Newborn Critical Care Center (NCCC) Clinical Guidelines

Transfusion of Blood Products

Objective: To guide decisions regarding administration of blood products in the NCCC with a focus on pRBCs and platelets.

PACKED RED CELL ADMINISTRATION

General Information

The most common cause of early neonatal anemia is blood sampling; make every effort to limit withdrawal of blood for diagnostic purposes. For inborn VLBW infants, the provider should collect a cord blood sample at the time of delivery for any initial laboratory sample needs, e.g. blood culture, CBC, Type and Screen, bilirubin level.

Other causes of anemia in the neonate that should be considered include:

- Hemolysis
- Intrapartum hemorrhage
- Neonatal hemorrhage
- Physiologic anemia / anemia of prematurity

At UNC Hospitals, each infant is assigned a packed red cell unit upon their first transfusion. Subsequent transfusions are taken from this designated unit, decreasing exposures to blood donors and thereby reducing the risks associated with transfusion. If the volume of transfusions exceeds the volume of the unit or if the unit expires (> 42 days), a new unit will be assigned to the patient. Infant type and screen samples **expire after 4 months (NOT 120 days)** unless discharged first.

Guidelines for pRBC Administration

The volume of RBC transfusion should equal 15 mL/kg unless the infant is volume sensitive.

***For infants with birth weight ≤ 1000g AND birth gestation 22^0 - 28^6 weeks AND < 36 weeks PMA**, use the following transfusion thresholds per the TOP trial[1]:*

	Respiratory Support*	**No Respiratory Support**
1st week of life	Hgb < 11 g/dL or Hct < 32%	Hgb < 10 g/dL or Hct < 29%
2nd week of life	Hgb < 10 g/dL or Hct < 29%	Hgb < 8.5 g/dL or Hct < 25%
≥ 3 weeks of life	Hgb < 8.5 g/dL or Hct < 25%	Hgb < 7 g/dL or Hct < 21%

**Respiratory Support = mechanical ventilation, CPAP, FiO2 > 0.35, or NC ≥ 1LPM (regardless of FiO2)*

***For infants with birth weight > 1000g OR birth gestation ≥ 29⁰ weeks OR >36 weeks PMA**, consider the following transfusion thresholds per the American Red Cross recommendations (based on available literature and expert opinion)[2]:*

• Severe cardiopulmonary disease: mechanical ventilation with FiO2 > 0.35* ** If mechanically ventilated with FiO2 ≤ 0.35, use clinical discretion*	Hct < 40-45% or Hgb < 13.5-15 g/dL
• Moderate cardiopulmonary disease (CPAP, HFNC, LFNC, oxyhood) • Major surgery up to 48 hours post-operative	Hct < 30-35% or Hgb < 10-12 g/dL
• Stable anemia with unexplained poor growth, moderate to severe apnea, or sustained tachycardia	Hct < 20-30% or Hgb < 7-10 g/dL
• Stable preterm or term infant • Acute blood loss	Hct ≤ 20% or Hgb < 7 g/dL

The above recommendations are for infants. As patients age, consider using the pediatric standard transfusion threshold of hemoglobin < 7 g/dL (Hct 20%). In hemodynamically stable children with hemoglobin ≥7 g/dL, transfusions are generally unnecessary unless one of the following applies: acute brain injury, ARDS, allo- or auto-immune mediated hemolytic anemia, ECMO and cardiac disease.[2]

PLATELET ADMINISTRATION

- It is **not recommended** to use platelets as colloid or volume expansion in the setting of critical illness or hypotension, given evidence that platelet transfusions are independently associated with increased mortality and a variety of adverse events in a dose-dependent manner.
- The volume of transfusion should equal 10 - 15 mL/kg and transfusion should take place over 30-60 minutes.
- Once delivered to the unit, platelets must be transfused within 4 hours.

