



Management Of Acute Cardiogenic Shock Secondary To Viral Myocarditis Using Mechanical Circulatory Support

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Background

- Viral infections ranging from Influenza A to Covid-19 are associated with fulminant myocarditis and can progress to hemodynamic instability with cardiogenic shock, arrhythmias, and multi-organ failure in as few as 2 days.¹
- Consequently, early diagnosis and prompt initiation of life support-based treatment are imperative for mitigating mortality risks.
- Mechanical circulatory support devices have enhanced survival rates compared to vasoactive support alone. These devices include intra-aortic balloon pump, extracorporeal membrane oxygenation (ECMO), Impella and Ventricular Assistance Devices (VADs).

Case Presentation

A 38-year-old female with a history of PCOS presented to the emergency department after a syncopal episode at home. She had tested positive for Influenza Type A at urgent care and since had experienced poor oral intake and chest pressure. Initial vital signs revealed hypotension (BP 46/28) and tachycardia. Electrocardiogram revealed ST elevations in leads II, III, aVF, V4 and V5 with troponin level in the 60s.

Initial Management

- Initial concern was for acute cardiogenic shock in the setting of suspected viral myocarditis. Patient was started on norepinephrine for hypotension and admitted to the cardiac ICU.
- Transthoracic echocardiogram showed left ventricular global hypokinesis with cardiac index of 1.1. Swan-Ganz catheterization showed a right atrial pressure of 0.9 and mixed venous sat of 38%. A dobutamine infusion was started. Cardiothoracic surgery was consulted for mechanical circulatory support.

Initial Management

Cardiothoracic Surgery Consult

- Patient taken to the OR with a plan for Impella device placement under monitored anesthesia care, but placement was unsuccessful due to inadequate size of the right axillary artery.
- Patient instead placed on VA ECMO via femoral cannulation and admitted to CTICU.

Intensive Care Unit Management

- **Hospital day 1:** Patient went into atrial fibrillation with rapid ventricular response with low aPTT and was taken to OR for a suction thrombectomy under MAC after the discovery of a RA thrombus (Figure 1) on bedside echo.
- Due to failure to relieve significant clot burden and stasis of the heart, she was transitioned to cardiopulmonary bypass, then converted from VA ECMO to biventricular assist devices (BiVAD, Figure 2). Patient received 10 pRBCs, 7 FFP, 4 PLT, 4 cryoprecipitate.

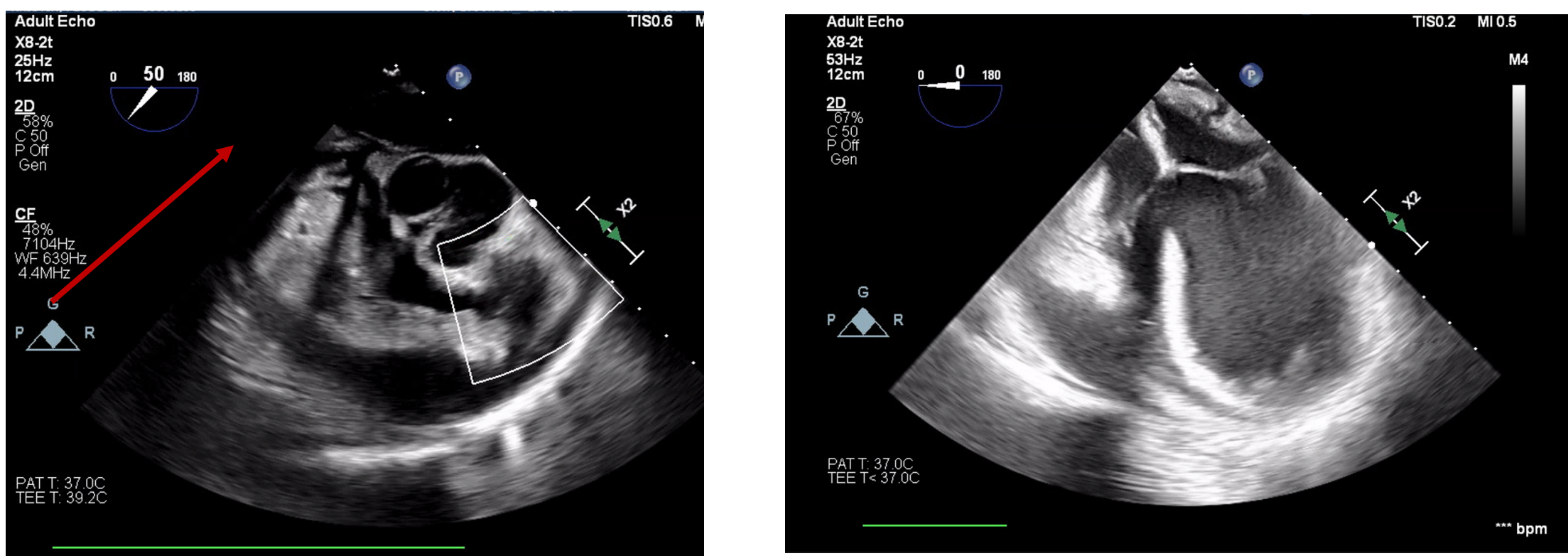


Figure 1: RV thrombus with significant clot burden and stasis of heart visualized on echocardiography

