Tips for Transfusing Tots

Dr. Eileen McBride
Head, Division of Hematology and Transfusion Medicine, CHEO

Brennah Holley RN
CNS, Roger Neilson Children's Hospice

OBJECTIVES

At the end of this presentation participants will be able to:

1. List ABO compatible components for patients
2. Identify indications for Red Blood Cell Transfusion
3. Identify special considerations for the administration of blood products to neonates and children

PRE-TEST – Q1

Do you have any ABO antibodies?

a) Yes

b) No

PRE-TEST Q2

Which would be the most appropriate for red cell transfusion?

a) Hb 37 (2yo with severe iron deficiency)
b) Hb 95 (9yo with sickle cell (SC) VOC
c) Hb 81 (14 yo with AML)
d) Hb 85 (6 week old thriving, late prem)

PRE-TEST Q3

What is the maximum length of time a blood transfusion should take?

a) 2 hours

b) 3 hours

c) 3.5 hours

d) 4 hours

CASE STUDY Q1 - Pre

- Sarah is a term infant. Her blood group is A +
- Mom's blood group is B+

What is the best blood type if Sarah needs a red cell transfusion?

a) AB+

b) O+

c) A+

d) B+

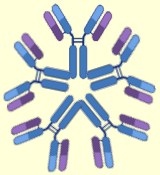
e) O-

TYPE AND SCREEN

- Blood type/group testing
  - ➔Forward (red cell)
    - Which (if any) antigens are present on patient's red cells?
    - Antisera **(anti-A, anti-B, anti-D)** against patients red cells/antigens
  - ➔Reverse (plasma)
    - Which (if any) **IgM** antibodies are present in the patient?
    - Patients' plasma against **A , B** expressing cells
- Screen
  - Looks for ***other (non-ABO), IgG*** red cell antibodies

