TABLE OF CONTENTS

Adult Therapeutic Plasma Exchange (Plasmapheresis) ............................................... 2
  Policy .................................................................................................................. 2
  Guiding Principles and Values ................................................................. 2
  Guidelines ...................................................................................................... 3
  Procedure ...................................................................................................... 5
Pediatric Therapeutic Plasma Exchange (Plasmapheresis) .......................... 6
  Guidelines ...................................................................................................... 6
  Procedure ...................................................................................................... 7
References ........................................................................................................ 8
Related Documents ......................................................................................... 8
Appendix A – Therapeutic Plasma Exchange (TPE) – Replacement Solutions 10
ADULT THERAPEUTIC PLASMA EXCHANGE (PLASMAPHERESIS)

POLICY

1. Therapeutic Plasma Exchange (TPE) is performed on either inpatients or outpatients under the following circumstances:
   
   1.1. Only with a Hematologist’s order using the Preprinted Orders (PPO0193MR) for Therapeutic Apheresis Procedures (Hematology)
   
   1.2. Only by qualified Apheresis Unit Registered Nurses using the Blood Cell Separator.
   
   1.3. At the QEII, VG site, in the Medical Day Unit (MDU) or at the patient’s bedside.
   
   1.3.1. TPE’s that will not be completed prior to 1630 hrs or when Medical Day closes or procedures performed after hours will be performed in the inpatient hospital room.
   
   1.3.2. Patients in the intensive care unit or intermediate care units will have TPE’s performed at their bedside.
   
2. The Registered Nurse (RN) is to adhere to the guidelines and procedures as outlined in subsequent sections, and prior to performing the procedure is to be deemed competent in the following policies:
   
   • CC 50-049 Non-tunnelled Hemodialysis Central Venous Catheter (CVC) (PELC)
   • CC 50-050 Care of The Tunnelled Hemodialysis Central Venous Catheter (PELC)
   • CC 75-005 Blood Transfusions: Administration of Blood, Blood Components and Blood Products
   • CC 80-015 Non-tunnelled Central Venous Access Catheter (multilumen) (PELC)
   • CC 80-016 Tunnelled External Central Venous Catheter (Hickman) (PELC)
   • CC 80-019 Peripheral IV Therapy Initiation and Maintenance (PELC)
   • CC 80-021 Central Venous Access Device (CVAD) Umbrella Policy (PELC)
   • CC 80-022 Care of an Occluded Central Venous Access Device (CVAD) (PELC)
   • CC 85-079 Venipuncture for Blood Specimen/Blood Culture Collection (PELC)
   • MM 30-005 Direct IV Administration of Medication (PELC)

GUIDING PRINCIPLES AND VALUES

1. Data entered about the patient, the type of replacement fluid (see Appendix A Therapeutic Plasma Exchange – Replacement Solutions), and the overall fluid balance will allow the Blood Cell Separator to customize the following parameters:
   
   1.1. the pump flow rates (inlet, plasma, collect and replace)
1.2. the centrifuge speed
1.3. remove / collect volumes
1.4. run time

2. The whole blood (WB): AC ratio is defaulted to 10:1. The anticoagulant (AC) infusion rate defaults in response to selected replacement fluid and can be optimized by the RN.

3. The plasma volume exchange will default to a 1.0 plasma volume. The RN may manually adjust the replacement volume, the volume removed or the run time to increase or decrease the plasma volume to be exchanged. For certain conditions, i.e. TTP, the physician or research protocols may request a 1.5 plasma volume to be exchanged.

4. The fluid balance is defaulted to 100%. Fluid balance is customized by the RN according to the patient’s blood pressure.

5. The blood inlet speed may vary from 25-150 mL/min. It is advisable to run the inlet speed to a maximum of 80 mL / min to allow the patient’s internal fluid shifts to equilibrate.

6. The volume of replacement fluid required to complete a TPE may vary daily depending upon the patient’s height, weight and hematocrit.

GUIDELINES
1. Ensure informed consent has been obtained from the patient or substitute decision maker prior to initiating the procedure. (Refer to CH 70-045 Consent to Treatment)
   
   Note: The MSICU (Medical/Surgical Intensive Care Unit) consent covers the consent for TPE. (Refer to Consent to Treatment CH 70-045)

2. Perform all TPE’s with the Blood Cell Separator; using the TPE kit and the dual-needle system.

3. Implement the alarm test during the priming sequence for all TPE’s.
   
   3.1. In the event of an alarm, at any stage of a TPE (prime, run or rinseback), address the cause of the alarm as soon as possible. (Refer to the “troubleshooting” section of the Operator’s Manual for the action required to correct the alarm.)