Intensive Care Unit Management

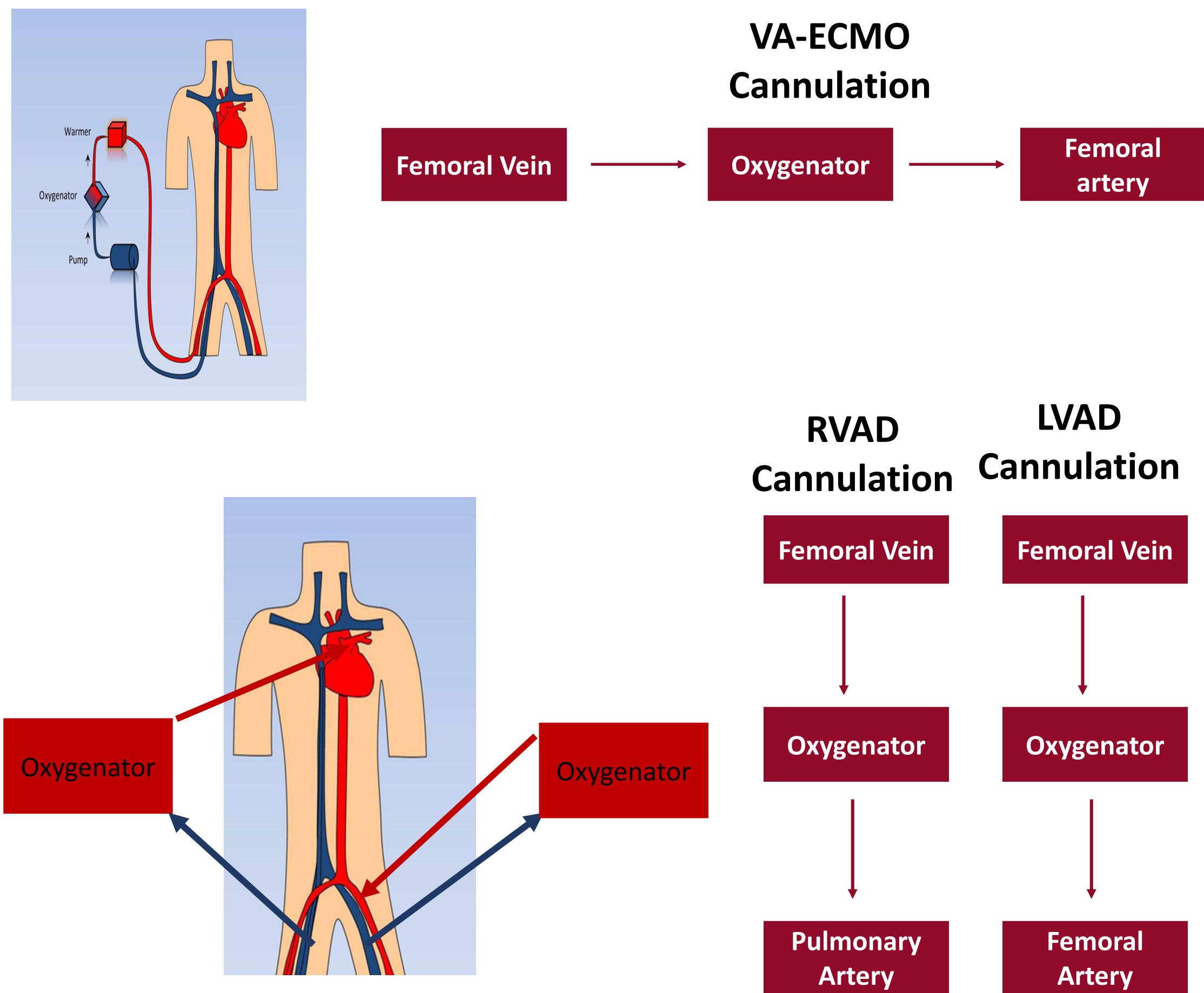


Figure 2: VA ECMO² with femoral cannulation to BiVAD² and the corresponding cannulations.

