SARASOTA MEMORIAL HOSPITAL

NURSING PROCEDURE

TITLE: EXCHANGE TRANSFUSION OF THE INFANT (nur12)  
DATE: 2/88  
REVIEWED: 2/17  
PAGES: 1 of 8

ISSUED FOR: Nursing – Neonatal Services

RESPONSIBILITY: RN – Neonatal Services

PURPOSE: To provide guidelines for safe sterile removal of infant’s blood and administration of donor blood.

1. In hyperbilirubinemia: To remove bilirubin and the antibody coated RBC’s from the infant’s circulation.
2. In sepsis: To remove levels of circulating endotoxins.
3. In anemia or polycythemia: To establish a normal hematocrit.
4. In severe fluid or electrolyte imbalance: To return balance.

KNOWLEDGE BASE:

1. The procedure reduces elevated Bilirubin or electrolyte serum levels when they have reached an unsafe level that cannot be reduced by other means.
2. Whole blood is optimal
3. Reconstituted Packed Red blood cells (PRBC's) plus fresh frozen plasma
4. Fresh heparinized blood is preferable
5. Washed cells may be used for hyperkalemic infants.
6. As both stored whole blood and reconstituted blood may be platelet poor, platelet transfusion may also be required.
7. The donor blood may be more acidic than desirable and infant should have blood gasses drawn prior, during and post transfusion.
8. Infant needs a blood clot or cross match sent if:
   a. Designated donor that is not type "O"
   b. If infant has an antibody
   c. > than 3 months age completed

For procedure, see ADMINISTRATION OF RED BLOOD CELLS AND WHOLE BLOOD TO A NEONATAL PATIENT (nur18)

EXCEPTIONS: None.

DEFINITIONS:

1. Exchange transfusion (ET): The process of repeatedly withdrawing small volumes of infant blood through an umbilical catheter and replacing with equal volume of donor blood until the majority of the infant’s blood has been removed and replaced.

2. Double Volume Exchange: The volume exchanged is usually 160ml/kg in full term infants and 180ml/kg in premature infants. This involves double the volume of the infant’s blood.
3. Partial Volume Exchange: The volume exchanged is less than 2 volumes of the infant’s blood volume or less than 160 ml/kg.
   *Cochrane review states insufficient data to support or refute the use of single volume exchange transfusion as opposed to double volume exchange transfusion in newborns with jaundice. Double volume exchange transfusion is still indicated for infants with severe jaundice and RH hemolytic diseases.

**EQUIPMENT:**

*Parental consent necessary prior to procedure*

Assemble the following:

**Personnel:** The procedure is performed by one physician/ARNP, a Registered Nurse (RN) and a scribe (if possible).

1. Identify Infant per procedure
2. Perform Time-Out procedure and document on EMR
3. Prepare the infant:
   a. Put baby supine on Ohio Platform with Servo probe in place.
   b. Obtain Chemstrip to determine if PIV is needed immediately.
   c. Contain all 4 extremities with soft bindings pinned to bedding.
   d. Put CR monitor, pulse ox and B/P cuff on infant.
   e. Keep upper body available to view color and respiratory effort.
   f. Provide sedation as ordered. Protect eyes from overhead lights.
4. Prepare equipment using sterile technique:
   a. Open instrument tray on cart.
   b. Pour sterile heparin flush from pre-filled syringes, into large glass cup and open iodine swabs.
   c. Add syringe(s) (size of Physician choice), suture, and catheter size of physician’s choice, stopcock(s), and umbilical tape.
   d. Assist physician with gowning and gloves.
   e. Set up parenteral fluid using KVO tubing and appropriate size syringe (example IV is ordered at 1 ml/hr, use 30 ml syringe for 24 ml)

2. Equipment For transfusion:
   a. Radiant Servo Controlled warmer;
   b. Cardio-Respiratory monitor with B/P capabilities; and pulse oximeter
   c. Resuscitation Equipment including Ambu bag or T-Piece resuscitation device, oxygen and suction;
   d. Chemstrip machine;
   e. Exchange transfusion form;
   f. NG tube 6.5 fr. – 8 fr.;
   g. Bili lights, blanket, eye patches (if phototherapy in
progress during procedure).

h. Alcohol wipes
k. Sterile 4x4s, gloves
l. IV Pole
m. Disposable exchange transfusion tray
n. Tape measure
o. Order set for labs activated
p. Medfusion pump (programed to run fluids at a high rate & labeled “Exchange Transfusion only”)
q. Blood warmer and appropriate coil tubing
r. Large bore IV extension tubing
s. Heparinized saline bag
t. KVO tubing
u. Lab tubes
   a. Chem 7/Chem8
   b. CBC/d/plt
   c. Bili
   d. Glucose

