Transfusion Medicine Potpourri

BUMC - Phoenix

Internal Medicine Residents

September 29, 2015

United Blood Services

Clinical case

- A 24 year old female with sickle cell anemia has just moved to the area and presents as a new patient.
- H/H is 7.5/23%
- Patient is afebrile and stable.
- **Do you transfuse her? Y or N**
- Why do we give red cells?
- What guidelines would you follow?

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Annals of Internal Medicine | Clinical Guideline

Red Blood Cell Transfusion: A Clinical Practice Guideline From the AABB*

Jeffrey L. Carson, MD; Brenda J. Grossman, MD, MPH; Steven Kleinman, MD; Alan T. Tinmouth, MD; Marisa B. Marques, MD; Mark K. Fung, MD, PhD; John B. Holcomb, MD; Orieji Illoh, MD; Lewis J. Kaplan, MD; Louis M. Katz, MD; Sunil V. Rao, MD; John D. Roback, MD, PhD; Aryeh Shander, MD; Aaron A.R. Tobian, MD, PhD; Robert Weinstein, MD; Lisa Grace Swinton McLaughlin, MD; and Benjamin Djulbegovic, MD, PhD, for the Clinical Transfusion Medicine Committee of the AABB

- Patients **without** preexisting cardiovascular disease:
  - If no significant s/sx of anemia or hypoxia, avoid RBC transfusion when Hb is > 7-8 g/dl.
- Patients **with** preexisting cardiovascular disease
  - If no significant s/sx of anemia or hypoxia, avoid RBC transfusion when Hb is > 8 g/dl.
- Hemodynamically stable patients with ACS acute coronary syndrome,
  - No consensus upon transfusion thresholds
  - Base transfusion decisions on patient factors as well as laboratory data.

Transfusion Safety

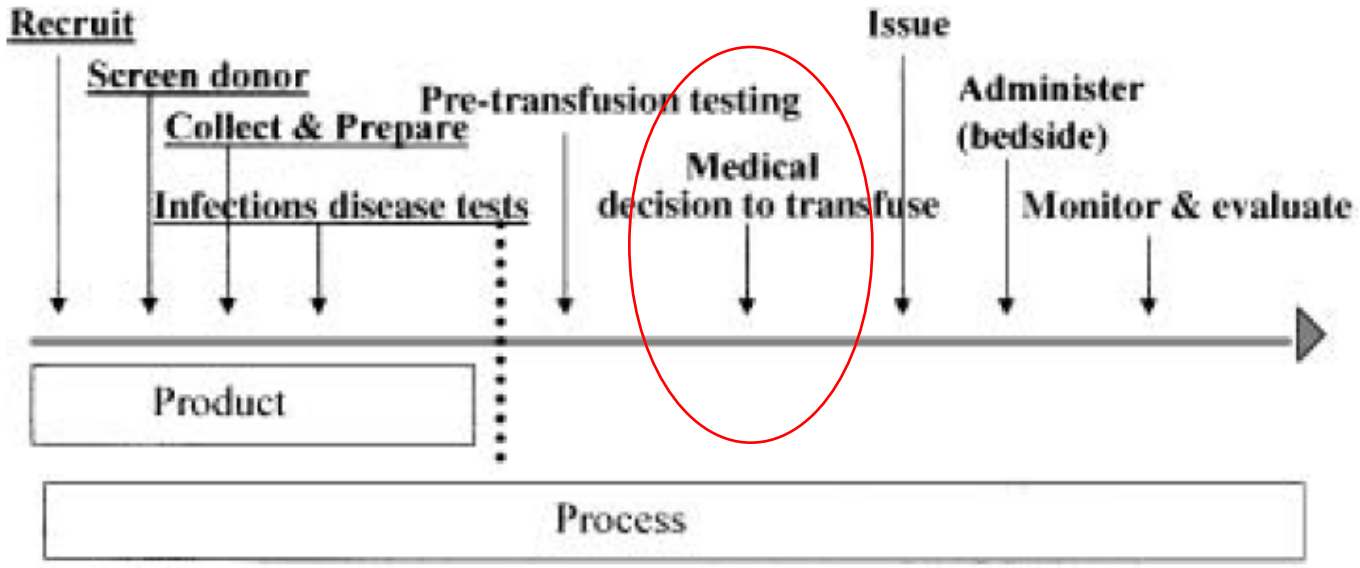

Fig. 1. Transfusion safety is more than component safety. Safe transfusion therapy depends upon an interconnected series of processes that begin with the donor and end with the patient.

Walter H. Dzik, MD

TRANSFUSION 2003;43:1190-1199.

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Moving from *liberal* transfusion strategy to a *restrictive* one…

- Noninferiority demonstrated in ICU, cardiac surgery, and postoperative settings

- TRICC trial – Adult critical care
  - Hebert et al. NEJM 1999;340:409-417.
- Texas Heart Institute – Coronary Artery Bypass Graft
  - Bracey et al. Transfusion 1999;1070-77.
- TRACS Study – Elective Cardiac Surgery
  - Hajjar et al. JAMA 2010;304(14):1559-1567.
- FOCUS trial – Orthopedic surgery with high risk cardiac patients
  - NHLBI-sponsored study entitled "Functional Outcomes in Cardiovascular Patients Undergoing Surgical Hip Fracture Repair"
  - Carson et al. NEJM 2011;365:2453-62

True or false:

More blood is often not better.

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Optimizing Patient Outcomes

- Better transfusion practices are part of better patient outcomes
- The treatment goal is to relieve the patient's s/sxs with the minimal effective dose of blood product.
- The right product for the right indication at the right time.