4. Prior to initiating the first TPE obtain a CBC, INR and PTT and the patient’s height and weight.

5. As the extra corporeal volume of the Blood Cell Separator must be no greater than 10% of the patient’s TBV, assess patients with a low TBV for the need of a packed red blood cell (PRBC) transfusion or a blood /albumin prime prior to a TPE being performed.

6. When ordering the replacement fluid from Blood Transfusion Service (BTS), BTS sends the total volume of replacement fluid required to Apheresis. Each unit is checked according to the CC 75-005 Blood Transfusions: Administration of Blood, Blood Components and Blood Products. If the replacement fluid requires cold storage, continue to store it in the transport cooler provided by BTS until required.
7. If the type of replacement fluid is changed during the TPE, ensure that the “Type of Replacement Fluid” entered into the Blood Cell Separator is also changed. (The flow rates and run time will change).

8. Use the Blood Warmer for all TPE’s to help decrease citrate reactions. (See AU 02-001 Blood/Fluid Warmer).
   8.1. Connect the Blood Warmer at the return line, prime at the end of the priming sequence and flush with saline at the end of rinseback. (The blood warmer tubing volume is 36 mLs.)

9. Avoid performing plasma exchange within 24 hours of an invasive procedure.
   9.1. If it is necessary to perform a TPE prior to or post procedure, the replacement fluid of choice is Fresh Frozen Plasma (FFP)

10. If the red blood cells in the TPE Kit cannot be returned to the patient, inform the Hematologist of the estimated blood loss. The Hematologist decides whether or not to transfuse.

11. In the event of an adverse reaction, pause the procedure. In transfusion reactions, flush the blood warmer tubing with Normal Saline prior to resuming the procedure.

12. Discard disposable sets for all TPE’s as biomedical waste. Place the collected waste plasma in a hard plastic sealable container, label as “Body Fluids” (Refer to Biomedical Waste Management CH 90-017)

13. Use the patient’s peripheral veins for TPE’s as the preferred site. Assess for the following conditions which would indicate the need for the insertion of a central line (Vascath, Hemostar or Hickman Pheresis catheter)
   13.1. The patient has small peripheral veins that would not support an adequate inlet flow.
   13.2. The length of the procedure (E.g. a 1.5 plasma volume exchange may take too long.)
   13.3. The expected number of procedures (E.g. the number of treatments ordered is indefinite.)
   13.4. The patient is not able to assist in maintaining an adequate flow (the patient is unconscious or is unable to move or make a fist.)

14. In procedures performed peripherally:
   14.1. Place the return line in a vein capable of receiving a 18-20 gauge needle, (either an AV fistula needle or peripheral IV catheter.
   14.2. Insert the access line in the antecubital fossa in either the median cubital or basilic vein. Use a 17 gauge AV fistula needle where possible.
   14.3. Adhere to Peripheral IV Therapy Initiation and Maintenance CC 80-019 for arm preparation prior to venipuncture for TPE.

15. As patients may experience citrate reactions during a TPE, observe for signs and symptoms (refer to Documents: Complications of Therapeutic Apheresis and Suggested Management) and treat as per Pre-printed Orders for Therapeutic Apheresis Procedures (Hematology) PPO0193MR.
16. Assess patients with cold agglutinins for the need to have the room warmed, warm blankets, and warmed replacement fluids. Consider increasing flow rates to prevent the blood from cooling.

**PROCEDURE**

**Equipment**

- Operator’s Manuals
- Blood Cell Separator
- Blood Warmer and blood warmer tubing
- Single-stage channel filler
- TPE disposable set
- 1000 mL 0.9% Sodium Chloride
- 1000 mL ACD-A
- Replacement fluid as ordered by the Hematologist
- Dravon clamps (3)
- AV Fistula Set needles x 2 or equipment for accessing central venous catheter
- Alcohol swabs
- Tape
- 100 mL 0.9% Sodium chloride
- Heat sealer
- Equipment for arm preparation
- 2x2 gauze (sterile)
- Vacutainer tubes
- Patient labels
- Gloves – sterile and clean
- Fenwal 600 mL transfer pack and / or Fenwal 2000 mL transfer pack

1. The Hematologist provides the procedure orders, ensure the consent is obtained (CH 70-005 Consent to Treatment).

2. If the patient does not have an existing central venous line, assess the peripheral veins.
   
   2.1 If not able to accommodate a 17 gauge AV fistula needle or the patient is not able to maintain adequate access flow, the Hematologist arranges for insertion of a central venous catheter.

