Hemodialysis (HD) or Continuous Renal Replacement Therapy (CRRT): Initiating & Discontinuing Therapeutic Plasma Exchange (TPE) Hemodialysis or TPE and CRRT Combo

Site Applicability

SPH Only: In-Centre Hemodialysis Unit, ICU/CSICU

Practice Level:

Specialized:

1. *Registered Nurses who have at least two years of experience in hemodialysis (including one year experience on 6D),*
2. *RNs have completed the required education and training (and provide nursing care in a St. Paul's Hospital Renal Program hemodialysis*
3. *RN performs this procedure in collaboration with Critical Care nurses in CSICU/ICU at SPH*

Need to Know:

1. Therapeutic plasma exchange (TPE) is indicated for various immune related disorders but not limited to renal, hematologic and neurologic conditions. However, patients with severe renal involvement requiring hemodialysis (HD) or continuous renal replacement therapy (CRRT) may also require a concurrent therapeutic plasma exchange treatment (see powerplan order in Cerner).
2. Prior to initiating therapeutic plasma exchange, RNs must ensure that patient's informed consent for the procedure and blood/blood products is obtained and signed.
3. 5% Albumin and fresh frozen plasma may be combined as treatment plan during therapeutic plasma exchange (TPE). When fibrinogen level of patient is low (less than 100 mg/dl), FFP is usually ordered as another source of coagulation factor that is usually given during the last part of the procedure to prevent a bleeding tendency.
4. This procedure is used for patients requiring both hemodialysis (HD) and therapeutic plasma exchange, or TPE and CRRT. This is often referred to as a "Combo". The "Combo" allows both procedures to be done together, thereby decreasing the time spent in the hemodialysis unit or in critical care unit by saving length of time for either Combo treatments.
5. COMBO treatments require one-to-one nursing care and therefore must be coordinated by the clinical nurse leader (CNL) of the hemodialysis unit (6D) or delegate.
6. CRRT is only performed by registered nurses in ICU/CSICU who have received education and training in CRRT Level 1 basics and the use of approved CRRT machine.

7. On initiation of TPE, arterial and venous pressure in the dialysis circuit will change as blood runs parallel through the TPE circuit.
8. The TPE circuit is connected to one of the limbs of the arterial Y connector and is used as access line; while one of the limbs of the venous Y connector is used as return line

Equipment and Supplies:

1. Spectra Optia® TPE machine
2. Spectra Optia® disposable Exchange set
3. Fistula or Graft – Refer to Hemodialysis: Cannulation of an Arteriovenous Fistula or Graft, procedure
4. Hemodialysis CVC sterile scrub tray (1)
5. 2% Chlorhexidine Gluconate and 70% Isopropyl alcohol swabs (8 to 10)
6. Sterile 10 mL syringe (4)
7. Disposable drape (blue pad) (1)
8. "Y" luer lock adaptor with clamps (3)
9. 20 mL pre-filled Normal Saline syringe (2 to 4)
10. 1 to 2 -Anticoagulant Citrate Dextrose Solution (ACD) formula A 500 mL bag
11. Preparation for Intravenous Calcium:
    - Calcium Gluconate 10% 1 g/10 mL IV Vials
    - Alaris Pump and Alaris Infusion Set
    - 1 - "Y" Luer Lock Adaptor with Clamps
    - 1 - 50 mL Normal Saline (NaCl 0.9%) bag

Assessment:

Anticoagulation:

TPE necessitates systemic anticoagulation to prevent thrombus formation and platelet deposition in the blood circuit of the TPE Spectra Optia® machine.

- ACD-A (Anticoagulant Citrate Dextrose Solution USP Formula A) is the anticoagulant of choice, which chelates serum calcium of patient and may result to reduce ionized calcium concentration. Calcium is required in the coagulation process.
- As it would be very dangerous to return blood to the patient with a very low ionized calcium concentration; the process is reversed by the infusion of calcium gluconate into the venous return line of one of the limbs of the venous Y connector.

Signs of Clotting:

- Arterial side: visible clotting and Arterial pressure (high negative)
- Venous side: visible clotting and/or high venous pressure

Signs & Symptoms of Hypocalcemia (as a result of ACD-A infusion):

- Mild: Tingling of lips, tongue and fingertips, muscle cramps particularly back and legs, shivering, light-headedness, twitching, and tremors.

