

# Management of a long term LVAD patient for a non-LVAD specialist

## Topic- Management of a long term LVAD patient for a non-LVAD specialist. 20 mins

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## Take-Home Points

- There is always a VAD Coordinator available 24/7
- It is a patient with an LVAD and not an LVAD with a patient
- When in doubt

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## LVAD

	HM3 controller	HVAD controller
Flow	4.0	4.0
Power	3.8	4.0
Speed	3.8	4.0
PI	3.8	4.0
PII	3.8	4.0

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## Topics of Discussion

- Basics
- Shared care
- Cases
- VAD parameters
- Anticoagulation
- Blood pressure management
- Testing and clinic visits
- VAD complications

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## VAD Basics

- Two devices currently available as DT or BT (HM-3 and Heartware)
- Keep it simple and stick with one device in the beginning
- Establish relationship with implant site and establish guidelines
- Figure out needs of both facilities
- Establish protocols for management of BP, anticoagulation, driveline infections and other complications
- Communication is the most important factor
- Be comfortable with what you know and more importantly with what you don't know
- Four parameters when you interrogate a VAD (Flow/Power/Speed/PI)
- MAP goal 60-80 mm Hg
- INR goal of 2-3 with ASA 81 mg daily
- Momentum trial (HM-3)- 77% survival, 10% stroke risk and 1% thrombosis at 2 years

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## Shared Care

- Partner with an implant site
- Shared responsibility and accountability
- Borrow protocols don't reinvent the wheel
- Establish what you are comfortable with and what you will need assistance with
- Partner with an individual not an institution
- You are a valuable referral source and a partner

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# Management of a long term LVAD patient for a non-LVAD specialist

### CASE 1

- You are seeing a 50 year old male s/p implant of HM-3 (6 weeks ago)
- Here for routine follow-up visit
- Main complaint is dizziness
- Medications-Lisinopril dose increased to 10 mg po bid/carvedilol 12.5 mg po bid/bumex 1 mg po bid
- PE-JVP flat/no edema, HR 80, No palpable pulse, Doppler MAP 80 mm Hg, lungs clear, VAD hum
- Labs-cr 1.7, bun 50, LDH 225, INR 2.3, Hg 12

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### Case 1

- VAD Interrogation
- Speed-5600
- Power-4.5 watts
- PI-2
- Flow-3 L/min
- Echo-LVEDD 5.0 cm, normal inflow and outflow velocities, septum midline, minimal MR, No AI, AV closed, IVC small
- ECG-Paced rhythm
- ICD Check-no VT/AF

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### Case 1

- Conclusion: Patient is likely dry and I would decrease his diuretic dose

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### VAD Parameters

- Speed-Pump speed is measured in RPM, and is adjusted with the aid of echocardiography to allow adequate left ventricular (LV) filling without development of suction (excessive emptying) with some aortic valve opening and no more than mild mitral regurgitation.
- Flow-Pump flow is measured in L/minute, and is dependent upon the pump speed setting and the pressure gradient across the pump (ie, preload and afterload). Pump flows are calculated from the pump speed and power use, with higher pump speeds and power resulting in higher displayed flows. However, these flows are only estimates and are not measured by a flow sensor

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### VAD Parameters

- Power-Pump power is measured in watts (W). Generally, there is a linear relationship between pump power and pump flow. Increases in LV preload and high pump speed settings increase pump flow and increase power consumption. The presence of aortic insufficiency also necessitates increased power consumption to generate increased pump flow. An abrupt increase in power output may indicate pump thrombosis or malfunction.
- Reductions in power consumption are typically due to reduced preload with reduced pump speed, but may occur with inflow cannula obstruction.
- PI-The PI is a dimensionless measure of the extent of LV pulsatility. The pulsatility index is inversely related to the amount of assistance provided by the pump. A low pulsatility index typically indicates either low intravascular volume or minimal native cardiac function. It is affected by LV preload, afterload, contractility, heart rate, and rhythm, as well as by pump speed.

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### Case 2

- 70 M s/p HM-3 as DT
- Post-operative course uneventful
- INR goal 2-3, ASA 81 mg daily
- VAD parameters-Speed 5500 RPM
- Clinic visit-dizziness/dark stools
- Exam-MAP 71, HR 80, INR 2.8, Hg 6.1 and platelet 200k
- VAD interrogation-Low flow alarms, PI of 1.8 and frequent PI events

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# Management of a long term LVAD patient for a non-LVAD specialist

## Case 2-Next steps

- A. Transfuse and send home
- B. Admit to ICU, Type and cross, GI consult, hold anticoagulation
- C. Reverse Anticoagulation
- D. Change VAD parameters

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## Case 2 continued

- Patient scoped, no clear source of bleeding noted
- Transfused
- What would you do next?
  - A. Restart AC (asa/Coumadin) with heparin GTT
  - B. Restart AC without heparin bridge
  - C. Change VAD parameters
  - D. Hold Coumadin and aspirin at discharge
  - E. B and C

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## Case 3 continued

- First bleed I usually resume same INR goal and ASA dosage
- If recurrent bleed, consider asking GI for push enteroscopy (upper small intestine)

