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Beaumont

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Neonatal Exchange Transfusions - Dearborn Blood Bank

Document Type: Procedure

I. PURPOSE AND OBJECTIVE:

This document is to provide policies and procedures that will be applied when preparing blood for exchange transfusion of infants from birth through four months old.

II. CLINICAL SIGNIFICANCE:

A. Group O, Rh(D) compatible red blood cells (RBCs) are resuspended in group AB plasma by the Blood Bank. The combined RBCs and plasma product is simultaneously infused as the infant's blood is withdrawn. The exchange is performed by a manual method (push-pull method or isovolumetric method).

III. SCOPE:

This document applies only to infants **from birth through four months old**. Exchange transfusion of these infants may be indicated in cases of hemolytic disease of the newborn and/or hyperbilirubinemia. Occasionally an exchange transfusion is used to eliminate toxins, drugs, or other chemicals when they have been administered to the mother near the time of delivery, when toxic doses have been administered to the infant, or if they accumulate at high levels in the infant as a result of prematurity and/or an inborn error of metabolism.

IV. DEFINITIONS/ACRONYMS:

A. CDM: Blood Bank Computer Documentation Manual, Computer Documentation Work flows

B. CMV: Cytomegalovirus

C. Special transfusion requirements: a patient's need for a component that has been modified or that contains special attributes; i.e., irradiated or antigen negative.

D. FFP: Fresh Frozen Plasma ; plasma that has been frozen within 8 hours of phlebotomy.

E. FP24: plasma that may be frozen up to 24 hours after phlebotomy.

F. RBC: Red blood cell product

G. Thawed plasma: refers to thawed FFP or FP24 (more than 24 hours after thawing) that has an expiration date of 5 days from the time of thawing. Thawed plasma may have a reduced concentration of Factors V and VIII.

V. POLICIES:

A. **Selection of the RBC Unit used for Infant Exchange Transfusion**
A standard neonatal RBC unit should be used for all infant exchange transfusions. The RBC unit should be

1. less than 5 days old (if possible)
2. Irradiated
3. Group O
4. Rh negative
5. Leukocyte Reduced
6. CMV Negative
7. Hemoglobin S (Sickle Cell) negative

B. **Compatibility Testing with the RBC Unit used for Infant Exchange Transfusion**

1. For neonates (less than four months old), refer to Transfusion Medicine policy, Neonatal Compatibility Testing Guidelines. If unexpected antibodies are detected/ present in either the neonatal or maternal record (current and historical), then the RBCs should be crossmatched in the same manner as they would be for the mother. The standard neonatal RBC unit must also be negative for any clinically significant antibodies.
2. For infants greater than four months old and less than one year old, policies and procedures outlined in Transfusion Medicine policies, RBC Crossmatch Guidelines apply.

C. **Policies relating to the Plasma used for Infant Exchange Transfusion**

1. Group AB plasma must be used.
2. Plasma that has been thawed in the 24 hours preceding dispense must be used to reconstitute the RBCs for an infant exchange transfusion.
    a. Use a plasma unit that was previously thawed, as long as the technologist has verified in the computer that it was thawed in the 24 hours preceding dispense, or

b. Thaw a new plasma unit.

3. This policy was adopted because plasma that has been thawed for greater than 24 hours may have a reduced concentration of Factors V and VIII.

D. **Expiration Date / Time of the Reconstituted Component (Pooled Plasma with RBCs) Used for the Infant Exchange**

1. The expiration date / time of the reconstituted component shall be the shorter of:
   a. 24 hours from the time that the RBCs were (time of spike); see step 3 of the Procedure, or
   b. The expiration date / time of any of the original components that were pooled together to make the reconstituted component.

E. **Labeling the Reconstituted Component (Pooled Plasma with RBCs) Used for the Infant Exchange**
This component should be labeled as described in the attached Job Aid: Labeling Blood Products / Reconstituted Whole Blood.

VI. SPECIMEN COLLECTION AND HANDLING:

Both a neonatal and maternal sample (if available) will be tested. All samples must meet the requirements found in the Transfusion Medicine Policies Triaging and Identifying Acceptable Samples for Testing and Forward Typing Determination of Neonatal ABO and Rh for Patients Less than Four months of Age by Tube Method.

