Heart and Vascular Center – Clinical Protocol HV.CP.08.204

SUBJECT/TITLE: **Protocol for Trialing Off Veno-Arterial (VA) Extracorporeal Membrane Oxygenation (ECMO)**

PURPOSE: Ensure safe management and appropriate documentation during V-A trial off.

TARGET POPULATION: Applicable patients on ECMO

DEFINITIONS: None

DETAILS OF THE ORDER:

A. V-A Trial Off:

1. Patient cannulas will be clamped off and extracorporeal blood flow to the patient will cease.

2. Blood will continue to circulate only through the ECMO circuit via the bridge when one is in place.

    a) If there is not one in place one may be cut in or blood flow may cease to flow all together.

B. Equipment:

1. Three (3) Tubing Clamps

2. 2 – 4 Hoffman Clamps (optional)

3. Additional Transonic Flow Probe

4. Additional Transonic Flow Box

PROCEDURE:

A. Ensure the following individuals are present. Respiratory Therapist, Bedside Nurse, ECMO specialist, ICU physician, ECMO physician. Strongly consider having the following individual's available cardiologist, cardiothoracic surgeon.

B. Prior to wean off ECMO the following minimal parameters must be met by the patient: Temperature > 35C, heart rate and rhythm which will adequately perfuse the patient, the air way is clear and ventilator settings are appropriate, PA pressures, and hematocrit are acceptable.

C. Transthoracic ECHO should be performed at the initial trial off period.

D. Relocate all essential medications infusing into the ECMO circuit to the patient, except the heparin drip.

E. Ventilator support to be managed by the ECMO Managing Physician

F. Have necessary ionotropic medication and pressors running at low dose or available as directed by the ECMO Managing Physician

G. Coordinate with managing physician on labs prior to trial start: typically, ABG, lactate, and SVO2

H. Discuss with ECMO Managing Physician success or failure criteria prior to trial start

I. Neonatal and Small Pediatric Patients:

1. Decrease pump flows by 10-20 mL/min increments until "idling" flows of 30mL/kg/min flows are achieved. This may be achieved best by placing a Hoffman clamp on the bridge.

J. Large Pediatric Patients and Adults Patients:

1. Adults only: draw up and give 1,000-2,000 Units of unfractionated heparin to the patient prior to decreasing flows as directed by the ECMO Managing Physician.

2. Decrease pump flows by 500mL/min until running at 1 LPM. This may be achieved best by placing a Hoffman clamp on the bridge.

K. Hoffman Clamp Method:

1. Place a Hoffman clamp on the bridge and completely occlude the tubing so the bridge is clamped off.

2. Open the bridge stopcocks to the circuit and off to the pigtails. If you see any blood coming across the bridge, the clamp needs to be tightened.

3. Place a transonic flow probe on the arterial/return line, above the bridge. This will allow you to trend how much blood is being delivered to the patient.

4. Slowly open the Hoffman clamp. This requires very small turns. You should see the blood slowly divert from the arterial side to the venous side, across the bridge. Watch the transonic closely to ensure you are slowly dropping blood flow to the patient. There should be a plan communicated between the ECMO specialist, bedside nurse, bedside respiratory therapist and ICU physician as to how long flows will be weaned to achieve idle flow.

a) Idle Flow for neonatal patients and small pediatrics=30mL/kg/min

b) Idle Flow for large pediatric patients and adult patients=500mL/min

5. If the bridge is completely open and idle flows have not been achieved, it may be necessary to place a second Hoffman clamp on the arterial/return line to restrict flow back to the patient.

6. As pump flow is decreased, change ventilator support and vasopressors as directed by the ECMO and/or ICU physician.

7. Wean and maintain minimal sweep gas flow, closely monitor CO2 via Terumo CDI.

L. Clamping off Trial:

1. If the patient's vital signs are acceptable, prepare to isolate the patient from the ECMO circuit and divert blood flow through the bridge.

   a) To remove the patient from ECMO on a CENTRIFUGAL SYSTEM, Unclamp the bridge (or fully open the Hoffman clamp) then place a tubing clamp between the patient's arterial cannula and the bridge. Place a tubing clamp between the bridge and the patient's venous cannula. Blood should now be flowing through the bridge and the patient is no longer supported by ECMO.

   b) To preserve the circuit flow through the bridge at NO LESS THAN 250mL/min for a ¼ inch circuit and 1LPM on a 3/8" circuit. Consider higher flows if circuit is questionable.

2. After clamping, turn the sweep gas off

3. Monitor the area of the circuit from patient to clamps for blood separation and/or clot formation.

4. Prior to flashing the cannulas restart sweep gas at the minimum rated flow for that oxygenator.

5. Flash the cannulas every 5-10 minutes (NICU/PICU) or 3-5 minutes (Adult) or as directed by the LIP. Consider flashing more frequently if anticoagulation is lower than routine parameters.

6. Notify the bedside nurse prior to flashing the cannulas for lab collection.

7. Prior to flashing the cannulas, decrease pump flow to idle flow

8. Repeat steps B-G for as long as the trial is ordered, not to exceed 1 hour.

9. FOR A CENTRIFUGAL SYSTEM: Unclamp the venous line, clamp the bridge and unclamp the arterial line.

10. Remain on ECMO flow for 5-10 seconds to flash the cannulas

11. It may be necessary to slowly increase the pump flow briefly to ensure a good flash.

12. Remove the patient from ECMO per protocol and resume the trial off.

13. Closely monitor the patient's temperature during trial off (NICU/PICU). Use of the overhead warmer or warm blankets may be necessary.

14. A VA ECMO clamp trial should last no more than 1 hour

15. Document the following:

    a) Start/end time

    b) Patient tolerance: (HR, BP, CI, ABG, drips)

    c) Flashing of cannulas

16. If ECMO will be continued, perform any necessary circuit interventions before returning to ECMO.

17. If ECMO will be discontinued, arrange for decannulation.

RELATED DOCUMENTS:

A. UI Heart and Vascular Center , Departmental Guideline Manual – *Heparinization Guidelines for Extracorporeal Membrane Oxygenation (ECMO) Adult Intensive Care Unit Patients* [HV.G.08.207]

B. UI Heart and Vascular Center , Departmental Guideline Manual – *Heparinization Guidelines for Extracorporeal Membrane Oxygenation (ECMO) Pediatric Intensive Care Unit (PICU) Patients* [HV.G.08.208]

C. UI Heart and Vascular Center , Departmental Guideline Manual – *Heparinization Guidelines for Extracorporeal Membrane Oxygenation (ECMO) Neonatal Intensive Care Unit (NICU) Patients* [HV.G.08.209]

REFERENCES:

L1 Brogen, T.V., Lequier, L., Lorusso, R., MacLaren, G., & Peek, G. (2017). *Extracorporeal life support: The ELSO red book* (5th ed.). Ann Arbor, MI: Extracorporeal Life Support Organization

L2 Brogan, T. V., Annich, G., Ellis, W. C., Haney, B., Heard, M. L., & Lorusso, R. (Eds.). (2018). *ECMO Specialist Training Manual* (4th ed.). Ann Arbor, MI: Extracorporeal Life Support Organization.

L3 University of Michigan, ECMO Specialist Training Manual.

L4 Wagoner, Scott, et al. (2003). *Children's Healthcare of Atlanta Policy and Procedure Manual.* Atlanta, GA: Children's Healthcare of Atlanta ECMO & Technologies Department.