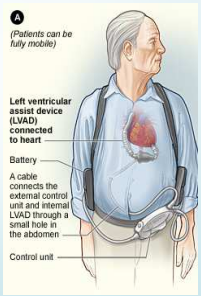
LVAD in a Community Hospital Are You Prepared?

Class: C75M119

Cheryl Herrmann
Cardiac Clinical Nurse Specialist
APN, CCRN, CCNS-CSC-CMC
UnityPoint Health Methodist/Proctor, Peoria,IL
HOI AACN President
cherrmann@frontier.com
www.cherylherrmann.com

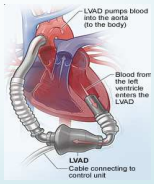
LVAD ~ Left Ventricular Assist Device

- A mechanical circulatory support (MCS) pump
  - Supports the damaged heart
  - Reestablished normal hemodynamics
  - Restores blood flow to vital organs
- Used in decompensating advanced heart failure patients who fail to improve or stabilize with optimal medical therapy.



LVAD ~ Left Ventricular Assist Device

- The basic parts of a LVAD
  - Cannula in left ventricle and cannula in aorta
  - Drive line to pump (controller)
  - Power source - batteries or console



Indications for Use

- Bridge to Transplant (BTT)
  - Non-reversible left heart failure
  - Imminent risk of death
  - Candidate for cardiac transplantation
- Destination Therapy (DT)
  - NYHA Class IIIB or IV heart failure
  - Optimal medical therapy 45 of last 60 days
  - Not candidate for heart transplantation
- Bridge to Recovery (BTR)
  - Reversible cardiac insults (AMI, PP cardiomyopathy, myocarditis)
- Bridge to Candidacy (BTC)
  - Not currently listed for transplant
  - No absolute or permanent contraindication to transplant

Reference: Stewart, Givertz. Mechanical Circulatory Support for AHF. **Circulation**: 2012:125:1304-1315

Assist Device History

- 1953 Era of Cardiac Surgery begins. 1st CBP
- 1963 First Report of artificial ventricle by Liotta
- 1966 Debakey 1st successful LVAD post cardiotomy shock wean and BTR
- 1969 Cooley 1st TAH as BTT post cardiotomy shock
- 1982 Jarvik -7 TAH for permanent support
- 1984 1st successful LVAD for chronic heart failure
- 1992 – 1998: FDA approves several devices for bridge to transplant
- 2003 FDA approves Thoratec HeartMate XVE (pulsatile flow) for Destination therapy
- 2006 Interagency Registry of Mechanically Assisted Circulatory Support (INTERMACS) establishd
- 2010 FDA approves HeartMate II (continuous flow)
- 2010 Heart Ware (continuous flow) preliminary results BTT

Innovative Pump Designs

- Improved clinical outcomes
- Altered the profile of mechanical circulation support
- Changed the structure of advanced heart failure programs
- With these new advances, new challenges and opportunities

Advanced Heart Failure Epidemic in USA

- Estimate to include 100,000 – 250,000 patients with refractory New York Heart Association (NYHA) class IIIB or IV symptoms
- Less than 2300 hearts are available
- Hearts reserved for younger patients with fewer morbidities
- Average weight time for Status I patient for a heart is > 6 months
  - Exposed to risks of infections, blood clots, pressure ulcers and exhaustion family members

- Age is the most common reason for ineligibility for Heart transplant
  - 75% of HF patients are over 65 y/o
  - Average age of hospitalized HF patients with low EF is 75 y/o
- Thus, elderly are a evolving population for DT-LVAD (DT = Destination Therapy)

Reference: Mebra, etc. Listing criteria for heart transplantation. J Heart Lung Transplant, 2006;25:1024-1042

LVAD considerations

- Allow patients to return home to improved quality of life while waiting for transplant
- Waiting for end-organ failure or more subtle signs of debilitation is no longer acceptable
- Should be considered an elective procedure in a medically stable patient not a "bailout" for the patient in refractory low cardiac output heart failure

Reference: Stewart, Givertz. Mechanical Circulatory Support for AHF. **Circulation**: 2012:125:1304-1315

UNOS (United Network Organ System) Status Classification Heart Transplant Waiting List

- **Status 1A or *urgent need*:** Requires intensive care hospitalization, life-support measures, certain cardiac supporting intravenous medications with a Swan-Ganz catheter, or mechanical-assist device(s).
- **Status 1B:** Dependent on intravenous medications or a mechanical-assist device – in the hospital or at home.
- **Status 2:** Stable on oral medications and able to wait at home.
- **Status 7 or inactive list:** Inactive due to a change in condition – patients do not lose time they have already accrued.

