1. Aim/Purpose of Guideline

To help staff manage significant jaundice safely and prevent complications of brain damage and kernicterus. Rarely there are other indications for exchange transfusion including volume overload.

2. The Guidance

Exchange transfusion must take place in an Intensive care setting with intensive and physiological biochemical monitoring, carried out by staff that are trained in the procedure ideally following written informed parental consent.

As severe Rh haemolytic disease of the newborn becomes increasingly rare, exchange transfusions are now infrequent procedures. In most cases optimizing phototherapy prevents the need for exchange transfusion.

2.1 Uses of Exchange Transfusion

- To remove the sensitised red blood cells and the circulating antibodies and reduce the degree of red cell destruction
- To control the blood volume and relieve potential heart failure.
- To correct severe anaemia and increase oxygen capacity of the infants blood
- Rarely indications include sepsis, disseminating intravascular coagulation, and removal of toxic drugs.

2.2 Antenatal Maternal Antibody levels

- **RhD negative mother, antibody level <4 iu/ml** low risk
  - Routine cord sample for group and DAT
  - Clinical assessment & newborn check only

- **RhD negative mother, antibody level 4-15iu/ml** intermediate risk
  - Urgent cord FBC, bilirubin and DAT and group. Notify neonatal team.
  - Repeat SBR by neonatal team at 4 hours
  - Decision to treat based on cord bloods and rate of rise in first 4 hours
  - Consider liaison with blood bank re possibility of exchange transfusion.

- **RhD negative mother, antibody level > 15iu/ml** high risk
  - Antenatal liaison between obstetrics, neonates and haematology
  - Urgent cord FBC, bilirubin and DAT & group
  - Phototherapy to commence within 1 hour of birth and ensure adequate fluid intake.
  - Repeat SBR at 4 hours by neonatal team.
  - Consider immunoglobulin which may prevent the need for exchange
  - Consider exchange transfusion according to the rate of rise.

2.3 Considering an exchange transfusion

Plot bilirubins on appropriate NICU chart. Start intensive phototherapy (refer neonatal jaundice guideline).

Cord blood samples should be taken for SBR, DAT and FBC by the midwifery staff and sent off with the knowledge of the neonatal team for urgent assay. The results should be available within 1-2 hours and it is the responsibility of the neonatal team to chase the results. It is important that the bilirubin is repeated in 4 hours to ascertain the rate of rise.
2.4 Intravenous immunoglobulin (IVIG)

IVIG contains pooled IgG extracted from the plasma of over 1000 donors. It acts by preventing the destruction of sensitised erythrocytes. IVIG is now indicated as an adjunct to continuous phototherapy in cases of immune mediated haemolysis such as Rhesus disease. It can administered whilst preparing for an exchange transfusion and it may improve bilirubin levels to an extent where the transfusion is no longer necessary. It is associated with fewer complications than compared to Exchange Transfusion and has been shown to be cost effective in this setting.

Contact pharmacist on call, complete IVIG database form, and liaise with microbiology and blood bank who need to approve its use.

- **Indications for use:**
  - Rhesus or ABO incompatibility with levels above or approaching the exchange line
  - Serum bilirubin rise > 8.5 micromol/litre/hour and close to exchange line.
  - Dose 500mg/kg over 4 hours.
  - Bilirubin levels should be **repeated 4 hourly following** administration of IVIG, and assess whether an exchange is still required.

2.5 Exchange Transfusion

If bilirubin levels remain high despite intense phototherapy and IVIG then an exchange transfusion is required to lower the serum bilirubin and prevent Kernicterus.

- **Indications:**
  - Bilirubin levels in excess of exchange transfusion line and according to NICE treatment threshold graphs.
  - Clinical signs and symptoms of acute encephalopathy (lethargy, irritability, abnormal tone and posture, apnoea and convulsion) must also be taken into account.
  - Rate of rise of bilirubin > 8.5 micromol/litre/hour and approaching exchange line.

2.6 Vascular Access

Access will be required for the transfusion ideally by a **UVC (blood in) and a UAC (blood out)**

Alternatives are:
  - A UVC (blood in and out)
  - A UAC (blood in and out)
  - A peripheral cannula (blood in) and a UAC or peripheral arterial line (blood out)

2.7 Blood- request “blood for neonatal exchange transfusion” from blood bank

**Product:** Plasma-reduced red cells (haematocrit 0.50 - 0.60)

**Age of blood product:** Within 5 days of collection

**CMV status:** CMV safe (either CMV negative or leucodepleted)

**Hb S Screen:** Negative

**Irradiation:** If time allows and if so, should be transfused within 24 hours of irradiation. This is essential if there has been a previous intrauterine transfusion.
**Volume:** Volume to be transfused is usually 160ml/kg for term & 200ml/kg preterm (i.e. 2 x blood volume) a double volume exchange can remove 50% of available intravascular bilirubin
Blood should be given through a blood warmer and a screen filter used.

