Is there an Optimal Peri-Operative Hemoglobin?

Dr Piyush Mallick
Al - Jahra Hospital, Kuwait
www.anesthesiahajahra.com

Moderators:
Dr Mahmoud Hanafi
Dr Salah Taqi
Complications : Blood Transfusion

- Immunological
  - Hemolytic
  - Non - Hemolytic
- Non immunological

*JAMA* 2000; 284:238-240
Immunological Complications

• Hemolytic Complications:
  – Acute
  – Late

• Non-hemolytic Complications:
  – Fever, Urticaria, Purpura, Anaphylaxis
  – Non Cardiogenic Pulmonary edema
  – Graft Vs Host dis.
  – Immunosupression

*JAMA* 2000; 284:238-240
Non-immunological Complications

- Coagulopathy
- Acid base
- Hypothermia
- Citrate toxicity
- $\uparrow K^+$
- Infections (viral, bacterial, parasitic)

JAMA 2000; 284:238-240
Other disadvantages of giving blood

- 12.5% cancellation in US all elective surgery due to blood shortages
- We only match for major antigens ......
- Bank blood is not normal – Stiff RBCs, 2,3 DPG ...
- New diseases like CJ ,West Nile...
- Presently allogenic transfusion is NOT SO BAD
TRALI & TACO

- Incidence ↑↑ (1:2500 to 1:5000)
- Poor understanding why it happens
- Typical clinical picture sudden onset illness
- ALI & volume status is key
- Ultrasound – IVC diameter and collapsibility as a diagnostic tool
What should be the Hemoglobin ???

In the peri-operative period
Anemia in mind only?
Erythrocytosis

Polycythemia
Anesthesia Implications

Hct > 50%

• Hydration
• Venisection
• Hydroxyurea, Interferon
• Hematology consult
Hemoglobin of 10 gm/dl
Hematocrit of 30 %

In 2010
Is it really needed for Peri-operative period?
Review of Literature
Carson JL, Lancet 1996

- 1958 pts undergoing surgery
- Mortality rate ↑ as the perioperative Hb ↓
- Pts with cardiovascular disease (CAD) & Hb < 10gm% had higher mortality
- Noncardiac Pts: Hb < 7gm% associated with increased mortality
Jehovah’s witness patients

Viele MK 1994: Transfusion
Outcome were similar to the Carson's study
Two more studies using more than 100 patients

- Orthopedic and Coronary artery surgery

- Out come: no difference

J Arthroplasty 1999 & Transfusion 1999
Meta-analysis

• Pooled data showed, restrictive is - at least as good, may be little bit better than liberal

• We save more blood

• Limited data is available, exactly what should be the numbers?

Cochrane Data Base Syst Review 2002 CD002042
Is the 10/30 rule still true ???

Answer is, NO
Where did the 10/30 rule come from?
Animal studies shows that there is an optimum oxygen delivery at Hct of 30% & Hb of 10 gm% (In Vitro study)

What about human beings? Is there any evidence?
Mayo clinic (1980) recommends:
Hct-30% & Hb 10gm%
Mayo 10/30 rule

- No Human studies
- Based on clinical experiences
- Eminence based opinion
- NO evidence to support this recommendation
Landmark studies & Recommendation till date

Consensus Conference For Perioperative RBC Transfusion

• NO transfusion if Hb $\geq 10$
• May NOT need if Hb 7 - 10
• Definitely if acute blood loss ( Hb $< 7.2$ )
• Check for transfusion triggers, NOT NUMBERS ALONE

This recommendation is there for the last 22 yrs .... How many of us are Aware & Follow THIS ???
Recent Landmark studies
PC Hebert et al, 1999

- 1999 NEJM: Randomized multicenter 838 patients (25 centers in Canada)
- Two groups
- Restrictive Hb 7-9 and Liberal 10-12
- End point of study 30 days mortality
- Restrictive 2.6 units and liberal 5.6 units
- Out come 22% restrictive and 28% liberal
Hebert study: Important Subset Analysis

Age < 55 yrs
APACHE < 20
Morbidity after 30 days: 16% vs. 8%
Hebert's Study findings

• A restrictive strategy of RBC transfusion is at least *as effective possibly superior* to a liberal transfusion strategy in critically ill patients

• With possible exception of pts with Acute MI & unstable angina
Hebert's study Findings

The CRIT study – Anemia and blood transfusion in critically ill.
Current clinical practice in America
Crit Care Med. 2004
4800 patients /213 hospital
ABC trial – Anemia and blood transfusion in critically ill


3600 Pts
Conclusions: ABC & CRIT Trials

- RBC transfusion is associated with ↑ mortality & ↑ hospital stay
- Even with evidence most of our practice is old fashioned
- ?? role of Hb based oxygen carrier (HBOC)
- Erythropoietin may come up
- We have became Medical vampire – Reduce your daily labs
Lecrory, 2007 JAMA