A. **Neonatal Sample Requirements:**

1. Samples may be a capillary sample or may be drawn into an EDTA tube, with affixed identifying label.
2. Cord blood samples are unacceptable for transfusion purposes.

B. **Maternal Sample Requirements:**

1. The specimen of choice is 6 ml EDTA sample with affixed identifying label.
2. Samples drawn in serum separator tubes are generally not acceptable.

VII. EQUIPMENT:

A. Heat sealer
B. Sterile Connecting Device
C. Plasma Bath
D. Digital Scale
E. Safety Glasses/Shield

VIII. SUPPLIES:

A. Hemostats or clamps

B. Transfer tubing

IX. QUALITY CONTROL:

Quality Control must be performed on day of use for the following:

A. Digital Scale

B. Weld acceptability on the Sterile Connecting Device (each instant of use)

X. PROCEDURE:

A. Before you get started

1. Obtain from the patient's physician the following information:
    a. The name and extension of the physician or registered nurse (RN) who will be our main contact during product preparation.
    b. The time at which the infant exchange transfusion will be performed; this time and the expiration time of the reconstituted whole blood must be considered.
    c. The total volume of reconstituted whole blood requested for transfusion to the infant. An additional 60 mL will be added to this volume to account for dead space in the transfusion tubing. Note: Depending on the volume desired it may be necessary to reconstitute more than one unit in order to obtain the required volume of reconstituted whole blood, for example if a double exchange is requested for the infant.
    d. The desired hematocrit of the final reconstituted product. If the physician is unsure of the desired hematocrit then ask him or her whether a hematocrit of approximately 55% is acceptable, which is typical for an infant exchange transfusion. Note that the desired hematocrit is used *to* determine the weight of plasma to add to the RBC Unit.

B. Preparation of Blood for Neonatal Exchange Transfusion

1. Obtain a fresh unit of RBCs (less than 5 days old if possible) and complete any required compatibility testing with the unit.
    Refer to the above policies, *Selection of the RBC Unit used for Infant Exchange Transfusion*, and *Compatibility Testing with the RBC Unit used for Infant Exchange Transfusion.*

    Note: If unexpected antibodies are detected present/in either the neonatal or maternal record (current or historical) then the RBC must be negative for any clinically significant antibodies and should be crossmatched in the same manner as they would be for the mother.
2. Irradiate the RBC unit if not already done; modify the RBC in the Blood Bank computer to reflect irradiation.
    Refer to Transfusion Medicine Policy, Irradiation of Blood Components Using the RadSource

RS3400 Blood Irradiator and Blood Bank CDM, Change Products.

3. Determine the weight of the RBC. Refer to Transfusion Medicine policy, Weighing Blood Products.
4. Determine the weight of plasma that will be used to reconstitute the RBCs.
    a. Refer to the attached nomogram for reconstituting a unit to the desired hematocrit to obtain the volume of plasma to add.
    b. If the weight falls between two numbers on the nomogram, use the smaller volume of plasma or use the calculation formula.
5. Thaw a unit of group AB plasma. This plasma will be used to reconstitute the RBCs. It is acceptable to use a previously thawed AB plasma if it is thawed <24 hours from time of product dispense.
6. Select the RBC and thawed plasma under the exchange transfusion order. Refer to the *Blood Bank CDM - Neonatal Exchange Transfusion for Patients Less than 4 months.*
7. Use the sterile connection device to attach a transfer pack to the thawed FFP. Refer to Transfusion Medicine Policy, Sterile Connection Device - Operation, Quality Control & Maintenance.
8. Divide the unit of plasma into 2 bags. Refer to Transfusion Medicine Policy, Aliquot Preparation.
    a. Plasma Bag 1: contains the plasma that will be used to reconstitute the RBCs (weight was calculated in step 9). Make sure to leave enough tubing attached to the plasma bag for the pooling process.
    b. Plasma Bag 2: contains the remainder of the plasma.
9. Modify the plasma in the Blood Bank computer to reflect the division. Refer to Blood Bank CDM - *Dividing Components.*
10. Physically pool the RBC and plasma bag 1 as follows:
    a. Make sure you are using proper eye protective device (safety glasses or full face shield before proceeding
    b. Place the RBC unit on the scale.
    c. Hold or hang the unit of plasma (plasma bag 1)above the unit of RBCs.
    d. Using a sterile double spiked transfer set, clamp off the tubing using the attaching pinch roller and aseptically insert one end of the transfer tubing into the bag containing the RBCs, the other end in to the thawed plasma.
    e. Open the pinch roller slowly and allow the plasma to flow into the unit of red blood cells until it reaches the final weight determined in step 4 for the reconstituted RBC.
    f. Close off the pinch roller; mix the newly reconstituted unit thoroughly. Reverse the position of the plasma and the reconstituted unit so that that unit is higher than the plasma.
    g. Open the pinch roller slowly and allow the well-mixed blood to flow back towards the unit of plasma; when the blood reaches the plasma unit, close off the pinch roller.