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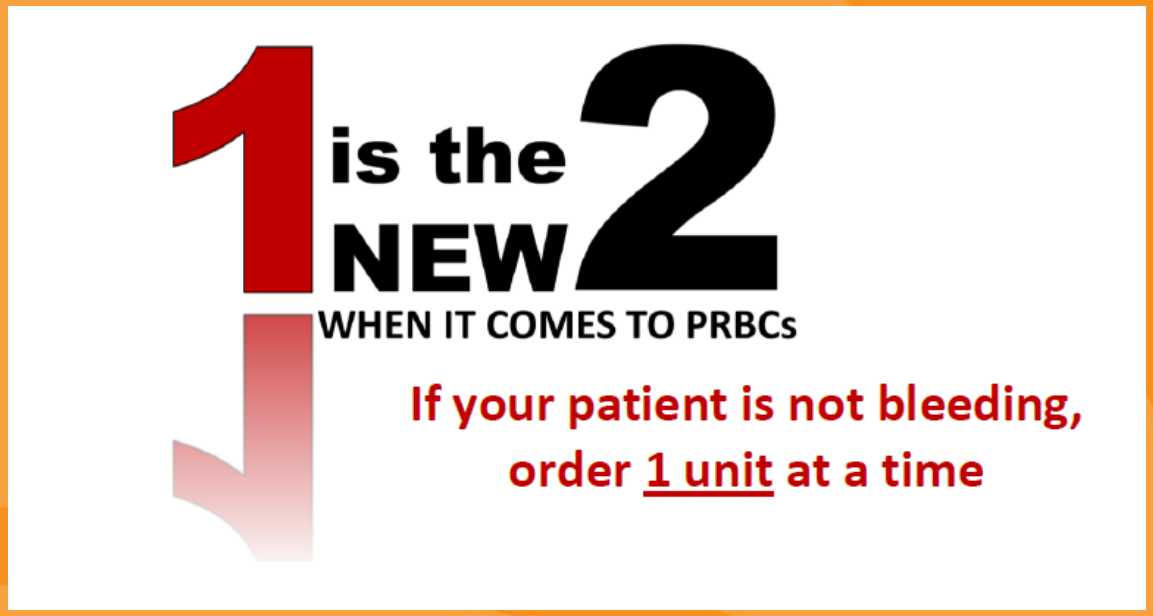
Other Advantages to Decreased Transfusion

- Adverse effects from transfusions
  - What are some infectious hazards of transfusion?
  - What are noninfectious hazards of transfusion?
- Limited community resource from a shrinking donor population
- Often one of the hospitals' highest costs

Case 1 continued

- 3 d later the patient's hemoglobin is 5.9 g/dl, HR 105, and she seems slightly out of breath at rest.
- **Do you transfuse her (Y/N)?**
- **Do you write the order for 1 or 2 units of PRBC?**



Graphic credit - Dr. Holly McDaniel

Transfuse **1 unit** PRBC →
Recheck H&H →
Determine **if** 2nd unit is needed

- Many patients will **not** require a second red cell unit!
- The treatment goal is to ameliorate the patient's symptoms with the ***minimal effective*** dose.

Ma, M., et al. (2005) Transfusion Medicine, 15: 307–312

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Clinical case continued

- **You order 1 unit – do you order T&C or T&S?**
- What is the difference?
- Why do we care? Why don't we always T&C everything?

Implementation Guide for
The Joint Commission
Patient Blood Management
Performance Measures
2011

Clinical case continued

- TJC has patient safety initiatives and patient blood management is included in these.

Set Measure ID	Measure Short Name
PBM-01	Transfusion Consent
PBM-02	RBC Transfusion Indication
PBM-03	Plasma Transfusion Indication
PBM-04	Platelet Transfusion Indication
PBM-05	Blood Administration Documentation
PBM-06	Preoperative Anemia Screening
PBM-07	Preoperative Blood Type Testing and Antibody Screening

- What else do you need to make sure is in the chart when you order blood products?

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Best Practices

- Prior to transfusion…
  - Written documentation of rationale for each transfusion
    - Specific and clearly address indications
  - Obtain informed consent
    - Delineate risks, benefits, alternatives to txn
- After transfusion…
  - Perform assessment of efficacy of transfusion
    - Relief of anemia symptoms
    - Cessation of bleeding
  - Observe for adverse effects of transfusion

Roseff et al 2002

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Clinical case continued

- You consent her for blood transfusion.
- Her son wants to know about risks of viral transmission from blood transfusion.
- **Which of the following is the most common virus?**
  - **HIV**
  - **HBV**
  - **HCV**
  - **HTLV**

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What are viral transmission rates for blood transfusion?

- HBV:
  - 1 in 800,000 units
- HCV:
  - 1 in 1 million units
- HIV:
  - 1 in 1.5 million units
- HTLV-I/II:
  - 1 in 3 million units

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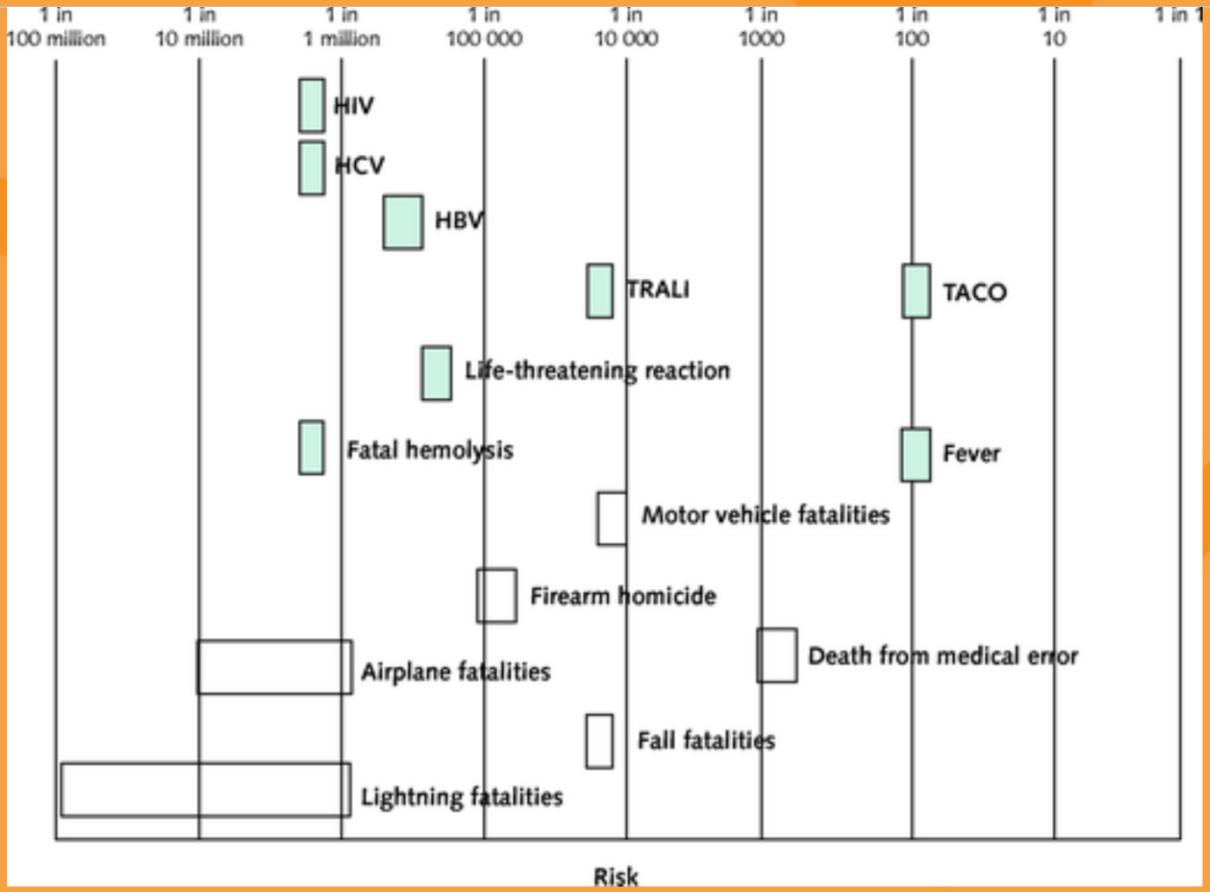

