Collection Analysis and Presentation of Blood Utilization Data to Improve Practice and Reduce Costs

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Disclosures

Haemonetics Corp.
IMPACT® Online

CSL Behring
Massive Transfusion Protocols
Fibrinogen Concentrate

Medtronic
Blood Management - Hemostasis
New electrocautery devices
good ideas

smart people

careful planning

no guarantee it will work
Blood transfusion targeted at the Overuse Summit, as the most commonly performed procedure in US hospitals”*

Five overused procedures:

1. Blood transfusions
2. Heart vessel stents
3. Ear tubes (tympanostomy tubes)
4. Antibiotics for the common cold (viral upper respiratory infections)
5. Early scheduled births (early induction) without medical need

Four Guidelines and Five Randomized Clinical Trials Supporting Hb Triggers of 7-8 g/dL

Society Guidelines:
– all supporting Hb transfusion triggers of 7 or 8 g/dL

2006 – American Society of Anesthesiologists
2009 – Society of Critical Care Medicine
2011 – Society Thoracic Surgeons/Cardiovascular Anesthesiologists
2012 – American Academy of Blood banks

Randomized Trials:
– all supporting Hb triggers of 7 or 8 g/dL

• Hebert PC, et al: NEJM 1999 – Critically ill MICU patients
• Hajjar LA, et al: JAMA 2010 – Cardiac surgery patients
• Lacroix J, et al: NEJM 2007 – Critically ill PICU patients
• Villanueva C, et al: NEJM 2013 – Severe GI Bleeding
Triggers don’t always apply in the OR

A) Active bleeding trumps a Hb trigger

A) Patients need resuscitation
   (1 liter IV fluid ≈ 20% acute Hb drop)
   (20% volume expansion)
Transfusion Requirements After Cardiac Surgery
The TRACS Randomized Controlled Trial
Hajjar LA: *JAMA*. 2010;304(14):1559-1567

1st and only prospective randomized transfusion study in postoperative cardiac surgery
502 patients

Postop Hb trigger of 8 vs. 10 g/dL

Maintained between:
8-9 g/dL vs. 10-11 g/dL
Hypothesis confirmed:

Restrictive transfusion is non-inferior

Hgb 8 ≈ Hgb 10
Main findings:

No difference in morbidity/mortality between Hb trigger of 8 vs. 10 g/dL for cardiac surgery.
Odds Ratio for Death:

1.2 for each additional RBC unit transfused
(Adjusted - Multivariate Logistic regression)
Adverse effects of low hematocrit during cardiopulmonary bypass in the adult: Should current practice be changed?

Robert H. Habib, PhD\textsuperscript{a,b,c}  
Anoar Zacharias, MD\textsuperscript{a,b,c}  
Thomas A. Schwann, MD\textsuperscript{a,b,c}  
Christopher J. Riordan, MD\textsuperscript{a,b,c}  
Samuel J. Durham, MD\textsuperscript{a,b,c}  
Aamir Shah, MD\textsuperscript{a,b,c}

Research

The impact of an hematocrit of 20\% during normothermic cardiopulmonary bypass for elective low risk coronary artery bypass graft surgery on oxygen delivery and clinical outcome – a randomized controlled study [ISRCTN35655335]

Christian von Heymann\textsuperscript{1}, Michael Sander\textsuperscript{1}, Achim Foer\textsuperscript{1}, Anja Heinemann\textsuperscript{1}, Bruce Spiess\textsuperscript{2}, Jan Braun\textsuperscript{1}, Michael Krämer\textsuperscript{1}, Joachim Grosse\textsuperscript{1}, Pascal Dohmen\textsuperscript{3}, Simon Dushe\textsuperscript{3}, Jürgen Halle\textsuperscript{3}, Wolfgang F Konertz\textsuperscript{3}, Klaus-Dieter Wernecke\textsuperscript{3} and Claudia Spies\textsuperscript{1}

Role of hemodilutional anemia and transfusion during cardiopulmonary bypass in renal injury after coronary revascularization: Implications on operative outcome*

Robert H. Habib, PhD; Anoar Zacharias, MD; Thomas A. Schwann, MD; Christopher J. Riordan, MD; Milo Engoren, MD; Samuel J. Durham, MD; Aamir Shah, MD
“Blood is Bad” Papers

Transfusion of 1 and 2 Units of Red Blood Cells Is Associated With Increased Morbidity and Mortality

Gaetano Paone, MD, MHSA, Donald S. Likosky, PhD, Robert Brewer, MD, MHSA, Patricia F. Theurer, BSN, Gail F. Bell, MSN, Chad M. Cogan, MS, and Richard L. Prager, MD, for the Membership of the Michigan Society of Thoracic and Cardiovascular Surgeons

Ann Thorac Surg, 2014

Morbidity and mortality risk associated with red blood cell and blood-component transfusion in isolated coronary artery bypass grafting*

Colleen Gorman Koch, MD, MS; Liang Li, PhD; Andra I. Duncan, MD; Tomislav Mihaljevic, MD; Delos M. Cosgrove, MD; Floyd D. Loop, MD; Norman J. Starr, MD; Eugene H. Blackstone, MD

Crit Care Med, 2006
“Blood is Bad” Papers

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Crit Care Med, 2006
“Blood is Bad” Papers


Association of bacterial infection and red blood cell transfusion after coronary artery bypass surgery  Ann Thorac Surg 2002

Blood transfusion: first, do no harm! Chest. 1999

Blood transfusion--when is more really less? N Engl J Med. 2007


Perioperative blood transfusion and postoperative mortality. JAMA. 1998
Conclusions:

(Despite potential confounders in retrospective studies)

• Anemia is bad

• Transfusion can be bad

• Better off with your own RBCs than someone else’s
Collection and Analysis of Blood Utilization Data

Presentation to the Red Cross Director’s Meeting
September, 2012

We Concluded...........
Collection and Analysis of Blood Utilization Data

Medicine lags behind fast food chains and auto parts stores in automating data collection

Example – ≈ ½ of U.S. hospitals still use paper anesthesia records
New Study Reveals Wide Variation in Blood Transfusion Practices During Surgery

Published: July 26, 2012

IRVINE, Calif., July 26, 2012 /PRNewswire/ -- According to a new study in the July 2012 print edition of Anesthesiology, blood transfusion, the most common procedure performed in U.S. hospitals\(^1\), has wide variation in frequency by surgical procedure and physician as well as wide variation in the hemoglobin trigger used to help decide whether to transfuse.\(^2\) The study also showed a significant number of transfusion decisions are made without laboratory hemoglobin measurements. The research adds to the growing clinical evidence highlighting the need for improved blood-management strategies. It also underscores the opportunity for noninvasive and continuous total...
Surgeons By Name

- Hb Transfusion Trigger to Target Range

Trigger to Target Range (FOCUS, and TRACCS trials)

Surgeons By Name:

YUH, DAVID D(T0263)
CONTE, JOHN V(P4472)
SHAH, ASHISH(T4981)
MONTGOMERY, ROBERT A(D8438)
BOAHENE, DEREK(T4986)
CAMERON, DUKE E(H6220)
BIVALACQUA, TRINITY(V0285)
AIN, MICHAEL C(N3992)
MAROHN, MICHAEL(T4035)
GALLIA, GARY(Q8196)
AGRAWAL, NISHANT(T0196)
ABULARRAGE, CHRISTOPHER(T6513)
CHOTI, MICHAEL A(L5869)
DESAI, NIRA(T5695)
DAGHER, NABIL(T8848)
AHUJA, NITA(L9589)
OSGOOD, GREG M(T5653)
EFRON, JONATHAN(T5723)
SPONSELLER, PAUL D(H7795)
GIUNTOLI, ROBERT(T3945)
EFRON, DAVID T(M5190)
WOLFGANG, CHRISTOPHER(V0315)
SCHOENBERG, MARK(L7514)
MENESHIAN, AVEDIS(O5491)
MAKARY, MARTIN(T3469)
EDIL, BARISH(T5364)
ECKHAUSER, FREDERIC(H5008)
CAMERON, ANDREW(O6339)
BLACK, JAMES(N1375)
COHEN, DAVID B(J2635)
WITHER, TIMOTHY(T4562)
GEBHART, SUSAN L(L9626)
GOKASLAN, ZIYA L(T0863)
SCHULICK, RICHARD D(C8896)
ALLAF, MOHAMAD E(P7197)
COON, ALEXANDER(T3599)
SCIUBBA, DANIEL(T1092)
NEUBAUER, PHILIP(T3648)
WOLINSKY, JEAN-PAUL(V0252)
RILEY, LEE H(C7095)
OLIVI, ALESSANDRO(E9456)
KEBAISH, KHALED M(S5860)
TAMAGRO, RAFAEL J(A7138)
CAMERON, JOHN L(C2936)
VRICELLA, LUCA A(T3778)
Surgeon #44 (with permission)

- Just completed his 2000th Whipple
- Difficult operation – pancreatic cancer
- Sent Surgeon #44 an email on 12/25
- Notified him he has the highest Hb in the hospital
• Next week in a Whipple case
  “If you hang that blood Steve Frank is gonna be all over our case”

Either:

A. He must have heard about the bathroom door

B. He didn’t want to be on the edge of the bell-shaped curve
Surgeon #44 (with permission)

**RBC Units/Patient**

- 2010: 2.5
- 2011: 2.0
- 2012: 1.5
- 2013: 1.0

**FFP Units/Patient**

- 2010: 1.2
- 2011: 0.9
- 2012: 0.6
- 2013: 0.4

**PLTS Units/Patient**

- 2010: 0.3
- 2011: 0.2
- 2012: 0.1
- 2013: 0.0
Impact Online® (Haemonetics, Braintree, MA)
Not just intraoperative but whole hospital blood use
A web-based intelligence portal
Quarterly Blood Utilization Reports


2. Sent to 140 JHH surgeons from 10 services

3. Cover letter with 4 graphs
   • Comparing surgeons - % pts. Transfused
   • Comparing surgeons - Units per patient
   • Hb Trigger - <7, 7-9, >9
   • Hb Target – Pts. Discharged at 1 g/dL Hb increments

4. Data from Impact Online
Quarterly Blood Utilization Reports

Data from IMPACT Online

My IMPACT Online - Surgeon Comparison
Transfusion Rate by Spine Surgeon

![Bar chart showing transfusion rate by spine surgeon.]

