Transfusion Safety: A High Reliability Approach

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Agenda

- Transfusion Safety case studies
- The imperatives for better blood utilization
- A High Reliability approach to Transfusion Safety
- Transfusion Safety Program foundations
- Summary/ Conclusions

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Case Study

Augie
Inpatient Postoperative Orthopedic Transfusion

3

Case Study

Jessica Rose
Outpatient Pediatric Oncology Transfusion

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Why Focus on Blood Utilization?

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Blood is High Volume

Blood transfusion is the single most common treatment for hospitalized patients, and there is an increasing shift towards outpatient transfusions

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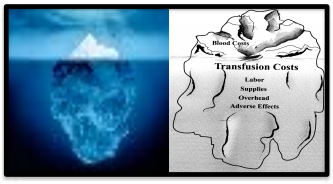
Blood is High Cost



When accounting for the labor and supplies to test, store and administer a unit of blood, the cost exceeds $1200/ unit; Adverse effects of transfusion can add an additional $1000/ unit

Hannon TJ, Paulson-Gjerde, K, Contemporary Economics of Transfusion, 2005

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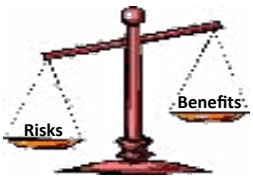
Blood is High Risk



Scientific evidence over the last 17 years has consistently shown that transfusions are less beneficial and more harmful than previously assumed

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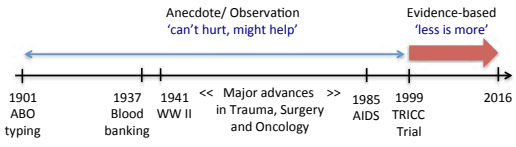
Advances in Transfusion Knowledge



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The New England Journal of Medicine

A MULTICENTER, RANDOMIZED, CONTROLLED CLINICAL TRIAL OF TRANSFUSION REQUIREMENTS IN CRITICAL CARE

- Prospective, randomized multicenter Canadian study with 838 critically ill ICU patients
- Liberal transfusion strategy (Hb 10.0 g/dL) vs restrictive strategy (Hb 7.0 g/dL)
- Overall, the adjusted multi-organ dysfunction score and in-hospital mortality were significantly higher in the liberal transfusion group than in the restrictive transfusion group
- No sub-group of these critically ill patients demonstrated an added benefit of higher Hgb levels, and most patients in the liberal transfusion group had worse outcomes

Hébert et al- NEJM 1999;340(6)

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The New England Journal of Medicine

A MULTICENTER, RANDOMIZED, CONTROLLED CLINICAL TRIAL OF TRANSFUSION REQUIREMENTS IN CRITICAL CARE

- Author conclusions:

  "A restrictive strategy of red cell transfusions is at least as effective as and possibly superior to a liberal strategy in critically ill patients, with the possible exception of patients with acute myocardial infarction or unstable angina."[1]

- Ranked as the #1 study that has changed the practice of transfusion medicine[2]

[1] Hébert et al- NEJM 1999;340(6)
[2] Blajchman, Transfusion 2005:45

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Evidence-Based Transfusion Practice

- Since 1999, over 20 clinical trials in high risk patients (neonatal and pediatric critical care, cardiac surgery, orthopedics, GI bleed, sepsis)[1-5] have reinforced the TRICC trial, showing no benefit of liberal transfusion therapy and a tendency towards harm
- A growing list of non-infectious risks of transfusion have been identified, including lung injury, volume overload, renal injury, multisystem organ failure and immunosuppression[6]

[1] Holst et al- NEJM 2014;371(15)
[2] Hébert et al- NEJM 1999;340(6)
[3] Hajjar- JAMA 2010;304(14)
[4] Carson et al- NEJM 2011;365(26)
[5] Villaneuva- NEJM 2013;368(1)
[6] Gilliss- Anesth 2011;115(3)

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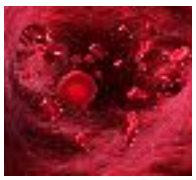


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Infectious Risks of Blood Transfusion

- HIV, Hepatitis (1:1,000,000)
- Bacterial contamination of platelets (1:3000)
- Emerging threats
  - nvCJD
  - West Nile
  - Chagas
  - Babesiosis
  - Chikungunya
  - **Zika**
  - Others?