- Severe: Frank tetany with spasms in other muscle groups, including life threatening laryngospasms, grand mal seizures and cardiac arrest.

Treatment of Hypocalcemia:

- Most often 10% Calcium Gluconate 1 g. IV/hour ordered by the MD and may be increased up to 2 g. IV/hour (see Powerplan Order in Electronic health record [EHR])

Effect of Hematocrit Level:

- Hematocrit (Hct) level entered in the patient data section is used by the Spectra Optia® system to calculate the limits for plasma volume and the initial plasma flow rate. If the entered Hct is higher or lower than the actual or current patient's Hct value, the system cannot correctly position the interface, thus causing alarms. (See B-00-12-10078, Appendix A – Trouble shooting common machine alarms)
- **Low Hematocrit (Hct)** - due to bleeding, anemia etc.; Centrifuge speed is lower as there are not as many RBCs to pull away from the interface.
- **High Hematocrit** - due to blood transfusion or incorrect level programmed into the Spectra Optia® TPE machine

Interventions:

During and at the end of each treatment:

- RNs must assess the patient for any signs and symptoms of hypocalcemia, hypotension, hemorrhage, vasovagal syncope, and reactions to given blood products (FFP and albumin).
- RNs must ensure that patient can be safely discharged and instructed of any changes in medications and/or in TPE treatment schedule. Monitoring and documenting of patient's conditions are expected
- RNs must ensure that all documentation and core data from the electronic health record (e.g. nursing narrative notes, iView), care guide form, and Canadian Apheresis Group (CAG) database are completed after each procedure.
- RNs are expected to inform treating nephrologist and other health care team members of any complications or adverse reactions.
- If patient admission to the hospital is required after a COMBO procedure, RNs must do a handover verbally and/or use the hand off tool from Cerner to the receiving ward staff.
- Print transfer ticket from EHR and send with patient upon transport
- RNs should follow safe cytotoxic practices when performing this procedure if patient is considered cytotoxic (Occupational Health and Safety Cytotoxic Handling Policy)

Procedures:

Initiating TPE with HD (COMBO)

STEPS	RATIONALE
1. Prepare and open HD scrub tray; then place in three luer lock Y connectors and pre-filled normal saline syringes	
2. Don appropriate protective personal equipment e.g. gown, sterile glove , face shield with mask	Maintain sterile technique to prevent infection and blood/body fluids contamination
3. Prime the three Y connectors with normal saline	This prevents air being introduced to the patient causing air emboli
4. Clean arterial and venous lumens using CHG 2% and isopropyl alcohol 70% swabs with a friction rubbing motion for 15 seconds. Allow to air dry for minimum of 30 seconds	
5. Attach to both arterial and venous lumen of CVC access (see image below)	
6. Initiate hemodialysis prior to starting TPE using regular initiation procedure.	See B-00-12-10152 - HD: Accessing a CVC with and without Tego connectors Normally hemodialysis takes longer than TPE procedure
7. Connect 10 mL syringe to one limb of the "Y" connector and aspirate blood in the venous line to prime the limbs prior to attaching to TPE lines	This prevents introducing air to the venous hemodialysis line that can cause air emboli
8. Attach the primed calcium gluconate infusion line to one of the limbs of the return Y connector (#3). (see image below)	
9. Decrease hemodialysis blood pump speed to 250 to 300 mL/min before starting TPE	Reduce the possibility of pressure alarms and stoppage of HD machine
10. Initiate TPE procedure as per protocol	Refer to B-00-12-10078: Initiating and Discontinuing TPE, procedure
11. Increase both TPE and hemodialysis blood pump speeds to optimize blood flow for both treatments	• For TPE, speed is determined by inlet flow and plasma removal rate • • For hemodialysis, the maximum and minimum venous and arterial pressure determine speed