3. Obtain the same day CBC, INR and PTT report and the patient’s height and weight.

4. Determine the volume of replacement fluid required and order from Blood Transfusion Services.

5. Explain the procedure to the patient. Assess vital signs.

6. Set up and prime the machine according to the manufactures guidelines (refer to Operator’s Manual). Enter the appropriate patient information (HCT, height, weight, gender).
7. Perform venipuncture according to CC 80-019 Peripheral IV Therapy Initiation and Maintenance or access the central line as per the appropriate process.


9. During the procedure, record the patient’s vital signs in the comment section of the run data every ½ hour or more often.

10. Following rinseback, remove the needles or disconnect the patient from the machine. Monitor the patient’s blood pressure prior to removing the return line. Repeat the patient’s vital signs and record as the post-procedure vital signs.

11. Discard disposable sets for all procedures as biomedical waste. Place the collected plasma in a white plastic bucket and label as “Body Fluids” – Biomedical Waste. (Refer to CH 90-017 Biomedical Waste Management.)

12. Document the procedure and any adverse reactions on the progress notes of the patient’s health record.

12.1 For ambulatory care patients, document in the Narrative Note section of the Nurse’s Notes.

PEDIATRIC THERAPEUTIC PLASMA EXCHANGE (PLASMAPHERESIS)

Note: The pediatric policy and guidelines are to be used in conjunction with the previous policy and guideline statements.

GUIDELINES

1. Prior to initiating the plasma exchange, obtain a CBC, INR, PTT and ionized CA++. Weigh child prior to each procedure.

2. Assess vascular access for each child. Whenever possible, use peripheral veins. If required the Hematologist arranges to have a central line (Vascath, Hemostar or Hickman catheter) inserted.

3. The Hematologist adjusts the medications listed on the preprinted orders for TPE in Apheresis to pediatric doses for the weight of the child.

4. Consider cardiac monitoring and pulse oximetry on young children (less than 20Kg) and on children who are hemodynamically unstable.

5. Follow the same guidelines for replacement fluids for pediatric patients as for adults.

6. For pediatric patients who weigh less than 20Kg or who weigh 20-40 kg and whose hemoglobin is less than 70g/L prime the circuit with packed red blood cells (PRBC). (The volume required for a blood prime is 250 mls).

6.1 Use a blood prime to avoid fluid shifts within the patient. Use CMV Negative, ABO compatible, irradiated PRBC’s. The hematocrit for undiluted PRBC’s is 50% -70%.

6.2 Refer to the Operator’s Manual, for helpful hints on blood prime in pediatric patients.

6.2.1 Patients who are hemodynamically unstable may also require blood prime.
6.2.2 To maintain the patient in an isovolemic state and in cellular equilibrium, do not perform rinseback.

6.3 The Hematologist ordering the procedure determines if the priming PRBC’s are to be returned to the patient during rinseback. If the blood is not to be re-infused, the rinseback may be bypassed after clamping the access. Enter “Change Mode” and press “Unload Set”. Disconnect the patient and obtain the run data prior to unloading the kit.

7. As symptoms of citrate toxicity are non-specific and difficult to detect in young children, assess for the following symptoms: abdominal pain, vomiting, pallor, bradycardia, tachycardia, hypotension, anxiety, sweating, agitation, licking their lips (tingling).

Note: In infants, semi-conscious and / or critically ill children, hypotension may be the first sign of hypocalcemia.

PROCEDURE

Equipment

- Operator’s Manuals
- Blood Cell Separator
- Blood Warmer and blood warmer tubing
- Single-stage channel filler
- TPE disposable set
- 1000 mL 0.9% Sodium Chloride
- 1000 mL ACD-A
- Replacement fluid as ordered by the Hematologist
- Dravon clamps (3)
- AV Fistula Set needles x 2 or equipment for accessing central venous catheter
- Alcohol swabs
- Tape
- 100 mL 0.9% Sodium chloride
- Heat sealer
- Equipment for arm preparation
- 2x2 gauze (sterile)
- Vacutainer tubes
- Patient labels
- Gloves – sterile and clean
- Fenwal 600 mL transfer pack and / or Fenwal 2000 mL transfer pack

1. Calculate the Total Blood Volume (TBV) use the following formula:

- Neonates (up to the age of one month) = 100mL /Kg
- Infants and children (from the age of one month up to the age of 10 years) = 80mL /Kg
- Adolescents (from age10 to18 years) = 70mL /Kg

This is a CONTROLLED document for internal use only. Any documents appearing in paper form are not controlled and should be checked against the electronic file version prior to use.
2. Regulate the blood inlet speed to be between 1.0 – 1.5 mL / Kg / min. After a blood prime, consider decreasing the inlet flow rate for approximately 10 minutes to monitor for transfusion reactions.


