Indications
The use of Anti-D immunoglobulin and more effective phototherapy has decreased the need for exchange transfusions to be performed, however they are still required.

Exchange transfusions are primarily used to manage severe anaemia, severe hyperbilirubinaemia, or a rapidly rising bilirubin level (> 7-10 µmol/L per hour) particularly in the presence of haemolysis e.g. haemolytic disease of the newborn.

If there are any concerns antenatally (positive antibodies, fetal anaemia, fetal transfusions) then cord blood should be sent for FBC, DAT and bilirubin. Discuss with the attending consultant regarding admission to NICU and starting phototherapy.

Initial Management of Suspected/Severe Jaundice
1. Phototherapy
   - With intensive phototherapy it may be possible to control the rise of bilirubin
   - Babies should be placed under phototherapy with adequate exposure

2. Start IV fluids (10% Dextrose) at appropriate daily infusion rate

After 4 hours repeat the bilirubin and PCV. If the bilirubin is still rising rapidly or has not fallen then move give immunoglobulin after discussion with consultant.

3. Immunoglobulin (Vigam®)
   - There is reasonable evidence to suggest that high dose intravenous immunoglobulin can prevent the need for an exchange transfusion for haemolytic disease
   - 1 g/kg – see appendix for prescribing regimen
   - Treatment can be started without prior approval from the Trust Immunoglobulin Board (agreed at DTC on 26/03/09), however an IVlg request form (click here) and an DTC compassionate request (click here, fill in Sections 1 and 2 only) must be completed in every case.

Repeat bilirubin and PCV after 4 hours. If the bilirubin is still rising rapidly or has not fallen then move Exchange Transfusion

Preparation
- Inform parents and explain procedure
- Ideally baby should have dedicated nurse and doctor for entire procedure
  - It is often useful to have a third person as well
- There still needs to be a doctor who is available to attend deliveries/see other babies
- Liaise with blood bank regarding the blood requirement
  - Ideally double volume exchange given = 180 mL/kg
- Needs ECG, BP, temperature and saturation monitoring
- Insert NGT and aspirate stomach if recently fed
  - Keep NBM during procedure

Full resuscitation equipment and drugs must be available

Vascular Access
2 access points are needed – 1 arterial and 1 venous
This is in addition to the line for 10% Dextrose

Ideally a UAC and UVC are best. The exchange can be done with only a single UVC/UAC if access is difficult.
Catheters are inserted and secured as per [Umbilical Lines and Infusions Guideline](#). All catheters used need to have 3 way taps. If it is only possible to site a UVC then is should be a large single lumen catheter.

**Before Starting the Exchange**

Baseline observations:
- Temperature
- Heart rate
- Respiratory rate
- Blood pressure
- Oxygen saturations

**Bloods**
- FBC
- Glucose
- U&E, Ca
- Bilirubin
- Blood gas
- Spun PCV
- Newborn Screening Card (Guthrie)
- For non-antibody haemolytic disease, send blood for G6PD and blood film

**Infusion Methods**

See [appendix](#) for example calculations

**Method 1 – Isovolumetric Exchange**

For when there are 2 access points – 1 removing the blood and the other for infusing the replacement blood
- The baby's blood is removed in aliquots over 5 minutes
- The same volume of replacement blood is given at the same time and same rate

**Method 2 – Push-Pull method**

This is for when there is only 1 access point such as a UVC
- Remove aliquot of blood over 2-3 minutes
- Then give the same volume of replacement blood over 2 minutes

**Method 3 – Continuous infusion**

- Replacement blood is infused via a pump
- The baby's blood is removed at a matching rate at 5 minute intervals

The chosen method will depend on what access has been obtained and the experience of the doctor performing/supervising the exchange.

**During the Exchange**

The 10% Dextrose infusion should continue

Observations should be repeated at 15 minute intervals
- Temperature
- Heart rate
- Respiratory rate
- Blood pressure
- Oxygen saturations

Every 30 minutes check the glucose level

Halfway through the procedure bloods should be sent for
- FBC
- Glucose
- U&E, Ca
• Bilirubin
• Blood gas
• Spun PCV

It usually takes 2-3 hours to perform the exchange transfusion

The target PCV range is 40-60
• If the PCV is > 60 then some of the replacement blood should be replaced with 0.9% NaCl or FFP. Discuss with consultant

It is imperative that all blood removed must be replaced with an equal volume or blood/saline/FFP

A detailed record of volume removed and replaced at each time interval should be kept – see final page

Watch for signs of potential complications – see below

**Complications**

• Air embolism
• Volume imbalance
• Arrhythmias
• Acidosis
• Respiratory distress
• Unexpected collapse
• Hyperkalaemia
• Anaemia/Polycythaemia
• Hypocalcaemia
• Hypoglycaemia
• Thrombocytopenia
• NEC

If the baby develops bradycardia, goes pale or appears in pain then STOP immediately and resuscitate the baby as appropriate

Once the baby has stabilised, it may be appropriate to continue.