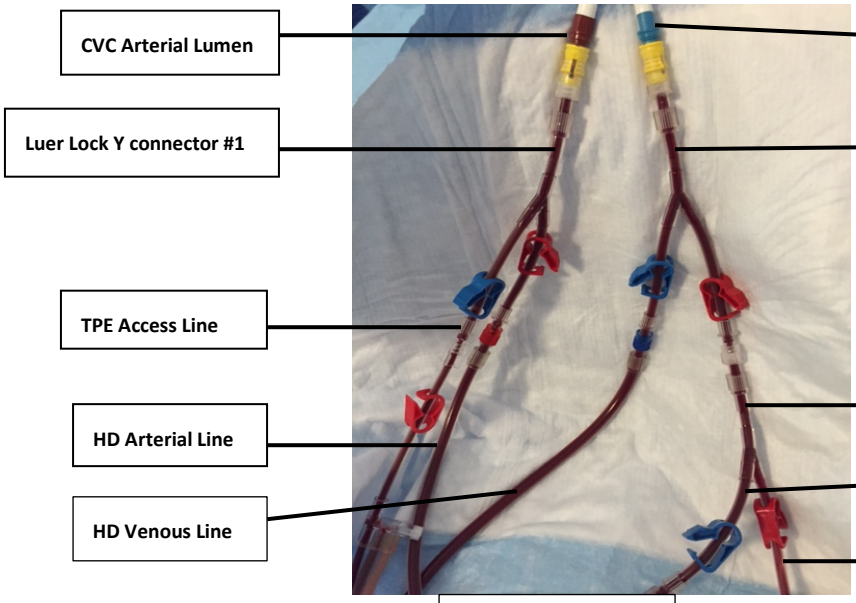

Image #1 TPE with HD

Initiating TPE with CRRT (COMBO)

STEPS	RATIONALE
1. Open a HD CVC scrub tray and place three luer-lock Y connectors on the sterile field	Maintain sterile technique to prevent infection.
2. Don sterile glove and face shield with mask	
3. Prime Y connectors with normal saline and prepare to attach to CVC access.	
4. Clean catheter lumens with CHG 2% & 70% isopropyl alcohol swab using rubbing frictions for 15 seconds. Allow to dry for minimum 30 seconds.	This is maintaining infection control and prevention
5. If CCRT is running, have the ICU/CSICU nurse press stop on the CRRT machine and clamp the access and return lines.	
6. Disconnect **CRRT access line** from CVC access and connect to **Y connector #1** and connect complete set up to **access line**	This facilitates an easier transition to start CRRT and TPE
7. Disconnect **CRRT return line** from access and connect to **Y connector #2** and connect complete set up to **return line**	
8. Ensure that CRRT **access** and **return** lines **are clamped** prior to disconnection from CRRT	

circuit and reconnection to one of the limbs of Y connector **#1** and Y connector **#2**	
9. Open all clamps on access and return lines	
10. Inform RN ICU/CSICU to restart CCRT machine	This will allow continuing the CRRT and preventing clotting of the circuit.
11. Establish with ICU/CSICU RN that CCRT is smoothly running prior to connecting the TPE lines to Y connector **#1** and Y connector **#3**	
12. Initiate TPE procedure as per protocol	Refer to B-00-12-10078: Initiating TPE, procedure The CRRT blood pump speed may need decreasing on initiation of TPE depending on access and return pressures. Titration of the CRRT blood pump may be required to maintain the operating limits for the CRRT machine to prevent alarms that may contribute to circuit clotting.
13. Attach the primed calcium gluconate infusion line to one of the limbs of the return Y connector **#3**. See image #2 below	Refer to powerplan order in Cerner for titrated calcium gluconate infusion