ANTIBODIES

IgM

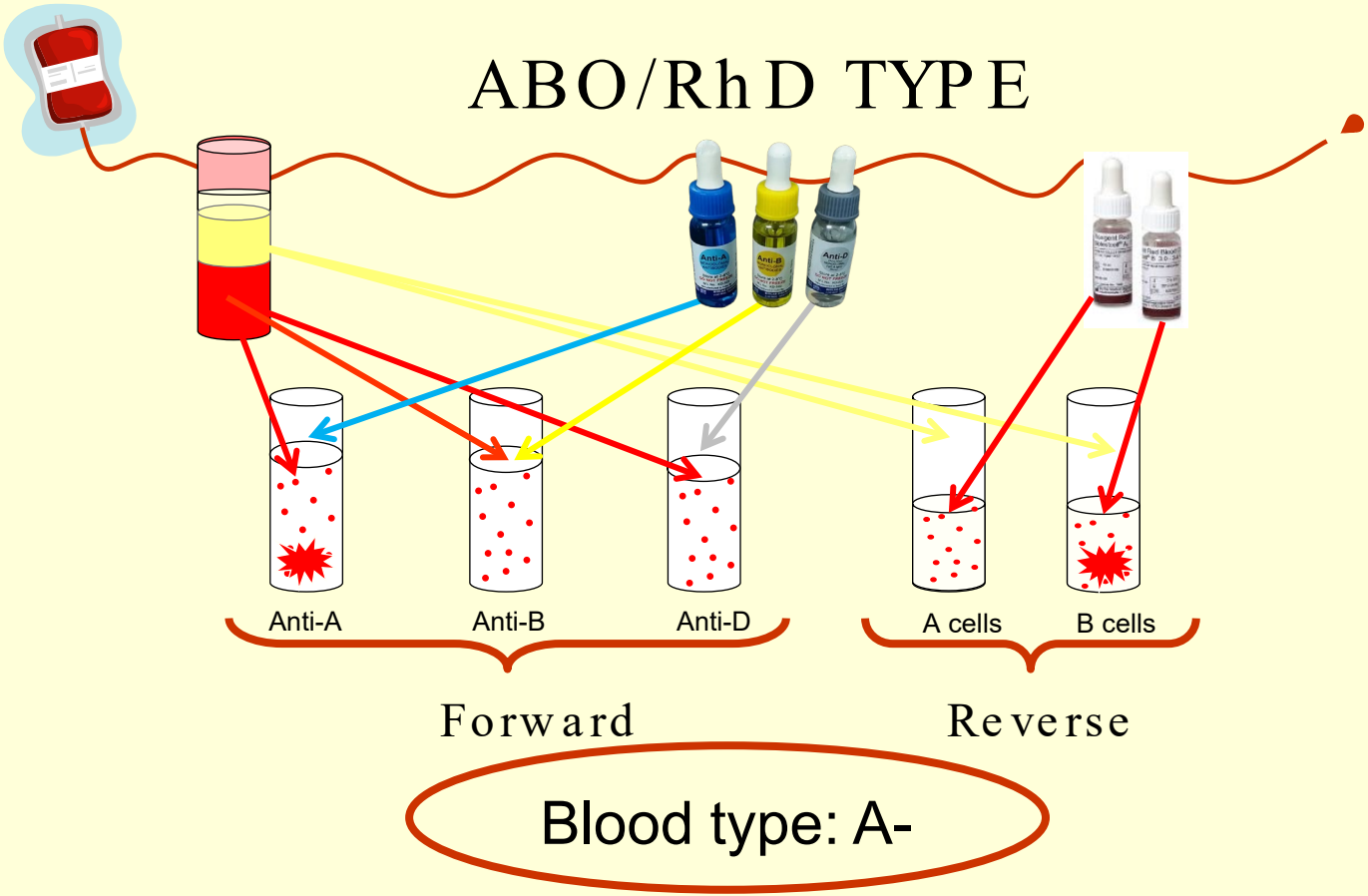


- Big size (Pentamer)
- Naturally occurring
- Don't cross placenta
- Immediate agglutination in vitro
- Fast testing @ room temperature
- Cause **intra-vascular** hemolysis in vivo!

IgG

- Small
- Require exposure
- Cross placenta
- Must add anti-human globulin for agglutination in vitro (IAT)
- Slow testing, need incubation @ 37^{o}
- Cause **extra-vascular** hemolysis (spleen)

ABO/Rh D TYPE



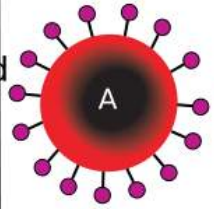
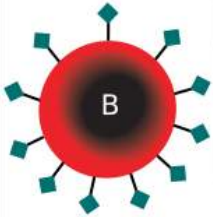
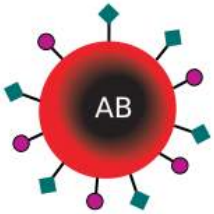
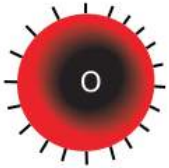
Blood type: A-

THE ABO'S AND D!

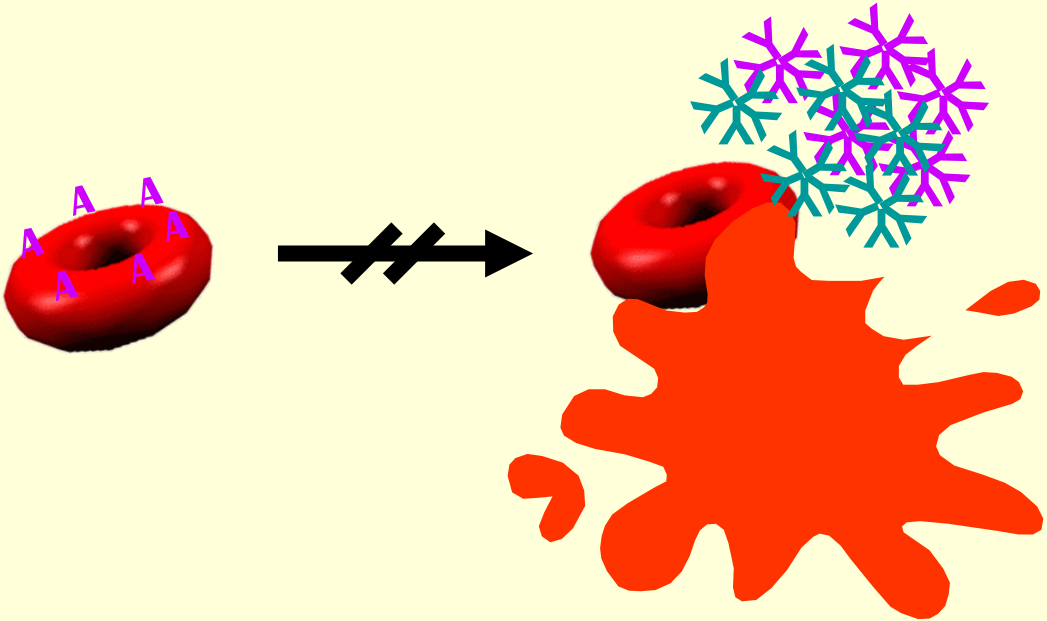
- A and B antigens are expressed on red cells
  - **are also on platelets
- Anti-A and Anti-B are ***naturally*** occurring (from ~4 mos)