- **Hospital Day 7:** Due to continued improvement (stable with appropriate flows on RVAD/LVAD), she went to the OR to wean from BiVAD to VV ECMO (required 6LPM sweep 90% FiO₂). However, she had RV distension, intra-op bleeding, and bigeminy (given amio/lido), so she was transitioned to VAV ECMO instead.
- **Hospital Day 8:** Inotropes decreased (on epi, milrinone, and low dose levo/vaso) with cardiac function returning, transitioned to VV ECMO (Figure 3).
- **Hospital Day 10:** Successful VV ECMO decannulation
- **Hospital day 28:** She remained oliguric despite tolerating regular diet and diuretic challenges, so a subclavian hemodialysis catheter was placed.

Intensive Care Unit Management

- **Hospital Day 31:** She was discharged requiring only hemodialysis, antibiotics, and anticoagulation.

Follow-up: At 14-day follow-up, she endorsed improvement in urine output and tolerated physical therapy.

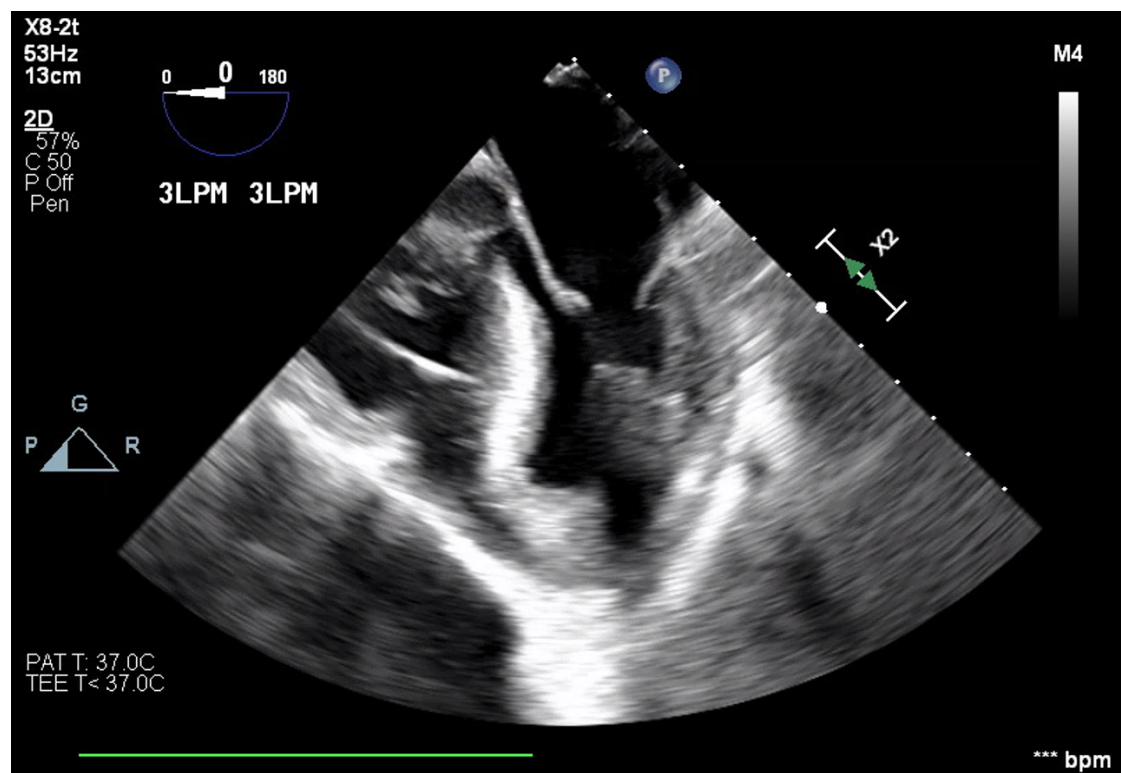


Figure 3: Echocardiography showing now decompressed right and left ventricles on 3LPM

Conclusions

- This case highlights the importance of prompt recognition and intervention in patients with fulminant myocarditis associated with viral infections.
- Use of mechanical circulatory support devices (BiVAD and ECMO) were important in stabilizing her condition and facilitating eventual recovery.
- The patient's progression from the brink of cardiac collapse to being discharged from the hospital and undergoing physical therapy demonstrates the profound impact of mechanical circulatory support devices in improving outcomes in refractory cardiogenic shock.

References

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2. Lawler, Patrick R., et al. "Extracorporeal membrane oxygenation in adults with cardiogenic shock." *Circulation* 131.7 (2015): 676-680.