Clinical case continued

- Blood bank calls back and says they have no history on your patient. You recall from your history that she is from out of state.
- **Does the patient's previous transfusion history matter (Y/N)?**
- Why?

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Clinical case continued

- You are concerned that you have been waiting for the patient's RBC unit for a long time.
- **Should you a) wait longer or b) call the Blood Bank?**

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Clinicopathologic Correlation

- Thorough blood bank evaluations can be very time-consuming.
- Communication between lab and clinical team is essential.
- Transfusion should not be delayed for completion of work-up if patient is clinically unstable!

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Clinical case continued

- The blood bank was able to obtain a previous history of an anti-Jk^a antibody and they are also detecting a new anti-S.
- They recommend giving red cells that are
  - < 7 d old
  - Hemoglobin S negative
  - Negative for Jk^a and S antigens
  - Phenotypically matched for Rh (D/Cc/Ee) and Kell antigens.

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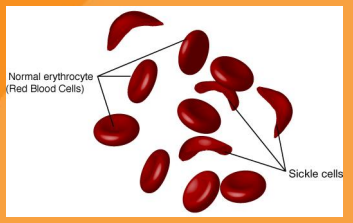
Rh/Kell matching in SCD



- Alloimmunization (formation of antibodies to red cell antigens) is a big problem in sickle cell patients.
- What are some reasons?
- To minimize this, it is recommended to match patient's phenotype for Rh (D/Cc/Ee) and Kell.

CME **Extended red blood cell antigen matching for transfusions in sickle cell disease: a review of a 14-year experience from a single center**

Michele LaSalle-Williams, Rachelle Nuss, Tuan Le, Laura Cole, Kathy Hassell, James R. Murphy, and Daniel R. Ambruso

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Clinical case continued

- 1 h into the transfusion of red cells, the patient's temperature↑ 1 C.
- **Should the nurse…**
  - **A) …stop the transfusion**
  - **B) …continue the transfusion**
  - **C) …call you, the covering physician**
  - **D) A&C**
  - **E) B&C**

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Clinical case continued

- You receive the call and correctly identify that this could be related to the transfusion.
- You look for other s/sxs and note her hypotension and shortness of breath
- What could this be and what should you do?

Transfusion Reactions

DDx of acute (< 6 h) transfusion reactions

- Hemolysis
- Septic transfusion reaction
- TRALI
- TACO
- Febrile
- Allergic

Initial management

- Stop the transfusion!!
- Keep IV access
- Monitor and support patient
- Perform clerical check and report transfusion reaction to BB

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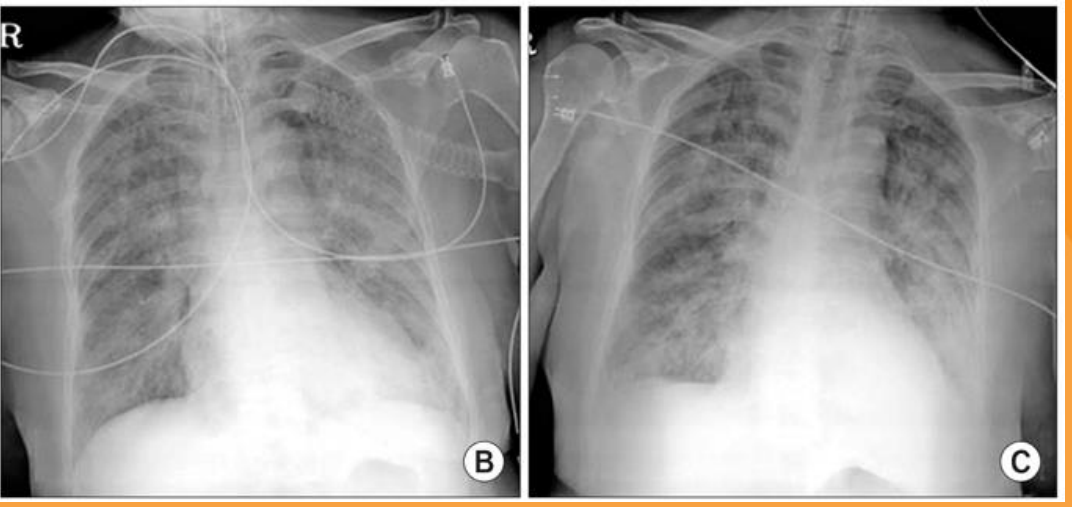
Clinical case continued

- Patient develops severe dyspnea and hypotension
- Oxygen saturations drop
- You get a STAT chest x ray---new onset bilateral pulmonary infiltrates.
- BB calls back
  - Pre and post DAT is negative
  - Repeat ABO/Rh confirms O neg blood group
  - Culture of bag is pending
- Patient does not appear volume overloaded but condition is worsening
- What is your working diagnosis?
- What should you do?