- RhD antigen is expressed on red cells
  - **not on platelets
- Anti-D is **not** naturally occurring (need blood exposure)

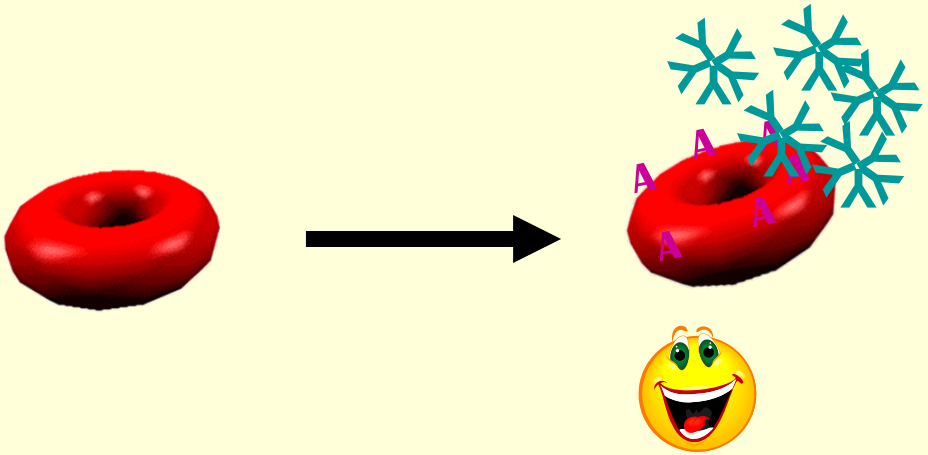
RED CELL ANTIGENS AND ANTIBODIES

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies present	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens present	 A antigen	 B antigen	 A and B antigens	None