h. Seal off the tubing at both the reconstituted unit and plasma side of the transfer set.

i. Create several segments of blood near the unit end to use for a hematocrit test.

11. Label a plastic test tube or plain microtainer with the donor number, cut several segments, and empty the contents of two or three segments into the tube/microtainer.
12. Take this tube to Hematology and ask for a hematocrit of the unit.
    a. Label the printout obtained from lab with the donor unit number.
    b. Record the results in the QC book.
    c. The actual hematocrit should be +/- 5% of the desired hematocrit. i.e (50 – 60% for a requested 55% hematocrit)
    d. If the actual hematocrit is not within 5%, contact the attending physician to approve the actual hematocrit.
13. Confirm the final volume of the reconstituted unit.
    a. If the final volume of the unit is 100 mL or short of the total volume needed, consult with the ordering physician to see if it necessary to confirm it is necessary to prepare additional units.
14. Modify the product to pooled in the Blood Bank computer, verify the CMV and HgbS Negative attributes are present, label the product, generate a crossmatch tag, and tag the product. Refer to the Blood Bank CDM - *Neonatal Exchange Transfusion for Patients less than 4 months.*
15. Complete the Infant Exchange Transfusion Worksheet, and staple it to the hematocrit results of the unit. Submit these to the Lead Medical Technologist /Supervisor for review.
16. If necessary, repeat all steps of the Procedure to obtain the final volume of reconstituted whole blood requested by the patient's physician.

XI. EXPECTED VALUES:

A. The actual hematocrit of the reconstituted unit should be +/- 5% of the desired hematocrit.

XII. REFERENCES:

1. AABB, *Technical Manual*, current edition.
2. AABB, *Standards for Blood Banks and Transfusion*, current edition.
3. College of American Pathologists, *Transfusion Medicine Checklist*, current edition.

Attachments

Infant Exchange Form

Nomogram for Reconstituting Packed RBCs for Infant Exchange Transfusion

Approval Signatures

Step Description	Approver	Date
	Jeremy Powers: Chief, Pathology	Pending
Policy and Forms Steering Committe (if needed)	Kelly Sartor: Supv, Laboratory	6/27/2022
Policy and Forms Steering Committe (if needed)	Gail Juleff: Project Mgr Policy	6/27/2022
	Kimberly Geck: Dir, Lab Operations B	6/26/2022
	Kelly Sartor: Supv, Laboratory	6/24/2022
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Nomogram for Reconstituting RBC Packed Cells for Infant Exchange

Desired Hct %	Initial Bag Weight	Plasma to Add	Final Bag Weight
40	250	131	381
40	270	149	419
40	290	166	456
40	310	184	494
40	330	201	531
40	350	219	569
40	370	236	606
40	390	254	644
40	410	271	681
40	430	289	719
40	450	306	756

Desired Hct %	Initial Bag Weight	Plasma to Add	Final Bag Weight
45	250	100	350
45	270	113	383
45	290	127	417
45	310	140	450
45	330	153	483
45	350	167	517
45	370	180	550
45	390	193	583
45	410	207	617
45	430	220	650
45	450	233	683

