RBC ALLOANTIBODY FORMATION IS NOT ASSOCIATED WITH RBC AGE IN PEDIATRIC SICKLE CELL DISEASE PATIENTS RECEIVING CHRONIC APHERESIS RBC EXCHANGE

Jennifer Crimmins, Cara Randall, Marian A. Rollins-Raval, Yara A. Park, Jay S. Raval
University of North Carolina
Department of Pathology and Laboratory Medicine
Outline

• Indications for automated red blood cell exchange (RCE)
• Alloantibody formation in sickle cell disease (SCD) patients
• UNC data
Indications for RCE

• Stroke prevention
  – Secondary prevention
    • Clinically apparent stroke: 11% of SCD patients before age 20
    • Silent stroke: 10-30% of SCD patients
  – Primary prevention
    • Children with TCD velocities >200cm/s → 40% stroke risk in 3 years

• Acute stroke

Schwartz et al, J Clin Apher 2016
Verduzco et al, Blood 2009
Alloimmunization

• Immune response to foreign antigens
• Implications:
  – Difficulty finding compatible units
  – Risk of transfusion reactions
• Prevention:
  – D, C, c, E, e, K matched
  – Antigen-negative units issued if patient has formed an antibody
  – Extended phenotypically-matched units issued at different times at different facilities
Alloimmunization Rates in SCD

- **Simple**
  - Pediatric: 0.143/100 units
  - Adult: 1.2-5.1/100 units

- **Exchange**
  - Pediatric: 0.013/100 units
  - Adult: 0.065-0.23/100 units

Michot et al, Transfusion 2015
Desai et al, Am J Hematol 2015
Wahl et al, Transfusion 2012
Tsitsikas et al, J Clin Apher 2016
Randall et al, Transfusion 2016
RBC age and alloimmunization in SCD

• Simple transfusion: RBC unit age associated with increased alloantibody formation

Desai et al, Am J Hematol 2015
RBC age and alloimmunization in SCD

• Chronic exchange transfusion:
  – Adults: No apparent association between RBC age and alloantibody formation in our patient population
  – Peds: No previous analyses conducted assessing RBC age as a risk factor for alloimmunization

Randall et al, Transfusion 2016
UNC project - Goals

• Determine RBC alloimmunization rate in pediatric SCD patients undergoing chronic RCE at our facility
• Determine the effect of RBC age on RBC alloimmunization rate
Methods

- Retrospective analysis of SCD patients receiving RCE over 32 months
- Inclusion criteria
  - Hgb SS disease
  - ≥ 3 RCE procedures
  - Age <18 years at the time of analysis
Methods

• All units were leukoreduced and at minimum matched for ABO, D, C, c, E, e, and K antigens
• All unit ages reported as 42-day maximums
• Included all transfusions in the previous 90 days when assessing new antibody formation
• Fully phenotypically-matched RBC special need initiated on a patient-by-patient basis (in general, >3 alloantibodies)
• RBC age assessed as mean and oldest unit age
Methods

• Multivariate logistic regression model constructed
• Cox proportional hazard model applied
• Statistical significant: \( p < 0.05 \)
Patient Demographics

• 12 patients, 365 RCE using 2656 units
• Mean age – 15.3 years
• M:F – 9:3
• 2/12 patients had ≥1 alloantibody prior start of study period
Results

- Antibody formation: 3 patients with 7 new alloantibodies identified
- RBC-AF rate = 0.26/100 units
## Results

<table>
<thead>
<tr>
<th></th>
<th>Patients with new RBC-AF</th>
<th>Patients without new RBC-AF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean RBC age</td>
<td>19 ± 10 days</td>
<td>20 ± 11 days</td>
</tr>
<tr>
<td>Oldest RBC age</td>
<td>26 ± 11 days</td>
<td>27 ± 12 days</td>
</tr>
</tbody>
</table>
Results

- No factor, including RBC unit age (either mean or oldest unit) was associated with risk of RBC-AF
Summary

• RCE is an important acute and long-term treatment strategy in SCD patients

• Our RBC-AF rate higher than previously reported
  – 0.26/100 units vs 0.013/100 units

• RBC age does not appear to be associated with increased antibody formation in pediatric SCD undergoing chronic RCE