

RT123 Pediatric Transfusion: Pints for Half-Pints

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DISCUSSION POINTS:

1. The differences between neonates and older children and adults, and how they affect transfusion
2. Indications for transfusion in neonates that differ from older children and adults
3. Blood products that are available for neonates/ the use of additive solutions for neonatal transfusion

To participants:

1. Do you routinely transfuse neonates?
2. What are your practices?
3. Do you use additive solutions?
4. When do you irradiate cellular blood products?

By the end of lunch, my hope is that you:

1. Will feel comfortable transfusing RBCs collected in additive solutions.
2. Will know the correct dose of components for neonatal transfusion.
3. Will have information to be able to formulate policies for the use of special blood products in your institution.

KEY LEARNING POINTS:

1) Physiologic differences between neonates and older children and adults:

- a. Normal value for newborn hemoglobin higher
 - i. Babies with congenital heart anomalies
- b. Role of hemoglobin F
- c. Differences in fetal erythropoietin
- d. Immunologic tolerance/ immunologic naiveté
 - i. Risk of transfusion associated graft v host disease (GVHD)
- e. Renal function is immature
- f. Hepatic function not yet fully developed
- g. Blood/brain barrier

2) RBC transfusion (~ 5 – 15 ml/kg)

- a. Anemia with signs and symptoms of decreased oxygen carrying capacity
- b. Simple, booster transfusions (<20 ml/kg)
 - i. The composition of RBC preservatives/anticoagulants
 - ii. Evidence that AS-1 and AS-3 are safe in small volumes
 - iii. No studies with AS-5
 - iv. Additive solutions – lower hematocrit
 - v. Reducing donor exposure
 - 1. Aliquots
 - 2. Assigning units
 - 3. Sterile connecting device
 - 4. Additive solutions
 - a. Increase in extracellular potassium (see table)
 - b. Decrease in 2,3 DPG
 - c. Fresh v older RBCs
- c. Hemolytic disease of the fetus and the newborn (HDFN)
 - i. Mom has antibody against an antigen that baby inherits from Dad that Mom lacks
 - ii. D still most common in some series; K1 next
 - iii. Consequence for fetus
 - 1. Heart failure from severe anemia
 - 2. Extramedullary hematopoiesis causing liver to reduce protein production leading to edema
 - 3. Kernicterus
 - iv. Intrauterine transfusion
 - 1. Irradiated, CMV safe, O negative, antigen negative, sickle negative
 - v. Management after birth – same blood requirements as above
- d. Use of erythropoietin
- e. Replacement of iatrogenic blood loss?

3) Platelet transfusion (~10 ml/kg)

- a. Thrombocytopenic patient with bleeding – same normal platelet values
- b. Higher “trigger” for neonates? – 100,000/µl trigger
 - i. Risks of intracranial hemorrhage
 - 1. Weak subependymal support in germinal matrix
 - 2. At birth, longer PT/PTT
 - 3. Platelet function
 - ii. Sick neonate: 50,000/µl trigger
Stable neonate: 20 – 30/µl trigger
 - iii. Extracorporeal membrane oxygenation ECMO
- c. Neonatal alloimmune thrombocytopenia (NAIT)
 - i. Platelet HDFN (Mom has antibody against platelet antigen that baby inherits from Dad)
 - ii. Caucasians, most against HPA-1a

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- iii. Thrombocytopenia (< 50,000/ μ l); risk of intracranial hemorrhage in utero, during delivery, after delivery
- iv. Best to use antigen negative platelets
 - 1. Availability? Testing?
 - 2. Trigger for transfusion?
 - 3. Mom's platelets – WASH AND IRRADIATE!
- v. Role of random platelets
- vi. Role of IVIG
- vii. Next pregnancy
 - 1. Intrauterine transfusion
 - a. Volume reduction, antigen negative, irradiated, CMV safe
 - 2. IVIG for Mom

4) Plasma (10 – 15/ ml/kg)

- a. FFP v thawed plasma v FP24
- b. Procoagulant deficiencies
- c. Limited donor exposure products available

5) Special blood products

- a. Irradiation – prevent post-transfusion GVHD
 - i. The evidence: intrauterine transfusion, exchange transfusion, cellular immune deficiency
 - ii. Logistics and standard of care issues
 - iii. When to irradiate – increases extracellular potassium
- b. CMV safe
 - i. Infants < 1200 grams; Mom CMV – or unknown
- c. Leukoreduction
 - i. Evidence?
- d. Sickle negative
 - i. Case studies in 60s
- e. Indications for washing
 - i. Remove antibody (NAIT, severe allergic reactions, IgA deficiency with antibody)
 - ii. ? Remove additive solutions, potassium

COMPOSITION OF RBCS (Drawn into 450-mL Blood Collection Sets)

	CPDA-1	AS-1	AS-3	AS-5
Sodium chloride (mg)	None	900	410	877
Dextrose (mg)	2000	2200	1100	900
Adenine (mg)	17.3	27	30	30
Mannitol (mg)	None	750	None	525
Volume (mL)	63	100	100	100
Hematocrit	~ 70%	55 – 60 %	55- 60%	55- 60%

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