3. Administration:
   a. Syringes: 3 ml; 6 ml; 12 ml; 60 ml;
   b. prefilled syringes of 3 ml of Normal Saline
c. Extension tubing;
d. Collection container for discarded blood;
e. Stopcock;

4. Medications:
   a. 10% Calcium Gluconate;
b. Albumin (Optional)
c. Resuscitation Meds.

**CAUTION NOTE:** Medications **CAN NOT** be added to the blood.

**PROCEDURE:**

**PREPARATION OF THE INFANT:**
1. The Registered Nurse (RN) will reinforce the physician’s explanation of the procedure to the parent(s).

2. The infant will be placed on the radiant warmer on Servo Control and on a cardio-respiratory monitor with alarm limits set and audible while procedure is performed. BP cuff should be placed on right upper arm.

3. Time out performed

4. All four extremities of the infant will be properly contained with soft bindings and assessed for proper circulation during and following the procedure.
5. The physician will place the umbilical/central line per procedure if not in place. Assist as appropriate. Line placement will be verified by x-ray. If a UAC and a UVC are in place, blood will be withdrawn via the UAC and transfused via the UVC.

6. Verify and/or establish a peripheral venous access and infuse fluids per physician’s order. An infusion containing dextrose will be necessary as a glucose source during exchange transfusion.

7. Place oral or nasal gastric feeding tube to straight drainage, aspirate, and record gastric content. Infant should be NPO pre and post at least 4 hours.

8. Usually phototherapy lights are off during the procedure. If they are used during the procedure to reduce tissue bilirubin, secure eye patches to prevent retinal damage before turning lights on.

9. Obtain heelstick or central blood sample for glucose.

VITAL SIGNS:
Record baseline vital signs and record every 15 minutes throughout the procedure, including BP. Glucose monitoring must be done before, during and after transfusion.

1. Proper identification of infant and the blood products must be verified in writing by two RN’s in the presence of the recipient, item by item, on the Blood Bank tag. The infant’s name and hospital identification number on the identiband must correspond with the same information that appears on the Blood Bank tag attached to the product.

2. Read the blood product type, blood unit number, blood group and Rh type on label. This information must correspond with the blood bank tag. Blood should be CMV Safe, leukocyte reduced and irradiated. If there is a problem with the identification of the blood, it must be returned to the Blood Bank.

PERFORMING THE EXCHANGE TRANSFUSION:

2. Connect large bore extension set tubing to blood syringe with pre-filtered blood. Prior to priming connect coil tubing and insert it into the blood warmer. Prime extension set and coil tubing with blood and connect to central line. Assemble stopcock per manufacturer instructions and tie the waste bag below the bottom of the bed. Each central line should have a 3-way stopcock attached.
Method A

The most common technique used to withdraw and administer blood is the “push-pull” technique. This will require a UVC be placed-use the special stopcock included in exchange transfusion tray. The push-pull technique is performed as follows:

a. Using a special stopcock included in exchange transfusion tray and appropriately sized syringe.
b. “Pull” 5 to 10 ml of blood, per order, from the infant, and discard into the fluid collection bag
c. “Push” the warmed donor blood into infant at a slow and consistent rate (usually 2-4ml/minute per cycle)
d. Continue this pattern of “pulling” blood from the infant, discarding it and “pushing” donor blood into infant until the desired amount of donor blood has been exchanged per order.

NOTE: The weight and stability of the infant will be a factor in the physician’s determination of the volumes for withdraw and administration. Blood is usually exchanged in aliquots of 10 to 20 ml for a term infant and 5 to 10 ml for a severely anemic, hydropic or pre-term infant. A guide for exchange amounts per weight follows:

- 5 ml for infant < 1500 gm
- 10 ml for infant 1500-2500 gm
- 15 ml for infant 2500-3000 gm
- 20 ml for infant > 3500 gm

Blood should be gently mixed after every deciliter of exchange to prevent setting of RBC’s with exchange of anemic blood at end of transfusion.

NOTE: All possible air bubbles must be removed from the blood to prevent the possibility of air embolism.

3. The first 5 or 10 ml of blood withdrawn from the infant may be used for pre-exchange lab studies, per physician’s order. Post-transfusion lab studies may also be ordered.