TRALI



1	TRALI Criteria		
	A	Meets Criteria for Acute Lung Injury (ALI):	
		i	Acute onset
		ii	Hypoxemia
			PaO_2/FiO_2 = 300
			or SpO_2 < 90% on room air
			or other clinical evidence of hypoxemia
		iii	Bilateral infiltrates on frontal chest radiograph
		iv	No evidence of left atrial hypertension (i.e., circulatory overload)
	B	No preexisting ALI before transfusion	
	C	During or within 6 hr. of transfusion	
	D	No temporal relationship to an alternative risk factor for ALI	
2	Possible TRALI		
	A	Meets ALI Criteria (as above)	
	B	No preexisting ALI before transfusion	
	C	During or within 6 hr. of transfusion	
	D	A clear temporal relationship to an alternative risk factor for ALI	

- **Clinicoradiologic** diagnosis:
  - New onset ALI within 6 h of transfusion
  - Fever, hypotension, no other risk factors
  - Noncardiogenic bilateral pulmonary edema

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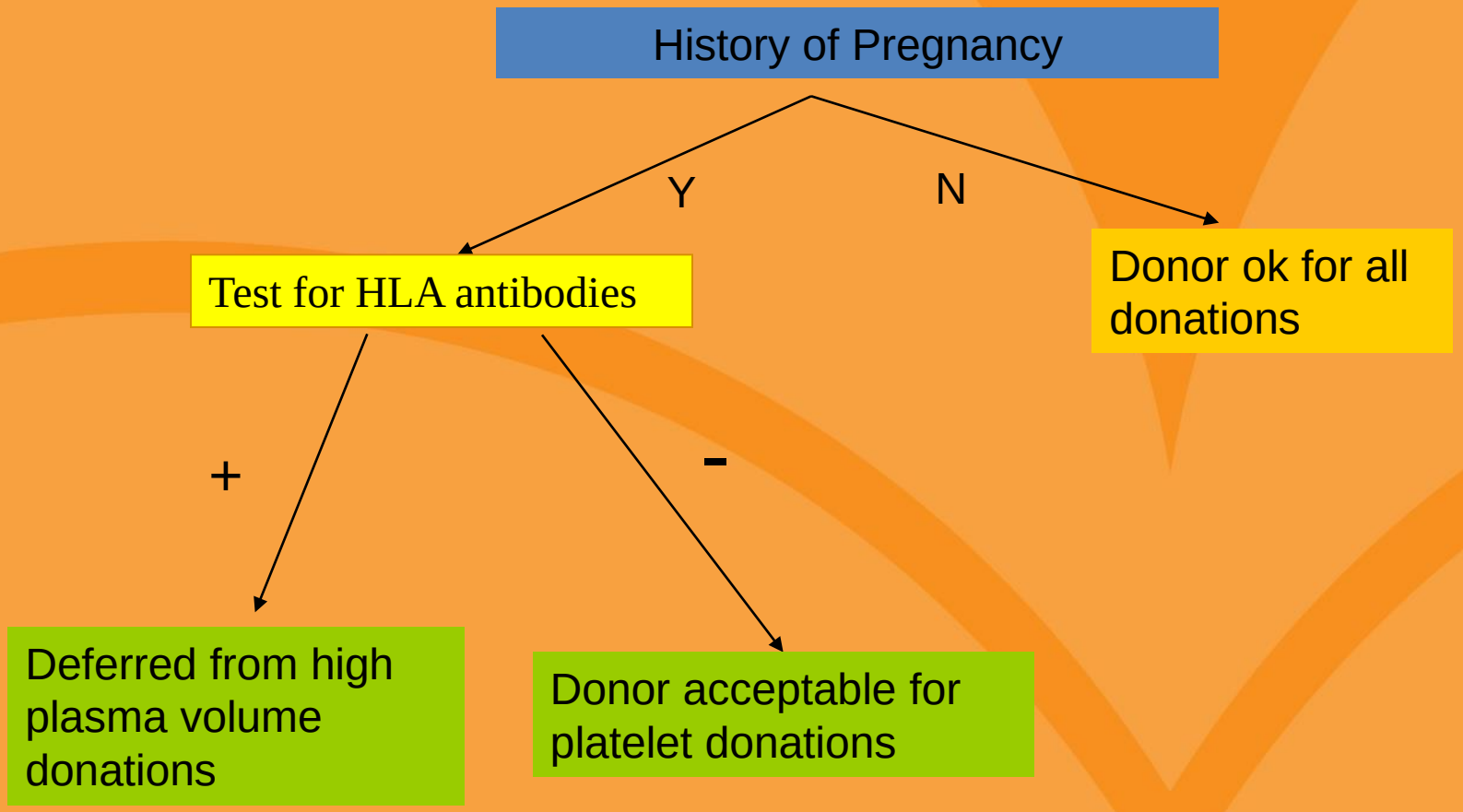
TRALI: Which products cause it?

- Historically was high volume plasma products
  - TRALI interventions has decreased % caused by plasma
- Now RBC are the most common cause

UBS TRALI risk mitigation



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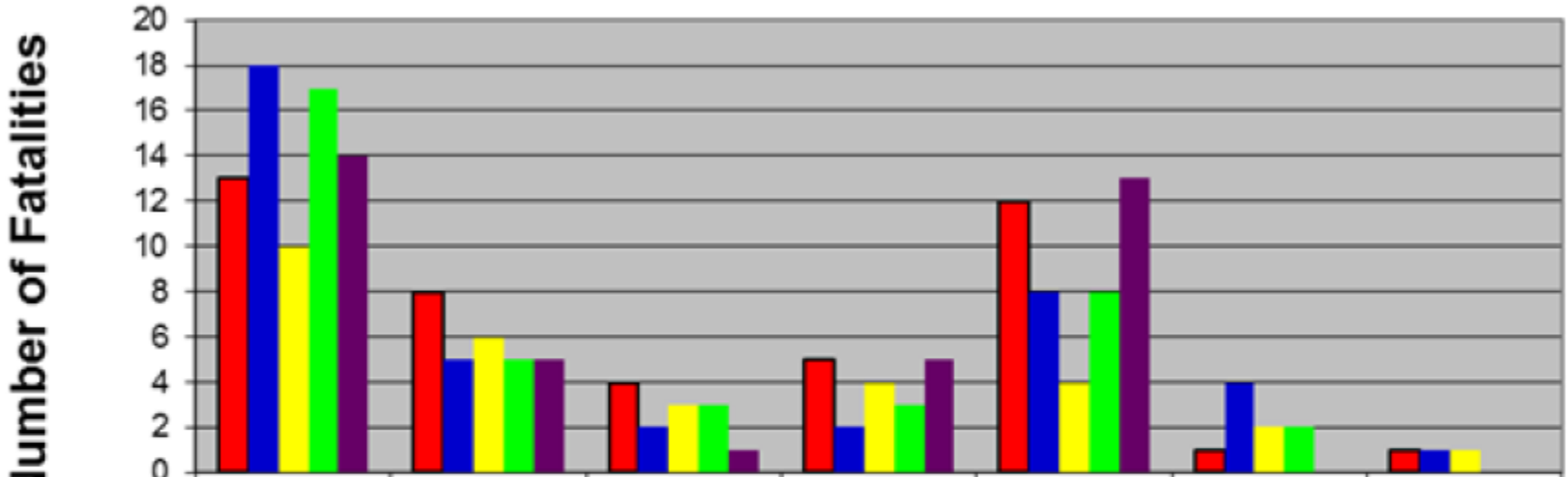
TRALI