Goodnough- CritCare Med 2003;31(12S)

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Non-Infectious Risks of Transfusion

- Febrile and allergic reactions 1- 2%
- Hemolytic transfusion reactions
  - Mistransfusion (clerical error) incidence 1:14:000-16,000[1]
- SIRS, TRIO, TRAKI, TRAGI
- TA- Microchimerism, TA- graft vs. host disease
- Transfusion Related Immunomodulation (TRIM)[4]
  - *Blood is a liquid transplant!*
- TRALI (1:10,000), TACO (1:16- 1:350)[2,3]

[1] Goodnough- CritCare Med 2003;31(12S)
[2] Rana- Transfusion 2006;46
[3] Li- Transfusion 2011;51(2)
[4] Blumberg, Transfusion 2005;45(S)

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Transfusion Associated Circulatory Overload (TACO)

- Evidence of circulatory overload within 6 hours of a transfusion[1]
  - Increased CVP and PCWP
  - BNP may help vs. TRALI
- Incidence 1- 8% (primarily FFP and RBC)
- Mortality 1- 3%
  - Mortality OR=3.2
  - Average LOS increase 4 days
- Risk factors
  - Extremes of age
  - Positive fluid balance (OR=9.4/L)
  - Renal dysfunction (CRF OR=27)
  - Volume of transfusion (OR=1.11/ unit)
  - High rates of transfusion (> 170 mL/ hr)
- **TACO is high incidence, high morbidity and largely avoidable!**

[1] Alam- TransMedRev 2013
[2] Murphy- AmJMed 2013
[3] Li- Transfusion 2011;51(2)

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Transfusion Associated Harm is **Dose Dependent**

Surgical Outcomes and Transfusion of Minimal Amounts of Blood in the Operating Room[3*]

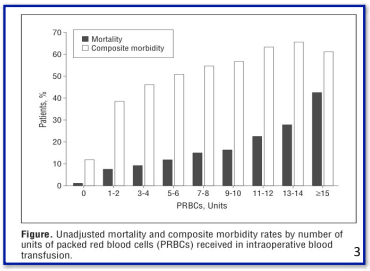

Figure. Unadjusted mortality and composite morbidity rates by number of units of packed red blood cells (PRBCs) received in intraoperative blood transfusion.

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Each unit of transfused RBC results in[3]:

- 4% increase in wound complications
- 1.5 day increase in length of stay
- 0.9% increase in mortality

*Data analysis of 941,496 patients in the NSQIP data set

[1] Bernard et al, JAmCollSurg 2009;208
[2] Ferraris et al, ATS 2011;91(6)
[3] Ferraris et al, Arch Surg 2012;147(1)
[4] Paone et al, ATS 2014;97(1)

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Blood is Poorly Utilized

In spite of the large body of evidence that supports more conservative transfusion practice, there is wide variation in transfusion practice and estimates that 30- 70% of transfusions are inappropriate or unnecessary

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A High Reliability Approach to Transfusion Safety

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Characteristics of High Reliability Organizations

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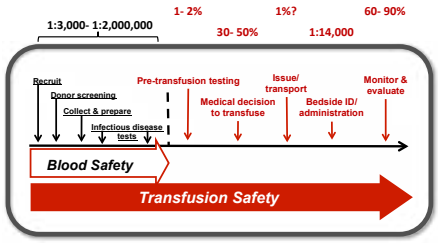
From Blood Safety to Transfusion Safety

Transfusion Safety Error Rates



Dzik, Transfusion 2003;43
Maskens, Transfusion 2014;54(1)

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General Approach to Transfusion Safety

- The key to implementing comprehensive, sustainable blood utilization efforts is framing appropriate blood use as a Patient Safety Initiative
  - No clinician comes to work with an intent to harm their patients
  - Most clinicians overestimate the benefits of blood transfusion and underestimate the risks
    - Lack of "basic training"
    - Clinicians don't know what they don't know
- Providing evidence based information in a supportive, educational and peer-to-peer manner gains buy in
- An effective Transfusion Safety Committee is the platform for continuous improvement

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Summary/ Conclusions

- Blood products save lives but also cause measurable harm with each unit transfused
  - Patients should receive no more or no less blood than is indicated by best available evidence
- Unnecessary transfusions lead to avoidable harm
- Given the breadth and scope of patient safety issues related to transfusion, a High Reliability approach is needed!

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