



TITLE: Extracorporeal Membrane Oxygenation (ECMO) Circuit Prime and Electrolyte Correction Protocol

STATEMENT:

The ECMO Circuit Prime and Electrolyte Correction Protocol is designed to provide the Advanced Technologies Specialist (ATS) with specific instructions for preparing the albumin primed and/or blood primed ECMO circuit.

SCOPE:

The Advanced Technology Specialist will implement this provider ordered protocol for preparing the extracorporeal circuit during ECMO initiation and circuit changes.

ELABORATION:

1. This protocol helps meet quality measures to ensure safety, quality and consistency/standardization in patient care.
2. The ECMO Circuit Prime and Electrolyte Correction protocol is included in the ECMO Cannulation and Circuit Change order sets.
3. This protocol outlines proper dosing of medication additives into the prepared ECMO circuit as well as proper blood sampling. Assembly and preparation of the ECMO circuit and ancillary equipment will be completed as outlined in the “Priming the ECMO Circuit” Guideline.

PROTOCOL

1. **The ECMO circuit prime consists of the following steps:**
 - a. CO₂ (gas) prime
 - b. 0.9% Saline prime
 - c. Albumin prime
 - d. Blood prime

Effective Date: 3/2017, 8/2019

ECMO Clinical Management Team Approval: 5/2016; 9/2018

Pediatric Subcommittee Approval: 2/2017; 7/2019

Pharmacy & Therapeutics Committee Approval: 3/2017; 8/2019

2. **Gas Prime**
 - a. Done on all circuits at the time of initial assembly.

3. **Saline Prime**
 - a. A saline primed circuit will be maintained at all times for immediate deployment. Saline primed circuits expire after 30 days, and must have the date, time and primer's initials clearly marked on the oxygenator.
 - b. The ECMO Staff is responsible for tracking the expiration dates and ensuring that a pre-primed circuit is available at all times.

4. **Albumin Prime**
 - a. The albumin prime is performed in circuits that are going to be used imminently.
 - b. Albumin primed circuits expire after 24 hours.
 - c. Volume (dose):
 - i. Neonatal circuit = 10 ml 25% Albumin
 - ii. Adult/Pediatric circuit = 50 ml 25% Albumin
 - d. The albumin prime should be completed even if the physician decides to emergently place the patient on ECMO without a blood prime.

5. **Blood Prime**
 - a. *Each unit* of Packed Red Blood Cells (PRBC) to be used during the circuit prime is prepared with the following medications:
 - i. 150 units Heparin
 - ii. 10 mEq Sodium Bicarbonate
 - iii. 40 ml 25% Albumin
 - iv. 30 ml FFP
 - v. 150 mg Calcium Chloride
 - b. When adding medications to the blood bag, ensure that heparin is added **BEFORE** calcium and mixed well, or the bag will clot.
 - c. Label each prepared unit with "ECMO PREPARED BLOOD" along with the date, time and initials of person adding medications.

6. Circuit Optimization and Electrolyte Correction

- a. Before initiating ECMO, obtain a sample of the blood in the ECMO circuit for blood gas and electrolyte analysis.
- b. In order to optimize PO₂/PCO₂ values within the circuit, turn on sweep gas flow at 1 LPM for 30-60 seconds. **DO NOT** leave sweep gas running in a closed system.

c. Calcium Correction

- i. Calcium replacement into the circuit is done with 10% Calcium Chloride as outlined below.

Circuit iCa ⁺⁺ value	Amount of CaCl ₂ Added
> 0.8	None
0.7 – 0.8	50 mg
0.5 – 0.69	75 mg
< 0.5	100 mg

- ii. If iCa⁺⁺ value greater than 1.2 mmol/L give 30 ml of 25% Albumin to the ECMO circuit.

d. Sodium Correction

- i. Sodium correction of the circuit is done using the appropriate dose of 3% Normal Saline as outlined below:

Neonatal: ml of 3% saline	Pediatric: ml of 3% saline
= (140 – circuit Na)(0.5L)/ 0.5 mEq/L	= (140 – circuit Na)(0.8L)/(0.5 mEq/L)
Ex: Circuit Na 120 would need 20 ml 3%	Ex: Circuit Na 120 would need 32 ml 3%

- ii. The physician may choose to correct to the patient’s actual sodium level, rather than “normal.” In this case substitute the ordered value for 140 in the equation.

e. Potassium Correction

- i. Goal circuit K⁺ is 3-6
- ii. If K⁺ is > 7, notify attending physician and prepare for hemofiltration or partial exchange of the circuit.
- iii. If K⁺ is < 2.5, notify attending physician and replace as directed.

- f. All high alert medications must be double-checked by a licensed provider (RN, ECMO Specialist, Perfusionist, MD)

7. The Advanced Technology Specialist will document the priming procedure, including circuit correction orders and calculations, in Electronic Medical Record

REFERENCES:

Extracorporeal Membrane Oxygenation. ECMO Extracorporeal Cardiopulmonary Support in Critical Care. 5th Edition.

ECMO Specialist Training Manual. 4th Edition.

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