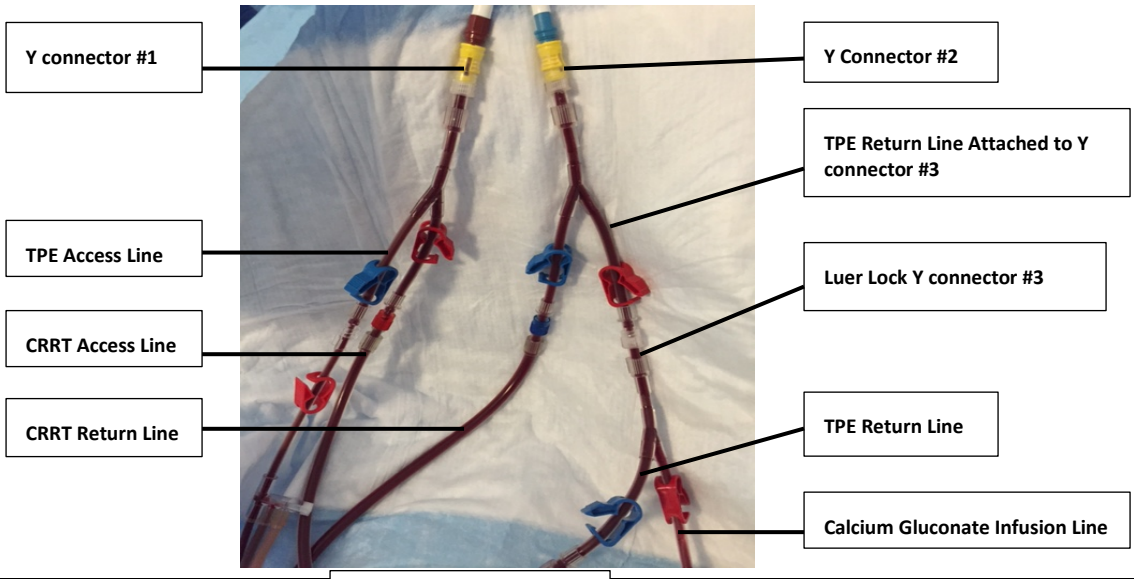

Image #2 TPE with CCRRT

Discontinuing COMBO

STEPS	RATIONALE
For Hemodialysis: When TPE procedure is completed, 1. clamp TPE access line of "Y" connector 2. Return the blood as per instruction from TPE Spectra Optia® Machine Manual. 3. Decrease blood flow if venous pressure increases to greater than 250mmHg. 4. Once all blood has been returned from TPE circuit or rinseback is completed, clamp all TPE return lines and calcium gluconate infusion lines of "Y" connector #3 **5.** Disconnect #3 "Y"connector from the TPE return line of "Y" connector #2 and remove the entire TPE circuit from the CVC access **6.** Ensure both limbs of the "Y" connectors are clamped and ends of both ports are closed with luer lock port caps. **7.** Increase HD blood pump speed to allowable maximum limit if previously decrease	• See B-00-12-10078: Initiating and Discontinuing TPE • See image 1 – TPE with HD • Reduce the possibility of alarms Always use aseptic technique to prevent contamination and infection
For CRRT: When TPE procedure is completed: 1. Once all blood returned from TPE circuit, have the ICU/CSICU nurse press stop on the CRRT machine and clamp the access and return lines 2. Disconnect CRRT access line from Y connector **#1** and connect to CVC access 3. Disconnect CRRT return line from Y connector **#2** and connect to CVC return access 4. Ensure that CRRT **access** and **return** lines **are clamped** prior to disconnection from Y connectors **#1** and **#2** and connect to CVC access again. **5.** Open all clamps on access and return lines **6.** Inform ICU/CSICU nurse to restart CRRT	• **See image 2** – TPE with CRRT • This facilitates easy transition to end TPE and restart CRRT • Always maintain aseptic technique to control and prevent infection

Remove used TPE tubings from the centrifuge and the disposable exchange set from the front panel. Leave on top of the TPE machine for technician to dispose and clean/disinfect the machine	See B-00-12-10078 – Discontinuing TPE, Procedure

Documentation

Cerner Electronic Health Record (iView)	
For TPE: ○ Diagnosis and patient's access ○ Pre weight and vital signs ○ Pre/post blood work ○ Most recent hematocrit ○ A/C Ratio and AC rate/volume ○ Maximum plasma removal rate and plasma removal rate ○ Replacement fluid type and exchange volume ○ Percentage of replacement ○ Vital signs post treatment ○ Length and number of treatment ○ Medications given ○ Final fluid balance/values: • Exchange volume • ACDA in collect bag • Ca replacement • Normal Saline (rinseback) • Total fluid in minus total fluid out equals to net fluid difference	**For HD:** ○ Pre weight ○ Amount of Fluid to be removed ○ Pre vital signs ○ Heparin as ordered ○ Potassium bath and conductivity ○ Length of treatment o Hourly checks or more frequently as needed ○ Patient's weight post treatment ○ Amount of fluid removed o Vital signs post treatment ○ Length of treatment ○ Medication given • Final values: • Final spKt/v • Final conductivity • Blood volume processed
CAG Database Enter Post TPE information for national core data record collection and tracking	
CRRT Record ICU/CSICU RN is responsible to record data related to CRRT information	

Patient and Family Education

1. Patient receiving TPE should be aware of signs and symptoms of mild hypocalcemia. These can include tingling of lips, tongue and fingertips, muscle cramps particularly back and legs, restlessness, BP may drop, shivering, light-headedness, twitching, and tremors.
2. Patient receiving TPE should also be aware of the treatment for hypocalcaemia. For mild symptoms, patient receives IV Calcium infusion and may be titrated as per prescriber order in the powerplan.