RED CELL COMPATIBILITY-ABO



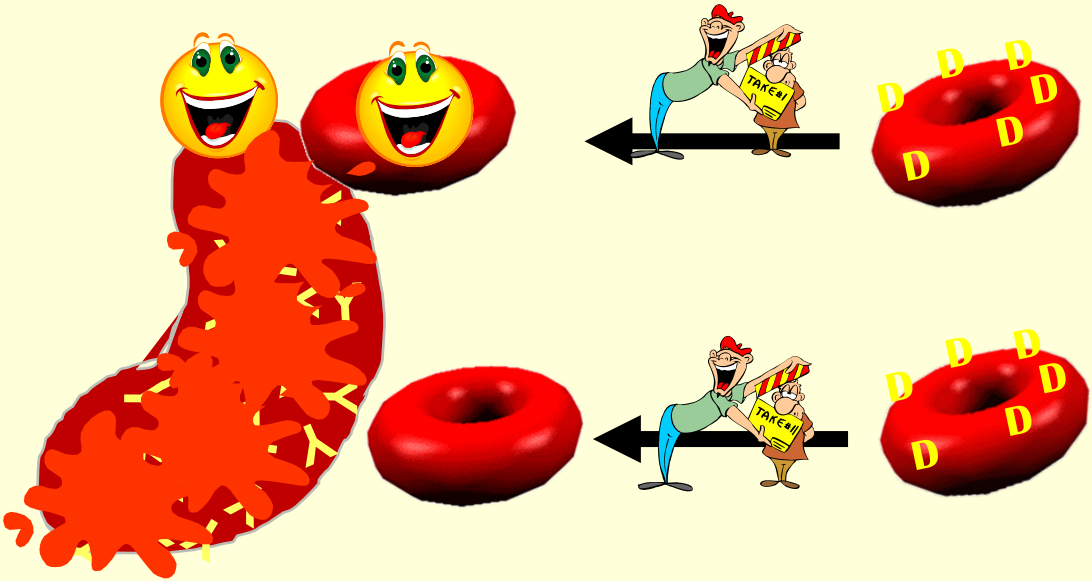
RED CELL COMPATIBILITY-ABO



Group O

Group A

RED CELL COMPATIBILITY - D

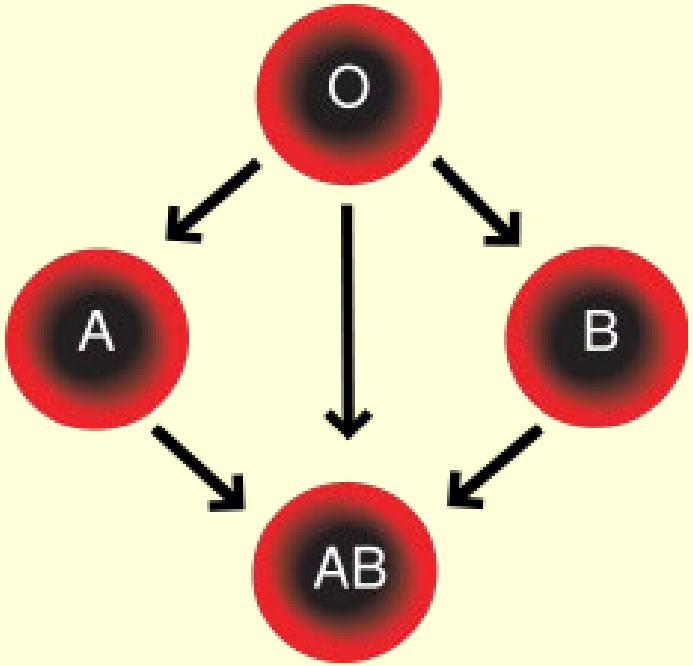


RED CELL COMPATIBILITY

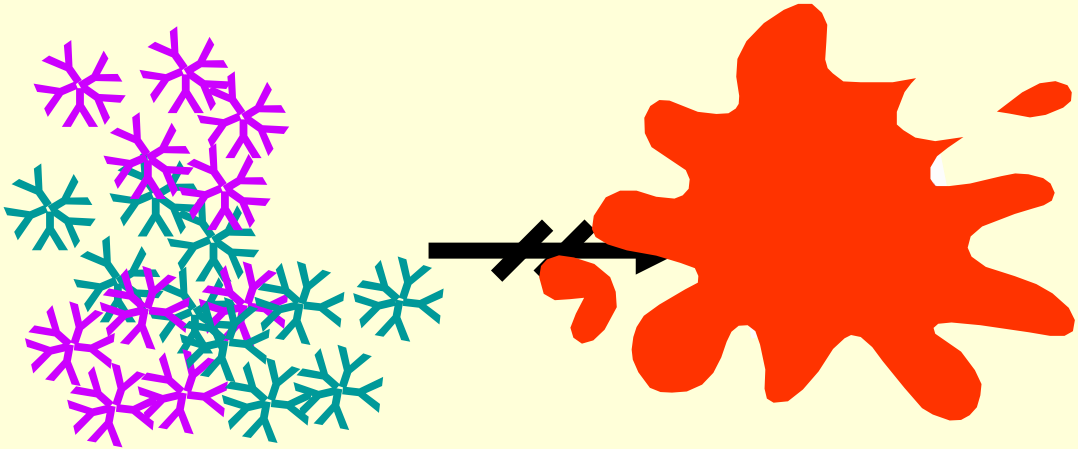
RECIPIENT \ DONOR	O+	O-	A+	A-	B+	B-	AB+	AB-
O+	✓	✓						
O-	*	✓						
A+	✓	✓	✓	✓				
A-	*	✓	*	✓				
B+	✓	✓			✓	✓		
B-	*	✓			*	✓		
AB+	✓	✓					✓	✓
AB-	*	✓					*	✓

*Rh+ donors *can* donate to Rh- recipient but the recipient may form anti-D antibody and when they have anti-D antibody they can no longer receive Rh+ blood.