- Incidence with interventions - 1:12,000
  - Incidence was ~1:1300 to 1:5000
  - Still is one of the leading cause of deaths reported to FDA
- Mechanism
  - Ill patient, “primed”
  - Infusion of anti-HLA antibodies or BRMs
  - Results in lung injury and pulmonary edema

Figure 1: Transfusion-Related Fatalities by Complication, FY2009 through FY2013



	TRALI	HTR (non-ABO)	HTR (ABO)	Microbial Infection	TACO	Anaphylaxis	Other
FY09	13	8	4	5	12	1	1
FY10	18	5	2	2	8	4	1
FY11	10	6	3	4	4	2	1
FY12	17	5	3	3	8	2	0
FY13	14	5	1	5	13	0	0

http://www.fda.gov/biologicsbloodvaccines

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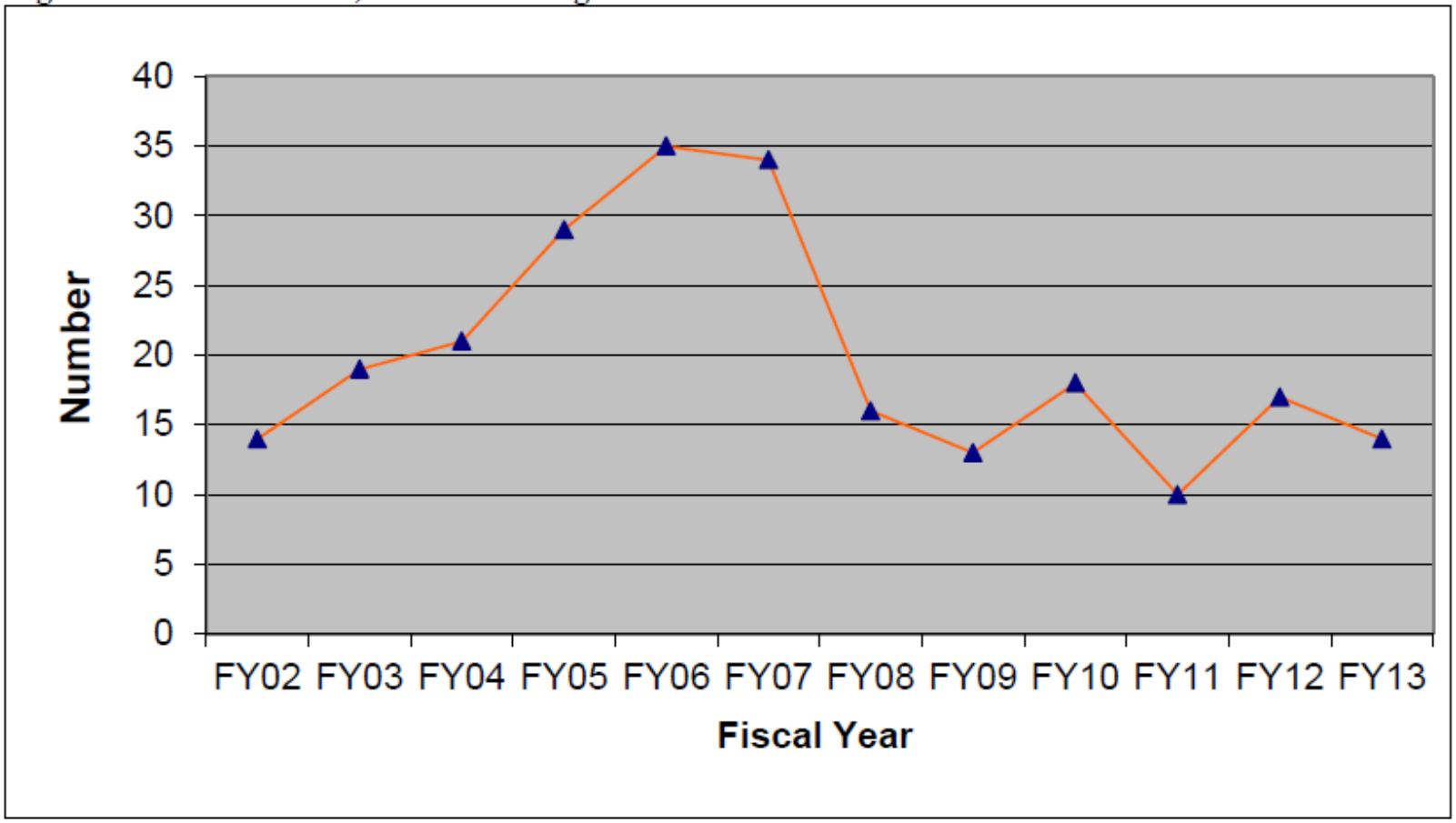
Fatalities Reported to FDA Following Blood Collection and Transfusion Annual Summary for Fiscal Year 2012