For neonates, use the following transfusion thresholds per the Curley et. al. RCT [3] and the American Red Cross recommendations (based on available literature [excluding the Curley RCT] and expert opinion)[2]:

• Active Bleeding • Surgery (pre-operatively or up to 48 hours post-operatively) • DIC • Neonate ≤ 30 weeks gestational age for the first 72 hours of life (due to risk of IVH in VLBW)	Platelet < 50,000/µl
• Term neonates • Preterm neonates >30 weeks gestational age • Preterm neonates ≤ 30 weeks gestational age AND > 72 hours old	Platelet < 25,000/µl

The above recommendations are for neonates. As patients age, consider using the pediatric standard transfusion thresholds:

- Patients actively bleeding or undergoing major invasive procedures/surgery maintain platelets >50,00/0µl
- Unstable, non-bleeding patients maintain platelets >20,000/µl
- Stable, non-bleeding patients maintain platelets >10,000/µl.

FRESH FROZEN PLASMA (FFP) ADMINISTRATION

- FFP contains physiologic quantities of all coagulation factors, including Factors V and VIII.
- All FFP is irradiated for infants less than 4 months or until discharge, whichever occurs later.
- The volume of transfusion should equal 10 - 15 mL/kg.
- FFP can be used for 6 hours after preparation. Once delivered to the unit, FFP must be transfused within 4 hours.

In general, FFP should be used as a therapy during active bleeding rather than as prophylaxis in stable, non-bleeding neonates. The American Red Cross recommends the following as indications for FFP: 1) active bleeding or risk of bleeding due to deficiency of multiple coagulation factors and 2) massive transfusion with coagulopathic bleeding.

There is no pediatric literature to guide transfusion thresholds. The following thresholds are based on adult literature and expert opinion: PT > 1.5x the mid-range of normal[6], aPTT > 1.5x the upper level of the normal range[6], INR >1.7.[5] Please see the "Coagulation Lab Values" for newborn-specific reference ranges.

CRYOPRECIPITATE ADMINISTRATION

- Cryoprecipitate is enriched with von Willebrand factor, fibrinogen, and factor VIII. Each unit of cryoprecipitate contains > 150 mg of fibrinogen and > 80 international units of factor VIII.
- The volume of transfusion should equal 10 - 15 mL/kg.

The following are indications for transfusion with cryoprecipitate per the American Red Cross recommendations (based on available literature and expert opinion)[2]:

- Hypofibrinogenemia (fibrinogen < 100 mg/dL) or dysfibrogenemia with active bleeding or undergoing an invasive procedure
- Massive transfusion when one or more blood volumes have been replaced, with rapid consumption of fibrinogen

PROCEDURES FOR ORDERING BLOOD PRODUCTS

- There must be a signed consent form on the chart for all blood product administration unless there is a life-threatening issue.
- Transfusion orders are located in the **"Neonatal Procedure Focused"** order set in Epic or by individually searching for the desired blood product.
    - The "**Prepare**" order should include the volume to be transfused plus an additional 5 mL to prime the IV tubing.
    - The "**Transfuse**" order should be written only for the desired transfusion volume.
- Furosemide (Lasix) should not be routinely ordered with transfusions.
- Blood components are typically given above total fluids, but may be given within total fluids if patient is extremely volume sensitive.
- For collection of samples for Type and Screen, see Appendix A.
- Direct donation is discouraged for the NCCC population given the increased risks of directed donor blood and time constraints. To proceed with direct donation, contact the blood bank.