Every ten minutes, someone is added to the national transplant waiting list.

119, 765 waiting for transplant – all organs

- 4093 waiting for heart transplant as of October 7, 2016
- 2382 Heart Transplants in 2016 as of October 7, 2016

http://www.unos.org/ Retrieved October 13,2016

Downstate Transplant Center Peoria, IL

- April 27, 1987 First Heart Transplant
  - April 2012 : 25 year survivor -- turned 80 y/o
- September 2016: 49 y/o heart transplant survivor celebrates 20 years of life with new heart
  - BiVAD: Bridge to Transplant for 4 months

Survival with LVAD

- Survival with HF listed as status II is similar to 2nd generation LVAD continuous flow pumps
- In 2009, only 14% of transplants occurred in status II patients
- LVAD may improved functional capacity and quality of life compared to optimal medical therapy

Reference: Stewart, Givertz. Mechanical Circulatory Support for AHF. **Circulation**: 2012:125:1304-1315

Back to Case Study #1 Admission Diagnosis

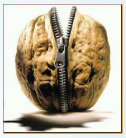
- Left thigh infected seroma with cellulitis at previous vein harvest site and previous hematoma site

Infection – I can handle that!

"What's an LVAD?"

"What do I do with it?"

LVAD Care in a Nutshell



- Is the patient talking to you?
  - This is GOOD!
- Did their caregiver come with them?
  - Use as a resource
- Call the LVAD center 800 number for advice
- Patient usually brings patient education manual with them – use it!

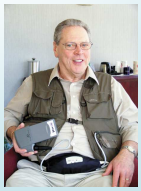
Caregivers and Patient

- Intensive Education
- Must master
  - Battery Changes
  - Driveline care
  - Device alarm troubleshooting

Caregiver

- The patient and caregiver will know more than we do as they live with this every day.
- It's okay for them to continue the care of the LVAD
- They take a "rescue bag" with them everywhere
  - Use this to get the implant center and MDs phone numbers

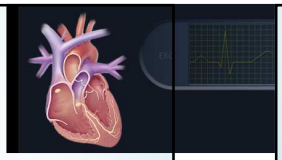
Patient Assessment



Assessment

- LVAD technology is advanced
- However, assessment techniques require a return to low-technology methods
- Assessments require basic nursing skills

Electrical System of the Heart



- Normally produces a mechanical response from the myocytes which causes contraction
- With LVAD electrical system less significant
  - Forward flow is maintained by pump not by mechanical response related to electrical activity
  - Pump operates irrespective of the electrical impulses
  - Arrhythmias that are typically lethal , may cause few or no symptoms in LVAD patient

Mechanical System

- Normally mechanical function of the heart produces forward flow of blood
  - This is measured as blood pressure and felt as a pulse
- When a patient has an dysfunctional ventricle, cardiac output is low and unable to sustain metabolic functions
- LVAD to failing heart restores forward flow
- LVAD either augments or takes over the function of the failing LV

Pulseless?

- LVAD is a continuous flow pump
- Blood moves in a constant flow pattern
- Constant flow does not produce a pulse
- Partial support may produce a diminished pulse
- Monitoring blood pressure and SpO_2 is difficult

Assessment

"*Back to the Basics*"

- Good peripheral circulation
  - Warm and pink legs and fingers
- Brisk capillary refill (< 5 seconds)
- Appropriate mentation
  - Follows commands
  - Able to talk to you and carry on normal conversation
  - Does not fall asleep
- Adequate urine output

Adequate Support/Circulation = all these present and absence of alarms from LVAD

Reference: Christensen, D. Physiology of Continuous-Flow Pumps. AACN Adv CC 2012;23:1,46-54

Blood Pressure

- LVAD produces blood flow during all phases of cardiac cycle
- No Systolic or Diastolic BP – it is a MAP
- Use doppler to get BP
- Target BP 70 – 90 mmHg

Pulse Oximetry

- May or may not be accurate due to little or no pulse
- Okay to monitor but in low saturation measurements, verify accuracy with ABGs

Vital Signs

- **B/P** Take manually with doppler.
  - The pressure you hear is the MAP
  - MAP should be 70 - 80
  - MAP > 90, call
  - With automatic BP you may get a systolic & diastolic pressure with a very narrow pulse pressure
- **Pulse** - - you may feel one radially, but it's not accurate. Need to Dopple.
- **Telemetry** – LVAD does not affect rhythm
- **Pulse ox** – likely accurate

Arrhythmias

- Use urgency to evaluate the cause of the arrhythmia
- If hemodynamically stable
  - Assess and treat arrhythmia in less urgent manner
- If hemodynamically unstable
  - Assess and treat arrhythmia immediately

Patient Pump Assessment

- Auscultate left upper quadrant over pump pocket as part of every assessment:
  - It should sound like a boat motor
  - If it sounds like a soda can with gravel in it, it's likely starting to clot.
    - What's the PT/INR?

Insertion Site

- The insertion site needs to be kept dressed at all times.
- After healed, sterile dressing changes are generally every other day – do what patient has been instructed
- Most of the time, family member will want to do the dressing change. You can watch, but it's fine for them to continue to do it.
- Assess site during dressing change. Notify MD if any concerns or signs of infection

Prevent infection

- Do everything you can to prevent infection!
- If the drive line gets infected, the patient will usually struggle with infection the rest of the time the LVAD is in.

Pump Assessment

Mechanics of LVAD

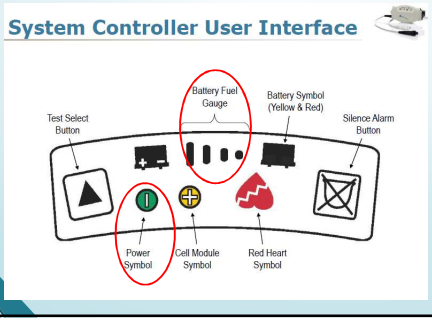
- LVAD is a machine
- Has no intuitive capabilities
- Programmed to run at certain speed
- Preload dependent
  - If inadequate blood is available for the pump to propel, the output of the pump decreases
  - When preload low (hypovolemia/dehydration), a negative pressure develops and lead to suction events in the ventricle

Power Source
Patient's Lifeline

Power Module
Use at Night

14 Volt Lithium Ion Batteries

This is what the controls look like up close and personal:

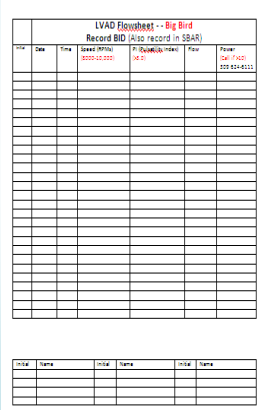


Device Parameters
Monitor every shift

- Document on flowsheet in patient's room:
- Device parameters
  - Speed
    - The speed of the rotor
  - Power
  - Flow
    - Flow range 3 – 10 liters/minute
  - Pulsatility Index (PI)
    - Measurement of the flow pulse through the pump

Observe for changes Call LVAD center for patient specific parameters.

Used for HeartMate II. HeartWare has different parameters


LVAD Flowsheet - - Big Bird
Record BID (Also record in SBAR)

Device Assessment

- Pump function
  - Auscultate left upper quadrant over pump pocket as part of every assessment:
  - It should sound like a boat motor
- Pump Parameters
- System controller settings, alarm status
- Review system controller event recorder log file
- Driveline connection to system controller and locked in place
- Exit site status, immobilization of driveline
- Backup system controller available & programmed

System Controller Self Test
Perform Daily

–Pump operation is not affected

–Checks lamps and audio tones only

•To Perform:

–Press and hold Test Select button

–After 3 seconds, verify all lamps illuminate and unbroken audio tone

–Release the button. Tone and lamps will remain for at least 5 seconds

Advisory & Hazard Alarms

- **Advisory Alarms**
  - Power Cable Disconnected
  - SC Battery Module Low
  - Replace System Controller
  - Low Speed Operation
  - Low Voltage
- **Hazard Alarms**
  - Low Voltage
  - Percutaneous Lead Disconnected
  - Low Flow
  - Loss of Power

At Night

- Connect to power module
- Power module should be plugged into generator outlet in case electricity goes out
- There is 30 minute battery backup on power module and it will alarm loudly
- Power module cable is 20 feet long
- If bathroom not close enough, get commode

Other tips

- When changing from power module to batteries or vice versa, only disconnect one cable at a time. Disconnecting both at the same time, the LVAD will stop
- Never disconnect the DRIVE line from the pump
- Be care with the DRIVE line and other cables that they don't get tangled or catch on anything especially when ambulating
- Patients can only shower if okay with implant surgeon and then they have a special protective bag.

Specific LVAD Patient Care

43

Complications

- Stroke
  - Embolic more common than hemorrhagic
  - Optimum level of antiplatelet and anticoagulation therapy is unknown
  - INR 1.5 – 2.0
- Infection
  - Percutaneous driveline
  - Pump pocket
- Bleeding
  - Acquired von Willebrand syndrome from high sheer stress on blood
  - Chronic anticoagulation induced bleeding
    - Gi bleeding
    - Hemorrhagic strokes
- Mechanical failure

Hypovolemia

- LVAD is preload (volume) dependent
- If patient becomes dehydrated it causes the cannulas to suck up the walls of the LV
- This can cause arrhythmias
- Thus, keep patient euvolumic

Remember Sepsis/Infection Patients need lots of fluid!