UNIVERSAL DONORS - RBC



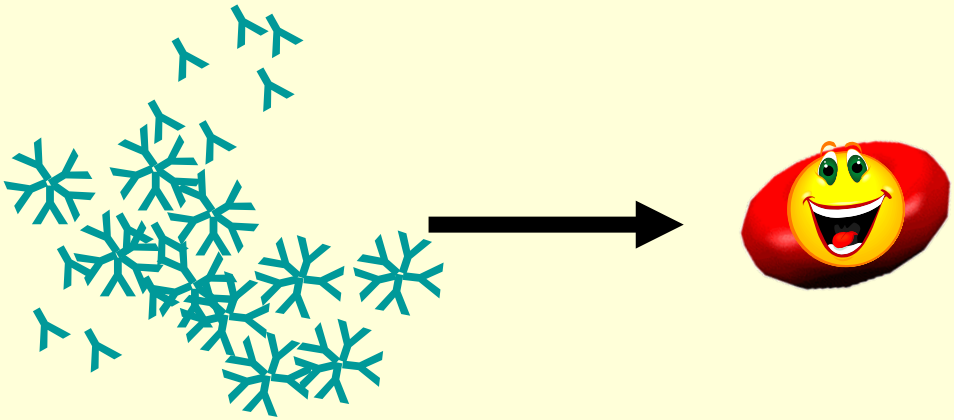
PLASMA COMPATIBILITY



Group O

Group A

PLASMA COMPATIBILITY



Group A

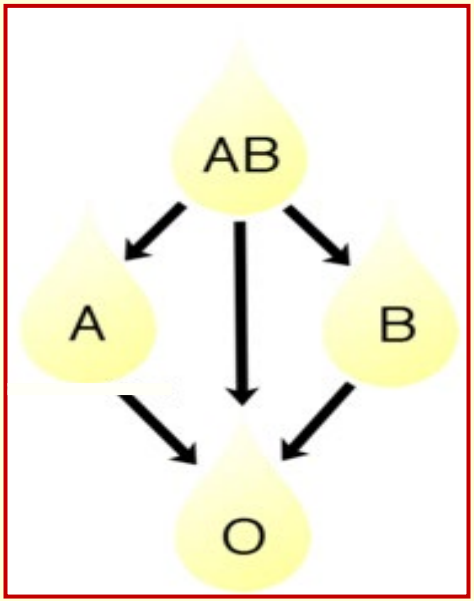
Group O

PLASMA COMPATIBILITY

RECIPIENT \ DONOR	O+	O-	A+	A-	B+	B-	AB+	AB-
O+	✓	✓	✓	✓	✓	✓	✓	✓
O-	✓*	✓	✓*	✓	✓*	✓	✓*	✓
A+			✓	✓			✓	✓
A-			✓*	✓			✓*	✓
B+					✓	✓	✓	✓
B-					✓*	✓	✓*	✓
AB+							✓	✓
AB-							✓*	✓

*Rh status does not affect plasma transfusion as there are no red cells in the product

UNIVERSAL DONORS - PLASMA



CASE STUDY Q2 - Pre

Sarah is growing up! She is now 1 year old. She loves milk and is very picky about other food.

"Routine" bloodwork results at a follow-up appointment: **Hgb 37**

What is the best initial treatment?

a. PRBC transfusion
b. Start oral iron supplement
c. IV iron infusion
d. Reassurance

WHEN TO TRANSFUSE?

- When benefit outweighs risk
- Alternatives are not as effective
- Alternatives are not (practically) available

- Evidence based guidelines
  - Red cells
  - Platelets
  - Plasma

TAINTED BLOOD - CANADA

Commemoration of the Tainted Blood Tragedy

It has often been said that the lessons learned in the tainted blood tragedy must not be forgotten and that the pain and suffering experienced by so many must not be in vain. The Canadian Hemophilia Society (CHS) ensures that this does not happen by holding national and provincial Commemorations of the Tainted Blood Tragedy saluting those now silent victims.

History

When AIDS appeared in the early 1980s and soon became an epidemic, the entire Canadian blood supply system was affected. Over the next years, HIV had a huge impact on the hemophilia and blood-transfused communities. With the advent of HIV testing in 1985, it was recognized that a very high percentage of those with severe hemophilia and hundreds of others receiving blood or blood products had been infected.

