Policy Name: ECMO Anticoagulation

Effective Date: 04/30/15

Policy Primary: DUH ECMO Medical Director

Status: Published

Final Approval:
Approved by: DUH ECMO Steering Committee Date: 07/01/14

Glossary:
Term:
Definition:

Definitions:
ECMO- extracorporeal membrane oxygenation

Level: Interdependent - asterisked [*] items require an order from a health care practitioner licensed to prescribe medical therapy.

Personnel:
All healthcare professionals caring for the ECMO patient.

Competencies/Skills:

Required Resources:

Policy Statement:

Purpose: To establish standard guidelines for anticoagulation management during ECMO support.

Anticoagulation for the Initiation of ECMO

- *Prior to cannulation on the order of the Cannulating Surgeon, 50units/kg of heparin may be administered to the patient up to a total max dose of 5000 units of heparin for adult patients.
- 100units of heparin may be administered to the ECMO prime for blood primed circuits.
- Immediately after ECMO initiation the following labs will be drawn:
  - ACT
    - *As ordered by provider and available.
  - PTT
  - Stat Functional ATIII
    - *Replace ATIII with Thrombate or FFP as clinically warranted for critical ATIII less than 60% and for concerns for heparin resistance.
  - Fibrinogen
    - Transfuse cryoprecipitate as clinically warranted for critical fibrinogen less than 100mg/dL.
Platelets
- Platelet infusion should be started immediately after ECMO initiation for all neonatal patients and pediatric patients receiving a blood primed circuit. Do not wait for platelet count to begin transfusion in this population.
- Transfuse platelets for critical platelets less than 100K (neonates/pediatrics)/75K (adults) unless otherwise prescribed.

Anticoagulation Management for Maintenance of ECMO

- ECMO Heparin Drip
  - Only standard heparin infusion bag for ECMO (25,000 unit heparin in 250 ml D5W pre-mix) will be used.
  - The site of the heparin infusion may be:
    - ECMO circuit for neonatal/pediatric patients with limited access.
    - Patient access for all other patients.
  - See below for heparin administration safety.

- Initial heparin infusion
  - Starting heparin infusion rate will be:
    - 25 units/kg/hour for ≤25kg
    - 15 units/kg/hour for >25kg
  - Use ideal body weight
  - Maximum total starting heparin infusion rate of 1000 units/hour or as otherwise ordered with primary managing attending approval.
  - Heparin may be held, increased, or reduced as ordered by provider as indicated by patient condition.
  - Confirm anticoagulation plan with cannulating surgeon and ICU attending prior to initiating heparin.

- Titrating Heparin Infusion
  - Heparin infusion will be titrated per provider order based on results of coagulation labs:
    - aPTT
      - Q6 Hours
      - Target value is 60-80 sec for adult VA ECMO, post-lung transplant VV ECMO, and ALL neonatal/infant ECMO.
      - Target value is 40-60 sec for remaining adult VV ECMO patients.
      - Target may be decreased for patients with high bleed risk, typically to 40-60 sec.
    - “Heparin level”/anti-Xa (currently ordered as “Unfractionated Heparin Level”)
      - Neo/Pediatrics:
        - Q6 Hours x 24 hours, then Q12 Hours plus PRN
        - Target value is 0.4-0.7 or as otherwise ordered by Provider.
        - *Target may be decreased for patients with high bleed risk, typically to 0.2-0.4.
      - Adults:
        - *As clinically indicated under the direction of the ICU attending or Surgery Attending.
    - Adjuncts to Anticoagulation Management
- Stat Functional Antithrombin III
  - Stat Functional Antithrombin III will be monitored with initial labs after ECMO initiation, 24 hours after ECMO initiation, and as *clinically indicated under the direction of the managing attending physician.
  - *If value is < 60% and there is evidence of heparin resistance (increasing heparin dose without expected response), consider factor replacement (Thrombate dosing to be discussed with managing attending physician prior to administration).

- Platelets
  - Neonatal/Pediatric:
    - Platelet count will be monitored q6 hours until stable for 24 hours, then q12 hours.
  - Adult:
    - Platelet count will be monitored q12 hours.
  - *Platelet count will be monitored more frequently for bleeding patients as ordered by provider.
  - Recommended transfusion trigger is less than 100K in neonates/pediatric, less than 75K adult patients.
  - *Transfusion trigger may be reduced for blood conservation patients.
  - For acute drop in platelet count of 50% or greater not as a result of hemodilution, consider HITT and send HITT panel. (Consider consult with Pediatric Hem/Onc 970-6491 or Adult Coagulation Service 970-1526).

- Fibrinogen
  - Fibrinogen will be monitored q day and prn for neonates/pediatrics, as needed for adults.
  - Recommended transfusion trigger is less than 150mg/dL for clinical bleeding or risk of clinical bleeding (i.e. neonatal patients).