Figure 2: TRALI Cases, FY2002 through FY2013



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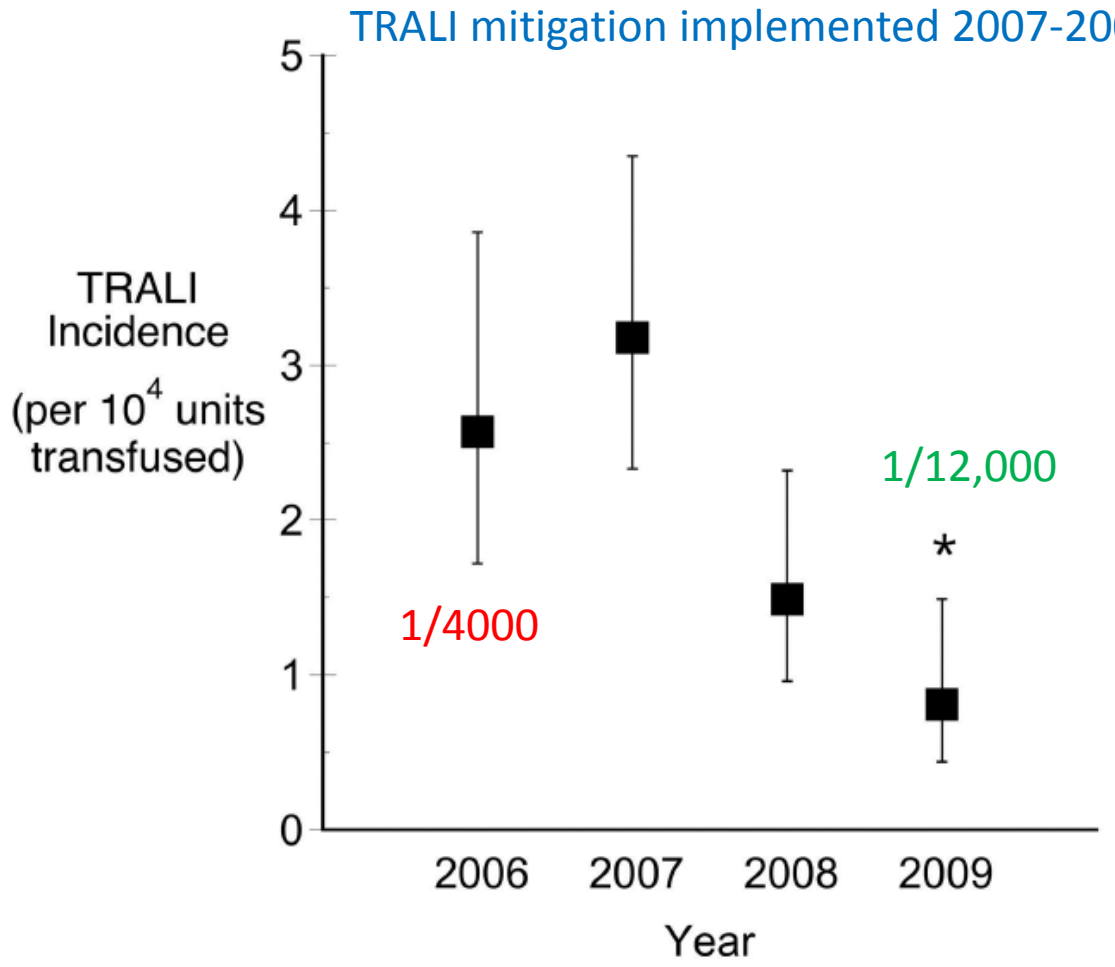
blood
JOURNAL OF THE AMERICAN SOCIETY OF HEMATOLOGY

TRALI incidence by year at 2 academic medical centers (2006-2009).



Toy P et al. Blood 2012;119:1757-1767

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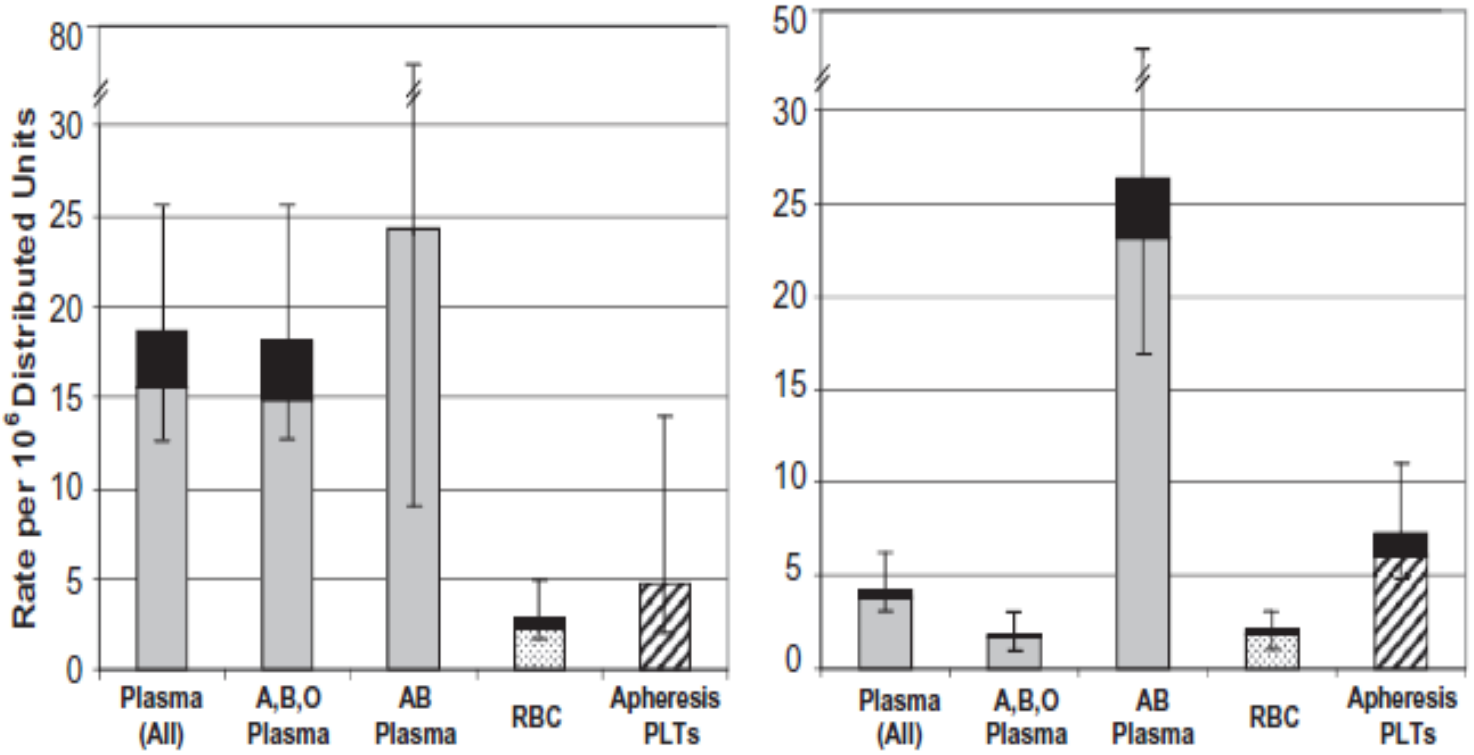

Fig. 2. Residual TRALI risk per distributed component. The rate of high-probability TRALI cases as classified by the American Red Cross hemovigilance program are expressed per million distributed components for 2006 for plasma (all groups, 31 cases); group A, B, and O plasma (28 cases); group AB plasma (three cases); RBCs (17 cases); and apheresis PLTs (three cases) and compared to 2008 to 2011 for plasma (all groups, 28 cases); group A, B, and O plasma (11 cases); group AB plasma (17 cases); RBCs (49 cases); and apheresis PLTs (23 cases). (■) Reported fatalities. Lines show 95% CI for the overall (fatal and nonfatal) rates.

Eder et al, Transfusion, 2013;53:1442-1449

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Patients at higher risk of TRALI

- Shock
- Alcohol abuse
- Positive fluid balance
- Current smoking
- Liver surgery, especially liver transplant patients
- Peak airway pressures of > 30 cm H20
  - If ventilated prior to development of TRALI

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TRALI: Differential Diagnosis

- Rule out cardiogenic pulmonary edema
  - Perform CXR
  - Evaluate for hypervolemia
  - BNP levels of <50 pg/ml have strong NPV for circulatory volume overload (TACO)
    - >100 pg/ml suggestive of heart failure
- Underlying illness or comorbidities (pnuemonia)
  - Pre- and posttransfusion oxygen saturations
- TRALI can be hard to diagnose in ICU setting
  - Patients have with other reasons for dyspnea and hypoxia

True or False

TRALI should be treated supportively

- **A) True**
- **B) False**

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Acute Management & Treatment

- Stop the transfusion and report the reaction
- Supportive care
  - Supplemental oxygen and aggressive ventilatory support if needed
    - No role for diuretics
    - No proven benefit to NSAIDs or corticosteroids
- Recovery, usually spontaneous:
  - Clinical 24-96 h
  - CXR 96 h
- Long term effects
  - Usually none, lung damage tends to be transient
  - 20% will have a prolonged course and/or a fatal outcome
    - Mortality 5-10%

Which is more common?

- A) TRALI – Transfusion related acute lung injury
- B) TACO – Transfusion associated circulatory overload

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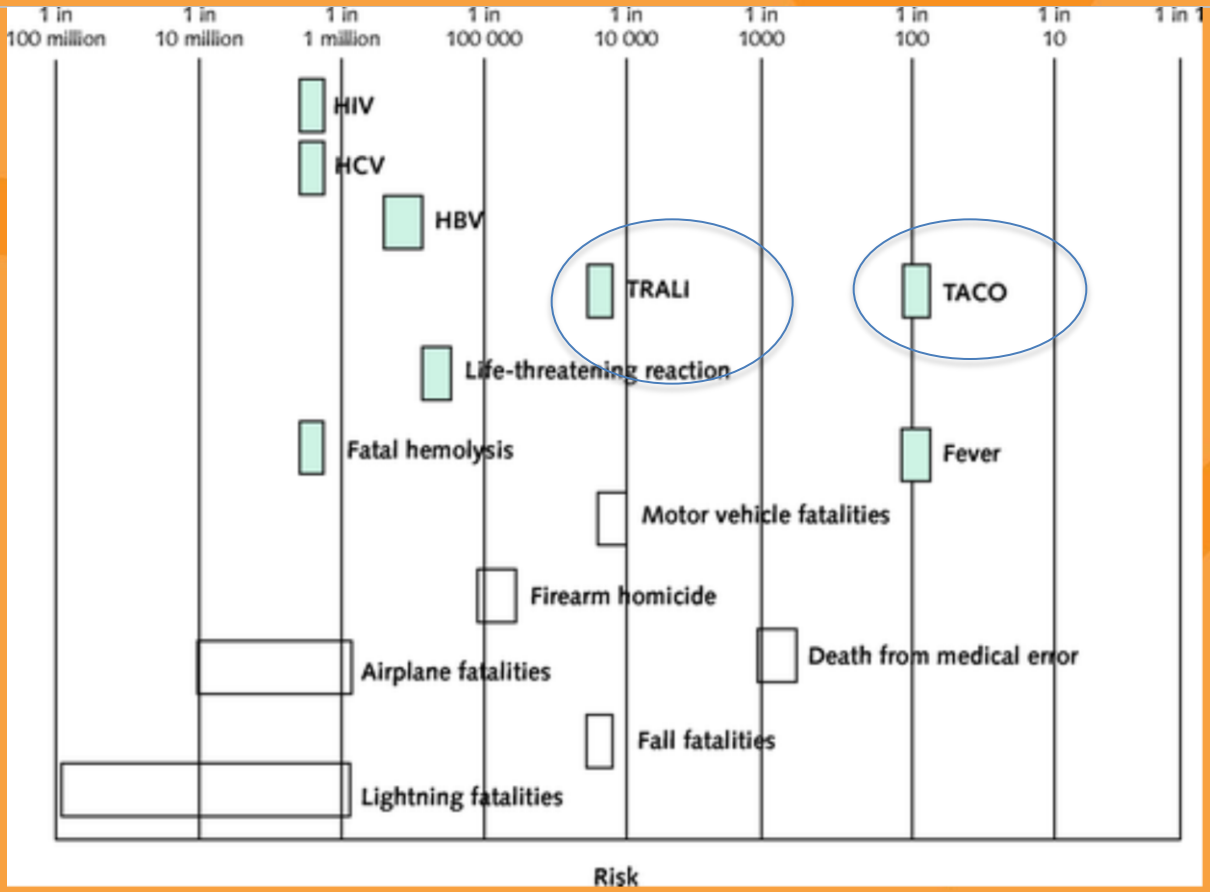

Transfusion Associated Circulatory Overload (TACO)

- Volume overload of any product
  - Depends on rate and amount of transfusion
  - Risk ↑with extremes of age and ↓cardiac function
- 1-8% of transfusions, mortality ~1-8% of cases
- Findings:
  - Cough, dyspnea, tachycardia, hypertension, headache
  - ↑ BNP, cardiogenic pulmonary edema
- Treatment: Stop the transfusion, report the reaction, treat supportively (diuretics)
- Prevention: Conservative rate and vol of transfusion

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Clinical case continued

- Your patient is transferred to the unit for observation.
- Ultimately, intubation is not required.
- Her dyspnea decreases over the next 24 h
- CXR findings resolve over the following 24 h.
- You re-check the H&H. What would you expect it to be after 1 unit PRBCs?
- It is 6.9 g/dl. What now?

Clinical case continued

What should you do if this patient requires another transfusion in the future?

