

STANDARDIZED PROCEDURE

NEONATAL EXCHANGE TRANSFUSION (Neonatal)

I. Definition

To exchange all or part of an infant's blood supply for certain medical conditions. A double volume exchange transfusion is replacing the baby's total blood volume twice, leaving the intravascular amount the same. A partial exchange is either increasing or decreasing an infant's hematocrit, while maintaining a constant blood volume.

II. Background Information

A. Setting

Inpatient neonatal patients or outpatient during Emergency Transport of neonatal patients. If appropriate, implement procedural support, if available- make sure Child Life is involved, and use age appropriate language and age appropriate developmental needs with care of children.

B. Supervision

The necessity of the procedure will be determined by the Advanced Health Practitioner (AHP) in verbal collaboration with the attending physician or his/her designee. Direct supervision is necessary until competency is determined and the minimum number of procedures is successfully completed, as provided for in the protocol. After that time, the attending physician or his/her designee must be available.

Designee is defined as another attending physician who works directly with the supervising physician and is authorized to oversee the procedures being done by the AHP.

C. Indications

Double Volume Exchange:

1. Hyperbilirubemia
2. Hyperammonimia
3. To remove bacterial toxins
4. To correct life-threatening electrolyte and fluid imbalance

Partial Exchange Transfusion

1. Severe anemia in the face of normal or excess blood volume.
2. Clinical polycythemia

D. Precautions/Contraindications

1. When alternatives such as a simple transfusion or phototherapy would be just as effective with less risk.
2. When a contraindication to placement of necessary lines outweighs the indication for exchange transfusion
3. When the patient is unstable and not likely to benefit from the procedure.

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The AHP will notify the physician immediately under the following circumstances:

1. Patient decompensation or intolerance to the procedure
2. Outcome of the procedure other than expected

E. General information

Double Volume Exchange

Try to use the freshest blood available (procured within 3-5 days) for the double volume exchange. If whole blood is not available, use a combination of fresh frozen plasma and packed red blood cells. The exchange volume is twice the infant's blood volume, using 85 ml/kg as the infant's blood volume. This procedure should be done slowly, over a minimum of 45 minutes and the blood volume should be kept fairly constant. See nursing procedure for further information. A consent must first be obtained for blood transfusion.

Partial Exchange

A consent must first be obtained for blood transfusion when raising hematocrit. An exchange is usually done for polycythemia when the HCT is between 65-72, depending on if infant is symptomatic or not. Use normal saline for an exchange to lower Hct. An exchange is done to raise the HCT when the infant has a chronic anemia, with a normal blood volume. Use PRBC's to raise Hct. An infant's blood volume is 85 ml/kg. The desired Hct is usually 45 –55%. Use the following formulas to calculate the amount of the exchange:

To Lower Hematocrit:

$$\text{Volume to exchange} = \frac{(\text{Wt in Kg} \times 85) \times (\text{Observed Hct} - \text{Desired Hct})}{\text{Observed Hct}}$$

To Raise Hematocrit:

$$\text{Volume to exchange} = \frac{(\text{Wt in Kg} \times 85) \times (\text{Desired Hct} - \text{Observed Hct})}{\text{Hct of PRBC's}}$$

III. Materials

A Double Volume Exchange

1. Hat
2. Mask
3. Sterile gloves
4. Sterile gown
5. Umbilical catheter tray with extra catheters
6. Heparinized flush solution
7. 10 or 20 ml syringes (depending on size of infant)
8. Blood warmer, filter, and tubing
9. Whole blood, or FFP and PRBC's
10. Calcium Gluconate

B. Partial Exchange Transfusion

1. Hat

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2. Mask
3. Sterile gloves
4. Sterile gown
5. Umbilical catheter tray with extra catheters
6. Heparinized flush solution
7. 10 or 20 ml syringes (depending on size of infant)
8. Normal Saline or PRBC's

IV. Exchange Transfusion

A. Pre-treatment evaluation

1. Premedicate infant for pain control and/or sedation. Assess need for further medication throughout the procedure.
2. Check relevant labs
3. Obtain consent for blood transfusion

B. Set up (if applicable)

Double Volume Exchange

1. Calculate the volume to be exchanged (2 X 85 ml/kg).
2. Check the hematocrit of donor blood.
3. Run the filtered blood through the blood warmer to maintain a temperature of 37-38° C.

Partial Volume Exchange

1. Calculate the amount of normal saline to be exchanged for the infant's blood to lower the hematocrit to the desired value, or the amount of PRBC's needed to be exchanged for the infant's blood to increase the hematocrit.

C. Patient Preparation

1. Don hat and mask, scrub hands, don sterile gown and gloves
2. Insert umbilical arterial and venous catheters per procedure, or a single umbilical catheter. Ensure adequate placement. Never infuse PRBC's through an umbilical arterial catheter. Only blood with a Hct < 55 may be infused through an umbilical venous catheter.
 - a. For a partial exchange, insert umbilical catheter per procedure. If unable to place an umbilical catheter, the partial exchange can be done by withdrawing blood from a peripheral arterial line and infusing saline or PRBC's through a PIV.