More than 1,100 transfused Canadians were infected by HIV, of whom 700 had hemophilia and other bleeding disorders, and 400 were transfusion recipients for other reasons (trauma, surgery, childbirth, cancer...). Between 700 and 800 of these people have passed away.

A much larger number of people – up to 20,000 – were infected with the hepatitis C virus (HCV) through blood and blood products before testing was introduced in 1990. The number of people who have died from hepatitis C related liver disease caused by tainted blood is not known but could be in the thousands, and continues to rise.

The tainted blood tragedy is one of the worst public health disasters that Canada has ever faced.

RED CELLS - STUDIES

- TRICC trial[1]
  - Decreased mortality in restrictive group
- TRIP ICU trial[2]
  - No difference in mortality or adverse outcome
- PINT Study[3]
  - No difference in mortality or severe morbidity

1. Hebert et al, N Engl J Med 1999;340:409-17
2. Lacroix et al, N Engl J Med 2007;356:1609-1619
3. Kirpalani et al, J Pediat 2006;149:301-307

TAXI-CAB

Pediatric Critical Care T.A.X.I. Transfusion and Anemia Expertise Initiative

BLOOD NET
The Pediatric Critical Care Blood Research Network

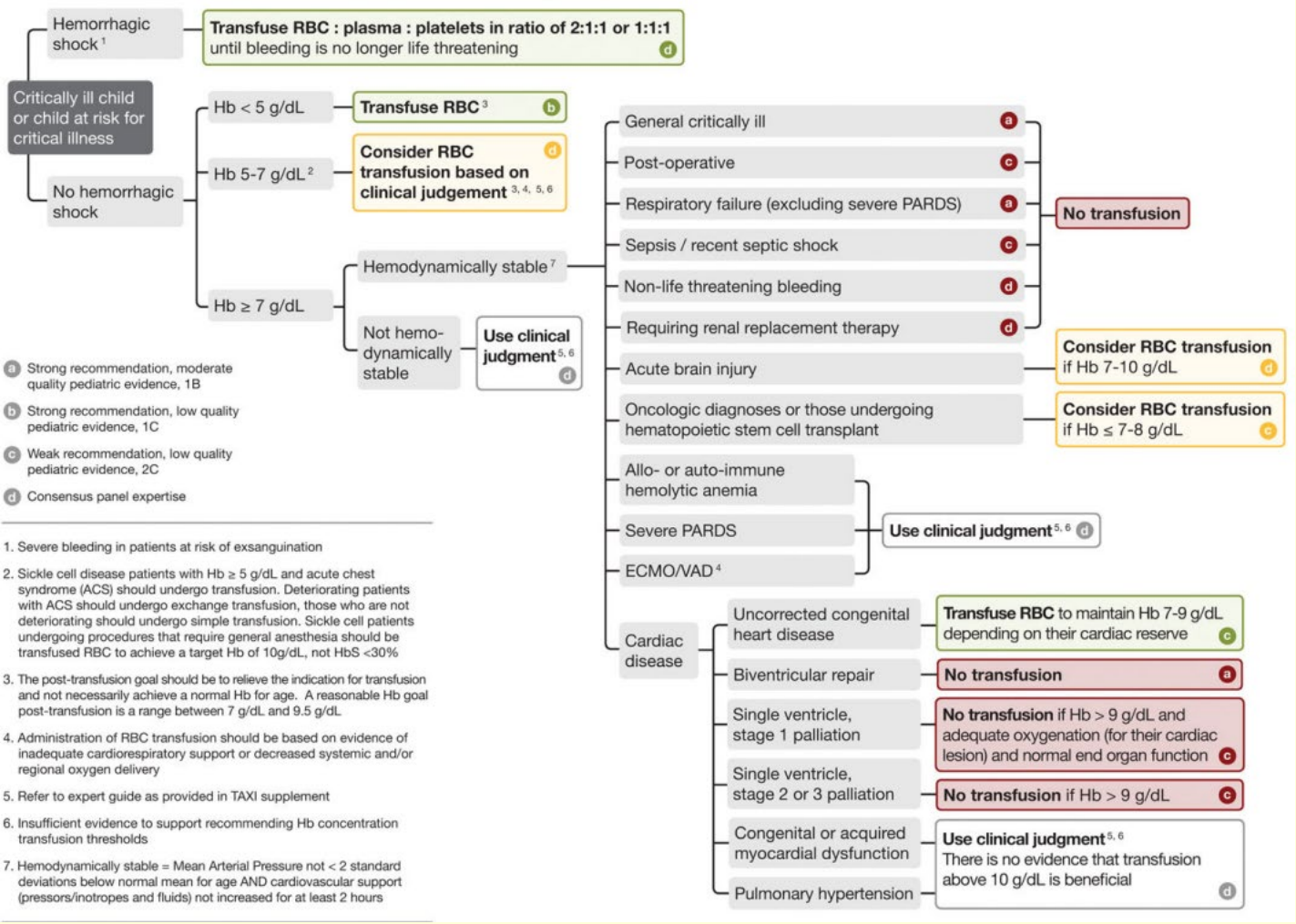
Pediatric Critical Care Transfusion and Anemia eXpertise Initiative (TAXI)

