Left Ventricular Assist Device (LVAD) Complications

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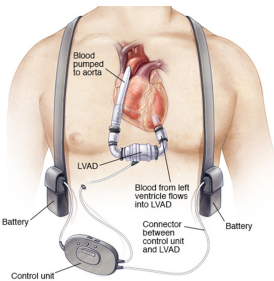
C Partyka et al. *Emerg Med Australas*, 2014. PMID 24707998
M Anderson et. al. *J Heart Lung Transplant*, 2009 PMID 19560703
JC Greenwood et al. *Emerg Med Clin North Am*, 2014. PMID 25441039

Tips

- These patients **MAY NOT HAVE A PULSE**
  - May need ABG since pulse ox may be inaccurate without pulse
- Contact your hospital's or network's LVAD Coordinator immediately to help with management and troubleshooting.
- Patients are usually on diuretics, and may intravascularly depleted or have electrolyte abnormalities



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LVAD Patient in Extremis: Step-Wise Diagnostic Approach	
1st	• Address airway, breathing, circulation; Obtain IV, O2, monitor • Measure blood pressure: May need manual cuff with Doppler to obtain mean arterial pressure (MAP), or use arterial line (MAP goal 70-80 mmHg) • Assign someone to call LVAD Coordinator
2nd	• **A**uscultate precordium. Is there a hum? – Yes → LVAD is working. No → LVAD is not working. • **B**attery – Make sure it is plugged in. • **C**ontroller – Check for alarms. • **D**riveline – Check device type, evidence of infection/damage • **E**chocardiogram
3rd	• Obtain VAD variables: Flow, Power, Speed, Pulsatility Index
4th	• Obtain ECG • Obtain labs (CBC, electrolytes, coagulation studies, LDH, type and screen given GI bleed risk, ± blood cultures for infection concern, ± ABG)

Echocardiogram Findings	Potential Causes	Management (with LVAD team)
Big RV + Big LV	Pump failure, Pump thrombosis Valve disorders	Heparin, antiplatelet agents, thrombolytics
Big RV + Small LV	Right heart failure, ST-elevation MI Pulmonary hypertension **Note**: If LV to outflow cannula size ratio is 1:1, then high risk for suction event	IV fluids, ECG, consider inotropes
Small RV + Small LV	Hypovolemia Sepsis GI bleed	IV fluids, consider blood transfusion, antibiotics

Updated 11/21/16

LVAD Complication	Comment	Management (with LVAD team)
Arrhythmia	Up to 50% with sustained VT/VF in first 4 weeks after LVAD placement Difficult to determine primary vs. secondary cause: • **Primary**: compromised myocardium + scar tissue **Secondary**: electrolyte abnormalities, hypotension, suction events	Depending on the cause: • IV fluid challenge is reasonable • Reduce pump speed • Correct electrolytes • Electrical or pharmacologic (amiodarone) cardioversion
Infection	Up to 42% experience sepsis within 1 year (REMATCH Study). Most infections are in first 3 months. 9% are fungal.	Broad spectrum antibiotics + antifungal
Thrombus (pump thrombus, PE, stroke/TIA)	High risk despite anticoagulation. Pump thrombus suggested by warm device and increased power output. Elevated LDH	Heparin, thrombolytics, antiplatelet agents
Bleeding	Patients may have an acquired Von Willebrand Disease coagulopathy	If life-threatening, reverse anticoagulation and transfuse as needed.
Suction Event (An underfilled LV causing suction of myocardium into LVAD)	Can be caused by right heart failure, hypovolemia, sepsis, restrictive cardiomyopathy, arrhythmias	IV fluids to increase LV filling
RV Failure	Due to AMI or previous RV failure	IV fluids and consider inotropes. Aspirin and heparin if AMI
Cannula Malposition	Consider in setting of new VT, suction event, chest compressions, or trauma	Requires surgical exploration
Device Malfunction, Pump Failure	Suggested if no hum and MAP <40 mmHg	Treat cardiogenic shock: IV fluids, vasopressors, ACLS protocols, consider heparin for thrombosis
Cardiac Arrest	Multiple potential causes including all those listed above	ACLS algorithms except: • Chest compressions are controversial as they could dislodge the device. • Do NOT place defibrillation pads directly over device. • Assign one person to assess device placement during and after code.

AMI: acute myocardial infarction; GI: gastrointestinal; LV: left ventricle; MAP: mean arterial pressure; PE: pulmonary embolism; ROSC: return of spontaneous circulation; RV: right ventricle; TIA: transient ischemic attack; VT: ventricular tachycardia; VF: ventricular fibrillation

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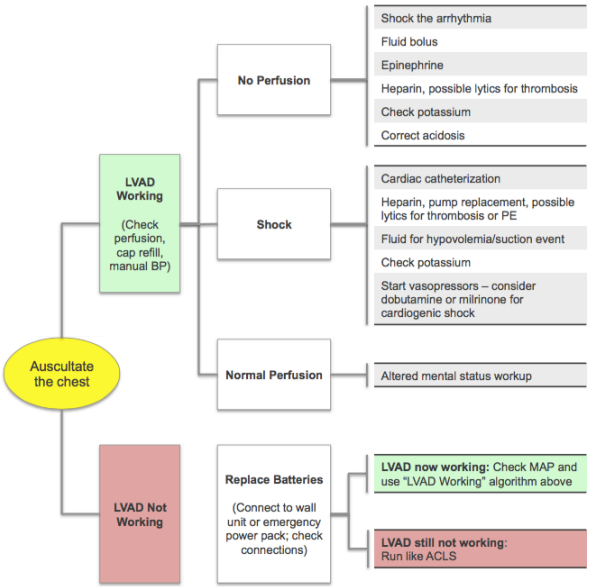
Altered LVAD Patient



Adapted from algorithm by Dr. Zach Shinar at EMCrit.org

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