3. Patient receiving TPE should also be aware of possible blood product reactions which may include rash, itchiness, back pain or fever.
4. Before discharge, patient should be aware and instructed of any changes in medications, condition and care of access site, and/or in TPE treatment schedule.

Related Documents

1. B-00-12-10152 - HD: Accessing a CVC with and without Tego connectors
2. B-00-12-10059 – Hemodialysis: Administration of IV medication via the Venous Injection Port during Hemodialysis
3. B-00-12-10078 - Hemodialysis: Initiating and Discontinuing Therapeutic Plasma Exchange
4. B-00-12-10101 – Hemodialysis: Attaching or Changing TEGO Connectors on Central Venous Catheters (CVC)
5. B-00-13-10068 – Blood/Blood Products: Transfusion Reaction Identification and Management
6. CST Cerner Help at http://cstcernerhelp.healthcarebc.ca/#t=Whats_New%2FWhat_s_New.htm
7. Occupational Health and Safety Cytotoxic Handling Policy

References

1. Bambauer, R., Latza, R. & Schiel R. ((2013). (4th Edition). Therapeutic Plasma Exchange and Selective Plasma Separation Methods. Pabst Science Publishers, Lenegerich.
2. Daugirdas, J., Blake, P. & Ing, T. (2015). (5th Edition). Handbook of Dialysis. Wolters Kluwer Health, Philadelphia
3. Dechmann-Sultemeyer, T., Linkeschova, R., Lenzen, K., Kuril, Z., Grabensee, B., Voiculescu, A. (2009).Tandem plasmapheressis and hemodialysis as a safe procedure 82 patients with immune-mediated disease. Nephrology Dialysis Transplantation. 24(1), 252 - 257.
4. Kaplan, A. Appel, G., & Pussey, C. (2021). Literature review: Anti-GBM (Goodpasture) disease: Treatment and prognosis. UpToDate & Wolters Kluwer. https://www.uptodate.com/contents/anti-gbm-goodpasture-disease-treatment-and-prognosis?search=Combination%20Hemodialysis%20with%20Therapeutic%20Plasma%20Exchange&source=search_result&selectedTitle=5~150&usage_type=default&display_rank=5#H13476768
5. Linenberger, M.L. & Price, T.H. (2005). Use of Cellular and Plasma Apheresis in the Critically Ill Patient: Part II: Clinical Indications and Applications, Journal of Intensive Care Medicine. 20(2), 88 - 103.
6. Madore, F. (2002). Plasmapheresis. Technical aspects and indications. Critical Care Clinics. 18: 375-392.
7. Mcleod, B.C. (2005). Therapeutic Apheresis: A Physician's handbook (1sted.). Bethesda, Maryland: AABB.
8. Terumo BCT, Inc. (2015). Spectra Optia® Apheresis System, Operator's Manual.
9. Terumo BCT, Inc. (2010). Spectra Optia® Apheresis System, Therapeutic Plasma Exchange (TPE) Procedure Guide and Essential Guide.

10. Tolwani, A., Willie, K., Schwab, S. (Editor), & Sheridan, A. (Editor) (2016). Literature review: Anticoagulation for continuous renal replacement therapy. UpToDate & Wolters Kluwer. http://www.uptodate.com/contents/anticoagulation-for-continuous-renalreplacement-ther...
11. Thomas, G., Schwab, S. [Editor], & Sheridan, A. [Editor] (2016). Literature review: Continuous renal replacement therapies: Overview. UpToDate & Walters Kluwer http://www.uptodate.com/contents/continuous-renal-replacement-therapiesoverview?topi...

Persons/Groups Consulted

Renal Practice Group

Developed by

NE Hemodialysis

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