

Emergency Department Extracorporeal Membrane Oxygenation/Extracorporeal Life Support for Out of Hospital Cardiac Arrest (ED ECMO for OHCA)

Broadened Criteria to Initiate ED ECMO EVAL

- a) Adults <70 years
- b) Out of hospital cardiac arrest
- c) VF/VT First presenting rhythm
- d) Remains in cardiac arrest after 10 minutes of ACLS

ED ECMO EVAL Page can out if ALL above criteria met

Exclusion Criteria:

- a) Significant Trauma
- b) Suicide
- c) Overdose
- d) Pre-existing significant neurological disability
- e) *Confirmed* or *presumed* significant non-cardiac co-morbidities that cause limitations in activities of daily living such as:
 - i. COPD, pulmonary fibrosis (exclude patients on oxygen)
 - ii. Liver cirrhosis (exclude patients with ascites, stigmata of liver disease, jaundice, upper GI bleeding)
 - iii. Renal failure on dialysis (exclude patients with fistula or tunneled catheter present)
 - iv. Cancer (exclude patients with port)
 - v. Morbid obesity (due to technical difficulties with emergent cannulation)
 - vi. Severe and uncontrolled CHF (exclude patients with severe pitting edema)
 - vii. VAD patients (mechanical circulatory support)
 - viii. Active infection in groin

Upon ED Arrival-- Exclusion Criteria

1. Arterial PaO₂ <50mmHg upon arrival to ED

Physician MAY consider these additional criteria for cancellation of ECMO

1. *ETCO₂ during resuscitation OR upon ED arrival of <10cmH₂O*
2. *Lactate >18 mmol/dL*
3. *NIRS/rSO₂ upon arrival to ED <42%*

Pre-hospital and Emergency Department Process:

1. BLS/ALS calls base to report medical/cardiac arrest with active CPR, no ROSC.
2. ED Charge RN ascertains
 - i. Age
 - ii. Confirms atraumatic
 - iii. Confirms VF/VT

3. ED Attending Notified
ED ECMO EVAL Page CANNOT go out unless ALL of above are met
4. ED Attending confirms above and decision made to Call Page Operator (1-2222) for **"ED ECMO EVAL"**
5. 6French sheath opened and prepared. ED access MD dons sterile gown/gloves.
6. Patient Arrives in ED. (*Resuscitation as normal with below clarifications*)
 - i. ED RN/Tech Prepares Arterial Transducer Kit.
 - ii. Pharmacy prepares Epinephrine Drip at 50mcg/min or 0.7mcg/kg/min
 - iii. RT manually ventilates patient in sync with compressions
 - iv. EMS retained for chest compressions
 - v. Quality/Rate of Chest Compressions Monitored with Sensor Pads
 - vi. Intubation confirmed with ETCO2 waveform or Intubation performed
 - vii. Groin shaved as needed. Groin full sterile preparation.
US evaluation of both sides of femoral region by "best ED provider" as determined by ED Attending. Sterile preparation, full drape over legs/groin, abdomen with placement under live sterile US guidance femoral sheath (6 French)
 - 1) First: Left Femoral Artery
 - 2) Second: Right Femoral Vein
 - viii. Femoral Artery sheath connected to transducer for *waveform confirmation* of arterial placement.
 - ix. Upon waveform confirmation of arterial access with 6 French sheath, ED Pharmacy/RN draws and administers
 - a. **5,000 Units Heparin as intravenous bolus through venous access.**
 - b. 1gm of cefazolin (Ancef)
 - x. PIK kit wire threaded into Arterial sheath and confirmed with US in Aorta.
 - xi. PIK kit wire threaded into Venous sheath and confirmed with US in IVC/RA.
 - xii. Peripheral IV only. IO only if needed. No other central lines to be placed due to bleeding risk.
7. Await CVICU ECMO RN Arrival with ECMO Cart and Circuit
8. CT Surgery Attending arrives in ED to assess patient.
9. **TIME OUT!**
 - a. **Room silent**
 - b. **EMS confirms**
 - i. **Age**
 - ii. **Confirms atraumatic**
 - iii. **Confirms VF/VT**
 - iv. **Confirms NO EXCLUSION criteria**
 - c. **CT Surgery, CVICU RN, ED ATTND, Cardiology (if present) all must agree to above criteria before beginning procedure**
- (**STOP if CVICU ECMO RN not present**)
10. Page Operator Notified: **ED ECMO ACTIVATION**
 - i. **Must have approval of and give name of CT Surgeon (as applicable) for page to be sent out.**
11. *All providers in room don masks and hats*
12. ED ECMO Cart and Circuit prepared