Stacey Valentine, MD MPH

2018 AABB Meeting
Boston, MA

AABB 18 BOSTON

PALISI Pediatric Acute Lung Injury & Sepsis Investigators



Pediatr Crit Care Med. 2018 September ; 19(9): 884–898.

RED CELL INDICATIONS

- < 50g/L
  - Probably (EXCEPT Iron Deficiency)
- 50-70g/L
  - Consider – use clinical judgement
- >70g/L
  - Acute brain injury (70-100)
  - Oncology diagnoses (70-80)
  - Uncorrected CHD (70-90)

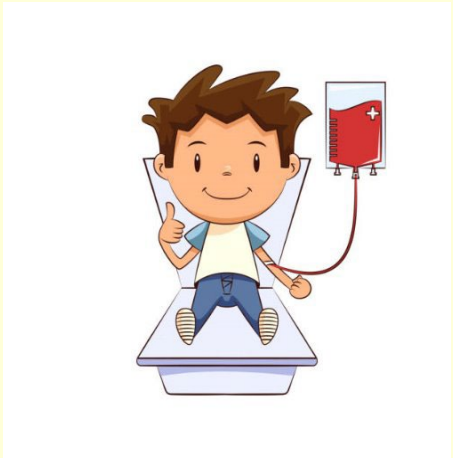
CASE STUDY

Sarah's 9-year-old brother, Ben, presents to the emergency department for difficulty breathing. He has sickle cell disease.

Ben is diagnosed with Acute Chest Syndrome.

- Hgb 55
- 35 kg

The hematologist on call recommends a simple transfusion.



CASE STUDY – Q3 Pre

What is the best transfusion order?

a) 475mL Oneg red cells IV Push
b) 1 unit phenotype matched red cells over 6 hours
c) Premedicate with 10mg/kg Diphenhydramine, 2 units Oneg over 4 hours
d) 1 unit phenotype matched, sickle neg, over 3.5 hours

CONSIDERATIONS

RATE OF TRANSFUSION

- Type of IV line
- Size of line
- Patency
- Compatibility

NEONATE

- Neonates NPO during transfusion?

CONSIDERATIONS

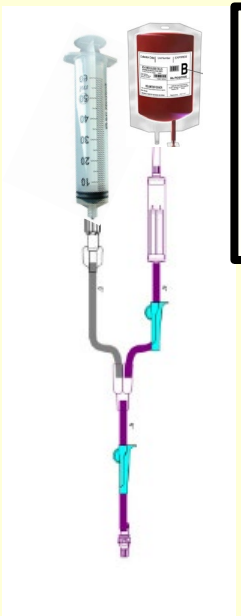
STABILITY

- 4 HOUR MAXIMUM out of controlled environment
- What does this mean?

