**Guideline for red blood cell (RBC) transfusion**

**Background:**
- Sick neonates are one of the most heavily transfused groups of patients in hospitals. As oxygen (O₂) delivery is reduced, O₂ consumption is maintained by increased extraction until the patients exceed their ability to cope with the restriction. Consequently, O₂ consumption becomes limited by O₂ delivery. It is the inability to accurately define this transition that complicates transfusion medicine. (La Gamma 2012)

The purpose of transfusion is to maintain adequate tissue oxygenation. At an unknown, but variable, critical point, this becomes limited by oxygen delivery in blood, called “critical O₂ point”.
- Adhering to a local transfusion guideline has been shown to reduce number of transfusions and hence donor exposure (Baer 2011).
- The unit uses the paedipack system for transfusions as this lessens donor exposure (please see the SHO handbook for further information on paedipacks and how to order these).
- Large volume 20 ml/kg RBC transfusions lead to larger rises in Hb (haemoglobin) and fewer overall transfusions than small volume transfusion 10ml/kg (Paul 2002).
- No clinical benefits have been observed if fresh RBCs (<5 days old) are used for transfusion compared to standard blood bank policies (Fergusson 2012).
- Frusemide is **not** routinely prescribed as it has few clinical benefits (Balegar 2011).

**Liberal vs Restrictive policies:**
- No clear clinical benefit in favour of liberal thresholds from 3 neonatal trials (Bell 2005)(Kirpalani 2006)(Chen 2009) and several adult trials (Carson 2012).
- Conflicting long-term outcomes from two large neonatal trials:
  - poorer neurocognitive profile (McCoy 2011) and reduced brain volume (Nopoulos 2011) in **liberal** group,
  - some cognitive delay (Whyte 2009) in **restrictive** group.
- Currently, a large, multi-centre study (ETTNO trial) is ongoing to determine long-term neuro-cognitive outcome.
- In view of lack of clear evidence in favour of a liberal policy; restrictive (or conservative) thresholds should continue in practice(Whyte 2011).

**When to consider RBC transfusion:**

<table>
<thead>
<tr>
<th>Clinical Variables</th>
<th>Oxygen Requirement</th>
<th>Haemoglobin Threshold</th>
<th>Haematocrit threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFOV, INO, ECMO</td>
<td>Any</td>
<td>&lt;140g/l</td>
<td>&lt; 42%</td>
</tr>
<tr>
<td>Ventilated</td>
<td>FiO₂ ≥ 0.3</td>
<td>&lt; 120g/l</td>
<td>&lt; 36%</td>
</tr>
<tr>
<td></td>
<td>FiO₂ &lt; 0.3</td>
<td>&lt; 110g/l</td>
<td>&lt; 33%</td>
</tr>
<tr>
<td>CPAP dependant</td>
<td>FiO₂ ≥ 0.3, clinically unstable</td>
<td>&lt; 100g/l</td>
<td>&lt; 30%</td>
</tr>
<tr>
<td></td>
<td>FiO₂ &lt; 0.3, stable</td>
<td>&lt; 80g/l</td>
<td>&lt; 24%</td>
</tr>
<tr>
<td>Breathing normally (reticulocyte count &lt;5%)</td>
<td>Requiring O₂</td>
<td>&lt; 80g/l</td>
<td>&lt; 24%</td>
</tr>
<tr>
<td></td>
<td>In air</td>
<td>&lt; 70g/l</td>
<td>&lt; 21%</td>
</tr>
<tr>
<td>Elective or semi-elective surgery (D/W Anaesthetic Consultant)</td>
<td></td>
<td>&lt; 100g/l</td>
<td>&lt; 30%</td>
</tr>
</tbody>
</table>

Cumulative blood loss of 10% of total blood volume during first week of life
Transfusion sparing practices:
- Delayed cord clamping or cord milking results in increased haematocrit in ELBW infants and limits number of transfusions (Rabe 2012).
- In-line or point-of-care analysis limits blood-loss and number of transfusions in ELBW infants (Carroll 2012).
- No current evidence of clinical benefit from either early or late erythropoietin for limiting transfusions (Aher 2012)

Adverse effects:
Several observation studies have noted an association between packed RBC transfusion with late necrotising enterocolitis: transfusion related acute gut injury or TRAGI (Mohamed 2012), and with early severe IVH (Christensen 2012). However, no cause and effect relationship have been established.
A registry has been established for recording cases.

The transfusion triggers listed above are only guidelines and some neonates will not be clinically compromised at these Hb concentrations, thus would not automatically require transfusion. However some neonates ie those with hypovolaemia resistant to crystalloid, septic shock, NEC or undergoing/ recovering from major surgery may be considered for transfusion at higher thresholds than those listed above.
For patients that are breathing normally, always evaluate the reticulocyte count before deciding whether to transfuse. A robust reticulocyte count suggests increased RBC production; postponing transfusion may be appropriate if the clinical condition allows. Remember to start iron replacement as Sytron on day 28 of life.

Always discuss with the registrar or consultant before prescribing blood.

References:
Aher, Sanjay M, and Arne Ohlsson. 2012a. ‘Early Versus Late Erythropoietin for Preventing Red Blood Cell Transfusion in Preterm And/or Low Birth Weight Infants’. Cochrane Database of Systematic Reviews (Online) 10:
———. 2012b. ‘Late Erythropoietin for Preventing Red Blood Cell Transfusion in Preterm And/or Low Birth Weight Infants’. Cochrane Database of Systematic Reviews (Online) 9.
Baer, Christensen. 2011. ‘Implementing a Program to Improve Compliance with Neonatal Intensive Care Unit Transfusion Guidelines Was Accompanied by a Reduction in Transfusion Rate: a Pre-post Analysis Within a Multihospital Health Care System’. Transfusion 51 (2) (February): 264–269.

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