Minimizing transfusion requirements for children undergoing craniosynostosis repair: The use of preoperative recombinant erythropoietin and intraoperative autologous blood recycling

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Introduction:
Children with craniosynostosis may require cranial vault remodeling to prevent or relieve elevated ICP and to correct abnormalities in the craniofacial skeleton. The procedure is associated with high blood loss and transfusion rates.1,2 Transfusion risks include transmission of infectious agents, bacterial contamination, acute hemolytic reactions, transfusion-related lung injury, and inflammatory processes.3,4 The main indication for transfusion in craniosynostosis is low preoperative hematocrit.5

To minimize the rate of transfusion we instituted a protocol with the following three components:
1) the use of erythropoietin therapy to increase preoperative hemoglobin
2) the use of an intraoperative blood recycling device
3) acceptance of a lower level of hemoglobin as a trigger for transfusion.

Methods:
• Retrospective chart review of infants under 18 months between 2003 and 2012.
• Data points collected: age of patient at surgery; preop, intraop postop, and postop day one hemoglobin levels; amount of autologous and allogeneic blood transfusion; estimated surgical blood loss, type and length of procedure, and length of hospital stay.
• Exclusion criteria: age greater than 18 months, prior surgery, failure to complete the protocol, and lack of availability of complete medical records.
• Discrete variables were compared using Fisher’s Exact test. Continuous variables were compared using Student’s t test.

Results:

<table>
<thead>
<tr>
<th>Data Point</th>
<th>Protocol</th>
<th>Control</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Number</td>
<td>26</td>
<td>32</td>
<td>0.139</td>
</tr>
<tr>
<td>Age (months)</td>
<td>7.0 (±3.9)</td>
<td>8.4 (±3.4)</td>
<td>0.001</td>
</tr>
<tr>
<td>Pre-op Hgb</td>
<td>9.7 (±1.2)</td>
<td>12.0 (±1.4)</td>
<td>0.004</td>
</tr>
<tr>
<td>EBL</td>
<td>114.5 (±60.8)</td>
<td>212.0 (±162.2)</td>
<td>0.011</td>
</tr>
<tr>
<td>Length of Surgery (hours)</td>
<td>2.8 (±0.9)</td>
<td>4.0 (±0.9)</td>
<td>0.001</td>
</tr>
<tr>
<td>Percent transfused</td>
<td>96%</td>
<td>56%</td>
<td>0.090</td>
</tr>
<tr>
<td>Amount transfused (ml/kg)</td>
<td>21.6 (±12.9)</td>
<td>14.7 (±16.6)</td>
<td>0.011</td>
</tr>
<tr>
<td>Length of stay (days)</td>
<td>3.4 (±0.7)</td>
<td>2.6 (±1.0)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

A sub-analysis of the protocol group revealed that 70% of children < 6 months and 50% children > 6 months were transfused (P < 0.446). During the first 18 months of the protocol, 70% of the patients were transfused, while the number fell to 40% in the last 18 months (P < 0.1649). The study was underpowered in both instances to determine statistical significance.

Conclusions:
• In this study, although the protocol group had a higher EBL and length of surgery, they were transfused less and had a shorter length of stay in the hospital.
• Recombinant erythropoietin effectively raised the pre-op hemoglobin in the protocol group.
• After protocol implementation, the rate of transfusion was noted to fall as time elapsed, perhaps reflective of the acquisition of experience amongst the involved specialists.

A protocol that includes preoperative recombinant erythropoietin, intraoperative autologous blood recycling, and accepting a lower transfusion trigger may be effective in significantly decreasing the rate of allogenic blood transfusions in cranial vault remodeling surgery. The concomitant decrease in transfusion-related complications may lead to better outcomes.

References: