

Purpose: To outline the care and management of the patient receiving therapeutic plasma exchange utilizing the Gambro Prismaflex Machine

Scope: Adult patients

Responsibility: Registered Nurses who have successfully completed the required education for therapeutic plasma exchange; Providers; Perfusionists

Background:

1. Therapeutic plasma exchange is a method of extracorporeal blood purification designed to remove large-molecular-weight substances from the plasma.
2. A plasma filter is used to separate plasma from other cellular elements using a semi-permeable membrane.
3. TPE removes all circulating substances in the plasma, necessitating certain measures to prevent disturbances in clotting factors, electrolyte levels and any other substances that may be depleted by the procedure.
4. Regional anticoagulation, using either heparin or citrate, can be used for the duration of the procedure.
5. The volume of plasma removed should be replaced with either 5% albumin or fresh frozen plasma (FFP).

Equipment / Supplies:

- Antiseptic solution
- Sterile gloves, gown, masks, caps, towels, gauze
- Gambro Prismaflex Machine
- Gambro TPE 2000 Filter
- Appropriate central line for access
- Albumin (obtain from pharmacy) or FFP (obtain from blood bank)
- Heparin syringe for filter priming (obtain from pharmacy)
- Heparin syringes for central line dwell (obtain from pharmacy)
- Heparin infusion bag for regional anticoagulation (obtain from pharmacy)
- Sodium chloride 0.9% (normal saline) for machine priming (obtain from unit supply)
- Calcium chloride or calcium gluconate as needed (obtain from unit supply)

Procedure:

- A. Provider will ensure appropriate access is available for the procedure, according to hospital policy SP&CI-014B.
 1. Assist MD during insertion as needed.
- A. Preparing Gambro Prismaflex Machine
 1. Prepare per Prismaflex Instructions
 2. Connect to access per hemodialysis catheter management policy SP&CI-014E
- B. Initial Nursing Assessment and Care:
 1. Verify that consent has been obtained and documented per hospital policy PROE-101-104, PROE-113
 2. 1 to 1 nursing to patient assignment will be utilized during the exchange session
- C. Record vital signs and hemodynamic values using the CRRT/TPE/Aquapheresis Flowsheet
- D. Ongoing Assessment and Care:

1. Record vital signs, hemodynamic values, pressure parameters and flow parameters as ordered.
 - i. Vital Signs include:
 - a) Blood pressure
 - b) Heart rate
 - c) Temperature
 - ii. Circuit pressure parameters include:
 - a) TMPa
 - b) Access Pressure
 - c) Venous / Return Pressure
 - d) Effluent Pressure
 - e) Pressure Filter Drop
 - f) Filter Pressure
 - iii. If using FFP, document in Intake and Output section by adding a row for Transfuse Plasma for cumulative plasma volume
2. Review results and notify provider for any changes from the patient baseline.
3. Inspect dressing and assess catheter exit site for any evidence of leakage.
4. Notify provider if dressing is damp, loose, or soiled.

E. Documentation:

1. Document patient's neurologic exam
2. Document any changes in patient condition and related interventions
3. Document all monitoring variables
4. Document patient and family education

F. Patient and Family Education:

1. Educate patient/family regarding ongoing monitoring and interventions.

Calculation of Estimated Plasma Volume (EPV) and Exchange Volume

A. Calculate the patient's estimated plasma volume using the following equation:

1. $EPV (L) = [Weight (kg) * 0.065] \times [1-HCT]$
 - i. Example: For HCT: If HCT = 24.2, divide by 100 and utilize 0.242 for calculation
 - ii. Note that the EPV is calculated in liters. This will need to be converted to mL by multiplying by 1000.
 - iii. Typically, actual body weight (ABW) is used in the calculation, unless the patient's actual body weight is > 140% of the ideal body weight (IBW). In this case, use the following equation to calculate the Albumin dosing weight to be used for the EPV calculation:
 1. $Dosing Weight = [(ABW-IBW) \times 0.2] + IBW$

B. The actual exchange volume is calculated by multiplying EPV by the number of exchange volumes required (usually 1-3), depending on the clinical situation and disorder being treated. See appendix below for correction factor suggestions. The final correction factor to be used will be determined by the treating provider.

C. Round the actual exchange volume to the nearest 500 mL, considering the albumin bottle size of 500 mL.

D. Order the albumin route as Other – OR/Procedural Use

E. Order the albumin frequency as Once

F. Order comments should include "Please request from Pharmacy when needed."

Ordering of FFP (if indicated)

A. Calculate exchange volume as directed above

B. EPIC order for Order and Transfuse Plasma

C. Order the number of units of FFP needed and write an approximate volume needed for the exchange volume in the comments section

D. Indication: Therapeutic Plasma Exchange

Typical TPE Prescription Parameters

- A. Blood Flow Rate: 150-250 mL/min
- B. Net Fluid Balance: 0 mL/hr
 - a. Does not account for pre-filter infusion of heparin or normal saline, as this is not considered part of the exchange volume.
- C. Replacement Substitution Fluid Flow Rate: Start at 2000 mL/hr. May increase up to 3000 mL/hr to keep filtration fraction < 15%.
- D. Titrate to maintain TMPa < 100. To reduce TMPa:
 - a. Increase blood flow rate
 - b. Decrease replacement / substitution fluid flow rate

Anticoagulation

- A. If deemed necessary by the treating provider, anticoagulation can be used for the duration of the exchange session.
 - 1. Heparin for Filter Priming
 - i. The typical heparin bolus is 30 units/kg based on actual body weight with a maximum bolus dose of 2000 units.
 - ii. The heparin bolus should be entered with a route of Prefilter port.
 - iii. The heparin bolus should be ordered with a frequency of once.
 - iv. These orders should be verified as a syringe that is compounded in the pharmacy.
 - v. Heparin for filter priming will be injected into the pre-filter port as blood flow begins through the filter
 - 2. Heparin Infusion for Regional Anticoagulation
 - i. The heparin infusion dose is 5-10 units/kg/hr. This will be based on the following weights:
 - 1. If Actual Body Weight (ABW) < Ideal Body Weight (IBW): Use Actual Body Weight
 - 2. If Actual Body Weight > Ideal Body Weight: Use Adjusted Body Weight
 - a. $\text{Adjusted Body Weight} = [(\text{ABW} - \text{IBW}) * 0.4] + \text{IBW}$
 - ii. The heparin infusion should be verified as the 10,000 unit / 1000 mL product with a route of Prefilter port
 - iii. Due to the short time frame of plasma exchange, PTTs will not be routinely checked during therapy
 - iv. Heparin infusion for regional anticoagulation will be administered via the pre-blood pump infusion site

Heparin Catheter Dwell:

- A. Per the hospital's dialysis catheter dwell policy, SP&CI-014E, the plasma exchange catheter will be locked with heparin dwells between sessions.
- B. The heparin to be used for this indication should have a concentration of 1000 units / 1 mL.
- C. These orders should be verified as a syringe that is compounded in the pharmacy with a route of Intracatheter.
- D. The heparin dwell orders should be placed with a route of Intracatheter.
- E. The heparin dwell orders should be placed with a frequency of Once or One Time Daily PRN.
- F. The volume of each catheter differs and the care team will enter the orders based on the volume listed on the catheter port. Each catheter will have two ports, so two separate orders will be needed.
 - 1. For example:
 - i. Heparin 1600 units / 1.6 mL Day PRN to be used as a catheter port lock in the red port, route: catheter port. The team will write order comments to identify which port each product is to be used for. The order must include port color.

- ii. Heparin 1800 units / 1.8 mL QDay PRN to be used as a catheter port lock in the blue port, route: catheter port. The team will write order comments to identify which port each product is to be used for. The order must include port color.
- G. Before accessing a catheter that contains a heparin dwell, 3-5 mL must be withdrawn to remove the heparin dwell
- H. The RN must label the catheter to denote that it contains a heparin dwell.

Laboratory Monitoring

- A. Providers should consider monitoring the following laboratory parameters before and after plasma exchange sessions. Post-exchange labs can be sent between 2-4 hours after the end of the exchange session.
 - a. Basic Metabolic Panel
 - b. Phosphorus
 - c. Magnesium
 - d. Ionized Calcium
 - e. Complete Blood Count
 - f. PT with INR
 - g. PTT
 - h. Fibrinogen
 - i. TEG

Medication Considerations

- A. ACE-Inhibitors should be discontinued for at least 24 hours before initiation of therapeutic plasma exchange
- B. Discuss any pertinent medications with the Neurocritical Care Clinical Pharmacy Specialist to determine if any supplemental doses will be needed following the plasma exchange. Medications known to be highly protein bound may be removed during plasma exchange and may require supplemental dosing.

References:

Ibrahim RB, Liu C, Cronin SM, et al. Drug removal by plasmapheresis: an evidence-based review. *Pharmacotherapy* 2007; 27(11): 1529-1549.

Kes P, Basic-Kes V, Basic-Jukic, N, Demarin V. Therapeutic plasma exchange in the neurologic intensive care setting recommendations for clinical practice. *Acta Clin Croat* 2012; 51: 137-153.

Szczepiorkowski ZM, Winters JL, Bandarenko N, et al. Guidelines on the use of therapeutic apheresis in clinical practice - evidence-based approach from the apheresis applications committee of the American Society for Apheresis. *J Clin Apheresis* 2010; 25: 83-177.

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