**At the end of the Exchange**

Send bloods for
• FBC
• Glucose
• U&E, Ca
• Bilirubin
• Blood gas
• Spun PCV

Baby should remain on intensive phototherapy with 4-6 hourly bilirubin/PCV measurements and daily FBC.

The procedure should be documented in the notes along with the record of volumes infused and removed.

**Removal of lines**

Leave catheters in until the baby has been reviewed. Sometimes a second or subsequent exchange transfusion is necessary.
References

1. Newcastle Upon Tyne Hospitals NHS Trust, Neonatal Services Guidelines, Exchange Transfusion
2. Auckland District Health Board, Newborn Services, Guidelines and Protocols, Exchange Transfusion

Guideline prepared by Dr. Tim. Marr, Neonatal Specialist Registrar
Reviewed and Approved by Neonatal Clinical Management Group February 2009

Ratified by Dr. Peter Reynolds, Chair Childrens Clinical Governance Group April 2009
Review April 2012
**Appendix 1**

**Example Immunoglobulin (Vigam®) prescriptions**

Comes as 5 g/100 mL

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Total Volume of Vigam (mL)</th>
<th>mL/kg/min</th>
<th>mL/min</th>
<th>mL/hour</th>
<th>mL in 30 min</th>
<th>Time (hr)</th>
<th>Total infused (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>70</td>
<td>3.5</td>
<td>0.01</td>
<td>0.035</td>
<td>2.1</td>
<td>1.05</td>
<td>0.5</td>
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<tr>
<td>Total</td>
<td>26</td>
<td>1.3</td>
<td>0.01</td>
<td>0.013</td>
<td>0.78</td>
<td>0.39</td>
<td>0.5</td>
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<tr>
<td>Total</td>
<td>16</td>
<td>0.8</td>
<td>0.01</td>
<td>0.008</td>
<td>0.48</td>
<td>0.24</td>
<td>0.5</td>
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</tbody>
</table>

To complete infusion

Total Time: 9.1 hours
**Volume calculations**

Double volume = 180 mL/kg

**Aliquots to be removed/Infused**

<table>
<thead>
<tr>
<th>Weight</th>
<th>Volume</th>
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<tbody>
<tr>
<td>&lt;1000 g</td>
<td>5mL</td>
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<tr>
<td>1000-2000 g</td>
<td>10mL</td>
</tr>
<tr>
<td>&gt;2000 g</td>
<td>15mL</td>
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</tbody>
</table>

For a *3.5 kg baby* – total volume to be exchanged = 3.5 x 180 = 630 mL

- 630 mL in 15 mL aliquots
  - 630 ÷ 15 = 42 aliquots
  - 42 aliquots every 5 minutes = 42 x 5 = 210 minutes = 3½ hours
- Infusion rate (if using continuous infusion) = 630 ÷ 3.5 = 180 mL/hour

For a *1.3 kg baby* – total volume to be exchanged = 1.3 x 180 = 249 mL

- 250 mL in 10 mL aliquots
  - 250 ÷ 10 = 25 aliquots
  - 25 aliquots every 5 minutes = 25 x 5 = 125 minutes = just over 2 hours
- Infusion rate (if using continuous infusion) = 250 ÷ 2 = 125 mL/hour

For a *800 g baby* – total volume to be exchanged = 0.8 x 180 = 144 mL

- 145 mL in 5 mL aliquots
  - 125 ÷ 5 = 29 aliquots
  - 29 aliquots every 5 minutes = 29 x 5 = 145 minutes = just under 2½ hours
- Infusion rate (if using continuous infusion) = 145 ÷ 2.5 = 58 mL/hour

**Blood bank Requirements**

- 6 mL EDTA sample from Mother
- G&S sample from baby

Blood has to come from National Blood Transfusion Service (Tooting)

It will take a minimum of 2 hours for the blood to be available for the exchange.

If you known in advance then blood bank can check if the NBS has suitable blood available based on Mother’s sample.

Please inform blood bank of urgency

**Blood issued**

- < 5 days old
- Irradiated in last 24 hours
- Haematocrit 0.5 – 0.6
- CMV negative
## Exchange Transfusion Record

**Hospital No.:** 
**Name:** 
**D.O.B.:** 

**Team Performing Exchange Transfusion**

<table>
<thead>
<tr>
<th>Name</th>
<th>Grade</th>
<th>Signature</th>
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Do remove or infuse aliquots faster than every 5 minutes

<table>
<thead>
<tr>
<th>Time</th>
<th>Volume In/Infusion Rate</th>
<th>Cumulative Total</th>
<th>Volume Out</th>
<th>Cumulative Total</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>Total</td>
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**Time finished:** 

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Management of Severe Jaundice/Exchange Transfusion