637 Children critically ill (1 - 7 yrs)
Two arm restrictive or liberal

Outcome – No difference
Most recent Recommendations

SSC guideline 2008

• Don't give blood till Hb 7
• Target Hb: 7 to 9
• Hb > 9 : only in special circumstances

Grade 1B
Vincent (Critical care medicine) 2006

Multicenter observational study
3000 patients of which 33% received transfusion
Transfusion did not correlate with mortality
Young healthy volunteer with PA Catheter

• Bleed, ↓↓ Hb to 5
• Maintain Euvolemia
• OT settings
• No difference physiologic triggers except very mild tachycardia
• Conclusion: Euvolemia is the key
• ? IRB approval

( JAMA 1998, Anesthesiology 2000)
<table>
<thead>
<tr>
<th></th>
<th>Class I</th>
<th>Class II</th>
<th>Class III</th>
<th>Class IV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blood loss % Volume</strong></td>
<td>Less than 15%</td>
<td>15 to 30%</td>
<td>30 to 40%</td>
<td>More than 40%</td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>750 - 1000</td>
<td>1500-2000</td>
<td>More than 2000</td>
</tr>
<tr>
<td><strong>B P Systolic Diastolic</strong></td>
<td>Unchanged unchanged</td>
<td>Normal Raised</td>
<td>Reduced Reduced</td>
<td>Very low undetectable</td>
</tr>
<tr>
<td><strong>PULSE</strong></td>
<td>&lt; 100</td>
<td>&gt;100</td>
<td>&gt;120</td>
<td>&gt;140</td>
</tr>
<tr>
<td><strong>Capillary refill</strong></td>
<td>Normal</td>
<td>Slow &gt;2sec</td>
<td>slow.&gt; 2 sec</td>
<td>undetectable</td>
</tr>
<tr>
<td><strong>Respiratory rate</strong></td>
<td>14-20</td>
<td>20-30</td>
<td>30-40</td>
<td>&gt;40</td>
</tr>
<tr>
<td><strong>Urine out put/hr</strong></td>
<td>30 ml</td>
<td>20-30</td>
<td>10-20</td>
<td>Negligible</td>
</tr>
<tr>
<td><strong>Mental status</strong></td>
<td>Slightly Anxious</td>
<td>Mildly Anxious</td>
<td>Anxious/ confused</td>
<td>Confused lethargic</td>
</tr>
</tbody>
</table>
Let's take some clinical scenario peri-operative period

• 55 yrs old patient going for Liver resection, 26 yrs old for major vascular or 46 yrs old for APR

• Hb: 9gm%

• Approach?
Maximum allowable blood loss (MABL)

EBV X \( H_i \) — \( H_f \)

\[ \frac{H_f}{H_i} \]
What did we learn from Iraq & Afghanistan wars?

- In Trauma and Hemorrhage you ↓ your transfusion trigger
- Transfuse EARLIER than later
- 1:1:1 or 1:1 Policy looks promising
- Aim is to avoid lethal triad
- 1 unit PRBC: 1 unit FFP: 1 Plateletes
Transfusion Triggers

• Hb number alone
• Macro circulatory parameters
• Microcirculatory parameters
• Special parameters: $\text{VO}_2$, $\text{DO}_2$, Oxygen Flux, $\text{SCVO}_2$, $\text{SVO}_2$, Lactate, $\text{O}_2$ Extraction ratio etc etc
What is the trend?

- Using ↓conc. of Hb
- Main motivation - 1980 AIDS/Hep C epidemic
- Newer things: TRALI / TACO
- C J disease, West Nile virus
Let's review the literature so far..

Critical care medicine 2006;(36)
2266-2274
ACS = acute coronary syndrome; ICU = intensive care unit.

Upcoming things

- Perfluorocarbon
- Poly-Heme
- Hemopure
- Autologus blood transfusion, Cell saver
  Massive transfusion protocol
- Human Recombinant Hemoglobin
- Nano Hemoglobin
- Erythropoietin & PCC, ?? Novoseven ??
Conclusions

• We should not be transfusing looking just at a number
• Look for transfusion trigger both way
• Most of the studies support a Hb of 10 in CAD (2008 SSC guideline)
• Young and healthy patients: Hb 7 - 9gm/dl
Take home message

• There is nothing called 10/30 rule

• A healthy pt with Hb 7 gm % or above is not associated with ↑ mortality rather it improves it

• Give RBC if Hb < 7gm%
Take home message

- Each case is different & must be assessed in view of co-existing disease, anticipated intra-op loss (know the surgeon and surgery)

- Patients who tolerate anemia poorly are (CAD, severe pulmonary disease, age > 65) keep Hb > 9gm%
Thank you
Test

Please excuse us while the forum is getting organised. Feel free to read more >>

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