Desired Hct %	Initial Bag Weight	Plasma to Add	Final Bag Weight
50	250	75	325
50	270	85	355
50	290	95	385
50	310	105	415
50	330	115	445
50	350	125	475
50	370	135	505
50	390	145	535
50	410	155	565
50	430	165	595
50	450	175	625

Desired Hct %	Initial Bag Weight	Plasma to Add	Final Bag Weight
55	250	55	305
55	270	62	332
55	290	69	359
55	310	76	386
55	330	84	414
55	350	91	441
55	370	98	468
55	390	105	495
55	410	113	523
55	430	120	550
55	450	127	577

Desired Hct %	Initial Bag Weight	Plasma to Add	Final Bag Weight
60	250	38	288
60	270	43	313
60	290	48	338
60	310	53	363
60	330	58	388
60	350	63	413
60	370	68	438
60	390	73	463
60	410	78	488
60	430	83	513
60	450	88	538

Desired Hct %	Initial Bag Weight	Plasma to Add	Final Bag Weight
65	250	23	273
65	270	26	296
65	290	29	319
65	310	32	342
65	330	35	365
65	350	38	388
65	370	42	412
65	390	45	435
65	410	48	458
65	430	51	481
65	450	54	504

This chart is based on a approximate starting hematocrit of 85% for CPDA units. The weights in this chart include the total weight of product and the weight of the bag itself (approximately 30g for a 600mL product bag).

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Nomogram for Reconstituting RBC Packed Cells for Infant Exchange

Troubleshooting the plasma volume

·If the weight is between two numbers, use the lower weight to determine the plasma to add

·If the weight of the unit is not on the chart, add 1 mL of plasma per 5 gm of packed red blood cells.

Use the RBC net weight (the total weight (including bag) minus the weight of the bag), the RBC Hct obtained from hematology by attaching sample collection tubing with the sterile docker, and the desired Hct to calculate the required volume in grams of FFP using the equation below.

Formula: $$Amount\ of\ FFP = \left(\frac{Hct\ of\ packed\ RBC}{Desired\ Hct\ of\ resuspended\ unit} - 1\right) \times Wt.\ of\ RBC$$

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Patient Label

Infant Exchange Transfusion Worksheet

Verify the Following Steps:	Performed / Documented:
Name and extension for RN / Physician requesting exchange transfusion, and the time they called Blood Bank: (Name / extension / time called)	
Give best estimate for the time required for products to be ready (usually at least 2 hours): (√ / tech)	
Desired hematocrit (Hct) obtained from physician: (%)	
Desired total volume obtained from physician: (volume in ml)	
Fresh baby unit irradiated prior to poolin: (√ / tech)	
Total weight of the RBC: (weight in grams)	
Use the nomogram to determine the required volume of FFP to add.	
Fresh AB FFP thawed and modified (or thawed <24 hours from time of product dispense) in the Blood Bank computer system: (√ / tech)	
Divide the fresh FFP to get the required volume for pooling. Document the division on Blood *Product Division / Aliquot Preparation Log* (√ / tech)	
FFP modified in the Blood Bank computer system to reflect product division. (√ / tech)	
Pool the RBC and FFP aliquot and mix well before obtaining sample for hematocrit	
Hematocrit of the pooled product (obtained from Hematology)	
Pool the RBC and FFP aliquot and modify them to reflect the pooling in the Blood Bank computer system. Refer to Triage BBCDM / *Exchange Transfusion for Patients less than One Year Old.* Verify the correct volume and expiration date is used when pooling the products in the computer: (√ / tech) • Pooled product volume: RBC volume + FFP aliquot volume • Pooled product expiration date / time: 24 hours from the time of pool, unless the FFP became an open system and expires before	
Verify the Hemoglobin S Negative and CMV Negative attributes are added to the pooled product: (√ / tech)	
Print a crossmatch tag for the pooled product. (√ / tech)	

Product prepared by tech / date: _____

Attach the Hematology Lab printout