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## Anticoagulation

- Goal INR 2-3
- Coumadin and ASA
- NOAC's are currently not approved
- Obtain protocol from implanting center
- Discuss strategies for AC if INR is sub-therapeutic (Lovenox or heparin)
- Discuss strategies for management if INR is supratherapeutic

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## Bleeding and anticoagulation considerations

- GI BLEEDING
  - Decreased pulsatility has been considered to be a reason for increased bleeding in this patient population
  - Consider lowering anticoagulation/antiplatelet
- Thromboembolic events
  - Ischemic and hemorrhagic
  - Maintain if possible pump flow >3 LPM
  - Do not over anticoagulate to avoid hemorrhagic stroke
  - Infection has the potential to increase risk of bleeding and stroke

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## Other VAD Complications/Management Issues

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# Management of a long term LVAD patient for a non-LVAD specialist

## Hemolysis

- Plasma free HG >40 mg/dl
- LDH (3X upper limits of normal)
- Other clinical signs associated with hemolysis can include
  - anemia, low HCT, elevated bilirubin, hematuria, signs of heart failure, changes in Power (watts)

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## Infection

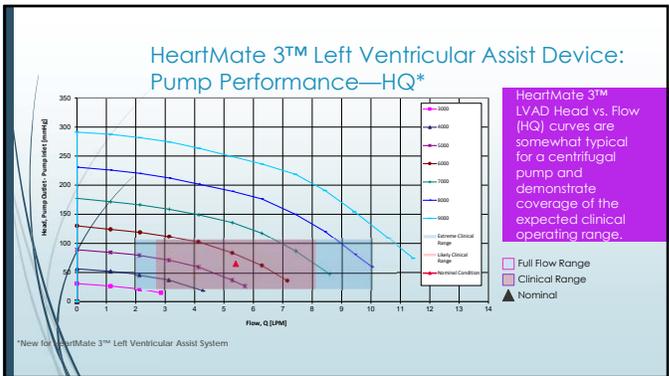
- Avoid movement/trauma to the driveline
- Meticulous aseptic lead exit site care
- Report any drainage/fever to implant center for further recommendations
- Showering
- Consider handedness of the patient prior to implant

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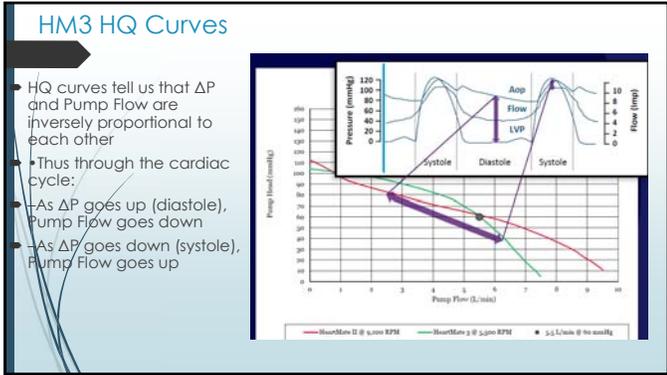
## Blood pressure management

- MAP goals are 60-80mm Hg
- Mean should not exceed 90 mm Hg
- HTN can decrease forward flow
  - Decrease in pump flow and power
  - Increase in PI
- Management of BP will help improve cardiac support and minimize risk of stroke
- Agents (ACE/ARB/BB/Hydralazine/Volume management)

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## Low Flow Management

Low CVP	High CVP without LV Collapse	High CVP + LV collapse
Bleeding	Volume Overloaded	Consider:
Volume depleted	Consider:	RV Failure
Consider:	Increase pump speed and monitor flow	Pulmonary hypertension
Volume repletion	Reassessment	Rule out tamponade
Check HCT		

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# Management of a long term LVAD patient for a non-LVAD specialist

## Arrhythmias

- VT or VF
- Pump Flow
- Power
- PI
- PI events

- **Typical causes**
- Electrolyte abnormalities
- Hemodynamic
- Adrenergic agents
- Elevated pump speed
- Inlet cannula touching septal wall

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## LVAD Post-operative parameter values

Value	Typical Range
Speed (RPM)	4850-6450 (Median 5400 RPM)
Flow (LPM)	2.9-7 LPM (Median 4.4)
Power (Watts)	3.2-6 watts (median 4.1 watts)

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## Optimal Speed Setting

- Normal CI
- Normal LV size
- No septal shift
- Intermittent Aortic valve opening

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## PI Events

- Not all PI events require clinical action
- If multiple PI events are noted and/or the patient is symptomatic investigating the cause is necessary
- Echo is useful in determining the cause
- Management may include: decreasing speed/volume management/cardiobversion

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## Adverse events

- Infection
- Bleeding
- Stroke
- Death
- Right heart failure
- Arrhythmias
- Hemolysis
- Pump thrombosis

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## Testing

- 6 MWT-Do this in your office
- Echocardiogram-Month 1, month 3, month 6 then every 6 months
- Ramp Study/LV optimization-Touch base with implant center
- ECG-Every visit
- Device Interrogation-93750 (every visit)

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