Suction events

- Caused by low preload (hypovolemia/dehydration)
- Negative pressure sucks part of the ventricular wall and covers cannula
- Can cause an arrhythmia
- Pump will alarm and automatically decrease the speed to release the suction
- Treatment = fluids!

Unresponsive?

- If LVAD running? If so, treat as any other unresponsive patient
  - Hypoglycemia
  - Stroke
  - Sepsis

Pump stops running

- Don't panic!
- Call implant center immediately
- Most patients have some heart function (EF) without the LVAD

Emergency Management

- Have the implant center phone numbers readily available
  - Place at Bedside
- Call them!
- Hand off these numbers to next shift

UnityPoint Clinic – Methodist Cardiology Patient

Emergency Contact numbers include:
- Dr Adler or MMG Cardiologist on call
- Debra Myers

Other Resources:
- University of Chicago VAD Coordinator 773-753-1880 pager # 4823
  - After hours: 773-702-2500 & ask to page the VAD coordinator on call
- Verify with patient if the patient is a University of Chicago or Northwestern patient.

Cheryl Herrmann is a great resource for questions:
Cell: 309-678-0559,
Home: 309-385-1082,

Tips:
- Avoid chest compressions , unless absolutely necessary as the cannulaes may dislodge in the heart.
- Do NOT place defibrillation paddles over the pump.
- Defibrillate at the nipple line or above
- Patient will not have a palpable pulse. You will need to use a doppler

For more info: www.thoratec.com

http://www.thoratec.com/videos/mp-mcs.aspx

Emergency Management

- Arrhythmias are major cause of emergencies
  - If LVAD is running, blood is still circulating
  - OK to defibrillate or cardiovert or external pace
    - Do not stop the pump!
    - Do not place pads over implanted pump
- Do NOT do chest compressions.
  - Compressions will displace cannulas
  - Call implant center before doing compressions
  - If LVAD is running, blood is still circulating
- Dehydration can cause lethal arrhythmias.
  - Need immediate bolus

Most Important!!

- No single parameter is a substitute for monitoring patient's clinical status!!
  - Note baseline values
  - Trends
  - Abrupt changes

LVAD in a Community Hospital Preparation

LVAD Training

October 17 & 18th CVICU, 5C, Rehab, Home Health RNs and Supervisors

Come learn the LVAD Assessment & Care

HLVI (MMG Cardiology) Classroom

Thursday October 17th

0745 – 0845

1345 – 1445

1500 - 1600
(Mostly for Home Health RNs – others welcome)
1745 – 1845

Friday October 18th

0745 – 0845

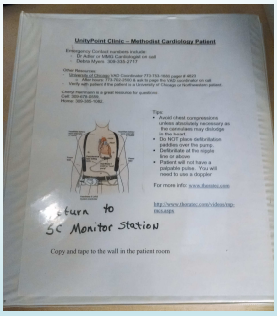
1000 – 1100
(Mostly for Home Health RNs – others welcome)
1200 – 1300 (ED MDs only) Café III

1745 – 1845

Resource Book

ED, CVICU, Progressive unit, Rehab & Nursing Office

- Alarm Flowcharts
- Emergency Management
- Emergency Contacts
- Patient LVAD pump resource manual



Placement of Patients

- CVICU if critically ill
- Cardiac Progressive if stable
- Rehabilitation Unit

Other Resources

- www.thoratec.com
- http://www.thoratec.com/videos/mp-mcs.aspx
- Hospital specific online LVAD learning module with quiz
- Also did education for EMS system

Destination to "Nowhere"

- Situations in which the device offers little or no improvement in quality of life
  - Ie – patient has stroke

Palliative Care

Discussion Topics

1. What to do if the LVAD fails and the patient requires an emergent operation
2. What to do if multiorgan failure develops and the LVAD does not seem to be helping a "futile "situation
3. What to do if the LVAD device becomes infected
4. What to do if the patient has a postop stroke
5. What to do if a patient has a traumatic injury or a terminal malignant tumor and the LVAD is functioning properly

Source: O'Neill. B. Destination to Nowhere. CCN 34:2,52

In Summary.....

- Many patients as recent as 10 years ago would have died without the support of LVADs and are living relatively normal lives
- More patient will come to the community hospitals because of other problems not LVAD problems
  - Abdominal pain
  - Gall stones
  - GI bleed
  - Pneumonia, etc