
- Symptoms
- Limits/Unacceptable states/Hopes/Fears
- Medications
- Spiritual or religious practices
- ACP/POA/AD
Pre-LVAD consultation

Medical Preparedness Planning and Personal Preparedness
Pre-LVAD consultation

• What would be some of your concerns about this patient given what we know?
• Barriers?
Pre-LVAD consultation

- History of chronic pain
- $$$
- Geography
- POA?
- Post-surgery caregiving
- Prior non-compliance
Post-LVAD course

- Underwent LVAD placement
- Underwent multiple shocks by ICD for VTach
- Did not require rehabilitation
- Came to follow-up appts. for a while.
- Now LTFU
Hospice-specific LVAD considerations

- Hospice Dx: Presence of Heart Assist Device
  - Z95.811
- Keep heart failure MD as the attending
- Additional costs:
  - Labs: INR/LDH
- Staff preparation:
  - Exam differences
  - Alarms
  - Death
  - Deactivation
Case presentation #2: HPI

- 42 year old F with end-stage heart failure s/p LVAD placement 6 months ago.
Case presentation #2: PHx

- CVA 4 months ago with minimal left sided residual weakness
- Chronic smoker
- Hypertension
- Coronary Artery Disease
- Dyslipidemia.
Case presentation #2: Hospital Course

- Admitted to hospital 7 days ago for altered mental status.
- Intubated for airway protection.
- CT of the brain showed acute infarcts in the parieto occipital regions.
- High LDH $\rightarrow$ heparin drip
Case presentation #2:
Hospital Course

- GI bleed → 3U PRBC’s
- Heparin drip held
- Worsening renal failure requiring CRRT
- Hypotension requiring vasopressors
- Pulmonary edema due to dysfunctioning LVAD.
- Initiated GOC discussion
- Patient and family desired discontinuation of life-sustaining therapies
Indications for LVAD deactivation

- Thrombotic/hemorrhagic stroke effective QOL
- Overwhelming sepsis
- Multi-organ system failure
- Poor QOL despite LVAD treatment
  - Chronic infections, recurrent bleeding
- Development of serious secondary comorbidities
  - Cancer, advanced dementia, renal failure needing HD
Logistics of LVAD deactivation

- Short answer: Call the LVAD team/coordinator
- In the hospital, they will perform the deactivation
- In the home, they will instruct the hospice nurse/physician
- Want to make sure that the alarms are deactivated so these are not distressing to the patient/family
Symptom management for LVAD deactivation

• Potential Symptoms: labored breathing, anxiety, secretions, flash edema (similar to HF exacerbation)
• Have additional medication drawn up and ready to administer at the bedside if needed.
• If distress is noted, utilize additional bolus doses
• Symptom relief is the priority
Symptom management for LVAD deactivation

- Opioids (IV, subQ, and SL): Morphine liquid (5-20mg) or Morphine (2-10mg IV/subQ)
- Benzodiazepine (IV, SL): Lorazepam liquid (1mg-2mg) or Lorazepam (1-2mg IV)
- Secretion medications (IV, SL): Glycopyrrolate Robinul 0.2 to 0.4 mg IV 20-30 minutes prior
Case presentation #3

- 86 year old F
- HFrEF
- OA, afib, CAD, CKD, HTN, gout, and PVD
- Not a candidate for AHT
- 4 hospitalizations in 3 months for HF
What is a pulmonary artery pressure sensor?

- Implantable, wireless PAP monitoring system
- Transmits the patient’s continuous PAP’s to an ambulatory healthcare provider
- CardioMEMS
Prior Methods for Monitoring Heart Failure

- Weight gain
- Extremity edema
- Fatigue
- Shortness of breath
- Orthopnea
- Paroxysmal nocturnal dyspnea

- JVD
- Third heart sounds
- Rales
- NT-proBNP guided titration
- Tele-monitoring
- Echo
PA Sensor and Delivery System

Innovation and Excellence in Advanced Illness at End of Life
How does it work?
How does it work?

Innovation and Excellence in Advanced Illness at End of Life
Is a PAP sensor palliative?

- ↓ HF-related hospitalizations
  - 28% at 6 months
  - 37% at 15 months
- ↓ overall mortality
- ↑ QOL
  - 3X ↑ in KCCQ scores
  - ↑ 6MW distance
Case presentation #3

• CardioMEMS placed
• No hospitalizations for 6 months
• Improved functional status
• Improved shortness of breath
• Discussed GOC, did ACP, and referred to PATH program
Questions? Answers?

THIS IS THE END OF THE PRESENTATION

ANY QUESTIONS? IF NO JUST CLAP
References

Inotropic therapy:

- Colucci “Inotropic agents in heart failure with reduced ejection fraction” www.uptodate.com May 25, 2018
LVAD:

- [https://patientdecisionaid.org/lvad/](https://patientdecisionaid.org/lvad/)
- Pre-Ventricular Assist Device Palliative Care Consultation: A Qualitative Analysis. Chuzi, Sarah et al. Journal of Pain and Symptom Management, Volume 57, Issue 1, 100-107

PAP sensor: