The Concept of Patient Blood Management

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Implementing patient blood management...
Prescribing blood: a checklist for clinicians

Always ask yourself the following questions before prescribing blood or blood products for a patient

1. What improvement in the patient's clinical condition am I aiming to achieve?

2. Can I minimize blood loss to reduce this patient's need for transfusion?

3. Are there any other treatments I should give before making the decision to transfuse, such as intravenous replacement fluids or oxygen?

4. What are the specific clinical or laboratory indications for transfusion for this patient?

5. What are the risks of transmitting HIV, hepatitis, syphilis or other infectious agents through the blood products that are available for this patient?

6. Do the benefits of transfusion outweigh the risks for this particular patient?

7. What other options are there if no blood is available in time?

8. Will a trained person monitor this patient and respond immediately if any acute transfusion reactions occur?

9. Have I recorded my decision and reasons for transfusion on the patient's chart and the blood request form?

Finally, if in doubt, ask yourself the following question.

10. If this blood was for myself or my child, would I accept the transfusion in these circumstances?
Key speaker: Bill Clinton

The 2013 Summit focused on three addressable challenges that are within our power to solve now:

• Challenge #1: Failure to Rescue
• Challenge #2: Medical Errors
• Challenge #3: Transfusion Overuse
Current transfusion practice:
“Behavior Based” NOT “Evidence Based”

• Unnecessary transfusion

• Estimated over-transfusion: 27-47 %
Blood product transfusions
Changing the paradigm

The Traditional Concept
• Blood products are an effective therapeutic intervention

The New Concept
• Transfusion of blood products is an undesirable outcome to be avoided

Blood still kills: six strategies to further reduce allogeneic blood transfusion-related mortality

Vamvakas EC, Blajchman MA. Transf Med Rev 2010
The culture of transfusion

Type of blood components transfused in different hospitals

**Patient Blood Management (PBM)** is the timely application of evidence-based medical and surgical concepts designed to maintain hemoglobin concentration, optimize hemostasis and minimize blood loss in an effort to improve patient outcome.
Why the shift to PBM

- Behaviour-based practice
- Infusion risks
- Supply issues
- Economics
- Patient outcomes
- Ethics and legal considerations

Five Drivers Shifting the Paradigm from Product-Focused Transfusion Practice to Patient Blood Management

Axel Hofmann, Shannon Farmer, Aryeh Shander

1) the aging population with a leveraged demand for blood products opposed to a shrinking donor base;

2) the growing awareness that transfusion is a complex service involving many different cost centers within a hospital and representing a multiple of the blood product cost;

3) the continuous effort to protect blood pools from known, new, or re-emerging pathogens while facing uncertainty over their potentially long silent carrier states;

4) the emerging evidence that transfusion is an independent risk factor for adverse outcomes;

5) a lack of evidence for benefit of transfusion for the vast majority of recipients
Risk for fatality from RBC transfusion contrasted with other life-events
Risk of transfusion in general surgery

Efficacy of red blood cell transfusion in the critically ill: A systematic review of the literature*

Paul E. Marik, MD, FACP, FCCM, FCCP; Howard L. Corwin, MD, FACP, FCCM, FCCP

- Meta-analysis of observational studies
- 45 studies - 272,596 patients
- Included surgical (trauma, general, ortho, neuro, and cardiac) and general ICU patients
- Multivariate analysis correcting for age and illness severity
- 42 of 45 studies: risks outweighed benefits of transfusion;
- risk neutral in 2 studies
- Transfusion an independent risk factor for increased:
  - Mortality
  - Infection
  - Multi-organ dysfunction
  - ARDS

*Crit Care Med 2008;36(9):2667-74
Blood transfusion is not an effective means of managing perioperative anaemia

- Negative impact on patient outcomes
  - A large-scale review by an expert panel demonstrated that blood transfusion was independently associated in a dose-dependent manner with:
    - Higher mortality and morbidity rates, nosocomial infection, septicaemia, pneumonia, delayed wound healing, stroke, myocardial infarction, renal impairment, thromboembolism, ARDS, acute lung injury and multisystem organ failure

Association of Blood Transfusion With Increased Mortality in Myocardial Infarction

A Meta-analysis and Diversity-Adjusted Study Sequential Analysis

Saurav Chatterjee, MD; Jørn Wetterslev, MD, PhD; Abhishek Sharma, MD; Edgar Lichstein, MD; Debabrata Mukherjee, MD, MS

- N = 729 (10 for analysis)
- A systematic search of publications (Jan 1966 – March 2012) utilizing MEDLINE, EMBASE, CINAHL, Scopus, Web of Science, and Cochrane Central Register of Controlled Trials databases
- All cause mortality in MI (Transfusion group 18.2% vs. non transfused group 10.2%)
- Multivariate analysis - blood transfusion associated with a higher risk for mortality
  - independent of baseline hgb, nadir hgb, and change in hgb during the hospital stay
- Blood transfusion or a liberal blood transfusion strategy is associated with higher all-cause mortality rates

Arch Intern Med. 2012 Dec 24:1-8
N = 552,951 elderly cases with 100,000 frequency-matched controls

Transfusions received 0 to 12, 13 to 30, and 31 to 48 months before cancer diagnosis or selection date

Transfusions received 0 to 12 months before cancer diagnosis and/or selection were associated with significantly elevated risk of:

- Overall cancer (OR, 2.05; 95% CI, 1.95-2.16), cancer of the stomach; cancer of the colon; cancer of the liver, kidney, renal pelvis, and/or ureter; lymphoma; myeloma; and leukemia

- Overall cancer risk increased with the number of transfused periods (p-trend < 0.0001)

- Risk of overall cancer and specific sites was elevated 0 to 12 months after blood transfusion
Risk vs. Benefit

“The issue (no longer) is whether or not blood transfusion is harmful, but the inflection point at which it is associated with more harm than benefit.”

Rao et al, JAMA 2005;292(13)
# Physiologic impact of red cell transfusion

<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Population</th>
<th>n</th>
<th>Blood Transfused</th>
<th>↑Hb</th>
<th>↑DO₂</th>
<th>↑VO₂</th>
<th>↓Lactate</th>
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<tbody>
<tr>
<td>Babineau et al (1992)</td>
<td>Postoperative</td>
<td>31</td>
<td>328 ± 9 mL</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Silverman et al (1992)</td>
<td>Septic shock 21–88 yrs</td>
<td>21</td>
<td>2 units</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Marik et al (1993)</td>
<td>Septic adults</td>
<td>23</td>
<td>3 units</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
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<td>Lorente et al (1993)</td>
<td>Septic adults</td>
<td>16</td>
<td>2 units</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>?</td>
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<tr>
<td>Gramm et al (1996)</td>
<td>Septic shock 46 ± 3 yrs</td>
<td>19</td>
<td>2 units</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>?</td>
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<tr>
<td>Casutt et al (1999)</td>
<td>Postoperative 32–81 yrs</td>
<td>67</td>
<td>368 ± 10 mL</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<td>Fernandes et al (2001)</td>
<td>Septic shock 18–80 yrs</td>
<td>10</td>
<td>1 units</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Suttner et al (2004)</td>
<td>Volume-res mechanically ventilated patients</td>
<td>51</td>
<td>1 or 2 units vs. 100% FIO₂</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>?</td>
</tr>
</tbody>
</table>
Benefit of transfusion?

TRICC Trial

Transfusion in Critical Care: TRICC Trial

"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 landmark study that has changed the practice of transfusion medicine\(^2\) but how many physicians are familiar with it?

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1. Hébert et al. NEJM 1999;340(6)
2. Blajchman- Transfusion 2005:45
Lack of sustainable benefit of transfusion

Randomised controlled studies including TRACS (Transfusion Requirements After Cardiac Surgery) have shown no benefit from liberal transfusion\(^1,2\)

Reviews of the literature have found little evidence of the benefits of transfusion\(^2\)

1. Adapted from: Hajjar LA et al. JAMA 2010; 304: 1559-1567
2. Hofmann A et al. The Oncologist 2011; 16 (suppl 3): 3-11
Liberal or Restrictive Transfusion in High-Risk Patients after Hip Surgery

- **Functional Outcomes in Cardiovascular Patients Undergoing Surgical Hip Fracture Repair (FOCUS)**
  - RCT of 2016 patients with hip fracture requiring surgery
  - > age 50 (mean age 81.6 years) with cardiovascular disease (62.9%) or risk factors for CVD (37.1%)
  - Randomized to liberal (single unit if Hgb < 10 g/dL) vs. restrictive (single unit for Hgb < 8 g/dL or symptomatic from anemia

Carson, JL et al. NEJM. December, 2011
Liberal or Restrictive Transfusion in High-Risk Patients after Hip Surgery

• Results
  
  – Primary outcome: death or inability to walk 10 feet without assistance at 60 days
  
  – No difference between liberal and restrictive transfusion group
  
  – Low rate of cardiovascular adverse events in both groups
  
  – 65% fewer units transfused in restrictive group and half received no transfusion

Carson, JL et al.
NEJM. December, 2011
Transfusion Strategies for Acute Upper Gastrointestinal Bleeding

Cándid Villanueva, M.D., Alan Colomo, M.D., Alba Bosch, M.D., Mar Concepción, M.D., Virginia Hernández-Gea, M.D., Carles Aracil, M.D., Isabel Graupera, M.D., María Poca, M.D., Cristina Alvarez-Urturi, M.D., Jordi Gordillo, M.D., Carlos Guarner-Arjente, M.D., Miquel Santaló, M.D., Eduardo Muñiz, M.D., and Carlos Guarner, M.D.

- **N = 921 patients – 2 groups [Restrictive strategy (n = 461) vs. Liberal strategy (n = 460)]**
- 51% Restrictive strategy vs. 15% Liberal strategy, did not receive transfusions (P<0.001)
- The probability of survival at 6 weeks was higher in the restrictive-strategy vs. liberal-strategy group (95% vs. 91%)
- Further bleeding - 10% restrictive group vs. 16% liberal group (P=0.01)
- Adverse events - restrictive-strategy 40% vs. liberal-strategy 48% (P=0.02)
- Restrictive strategy **significantly improved outcomes** in patients with acute upper gastrointestinal bleeding

N Engl J Med. 2013 Jan 3;368(1):11-21
What are “Transfusion Alternatives”? 

- Optimize hemodynamics and oxygenation 
- Physiologic tolerance of anemia 
- Use of erythropoietic stimulating agents 
- Use of intravenous iron 
- Minimizing blood loss 
  - Meticulous surgical haemostasis 
  - Manage coagulopathy 
  - Anti-fibrinolytics 
  - Perioperative cell collection and reinfusion 
  - Less labs.
Patient Blood Management: The Three Pillars

1st Pillar
- Pre-op anemia screening
- Refer for further evaluation if necessary
- ESAs
- Intravenous Iron
- Note: anemia is a contraindication for elective surgery

2nd Pillar
- Identify and manage bleeding risk and anticoagulants
  - ANH
  - Cell Salvage
  - DDAVP
  - TXA, Amicar
  - Topical hemostatics
  - Meticulous surgical hemostasis
  - Avoid secondary hemorrhage
  - Minimize phlebotomy

3rd Pillar
- Optimize hemodynamics
- Optimize ventilation and oxygenation
- Low hemoglobin threshold for transfusion
- Minimize oxygen consumption
- Avoid/treat infections promptly

© Axel Hofmann/Shannon Farmer - SHEF Meeting Perth August 2010
The pillars of patient blood management

1st Pillar
Optimize erythropoiesis
- Detect anemia
- Identify underlying disorder(s) causing anemia
- Manage disorder(s)
- Refer for further evaluation if necessary
- Treat suboptimal iron stores/iron deficiency/anemia of chronic disease/iron-restricted erythropoiesis
- Treat other hematric deficiencies
- Note: Anemia is a contraindication for elective surgery

2nd Pillar
Minimize blood loss & bleeding
- Identify and manage bleeding risk
- Minimizing iatrogenic blood loss
- Procedure planning and rehearsal
- Preoperative autologous blood donation (in selected cases or when patient choice)
- Other
- Meticulous hemostasis and surgical techniques
- Blood-sparing surgical techniques
- Anesthetic blood conserving strategies
- Autologous blood options
- Pharmacological/hemostatic agents

3rd Pillar
Harness & optimize physiological reserve of anemia
- Assess/optimize patient’s physiological reserve and risk factors
- Compare estimated blood loss with patient-specific tolerable blood loss
- Formulate patient-specific management plan using appropriate blood conservation modalities to minimize blood loss, optimize red cell mass, and manage anemia
- Restrictive transfusion thresholds

Preoperative
- Timing surgery with hematological optimization

Intraoperative
- Stimulate erythropoiesis
- Be aware of drug interactions that can increase anemia

Postoperative
- Vigilant monitoring and management of post-operative bleeding
- Avoid secondary hemorrhage
- Rapid warming/maintain normothermia (unless hypothermia specifically indicated)
- Autologous blood salvage
- Minimizing iatrogenic blood loss
- Hemostasis/anticoagulation management
- Prophylaxis of upper gastrointestinal hemorrhage
- Avoid/treat infections promptly
- Be aware of adverse effects of medication

Hofmann A et al. The Oncologist 2011;16:3-11
# Patient blood management (PBM)

<table>
<thead>
<tr>
<th>1st Pillar – optimise erythropoiesis</th>
<th>2nd Pillar – minimise blood loss &amp; bleeding</th>
<th>3rd Pillar – harness &amp; optimise physiological reserve of anaemia</th>
</tr>
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<td>Detect anaemia</td>
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<td>Assess/optimise patient’s physiological reserve and risk factors</td>
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<td>Manage disorder(s)</td>
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Adapted from: Hofmann A et al. The Oncologist 2011; 16 (suppl 3): 3-11
### Patient blood management (PBM)

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| Time surgery with haematological optimisation | Meticulous haemostasis and surgical techniques  
Blood-sparing surgical techniques  
Anaesthetic blood conserving strategies  
Autologous blood options  
Pharmacological/haemostatic agents | Optimise cardiac output  
Optimise ventilation and oxygenation  
Restrictive transfusion thresholds |

*Adapted from: Hofmann A et al. The Oncologist 2011; 16 (suppl 3): 3-11*
**Patient blood management (PBM)**

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</thead>
<tbody>
<tr>
<td>• Stimulate erythropoiesis</td>
<td>• Vigilant monitoring and management of postoperative bleeding</td>
<td></td>
</tr>
<tr>
<td>• Be aware of drug interactions that can increase anaemia</td>
<td>• Avoid secondary haemorrhage</td>
<td>• Optimise anaemia reserve</td>
</tr>
<tr>
<td></td>
<td>• Rapid warming/maintain normothermia (unless hypothermia specifically indicated)</td>
<td>• Maximise oxygen delivery</td>
</tr>
<tr>
<td></td>
<td>• Autologous blood salvage</td>
<td>• Minimise oxygen consumption</td>
</tr>
<tr>
<td></td>
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Adapted from: Hofmann A et al. The Oncologist 2011; 16 (suppl 3): 3-11
Can Patient Blood Management Reduce the Need for Transfusions?
The benefits of patient blood management (PBM)

rHuEPO = recombinant human erythropoietin
PAD = preoperative autologous blood donation,
CS = intra- or postoperative cell salvage

Allogeneic blood transfusion rate (\%)

-62\%  -58\%  -89\%  -65\%  -44\%
The benefits of patient blood management (PBM)

PBM can reduce blood transfusion rate in surgical patients by 75%

Red Cell Units Transfused
FY 1994 – FY 2010

Eastern Maine Medical Center
Annual Red Cell Transfusions

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Number of Red Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 93/94</td>
<td>4079</td>
</tr>
<tr>
<td>FY 94/95</td>
<td>4851</td>
</tr>
<tr>
<td>FY 95/96</td>
<td>5264</td>
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<tr>
<td>FY 96/97</td>
<td>6628</td>
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<tr>
<td>FY 97/98</td>
<td>7212</td>
</tr>
<tr>
<td>FY 98/99</td>
<td>7220</td>
</tr>
<tr>
<td>FY 99/00</td>
<td>8070</td>
</tr>
<tr>
<td>FY 00/01</td>
<td>9470</td>
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</tbody>
</table>