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D. Procedure

Double Volume Exchange

1. Perform time out with all appropriate steps.
2. If two catheters are in place, withdraw 5ml/kg blood from the arterial catheter and infuse 5ml/kg donor blood through venous catheter simultaneously.
 - a. If only an umbilical venous catheter is in place, withdraw 5-20 ml of infant's blood first, then replace with 5-20 ml of donor blood. Use smaller amount for smaller neonates – usually 5 ml /kg is desired amount at a time.
 - b. Continue in 5ml/kg aliquots until desired volume is exchanged.
3. Send first blood drawn for pre-exchange bilirubin, blood gas and other labs as noted in table 1.
4. The bedside nurse is to maintain strict in/out record, monitor vital signs, and blood temperature.
5. Halfway through the exchange, send blood gas and bilirubin.
6. To prevent hypocalcemia during procedure, give 30 mg/kg Calcium Gluconate IV after each 100 ml blood exchanged. May also administer Calcium Gluconate if there is unexplained tachycardia or arrhythmias.

Table 1
 Recommended Labwork for Double Volume Exchange
 (For hyperbilirubinemia)

Before	During	At Completion	4-6 hrs post-exchange
(Donor blood - Hct) Infant – ABG, Total & direct bilirubin, K, iCa, Total Ca, Hct, Plts, Glucose, ABG/VBG. PKU and Chromosomes as needed prior to procedure	Total and iCa halfway through procedure. Glucose q 30 minutes during exchange ABG/VBG half way through if infant is on increased oxygen or assisted ventilation	ABG/VBG Total & direct bilirubin and repeat Q hr X 2 iCa, Total Ca, K, Ca, Hct, Plts, Glucose. Glucose screen at 15, 30, & 60 minutes, then hourly until stable.	Hct at 4 hrs post procedure ABG/VBG prn Total & Direct bilirubin

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Partial Volume Exchange – To lower hematocrit

To Lower Hematocrit:

1. Perform time out with all appropriate steps.
2. Exchange the infant's blood for normal saline, in increments not to exceed 5% of the estimated total blood volume. Continue until the total exchange volume is reached.
3. Obtain a post-exchange hematocrit. If the Hct is 55% or greater, take out an additional 5 ml/kg of infant's blood to prevent further hemoconcentration.

To Raise Hematocrit:

1. Perform time out with all appropriate steps.
2. Exchange the infant's blood for donor blood, in increments not to exceed 5% of the estimated total blood volume. Continue until the total exchange volume is reached.

E. Follow-up treatment

Double Exchange Transfusion

1. At completion, send post-exchange labs (see Table 1).
2. Resume phototherapy if exchange was done for hyperbilirubinemia.
3. Observe in ICN. Do not feed for at least 4 hrs after umbilical lines removed.

Partial Exchange Transfusion

1. Send hematocrit at completion of exchange and 4 hrs after completion.
2. Observe in ICN for at least 4 hours and do not feed until at least 4 hrs after umbilical catheters removed

F. Termination of treatment

Stop the procedure if the infant's condition worsens

G. Potential Complications:

Double Volume Exchange

1. Same complications as UAC & UVC line insertion.
2. Microemboli

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3. Arrhythmias
4. Volume overload.
5. Cardiac arrest – from too rapid exchange or K⁺ toxicity.
6. Hyperkalemia, hyponatremia, hypocalcemia
7. Metabolic acidosis
8. Respiratory alkalosis
9. Thrombocytopenia
10. Infection
11. Transfusion reaction

Double Volume Exchange

1. Same complications as UAC & UVC line insertion.
2. Microemboli
3. Infection
4. Transfusion reaction
5. Anemia or polycythemia

IV. Documentation

A. Documentation is in the electronic medical record

1. Documentation of the pretreatment evaluation and any abnormal physical findings.
2. Record the time out, indication for the procedure, procedure, type, size, and placement of catheters used, method used, type and amount of blood products used and removed, EBL, the outcome, how the patient tolerated the procedure, medications (drug, dose, route, & time) given, complications, and the plan in the note.

B. All abnormal findings are reviewed with Attending or supervising physician

V. Competency Assessment

A. Initial Competence

1. The AHP will observe the procedure in its entirety at least once. Under the direct supervision of the attending physician the AHP will perform neonatal exchange

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- transfusions successfully **three** times and will be evaluated for competence and technical skill.
2. The AHP will demonstrate knowledge of the following:
 - a. Medical indication and contraindications of neonatal exchange transfusions
 - b. Risks and benefits of the procedure
 - c. Related anatomy and physiology
 - d. Consent process (if applicable)
 - e. Steps in performing the procedure
 - f. Documentation of the procedure
 - g. Ability to interpret results and implications in management.
 3. The AHP will ensure the completion of competency sign off documents and send them directly to the medical staff office.

B. Continued proficiency

1. The AHP will demonstrate competence by successful completion of the initial competency.
2. Each candidate will be initially proctored and signed off by an attending physician. AHPs must perform this procedure at least **three** times per year. In cases where this minimum is not met, the AHP must demonstrate skill with this procedure in a simulation or skills lab, or the attending, must again sign off the procedure for the AHP. The AHP will be signed off after demonstrating 100% accuracy in completing the procedure.
3. Demonstration of continued proficiency shall be monitored through the annual evaluation.
4. A clinical practice outcomes log is to be submitted with each renewal of credentials. It will include the number of procedures performed per year and any adverse outcomes. If an adverse outcome occurred, a copy of the procedure note will be submitted.

VII. RESPONSIBILITY

Questions about this procedure should be directed to the Chief Nursing and Patient Care Services Officer at 353-4380.

VIII. HISTORY OF POLICY

Initial policy approved 1986 by CIDP and EMB

Revised 4/89, 1/93, 5/01, 7/03, 12/05, 6/08, 2/11

Revised most recently July 2012 by Subcommittee of the Committee for Interdisciplinary Practice

Reviewed most recently July 2012 by the Committee on Interdisciplinary Practice

Approved most recently July 2012 by the Executive Medical Board and the Governance Advisory Council.

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