- **A) Give washed red cells**
- **B) Give irradiated red cells**
- **C) Give leukoreduced red cells**
- **D) Transfuse according to evidence based guidelines and clinical correlation**

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Leukoreduction vs. Irradiation vs. Washing

Leukoreduction

- ↓ CMV transmission
- ↓ HLA alloimmunization
- ↓ Febrile non-hemolytic transfusion reactions

Irradiation

- Prevents TA-GVHD

Washing

- Prevents allergic reactions but causes cell loss and decreased platelet function

Your overall gestalt: as clear as…

- A)

- B)

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Review

The Highlight Reel

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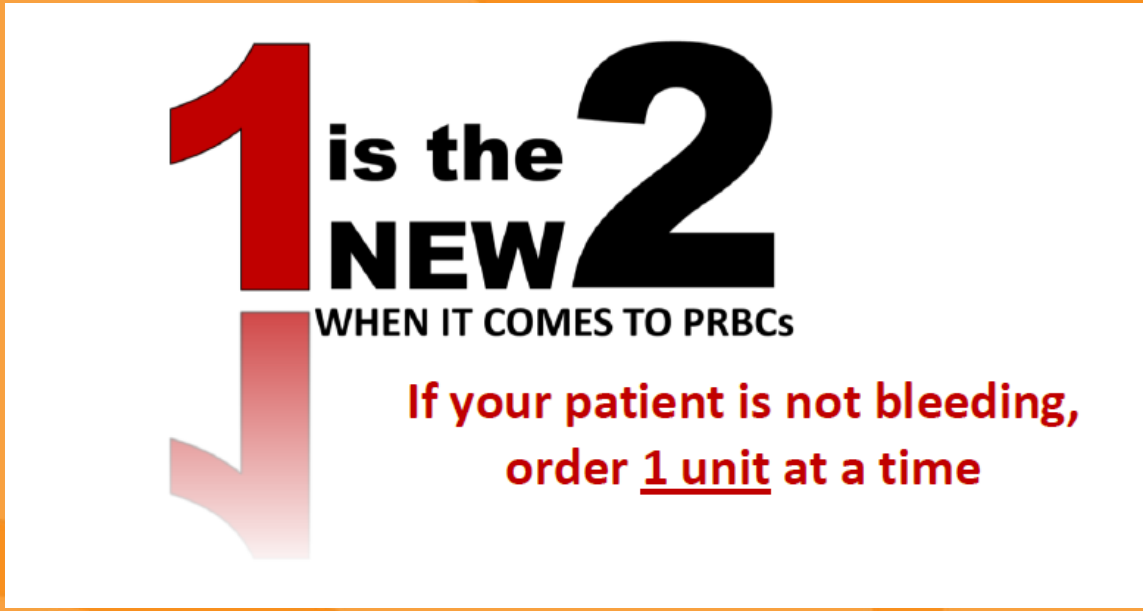

Transfuse **1 unit** PRBC →

Recheck H&H →

Determine **if** 2nd unit is needed

- Many patients will **not** require a second red cell unit!
- The treatment goal is to ameliorate the patient's symptoms with the ***minimal effective*** dose.

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Risks per Unit Transfused

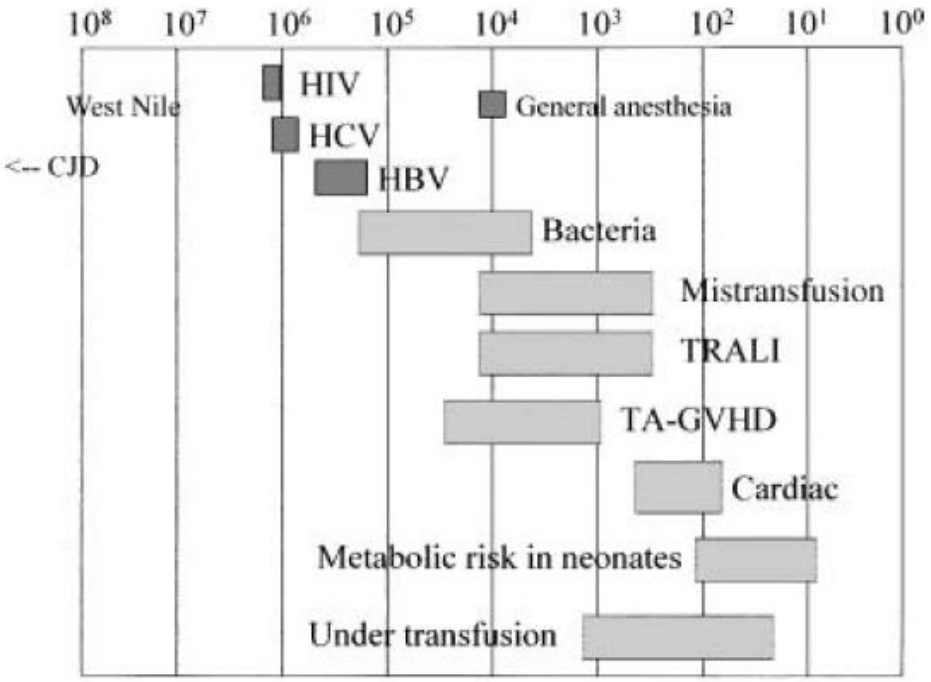

Fig. 2. Estimates of the current risk per unit of blood transfusion. The vertical bars represent log risk estimates (1-10, 1-100, etc.). The dashed edges to lighter shaded horizontal bars signify that the upper and lower estimates of risk are uncertain.

Walter H. Dzik, MD

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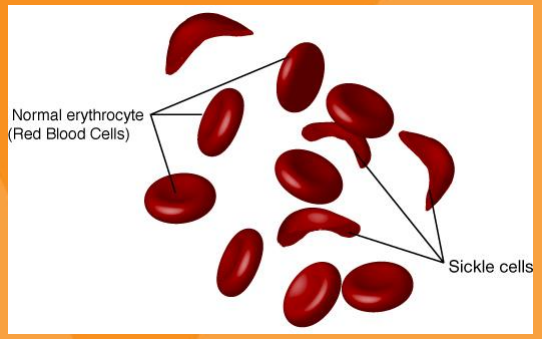
Transfusions for Sickle Cell Patients



- < 7 d old
- Hemoglobin S negative
- Honor alloantibodies (means antigen negative blood)
- Match patient phenotype for Rh (D/Cc/Ee) and Kell antigens to reduce alloimmunization

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Communication is essential.

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Questions?
Thank you!

Robin Cusick, MD

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