PEARLS OF LABORATORY MEDICINE

Patient Blood Management

Ryan A. Metcalf, MD, CQA(ASQ)

University of Utah and ARUP Laboratories

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Patient Blood Management (PBM)

- What is it?
  - Rationally optimizing anemia and hemostasis
  - Goal of restricting (optimizing) blood component use
- Why do we care?
  - Blood transfusion = most common procedure
  - Top five most overused
  - Standard of care

Value = Quality / Cost
Decline in transfusions in US\textsuperscript{4}

- 2008: \textasciitilde15 million RBC units transfused
- 2015: 11.3 million RBC units transfused

- Likely due to implementation of PBM programs including evidence-based transfusion guidelines
  - Several large trials support a “restrictive” transfusion strategy
What might a PBM program encompass?

- Education program
- Optimize blood component use
- Diagnose and treat perioperative anemia
- Reduce/optimize blood loss in surgery and from lab draws
- Challenge: blood transfusion ordered by a variety of specialties and administered by a variety of health care staff
## Red Blood Cell (RBC) Transfusion Trials Comparing Hemoglobin Thresholds

<table>
<thead>
<tr>
<th>Trial</th>
<th>Population</th>
<th>Participants (n)</th>
<th>Thresholds (hemoglobin)</th>
<th>Primary outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRICC</td>
<td>Critical care</td>
<td>838</td>
<td>7 g/dL vs 10 g/dL</td>
<td>30d mortality 18.7% vs 23.3%, P=0.11</td>
</tr>
<tr>
<td>FOCUS</td>
<td>Hip fracture</td>
<td>2016</td>
<td>8 g/dL vs 10 g/dL</td>
<td>Death or inability to walk across room at 60d, 35.2% vs 34.7%, P=0.9</td>
</tr>
<tr>
<td>Villanueva et al.</td>
<td>Upper GI Hemorrhage</td>
<td>921</td>
<td>7 g/dL vs 9 g/dL</td>
<td>Mortality at 45d, 5% vs 9% P=0.02</td>
</tr>
<tr>
<td>TRISS</td>
<td>Septic Shock</td>
<td>998</td>
<td>7 g/dL vs 9 g/dL</td>
<td>90d mortality, 43% vs 45% P=0.44</td>
</tr>
<tr>
<td>TITRE2</td>
<td>Post-cardiac surgery</td>
<td>2003</td>
<td>7.5 g/dL vs 9 g/dL</td>
<td>Infection or ischemic event in 3mo, 35.1% vs 33.0% P=0.3</td>
</tr>
<tr>
<td>TRICS-III</td>
<td>Cardiac surgery</td>
<td>4860</td>
<td>7.5 g/dL vs 8.5 or 9.5 g/dL</td>
<td>Composite, 11.4% vs 12.5% P&lt;0.001 for noninferiority</td>
</tr>
</tbody>
</table>
Treat the patient, not the laboratory value

- Indications for RBC transfusion
  - Significant acute hemorrhage
  - Significant signs/symptoms of anemia

- However, lab values (e.g. hemoglobin) do provide very useful information to help decide whether to transfuse or not
PBM strategies to reduce unnecessary transfusions

• Clinical decision support improves RBC usage\(^6\)
  • Best practice alert ("pop-ups") at computerized provider order entry

• RBC transfusion interventions reduce the proportion of patients transfused\(^7\)

• Initiatives that successfully reduce RBC transfusion also reduce health care costs
  • RBC acquisition cost \(~\$200\)
  • RBC total activity based cost \(~\$800+\)
Indications for transfusion of other blood components

- **Platelets**
  - Bleeding prophylaxis (general): platelet count <5-10k/ul
  - Procedures/hemorrhage: paucity of evidence

- **Plasma**
  - Massive hemorrhage
  - Disseminated intravascular coagulation
  - Thrombotic thrombocytopenic purpura
  - Replacement of plasma constituent for which a more targeted therapy is not available

- **Cryoprecipitate** (contains fibrinogen, FVIII, vWF, FXIII)
  - Control bleeding associated with fibrinogen deficiency
Education program

• Materials: e.g. learning modules
• In-person: e.g. grand rounds

• Indications for transfusion, risks, evidence

• Develop hospital guidelines, protocols for specific clinical situations
Anemia Management

- Preoperative
  - Screening: 3-4 weeks prior to elective surgery with expected major blood loss
  - Diagnose and treat iron/B12/folate deficiency anemia
- Optimize cardiac and pulmonary function
  - Acute normovolemic hemodilution
- Postoperative
  - Avoid unnecessary RBC transfusion
Optimizing Coagulopathy

- Preoperative
  - Algorithm for patients on anticoagulation or anti-platelet medication
- Management of bleeding patients
  - Body temp > 36C
  - pH > 7.2
  - Hemorrhage monitoring (e.g. viscoelastic tests and/or hemoglobin, platelet count, coags including fibrinogen levels)
- Protocols for administration of blood components, factor concentrates, and antifibrinolytic agents
- Antifibrinolytics for cardiac, ortho, obstetric hemorrhage, massive hemorrhage surgeries
- Uremic platelet dysfunction (e.g. di-deoxy arginine vasopressin, DDAVP)
Blood Conservation Strategies

- Minimize diagnostic blood loss
  - Reduced tube size
  - Fewer draws
- Surgical blood loss
  - “Close attention”
  - Minimally invasive techniques
  - Cell salvage
Optimal Blood Use with Patient-Centered Decision Making

- Informed consent
- Transfusion plan with thresholds based on risk
- Single unit transfusion policy
- Intelligent electronic ordering
- Ability to identify ordering provider
- Indication list (e.g. pocket card, posters)
- Documentation of the indication for each component
PBM-Related Metrics & Benchmarks\textsuperscript{9,10}

- Track anemia: preop, hospital-acquired, treated patients
- Use of antifibrinolytics, cell salvage
- Blood usage by dept or procedure or physician: # units/patient
  - Benchmarking
- Blood supply chain efficiency
  - Crossmatch : transfusion ratio (<1.7:1)
  - Issue : transfusion ratio
  - Wasted products

<table>
<thead>
<tr>
<th>Physician</th>
<th>RBCs Transfused / Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smith</td>
<td>0.5</td>
</tr>
<tr>
<td>Jones</td>
<td>8</td>
</tr>
<tr>
<td>Doe</td>
<td>1</td>
</tr>
<tr>
<td>Adams</td>
<td>1.2</td>
</tr>
</tbody>
</table>
PBM-Related Metrics & Reporting

• Patient outcomes!
  • In-hospital mortality
  • Morbidity (infections, myocardial infarction, stroke, etc.)
  • Length-of-stay (LOS)
  • Hemoglobin (presurgical and postoperative)
  • Hemovigilance (e.g. transfusion reactions)
• Report to clinicians and hospital administration
  • Include cost savings, return on investment
References

Disclosures/Potential Conflicts of Interest

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- **Patents**: No disclosures
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