References:

1. Kirplani H, Bell EF, Hintz S, et al. Higher or Lower Hemoglobin Transfusion Thresholds for Preterm Infants. N Engl J Med. 2020; 383:2639-2651.
2. American Red Cross. A Compendium of Transfusion Practice Guidelines. A Compilation from Recent Peer-Reviewed Literature. 4th Edition. 2021.
3. Curley A, Stanworth SJ, Willoughby K, Fustolo-Gunnink SF, Venkatesh V, Hudson C, Deary A, Hodge R, Hopkins V, Lopez Santamaria B, Mora A, Llewelyn C, D'Amore A, Khan R, Onland W, Lopriore E, Fijnvandraat K, New H, Clarke P, Watts T; PlaNeT2 MATISSE Collaborators. N Engl J Med. 2019 Jan 17;380(3):242-251.
4. Cooper ES, Bracey AW, Horvath AE, Shanberge JN, Simon TL, Yawn DH. Practice Parameter for the Use of Fresh-Frozen Plasma, Cryoprecipitate, and Platelets. JAMA. 1994;271(10):777–781. doi:10.1001/jama.1994.03510340067036
5. Holland LL, Brooks JP. Toward rational fresh frozen plasma transfusion: The effect of plasma transfusion on coagulation test results. Am J Clin Pathol. 2006;126(1):133-139.
6. Cooper ES, Bracey AW, Horvath AE, Shanberge JN, Simon TL, Yawn DH. Practice Parameter for the Use of Fresh-Frozen Plasma, Cryoprecipitate, and Platelets. JAMA. 1994;271(10):777–781.
7. Bell EF, Strauss RG, Widness JA, et al. Randomized Trial of Liberal versus Restrictive Guidelines for Red Blood Cell Transfusion in Preterm Infants. Pediatrics. 2005; 115: 1685 – 1691.
8. Kirpalani H, Whyte RK, Andersen C, et al. The Premature Infants in Need of Transfusion (PINT) Study: A Randomized, Controlled Trial of a Restrictive (Low) versus Liberal (High) Transfusion Threshold for Extremely Low Birth Weight Infants. J Pediatr. 2006; 149: 301 – 307.
9. Carson JL, et al. Red blood cell transfusion: A clinical practice guideline from the AABB. Ann Int Med. 2012;157:49-58.
10. Baer VL, Lambert DK, Henry E, Snow GL, Sola-Visner MC, Christensen RD. Do platelet transfusions in the NICU adversely affect survival? Analysis of 1600 thrombocytopenic neonates in a multihospital healthcare system. J Perinatol. 2007;27:790–796.

Reviewed December 2021 – Mackay / Patterson

APPENDIX A

TYPE AND SCREEN/BLOOD TYPE REFERENCE

Two blood samples are required for patients at risk for receiving a blood transfusion during their hospitalization.

IF PATIENT WAS BORN IN LABOR AND DELIVERY:

A sample for blood typing (ABO/Rh) should be sent on ***ALL*** NCCC admissions from L&D. If it is determined by the provider that a patient is at risk for a blood transfusion, a second sample for screening (**TYPE AND SCREEN**) should also be sent.

First Specimen:
OB will provide *1-2 mL of cord blood in a large lavender- or blue-topped tube* and label it with mom's sticker. Bring this tube back to the unit and affix the baby's patient ID label to the specimen as well.

- This can be tested for **BLOOD TYPE** only (check type sample). The order in Epic appears as "cord blood type."

Second Specimen:
A *large lavender-topped tube with 1-2 mL* of blood is required for the **TYPE AND SCREEN**.

- Do not send a bullet tube for this testing.
- Affix the large lab label along with an ID sticker to the specimen.
- The order in Epic appears as "Type and Screen."

If L&D did not provide a cord blood sample:
A *small tube/bullet tube* is acceptable for confirmatory **BLOOD TYPE** (check type sample).

- This sample must be drawn at a ***different*** time and sent in a ***different*** bag from the large lavender tube for Type & Screen.
- The order in Epic appears as "ABO/Rh."

IF PATIENT WAS AN OUTSIDE TRANSPORT:

Two different specimens are required.
Do not send both specimens to the lab in the same bag at the same time.

1. For the initial specimen (**TYPE AND SCREEN**): Collect 1-2 mL of blood and send in a *large lavender-topped tube.*

2. For the confirmatory **BLOOD TYPE** (check type sample): A *small tube/bullet tube* is fine to send for the confirmatory blood type (ABO/Rh) sample only.