4. Check and record the vital signs and procedure information:
   - q15 min during the first hour
   - q 30 min for the remainder of the procedure

5. Administer Ca Gluconate 10% intravenously for all pediatric TPE’s.

   Note: The pediatric team should determine the appropriate administration dose and rate of Ca Gluconate

REFERENCES
Blood Warmer Operator’s Manual
McLeod, Bruce C. Apheresis: Principles and Practice 2010 AABB Press
Terumo BCT Website and Operators Manuals

RELATED DOCUMENTS
 Policies
AU 02-001 Blood/Fluid Warmer Policy
CC 50-049 Non-tunnelled Hemodialysis Central Venous Catheter (CVC) (PELC)
CC 50-050 Care of The Tunnelled Hemodialysis Central Venous Catheter (PELC)
CC 75-005 Blood Transfusions: Administration of Blood, Blood Components and Blood Products
CC 80-015 Non-tunnelled Central Venous Access Catheter (multilumen) (PELC)
CC 80-016 Tunnelled External Central Venous Catheter (Hickman) (PELC)
CC 80-019 Peripheral IV Therapy Initiation and Maintenance (PELC)
CC 80-021 Central Venous Access Device (CVAD) Umbrella Policy (PELC)
CC 80-022 Care of an Occluded Central Venous Access Device (CVAD) (PELC)
CC 85-079 Venipuncture for Blood Specimen/Blood Culture Collection (PELC)
CH 70-045 Consent to Treatment
MM 30-005 Direct IV Administration of Medication (PELC)

Forms
PPO0193MR Pre-printed Orders for Therapeutic Apheresis Procedures (Hematology)

Appendices
Appendix A- Therapeutic Plasma Exchange – Replacement Solutions

This is a CONTROLLED document for internal use only. Any documents appearing in paper form are not controlled and should be checked against the electronic file version prior to use.
Other
Apheresis - Emergency Drug Doses
Complications of Therapeutic Apheresis and Suggested Management
(the above are published with this policy under the Documents section)

* * *
Appendix A

Therapeutic Plasma Exchange (TPE) – Replacement Solutions
The following may be used as a guideline for the replacement fluid to be used for specific diseases. The Hematologist ordering the TPE will ultimately decide which type of replacement fluid will be used.

1) FRESH FROZEN PLASMA (FFP), CRYOSUPERNATANT Plasma (CSP) AND/OR SOLVENT-DETERGENT TREATED PLASMA (SDP)
   - Thrombotic Thrombocytopenic Purpura (TTP)
   - Hemolytic-Uremic Syndrome (HUS)
   - These two conditions may have FFP, or cryosupernatant plasma (CSP) as replacement fluid
   - Good Pasture’s Syndrome if pulmonary haemorrhage is present
   - ABO incompatible liver/kidney transplant - pre and post transplant
   - Post biopsy – Hematologist may request FFP for first and second TPE for conditions normally replaced with 5% albumin to obtain benefit from coagulation factors in FFP
   - HELLP Syndrome
   - HIT
   - Idiopathic Thrombocytopenic Purpura

2) 5% ALBUMIN
   - Acute/chronic Guillain-Barré Syndrome
   - Myasthenia Gravis
   - Good Pasture’s Syndrome without pulmonary haemorrhage
   - Coagulation factor inhibitors (i.e. Factor VIII antibodies)
   - Multiple myeloma (may use a combination of Albumin and Saline)
   - Post liver transplant for ABO incompatibility (once coagulation factors in FFP not required)
   - Post kidney transplant for possible rejection of donated kidney
   - Chronic Inflammatory Demyelinating Polyneuropathy
   - Cold Agglutinin Disease
   - Cryoglobulinemia
   - Monoclonal antibody
   - Wegener’s granulomatosis
   - Encephalomyelitis – (Encephalomyeloradiculopathy)
   - Rapidly progressive glomerulonephritis
   - Stiff Person’s Syndrome (may be used in combination with Saline.)
   - Opsoclonus – Myoclonus Syndrome
   - Refsum’s Disease
   - Drug overdose and poisoning (involving protein-bound toxins)
   - Eaton-Lambert Syndrome
   - Hypercholesterolemia (may use a combination of Albumin / Saline)
• Pemphigus Vulgaris
• Autoimmune haemolytic anemia
• Systemic vasculitis (primary or secondary to RA or SLE)
• Light chain disease (Monoclonal paraproteinemia)
• Scleroderma
• Waldenstrom’s Macroglobulinemia
• Hyperviscosity (may use a combination of Albumin and Saline)
• Sjogrens Disease

**NOTE:** 5% Albumin is to be administered according to the CC 75-005 Blood Transfusions: Administration of Blood, Blood Components and Blood Products