4. Notify the physician performing the exchange transfusion when each 100 ml of blood has been exchanged.
   a. Calcium gluconate may be used at this time to counteract the effects of calcium binding by the preservative. The usual dose is 1ml/100 ml of blood exchanged.
   b. If calcium gluconate is given, it should be given via peripheral IV or UAC, but never via UVC into atrium but without other access, can it be given via UVC very slowly.
c. HCT, glucose and calcium are routinely done after exchange, CBC, Bilirubin, electrolytes, platelets may also be ordered.

5. When the last aliquot of blood is withdrawn from the infant it should be sent to the lab for post-exchange lab work - (same as pre-transfusion labs).

**Method B**

1. The second method is isovolumetric exchange with simultaneous infusion of donor blood through venous line and removal of baby’s blood through arterial line,
2. Infusion of donor blood may be through umbilical venous catheter or peripheral intravenous catheter.
3. Removal of baby’s blood may be from umbilical arterial or venous catheter, or peripheral arterial catheter.
4. Connect blood to be transfused to large bore IV extension tubing and then to the coil tubing for the fluid warming System.
   DO NOT PRIME WITH BLOOD AT THIS TIME.
5. Insert coil tubing into fluid warmer.
6. Prime extension set and coil tubing and connect to UVC or peripheral line.
7. Set up exchange Medfusion pump and program it to the ordered rate. (pump is able to run max. 350ml/hr.)
8. Set up UAC line with KVO heparinized fluid to a proximal stopcock. A special four way stopcock (included in ET tray) is attached to proximal stopcock and set up to waste bag.
9. The direction the handle of ET stopcock is pointing to indicates the port that is open to syringe. The handle is turned clockwise to withdraw blood at the rate and speed ordered by physician and to clear it to waste bag.
10. Follow steps as provided by manufacturer to make all connections to blood and waste bag.
11. With stopcock open to blood source, clear all air into Syringe. Turn in clockwise direction and evacuate in waste.
12. Upon completion of ET clear central lines of blood and infuse IV fluids with 0.5 to 1 U heparin/ml until no further ET are anticipated.

*For any infant in whom an exchange is likely and a UAC and UVC are going to be placed, make certain that the 4 way stopcock is available at the time of line placement.*

**POST EXCHANGE TRANSFUSION CARE:**

1. Umbilical catheters remain until discontinued by neonatologist.
2. Continue to assess the vital signs every 15 minutes x 1 hour, then every 30 minutes x 3 hours, or per the physician’s order.

3. Glucose within 1 hour of completion of transfusion. Hypoglycemia often occurs 1-2 hours after an exchange.

4. Neonates receiving antibiotics or anticonvulsants should be re-medicated per physician order following the exchange transfusion. Digoxin re-administration is not indicated unless cardiac status is deteriorating.

5. Resume phototherapy if it was being used prior to exchange transfusion. Bilirubin may rebound two to four hours after transfusion.

6. Evaluate hematocrit, hemoglobin and platelets at four hours after procedure.

7. Wait a minimum of four hours post transfusion to feed to minimize risk of necrotizing enterocolitis (NEC) or may be kept NPO if anticipating another exchange transfusion.

8. Talk to the family to inform them of the infant’s response to procedure and offer support.


DOCUMENTATION:
1. Using the “Exchange Transfusion Flowsheet”, record the blood in, out, and a running total. The vital signs and other comments may be added to this sheet, or documented on the Electronic Medical Record (EMR). At the end of the exchange transfusion, the total amount of blood given should equal the total amount of blood withdrawn.

2. Complete Blood Bank tag either on paper or in EMR, recording the type of blood product, date, time of administration and co-signature.

3. EMR: Document in I&O, the total amount of blood in and out in the appropriate flowsheet (the Exchange Transfusion Flowsheet has the more detailed documentation of this procedure), volume of flushes and other fluids, additional Vital Signs as appropriate, and infant’s tolerance of the procedure. Document size of central line used during transfusion.

COMPLICATIONS:
1. Hypocalcemia: May occur during exchange.
2. **Hypoglycemia:** This often occurs 1-2 hours after the exchange.

3. Heart failure, cardiac arrest, irregular cardiac rhythm, air embolus, bacterial infections, acidemia, transfusion reaction, NEC, over heparinization, thrombocytopenia, electrolyte imbalance.

4. Infection following exchange transfusion is uncommon, but is the most frequent complication to be considered.

5. Ampicillin, gentamicin and vancomycin are most frequently used antibiotics after exchange transfusion.

6. Exchange transfusion alters the blood levels of certain medications. Bilirubin may rebound after the exchange transfusion and should continue to be monitored per physician's orders.

**REFERENCE (S):**


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