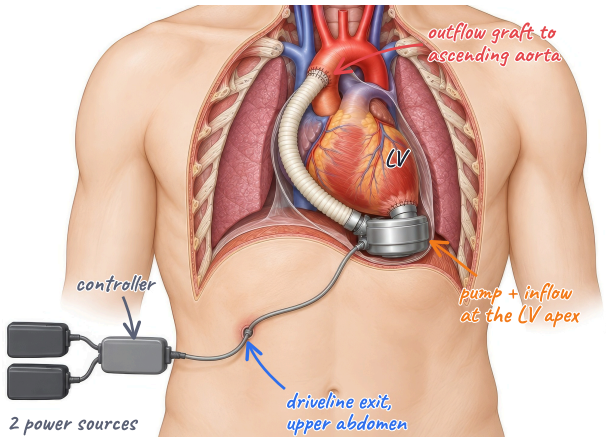
ER BASICS · ONE-PAGER

LVAD Basics

HeartMate 3 parameters, alarms, complications, anticoagulation and arrest care for critical care and transport exams

14 sources + more detail
erbasics.com/sheets/lvad.html
checked Oct 2026

DEVICE Pump, graft, driveline, power



1 The device

- Inflow at the LV apex, outflow to the aorta, driveline to an external controller and two power sources.
- HeartMate 3 (Abbott) is the only durable LVAD on the US market (newer pumps are trial-only): centrifugal, fully magnetically levitated.
- HVAD (withdrawn 2021) and HeartMate II pumps remain in a few patients.
- Preload dependent and afterload sensitive.

EXAM TIP A palpable pulse is often absent (some patients have one), so no pulse alone is not arrest. HeartMate 3 shifts speed every 2 seconds (an artificial pulse) that you may hear on auscultation.

2 Pump parameters

Trend against the patient's baseline; no single number defines status.

PARAMETER	WHAT IT IS	WHAT CHANGES MEAN
Speed (rpm)	Fixed by the VAD team; adults often 5,000 to 6,000	Set speed should not change (except brief PI-event drops)
Flow (L/min)	Estimate from speed, power, Hct	Low: low preload, high MAP, RV failure, tamponade
Power (W)	Measured energy to spin the rotor	Rise: thrombus or aortic insufficiency (report 10 W or more); slow fall: obstruction
PI	Flow pulse from native LV beats	Drop: low volume, bleeding, RV failure

PI event (LV collapse sensed): speed drops to the low limit, then ramps back, without an alarm. Thrombus raises power, so calculated flow may read falsely high.

3 Blood pressure and alarms

- Doppler with a manual cuff: the pressure where flow returns approximates MAP. Arterial line if unstable.
- MAP goal 75 to 90 mm Hg (ISHLT 2023); higher MAP lowers flow and raises stroke risk.
- Automated cuffs and SpO2 often fail; get an ABG if unstable.

ALARM	MEANING	FIRST STEPS
Low flow (red)	Under 2.5 L/min	Check connections; assess volume, bleeding, rhythm, RV
Pump off or driveline out (red)	Pump stopped	Reconnect; fresh batteries; controller swap if VAD center directs
Low battery (red)	Under 5 min left	Change power now
Advisory (yellow)	Battery under 15 min or a cable off	Reconnect or replace power

SAFETY Keep one power source connected at all times and change batteries one at a time; removing both stops the pump.

4 Complications

PROBLEM	CLUES	RESPONSE
Suction	Low flow, low PI, PVCs or VT, small LV	Volume or blood; treat the cause
Pump thrombosis	Rising power, high LDH and free Hgb, dark urine	IV heparin or bivalirudin; pump exchange if refractory
GI bleeding	Melena, falling Hgb (AVMs, acquired vWF loss)	Hold or reverse anticoagulation; endoscopy
RV failure	High CVP, low flow and PI	Inotropes, inhaled pulmonary vasodilator, RVAD
Stroke	New deficit, severe headache	Stat CT/CTA; hold anticoagulation until bleeding excluded
Driveline infection	Exit-site redness, drainage, fever	Cultures, antibiotics; often S. aureus or Pseudomonas

EXAM TIP Exam pairs: rising power, high LDH and dark urine mean pump thrombosis. Low flow and low PI after bleeding mean suction from low preload; give volume, not more speed.

5 Anticoagulation

- Warfarin, INR usually 2.0 to 3.0 (the implant center sets it).
- HeartMate 3: no routine aspirin since the August 2024 FDA label change (ARIES-HM3: fewer bleeds, no more clots).
- HeartMate II or HVAD patients may still take aspirin.
- Hold for significant bleeding; reverse if life-threatening with a high INR. Follow your institution's protocols.

6 Cardiac arrest (AHA 2025)

Check perfusion, not pulse. Adequate if any: normal skin color and temperature, normal capillary refill, MAP over 50 mm Hg (Doppler or arterial line), or PETCO2 over 20 mm Hg via ET tube or tracheostomy (supraglottic airways read falsely high).

1. Unresponsive: support ventilation, assess perfusion.
2. Adequate perfusion: no compressions; keep monitoring.
3. Impaired perfusion: compress now while a second rescuer checks alarms, hum, driveline, power and controller.
4. Either way, treat non-LVAD causes: arrhythmia, bleeding, low glucose, hypoxia, overdose, RV failure, sepsis, stroke.
5. Defibrillate and give ACLS drugs as usual; leave the pump connected.
6. Transport and contact the VAD center.

SAFETY Do not delay compressions to troubleshoot the pump. AHA 2025 calls dislodgement a theoretical risk; ISHLT links delayed CPR to higher mortality.

EXAM TIP Exam trap: unresponsive but warm with a MAP over 50 is not arrest; do not compress.

VT or VF may be tolerated while the pump flows, but treat it; ISHLT advises against letting it run over 30 minutes.

7 Transport

- Bring the backup controller, charged batteries, cables and the caregiver.
- Call the implant center's VAD coordinator (ask the patient or caregiver for the number); go to a VAD center if possible.
- Secure the driveline without pulling, twisting or kinking.
- Ground or air transport is fine; no MRI. Follow your agency's or institution's protocols.

MORE Continuous-flow physiology: why the pulse pressure narrows

A durable LVAD drains the LV apex and returns blood to the ascending aorta, in parallel with the native heart. The rotor runs at one fixed speed, so flow depends on the head pressure across the pump (aortic minus LV pressure): when the native LV contracts, head pressure falls and pump flow rises; in diastole flow falls. That swing is the pulsatility index (PI).

Unloading through the whole cycle lowers LV end-diastolic, wedge and left atrial pressures. Output is pump flow plus whatever the LV still ejects through the aortic valve, which in a well-unloaded ventricle opens intermittently or not at all. Diastolic pressure is held up by continuous flow and systolic pressure is barely augmented, so pulse pressure narrows to roughly 10 to 20 mm Hg: the pulse is weak or absent, oscillometric cuffs and oximeters fail, and the Doppler opening pressure stands in for MAP.

For education and exam preparation only. Not medical advice; follow current guidelines and your institution's protocols. ER Basics is an independent study aid not affiliated with any certifying body.