- i. ECMO Cart Supplies Opened
- ii. ECMO Circuit blue drape taken off. LINES NOT OPENED/UNSHEATHED EXCEPT by ECMO RN

13. CT Surgeon + ECMO RN initiate ECMO at direction of CT Surgeon
14. Await arrival of Interventional Cardiologist/Cath Lab Team
15. Await call from cath lab of "ready for patient."
16. ED RN with ECMO RN gives report to Cath Lab RN.
17. ECMO RN transports patient to Cath Lab.

Cardiac Cath Lab Process

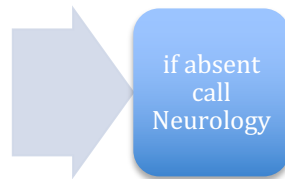
18. Arrival in Cath lab
19. ECMO RN to stay with patient during catheterization
20. Aortography/Aortic Root Angio
21. Coronary angiography/angioplasty per routine.
22. Pulmonary angiogram if no lesions seen.
23. LV Decompression (Atrial septostomy or Impella placement)
24. Superficial Femoral Artery (SFA) Cannulation

Cardiovascular Intensive Care Unit Process

25. ECMO RN Transports patient to CVICU
26. Additional Vascular Access obtained as needed.
27. Repeat Echocardiography for cardiac evaluation (at 24 hours post arrest)

Neurological evaluation and management (for workup of anoxic brain injury)

28. If concern for anoxic brain injury, consult Neurology
 - a. Serial neurological assessments
 - b. Guidance with temperature management
 - c. Guidance with sedation
 - d. Interpretation of EEG and NSE and Neuroimaging
29. Targeted temperature management
 - a. Begin immediately after initiation of ECMO
 - o Use Arctic Sun device when no heater cooler
 - b. Target temperature 36°C for 30 hours
 - c. Warming started at 30 hours at 0.2°C/hr to achieve 37°C by 36 hours
 - d. Temperature management 37 – 37.5°C for hours 36 – 72
 - e. Temperature management to continue till 72 hours
30. Clinical examination
 - a. Bedside exam (performed by ED / ICU nursing)
 - i. Brain stem exam
 1. Pupillary response to light (Pupillometer preferred)
 2. Corneal response
 3. Gag / tracheal response
 - ii. Response to noxious stimuli (central and peripheral)
 1. Withdrawal



2. Posturing
 3. No movement
 - iii. Ventilatory drive assessment (over breathing the vent yes/no)
31. Electroencephalogram
- a. Order 24-hour continuous EEG to start as soon as feasible
 - b. EPIC order: EEG Continuous Long-Term Monitoring. Reason: anoxic brain injury
32. Biomarkers
- a. Neuron specific enolase (NSE) ordered on day #0 and daily till day #2
33. Neuroimaging
- a. Head CT Scan (without contrast) during hours 24 – 48
 - b. Brain MRI (with/without contrast) with Neurology service input
34. Neurological prognostication:
- a. Neurology attending to discuss with CVICU attending before any family consultation and/or decision making regarding level of care.
 - b. Brain death testing to be performed with assistance of Neurology consult service in case of sustained loss of brainstem signs

At 96 hours post arrest

35. If patient not following commands
- i. Brain death evaluation performed
 - ii. CT Head Non-Contrast for hemorrhage
 - a) If brain dead, ECMO continued, but assessment made with family for organ donation by Donor Services
 - b) If not brain dead, ECMO weaned.
36. If patient following commands, ECMO wean begun per CVICU/CT Surgery.