No Flow, Know Flow: ECMO Rescue After Splenic Hemorrhage in an LVAD Patient

Hassan Kashif MS-2, Christopher Belcher MD, Javed Osmani DO, Blake Davidson MD

University of Kentucky College of Medicine

Introduction

- LVAD patients may present without palpable pulses or traditional hemodynamic markers, requiring vigilance for low-flow or device alarms [1]
- Cardiac arrest in LVAD patients carries high in-hospital mortality, with reported rates of 60.8% overall and 74.3% among those receiving CPR. [2]
    - Early ECMO intervention improves mortality and neurologic outcomes [3]
- Hypovolemia from intra-abdominal hemorrhage is a less common but fatal etiology of LVAD low-flow. [4]

Case Presentation

A 32-year-old man with a HeartMate III LVAD was brought to the ED by EMS minimally responsive with agonal respirations following reports from family of loud alarm coming from LVAD. Assessment of LVAD revealed a low flow state of 1.2L/min.

Differential Diagnosis

- Thrombosis
- Bleed
- Infection
- Other

ED Evaluation

Physical exam: acute distress, ill-appearing, absent of hum of LVAD, agonal respirations, capillary refill >3 seconds, GCS 3

Medical History: Nonischemic cardiomyopathy due to sarcoid myocarditis, heart failure with reduced ejection fraction (HFrEF), biventricular heart failure, stage 3b chronic kidney disease, chronic liver disease and cirrhosis

Results

•MCS code was called and CPR followed by ACLS was initiated due to agonal respirations. Patient became unresponsive during compressions. ECMO team was called and ECPR was completed with continued compressions.
•XR and CT post ECPR revealed hemoperitoneum and active extravasation around spleen from pseudoaneurysm
•Laparotomy was performed, revealing intra-abdominal hemorrhage due to splenic hilar hemorrhage with clear abdominal compartment syndrome.
•Splenectomy was performed resulting in resolved compartment syndrome and improved ECMO/LVAD flow
•Hospital day 3: Exploratory Laparotomy was performed, patient received 26L of blood
•Hospital Day 7: Patient mental status slow to recover and neurology stated chance of full/partial recovery. Patient underwent VA ECMO explanation and tracheostomy
•Discharged on care on Day 15 with GCS 9 & LVAD flows of 3.5-3.8L/min

Discussion

1. Activate LVAD and ECMO teams early for any known or suspected LVAD patient in distress to expedite device evaluation and circulatory support if needed [5]

2. Initial assessment should focus on mental status and auscultation: unresponsiveness with absent pump hum suggests a hypoperfusive or arrested state and warrants immediate CPR. [7]

3. Chest compressions are safe in modern LVADs and should follow standard ACLS protocols. Defibrillation should only be used if a shockable rhythm (VF/VT) is confirmed.

4. Evaluate the LVAD controller promptly:
    1. Low flow = possible hypovolemia or hemorrhage
    2. High power = potential pump thrombosis
    3. Ensure the device is powered and connected properly.

5. LVADs are preload dependent, meaning that any condition that reduces venous return can rapidly decrease device output and cause collapse. [8]

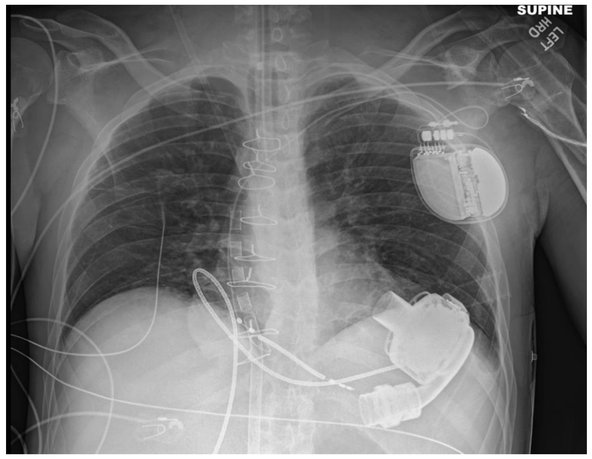

Figure 1. Supine chest radiograph demonstrating HeartMate III LVAD in the left upper quadrant. Endotracheal tube, ECMO cannulae, and central lines are visible, consistent with post-ECPR and intubation status.

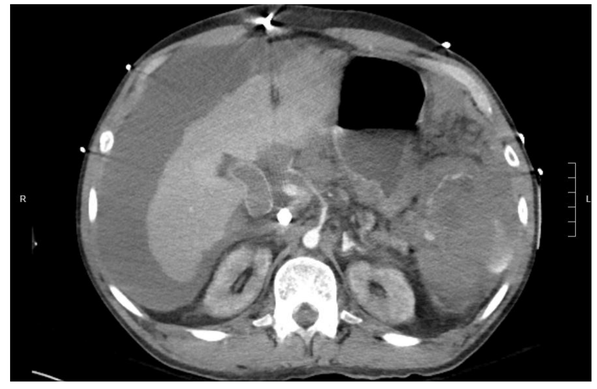

Figure 2. Contrast-enhanced CT abdomen revealing contrast at the splenic hilum, suggestive of active arterial bleeding. Surrounding hemoperitoneum supports the diagnosis of a ruptured splenic pseudoaneurysm

References

1. Long B. LVAD Patients: What You Need to Know. emDOCs.net - Emergency Medicine Education. Published July 24, 2015. https://www.emdocs.net/lvad-patients-what-you-need-to-know/
2. Barssoum K, Patel H, Rai D, et al. Outcomes of Cardiac Arrest and Cardiopulmonary Resuscitation in Patients With Left Ventricular Assist Device; an Insight From a National Inpatient Sample. *Heart, Lung and Circulation*. 2021;31(2):246-254. doi:https://doi.org/10.1016/j.hlc.2021.05.096
3. Jer C, Ryan Ruiyang Ling, Ramanathan K, et al. Extracorporeal cardiopulmonary resuscitation versus conventional CPR in cardiac arrest: an updated meta-analysis and trial sequential analysis. *Critical Care*. 2024;28(1). doi:https://doi.org/10.1186/s13054-024-04830-5
4. Takagi A, Nagai E, Toda T, et al. Emergency laparoscopic cholecystectomy for intraabdominal hemorrhage in a patient with a left ventricular assist device: a case report. *Surgical Case Reports*. 2019;5(1). doi:https://doi.org/10.1186/s40792-019-0756-9
5. Tonna JE, Abrams D, Brodie D, et al. Management of Adult Patients Supported with Venovenous Extracorporeal Membrane Oxygenation (VV ECMO): Guideline from the Extracorporeal Life Support Organization (ELSO). *ASAIO Journal*. 2021;67(6):601-610. doi:https://doi.org/10.1097/MAT.0000000000001432
6. Mukherjee, MD DM. CPR in Patients With Mechanical Circulatory Support - American College of Cardiology. American College of Cardiology. Published 2017. Accessed June 7, 2025. https://www.acc.org/latest-in-cardiology/ten-points-to-remember/2017/05/29/15/17/cardiopulmonary-resuscitation-in-adults-and-children?utm_source=chatgpt.com
7. Hayek S, Sims DB, Markham DW, Butler J, Kalogeropoulos AP. Assessment of Right Ventricular Function in Left Ventricular Assist Device Candidates. *Circulation: Cardiovascular Imaging*. 2014;7(2):379-389. doi:https://doi.org/10.1161/circimaging.113.001127