- TEG/ROTEM
  - TEG may be drawn to assess global anticoagulation and PRN for bleeding concerns.
  - TEG is POC test which must be arranged with ABG Lab prior to draw (681-3223).
  - Notify the ABG Lab that the patient is on ECMO with heparin so a heparinase cup can be prepared. An ACT must be run concurrently for heparinized patients. TEG must be walked immediately to ABG lab 6th floor DMP for analysis.

**Heparin Administration Safety**

- Heparin administration via patient access per unit policy.
- See Nursing Standards.
- Heparin administration via ECMO access FOR NEONATAL/PEDIATRIC PUMPS:
  - Only an ECMO Specialist or Perfusionist will attach drips to the ECMO Circuit.
Obtain standard heparin infusion bag for the ECMO pump (25,000 unit heparin in 250 ml D5W pre-mix).

Draw heparin drip in a syringe appropriate for no more than four times the hourly heparin rate (using a smart-site syringe set with microbore tubing and pressure sensing disc, being careful when priming to keep pressure on disc).

- Two medication-certified personnel will perform a double check:
- A double check must be performed at initiation of heparin drip, change of shift, with dosing changes, bag changes, and syringe changes
  - Verify:
    - Patient identifiers (name, MRN#)
    - Right drug
    - Right dose
    - Right route
    - Expiration date of bag.
    - Track IV tubing from bag to ECMO pump.
    - Validate drug placed in Alaris® guardrails with appropriate medication name (Heparin ECMO), concentration and dosage.
  - Dual sign off must be completed in Maestro.

- *A new provider order is required to hold heparin or restart heparin.
- During ECMO, all intravenous fluids given to the patient will be changed to non-heparinized solutions including the patient’s arterial line(s).

Heparin Alternatives

- **Bivalirudin**
  - For HITT positive patients, DC all heparin coated components of ECMO circuit.
  - Consult coagulation service.
  - 0.5mg/kg/hour is a typical starting infusion rate to achieve a goal aPTT of 60 seconds.
  - Titrate based on aPTT to goal of 60-80seconds or per managing attending physician. DC Heparin level and ATIII labs.

- **Argatroban**
  - Consider as a heparin alternative for patients with renal dysfunction.
  - Consult coagulation service.
  - 0.25mcg/kg/min is a typical starting infusion rate to achieve a goal aPTT of 60seconds.
  - Titrate based on aPTT to goal of 60-80seconds or per managing attending physician. DC Heparin level and ATIII labs.

Additional Information

- **Thrombate Dosing:**
  - Manufacturer Calculation:
    - IU=[(Desired ATIII – Baseline ATIII)xWeight (kg)]/1.4
    - Desired ATIII is typically 100-120%
    - Normal ATIII for neonates is 40-60%
  - For adults the following dosing may be used, rounding up or down units per vial:
    - Dose ATIII- 1000 units if AT <60% (one vial)

- **Antifibrinolytic Therapy**
Aminocaproic acid and tranexamic acid use has been safely reported in ECMO patients.

- **Platelet administration**
  - Do not increase heparin for platelet administration

- **Plasmapheresis and CVVHD**
  - Do not arbitrarily increase/decrease heparin for plasmapheresis or CVVHD.
  - If coag labs due during plasmapheresis, draw one hour after completion.
  - Only citrate should be used for plasmapheresis and CVVHD anticoagulation.
  - Consider ATIII replacement if plasmapheresis replacement volume used was Albumin.

- **Bleeding**
  - Consider sending TEG to distinguish between coagulopathy and surgical bleeding.
  - Bleeding patients may require a cooler of blood at the bedside.

- **Factor VII Replacement:**
  - Indication- life threatening hemorrhage unresponsive to more conventional therapies
  - The coagulation service must be notified prior to administering this drug. Page Peds Heme/Onc 970-6491 or Coagulation Service 970-1526. The coagulation service must approve the use of this drug and will recommend proper dosing- notify that patient is on ECMO- typical dosing is in slow, small increments.
  - Prior to administering this drug, the following steps must be taken:
    - Have blood products and back up ECMO pump at bedside.
    - 2 units PRBCs, 1 unit FFP (in cooler)
    - 20 ml/kg of platelets (minimum 50 ml; max 1 unit)
    - An ECMO surgeon and perfusionist must be in the hospital and available to respond in case an emergency arises.
    - ICU attending physician must be present at bedside.
    - Do not administer this medication to the ECMO pump.
    - Continuously monitor patient and ECMO pump for signs and symptoms of clotting.

**REFERENCES**

Citations:

Policies:

Authoritative Source:

Additional References:

Attachment Names:

Company:

Entities:
DUH