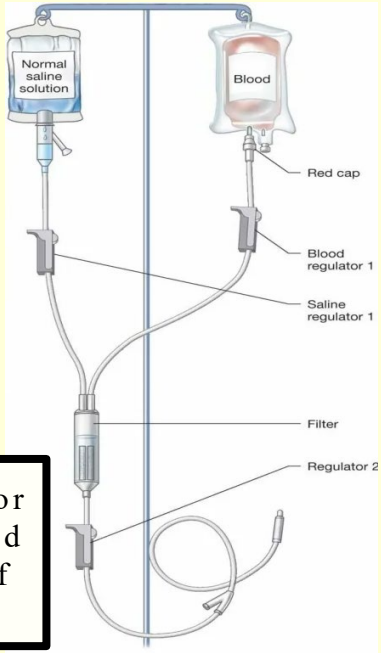
CONSENT & IDENTIFICATION

- Age of Consent in Ontario?
- Parent vs. Patient
- Independent double check

CONSIDERATIONS



Neonatal blood administration sets for volumes < 50 mls
Syringe pump may be used for administration



Use large volume set for volumes that exceed priming volume of tubing

ORDER & WASTAGE

- Order 10-15 ml/kg
  - 35 kg patient = order 350 to 525 ml
  - Rule of thumb +/- 10% of volume ordered

Example:

- Order 350 mL
- Received 380 mL
- Reduce waste. Administer it all!

MONITORING & DOCUMENTATION

VITAL SIGNS

- Baseline
- prior each unit
- 15 minutes after starting each unit
- at end of transfusion
- for reaction

START & END TIME

Include interruptions & volume infused

IV SITE

Watch for signs & symptoms that infusion is interstitial

Ontario Regional Blood Coordinating Network. (2022). *Bloody Easy 5: Blood transfusions, blood alternatives and transfusion reactions: A guide to transfusion medicine* (5.1 ed.). https://transfusionontario.org/wp-content/uploads/2022/10/BloodyEasy5.1_English_Final_2023_Interactive-June-28.pdf

TRANSFUSION REACTION

Signs & Symptoms of acute reaction:

- Fever
- Dyspnea
  - TACO (1 in 700)
  - TRALI – very rare (1 in 10 000)
- Urticaria & other allergic reactions
  - Minor are common
  - Anaphylaxis is rare
- Hypotension

Ontario Regional Blood Coordinating Network. (2022). *Bloody Easy 5: Blood transfusions, blood alternatives and transfusion reactions: A guide to transfusion medicine* (5.1 ed.). https://transfusionontario.org/wp-content/uploads/2022/10/BloodyEasy5.1_English_Final_2023_Interactive-June-28.pdf

TRANSFUSION REACTION

Management:

- Be prepared!
- Stop the transfusion
- Assess the patient
- Administer oxygen & medications as needed
- Call MRP
- May restart at a lower rate if clinical status allows
  - *Not applicable for anaphylaxis!*

Ontario Regional Blood Coordinating Network. (2022). *Bloody Easy 5: Blood transfusions, blood alternatives and transfusion reactions: A guide to transfusion medicine* (5.1 ed.). https://transfusionontario.org/wp-content/uploads/2022/10/BloodyEasy5.1_English_Final_2023_Interactive-June-28.pdf

POST-TEST Q1

Do you have any ABO antibodies?

a) Yes

b) No

POST-TEST Q2

Which would be the most appropriate for red cell transfusion?

a) Hb 37 (2yo with severe iron deficiency)
b) Hb 95 (9yo with sickle cell (SC) pain crisis)
c) Hb 71 (14 yo with ALL day 10 induction)
d) Hb 85 (6 week old thriving, late prem)

POST-TEST Q3

What is the maximum length of time a blood transfusion should take?

a) 2 hours

b) 3 hours

c) 3.5 hours

d) 4 hours

CASE STUDY Q1- Post

- Sarah is a term infant. Her blood group is A+
- Mom's blood group is B+
- What is the best blood type if Sarah needs a red cell transfusion?

a) AB+
b) O+
c) A+
d) B+
e) O-

CASE STUDY Q2- Post

Sarah is growing up! She is now 1 year old. She loves milk and is very picky about other food.

"Routine" bloodwork results at a follow-up appointment: Hgb 37

What is the best initial treatment?

a) PRBC transfusion
b) Start oral iron supplement
c) IV iron infusion
d) Reassurance

CASE STUDY – Q3 - Post

What is the best transfusion order?

a) 475mL Oneg red cells IV Push
b) 1 unit phenotype matched red cells over 6 hours
c) Premedicate with 10mg/kg Diphenhydramine, 2 units Oneg over 4 hours
d) 1 unit phenotype matched, sickle neg, over 3.5 hours

THANKS!

Does anyone have any questions?

emcbride@cheo.on.ca
bholley@rogerneilsonchildrenshospice.ca