Admissions
FY 05/06: 20,156  FY 09/10: 20,717
Patients Transfused:
FY 1994 - 2011

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Patients Transfused</th>
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<tbody>
<tr>
<td>FY94</td>
<td>1550</td>
</tr>
<tr>
<td>FY95</td>
<td>1686</td>
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<td>FY96</td>
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<td>FY10</td>
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</tr>
<tr>
<td>FY11</td>
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</tr>
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</table>
Number of allogeneic transfusions in the Netherlands from 2000 to 2010

The economic benefits of PBM

- Dutch hospitals began to implement PBM in 2002, especially for major orthopaedic surgery
  - There is a legal requirement for a complete preoperative assessment 3–4 weeks before all elective surgery

- Annual reports from the Dutch blood bank showed a 12% decline in the total number of allogeneic transfusions between 2000–2009
  - This decrease was concurrent with an increase in healthcare usage

- Hospital admissions increased from 1,600 to 2,300 per year per 10,000 inhabitants between 2000–2009

- PBM is estimated to have saved a net cost of €100 million nationwide in the Netherlands every year*

*Based on the current price of an allogeneic transfusion of RBCs at €204

Transfusion Rates All Cases: CABG, Valve, CABG/Valve
April 2008 – March 2011

Transfusion rate in 2006: 48%

23%
22%
24%
17%
27%
21%
28%
29%
25%
19%
21%
14%
Cardiac Surgery and Transfusions

• With reduction in transfusion rate from 48% to approximately 20%, there was a reduction in:
  – Perioperative AMI
  – New onset renal failure
  – Perioperative infection
  – Stroke
  – Length of stay
  – No change in mortality
Exposure to Allogeneic Transfusion
Institute of Cardiology 1999
Transfusion practice

- Mangano’s EPI II study
- 70 centers
- 16 countries
- 5065 patients
- Romania: 104 pts/year 2000

Pts with **NO transfusion:** RBC 33% FFP 77% Plt 83%

**Romania:** RBC 32% FFP 52% Plt 46%

<table>
<thead>
<tr>
<th></th>
<th>inop (%)</th>
<th>postop (%)</th>
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<tbody>
<tr>
<td>RBC</td>
<td>9-100</td>
<td>25-87</td>
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<tr>
<td>FFP</td>
<td>0-98</td>
<td>3-95</td>
</tr>
<tr>
<td>Plts</td>
<td>0-51</td>
<td>0-39</td>
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<table>
<thead>
<tr>
<th></th>
<th>inop</th>
<th>postop</th>
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<tbody>
<tr>
<td>total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RBC</td>
<td>2.5</td>
<td>3</td>
</tr>
<tr>
<td>FFP</td>
<td>3.2</td>
<td>4.6</td>
</tr>
<tr>
<td>Plts</td>
<td>6.3</td>
<td>5.8</td>
</tr>
</tbody>
</table>

Number of units per transfused patient

*Snyder-Ramos S et al. Transfusion 2008:1284*
Exposure to allogeneic transfusion in our department

Filipescu D et al. NATA 2002, SRATI 2010
Durability of Change in Transfusion Practice—Inappropriate Transfusions

- Multiple interventions evaluated 3 years after start of interventions: guidelines, educations, new transfusion form, prospective audit.

Reprinted from Tinmouth A. Transfusion. 2007;47:132S-136S, with permission from Blackwell Publishing.
Promoting responsible blood product use: change of behavior

- Audits
- Adoptions of guidelines
- Reminders
- Review the orders for surgery
- Informed consent
- Single unit order
- Education
- Local opinion leaders or champions

PBM

*Francis JJ et al. Implementation Science 2009:70*
Elements for change

The elements required to create change in physician transfusion practice include:

1. A desire for change
2. Providing a new behavior/practice
3. The change must be viewed as safe and simple
4. It must be viewed as non-threating to autonomy

Tinmouth A. Transfusion. 2007;47:132S-136S.
Preoperative PBM intervention implemented in US hospitals

Figure 5-2. Pre-operative PBM interventions implemented.
New goals: treat preoperative anemia and reduce the 1-3 U transfusion!

- Data from 188 consecutive patients who underwent CABG
- Mean perioperative transfusion rate of RBCs: 1.48 U
- In anaemic patients: 2.48 (±1.98)

Blood Transfusion: Who is at risk

The 1-3 units of RBC transfused

Goodnough LT, Shander A. A&A 2012
Anaemia is a predictor of red blood cell transfusions across surgery types

<table>
<thead>
<tr>
<th></th>
<th>Total patients (N)</th>
<th>Anaemic patients (%)</th>
<th>Patients transfused with allogeneic RBCs (%)</th>
<th>Non-anaemic</th>
<th>Anaemic</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>CABG</td>
<td>777</td>
<td>24</td>
<td>48</td>
<td>76</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>HECO</td>
<td>148</td>
<td>30</td>
<td>11</td>
<td>58</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>THR</td>
<td>1401</td>
<td>16</td>
<td>28</td>
<td>54</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>TKR</td>
<td>1296</td>
<td>18</td>
<td>28</td>
<td>60</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3622</strong></td>
<td><strong>19</strong></td>
<td><strong>32</strong></td>
<td><strong>62</strong></td>
<td><strong>&lt;0.001</strong></td>
<td></td>
</tr>
</tbody>
</table>

CABG: Coronary artery bypass graft
HECO: Hemicolecotomy
THR: Total hip replacement
TKR: Total knee replacement

Preoperative anaemia increases the need for perioperative blood transfusion

Musallam KM et al. Lancet 2011; 378: 1396-1407
Management of severe perioperative bleeding

Guidelines from the European Society of Anaesthesiology

Sibylle A. Kozek-Langenecker, Arash Afshari, Pierre Albaladejo, Cesar Aldecoa Alvarez Santullano, Edoardo De Robertis, Daniela C. Filipescu, Dietmar Fries, Klaus Görlinger, Thorsten Haas, Georgina Imberger, Matthias Jacob, Marcus Lancé, Juan Llau, Sue Mallett, Jens Meier, Niels Rahe-Meyer, Charles Marc Samama, Andrew Smith, Cristina Solomon, Philippe Van der Linden, Anne Juul Wikkelsø, Patrick Wouters and Piet Wyffels
We recommend that patients at risk for bleeding are assessed for anaemia 4–8 weeks before surgery

1C

If anaemia is present, we recommend identifying the cause (iron deficiency, renal deficiency or inflammation)

1C

We recommend treating iron deficiency with iron supplementation (oral or intravenous)

1B
Proposed algorithm for the detection, evaluation, and management of preoperative anaemia

1. Hb < 120 g/l for females
   Hb < 130 g/l for males
   - Evaluation necessary
   - Iron status?

2. Ferritin < 30 μg/l and/or TSAT < 15-20%
   - Rule out iron deficiency
   - Inflammation/chronic disease
   - Iron deficiency
     - Referral to gastroenterologist to rule out malignancy

3. Ferritin 30-100 μg/l and/or TSAT > 20%
   - Rule out iron deficiency
   - Inflammation/chronic disease

4. Ferritin > 100 μg/l and/or TSAT > 20%
   - Serum creatinine
   - Glomerular filtration rate
     - Low
       - Vitamin B₁₂ and/or folic acid
     - Normal
       - Referral to nephrologist
         - Chronic kidney disease (CKD)
           - Normal
             - Referral to nephrologist
           - Low
             - Anemia of chronic disease
               - Folic acid or vitamin B₁₂ therapy
               - Erythropoietin-stimulating agent therapy
               - No response
The Future

• In the future we should aim to reduce the transfusion risk for all patients to the level of the ALARA (as-low-as-reasonably-achievable) risk

Spahn D & Vamvakas EC. Blood Transf 2013:172-174
So Why Practice Patient Blood Management?

Blood transfusion is not an effective means of managing postoperative anaemia.

The concept of PBM is aimed at optimising erythropoiesis, minimising blood loss and optimising the patient’s physiological tolerance of anaemia.

Introduction of a PBM programme for surgical patients has been shown to:

- Significantly reduce the need for blood transfusion
- Significantly reduce serious complications, length of hospital stay and postoperative mortality
- Be cost-effective