- Physician Code: S5860, T0863, T3648, C7095, H7795, T4562, V0252, T1092, J1867, T5653, N3992

The chart illustrates the transfusion rate percentage (in %) for each physician code. The highest transfusion rate is observed for S5860, while the lowest is for N3992.
Quarterly Blood Utilization report

Transfusion rate by nadir hemoglobin

- < 7 g/dL
- 7-9 g/dL
- >9 g/dL

Year, Month:
- 2012 Jul
- 2012 Aug
- 2012 Sep
Quarterly Blood Utilization report

Last hemoglobin before discharge

200 patient “overtransfused”
“A novel method of data analysis for utilization of red cell transfusion”  
Frank SM, et al,  
TRANSFUSION, 2013

23,000 transfused Pts over 3 years
23,000 transfused Pts over 3 years

23,000 transfused Pts over 3 years
Cardiac Surgery

Restrictive Hb Trigger

Restrictive Hb Target

(90th %tile)
(75th %tile)
(50th %tile)
(25th %tile)
(10th %tile)

Hb (g/dL)
Hb comparison among providers is less offensive than blood use comparison

% of patients transfused

Average units/patient

Hb triggers and targets

 restricted Hb Trigger
restricted Hb Target

Surgeon A (n=133)
Surgeon B (n=83)
Surgeon C (n=60)
Surgeon D (n=102)
Surgeon E (n=82)
Surgeon F (n=69)
Surgeon G (n=57)
Surgeon H (n=139)
Surgeon I (n=55)
Surgeon J (n=100)
Benchmarking vs. other hospitals (> 500 beds)
% of patients transfused

Johns Hopkins
Casemix index for all 4,500 hospitals in the US “OUR PATIENTS ARE SICKER, CASES BIGGER”

Johns Hopkins Hospital Casemix Index = 1.897
97.5 Percentile
Development of a risk-adjusted blood utilization metric

TRANSFUSION, March, 2014
This patient has a hemoglobin equal to or greater than 8.0 g/dL or no hemoglobin results within the past 24 hours. Evidence-based guidelines suggest that transfusion above a hemoglobin of 8 g/dL is indicated only in special circumstances. You will need to select a primary indication for transfusion.
57% \downarrow \text{ in # RBC units/month given for Hb > 8 g/dL}

From 30 to 13 RBC units / day
**Most Recent Hb Prior to RBC Transfusion**

- 2% ≥ 10
- 7% ≥ 9
- 20% ≥ 8
- 52% ≥ 7
- 14% No Prior Hb Recorded
Percent Change in RBC Utilization
11 Surgical Services - Since September, 2011

<table>
<thead>
<tr>
<th>Service</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>-26.4%</td>
</tr>
<tr>
<td>Vascular</td>
<td>-23%</td>
</tr>
<tr>
<td>Urol.</td>
<td>-22%</td>
</tr>
<tr>
<td>Ortho</td>
<td>-15%</td>
</tr>
<tr>
<td>Cardiac</td>
<td>-11.2%</td>
</tr>
<tr>
<td>Tx.</td>
<td>-9%</td>
</tr>
<tr>
<td>Pediatric</td>
<td>-6%</td>
</tr>
<tr>
<td>Neuro</td>
<td>-1.2%</td>
</tr>
<tr>
<td>Thoracic</td>
<td>1.7%</td>
</tr>
<tr>
<td>OB/GYN</td>
<td>5%</td>
</tr>
<tr>
<td>Spine</td>
<td>6%</td>
</tr>
</tbody>
</table>
Changes in Blood Utilization from:
to January, 2012 – April, 2013

Numbers represent annualized costs

RBCs  \(-9.85\% \times \$12,000,000 = \$1,182,000\) cost avoidance
FFP  \(-8.58\% \times \$1,000,000 = \$85,800\) cost avoidance
PLTS  \(-1.84\% \times \$9,000,000 = \$165,600\) cost avoidance
Small decrease in autologous RBCs and CRYO

All Blood Products
\(-6.91\% \times \$22,000,000 = \$1,520,200\) cost avoidance
Conclusions

• There is general overuse of transfusion

• Successful blood management includes:
  
  Overuse and variability in blood use
  Recognizing risks and costs
  Data collection and presentation
  Both Hb Trigger and Target Audits with provider feedback

• Blood management = Reduced Cost
  Reduced Risk
  Improved Outcome