2.8 Equipment

- Cardio-respiratory monitoring equipment, including saturation and blood pressure monitoring.
- Heater
- Blood filter and giving set
- Volumetric pump
- Ranger blood warmer machine and set
- Sterile gowns, gloves and pack.
- Closed system urine bag/ paediatric waste urine bag and extension set
- Assorted lure lock syringes, 3way taps and extension sets depending on access
- Exchange transfusion observation and in/out chart
- Clock

2.9 Procedure

A two volume exchange should take up to 3 hours max, based on the cycle of in/out taking 4 mins, using the guide:
< 1kg use 5 ml aliquots
1-2kg use 10ml aliquots
2-3kg use 15ml aliquots
>3kg use 20ml aliquots

- **First remove aliquot of blood in volume as above.** Always ensure blood is removed first.
- This first aliquot withdrawn should be sent for FBC, U&E, LFT, phosphate, SBR, Hct, Calcium, magnesium, glucose and clotting.
- Infuse blood in the correct aliquots as above, with 4 minute cycles each for removal and infusion.
- Half way through repeat the bloods: FBC, U&E, LFT, phosphate, SBR, Hct, Calcium magnesium, glucose and clotting.
- At the end repeat the bloods FBC, U&E, LFT, phosphate, SBR, Hct, Calcium magnesium, glucose and clotting.
- Stop exchange transfusion if infant’s condition suddenly deteriorates – but always leave infant’s blood volume in balance.
- Sudden deterioration maybe be due to underlying condition, the procedure or an adverse reaction to transfusion. A transfusion adverse reaction report should be made.

At the end of the procedure for plethoric babies there should be a deficit of one aliquot.
Record the blood intake and output on appropriate paperwork
If necessary calcium Gluconate infusion can be given simultaneously through a separate IV line if levels are low.
2.10 Complications of a Exchange Transfusion

- Cardiac Arrhythmias
- Apnoea
- Acid base instability
- Circulatory overload
- Electrolyte disturbances, ie hypocalemia/hypoglycaemia
- Embolism
- Infection
- Necrotising enterocolitis
- Thrombocytopenia
- Intraventricular haemorrhage

2.11 Procedure: Nursing roles and Responsibilities

- Do not interrupt the phototherapy during exchange.
- Ensure parents are fully informed and have consented to procedure.
- Ensure baby is in the Intensive care room and begin monitoring heart rate, respiration a, blood pressure, oxygen saturations and temperature. Record baseline obs prior to procedure and then every 15 mins throughout the exchange.
- Maintain neutral thermal environment, ideally in open cot.
- Ensure analgesia is prescribed to keep baby settled and comfortable if required.
- Baby must be nil by mouth 2 hours prior to an exchange, leave NGT on free drainage
- Administer IV fluids as prescribed and observe all lines as per policy.
- Record pre transfusion blood glucose and then every 30mins throughout procedure
- Ensure day 0 blood spot sample has been taken and labelled.
- Adhere to Trust blood transfusion policy, volume to exchange is 160ml/kg – 200mls/kg. Check blood according to Trust Policy
- Prepare equipment using aseptic non touch technique, delivery suite ODA will assist/teach with blood warmer if not familiar with equipment.
- Insert the Ranger Blood Warming set into the Ranger prior to running through the blood. Connect the inlet line to the bloods site. Invert the bubble trap and prime the inlet line and bubble trap until full. Turn the bubble trap right side up and prime the patient line.
- Place the bubble trap into the holder on the warming unit.
- Close the patient line clamp and turn the unit on, it will automatically heat up to 41 degrees. The warming set is now ready for use, the unit will alarm if the temperature goes above 41 degrees.
- Connect the patient line onto the 3 way tap of the venous line/UVC
- Connect the closed drainage system with 3 way tap and extension to the arterial line.
- Use a chart to document in and out volumes (appendix 3)
- All clinical staff should be ready to start simultaneously and should have no other workload ie 1:1 care.
- All lines should be monitored for extravasation, blanching, erythema, leakage, and oedema. They should be recorded as per Trust policy.
• On completion the lines should be flushed with saline to maintain latency
• Inform parents that procedure has been completed.
• Documentation - contemporaneously documented, accurate fluid balances, sample taken, observations, and any untoward reactions and outcomes reported appropriately.
• Disposal of all Blood products as per Trust policy.

2.12 Nursing care post procedure

• Continue to nurse baby under phototherapy as required
• Continue continuous monitoring for next 6 hours
• Observe lines
• Monitor and record blood glucoses at 1,2 and 4 hours post transfusion
• Observe for any distension, vomiting, and blood in stools
• Urinalysis
• Recomence enteral feeding 2 hours post transfusion.
3. Monitoring compliance and effectiveness

<table>
<thead>
<tr>
<th>Element to be monitored</th>
<th>Key Changes in Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>Dr Paul Munyard, Sarah Tabrett ANNP</td>
</tr>
<tr>
<td>Tool</td>
<td>Audit.</td>
</tr>
<tr>
<td>Frequency</td>
<td>As directed by audit findings</td>
</tr>
<tr>
<td>Reporting arrangements</td>
<td>Child Health Directorate Audit and Neonatal Clinical Guidelines</td>
</tr>
<tr>
<td>Acting on recommendations and Lead(s)</td>
<td>Dr Paul Munyard, Sarah Tabrett ANNP</td>
</tr>
<tr>
<td>Change in practice and lessons to be shared</td>
<td>Required Changes in Practice will be identified and actioned within 3 months</td>
</tr>
</tbody>
</table>

4. Equality and Diversity

4.1. This document complies with the Royal Cornwall Hospitals NHS Trust service Equality and Diversity statement.

4.2. Equality Impact Assessment
The Initial Equality Impact Assessment Screening Form is at Appendix 2.
## Appendix 1. Governance Information

<table>
<thead>
<tr>
<th>Document Title</th>
<th>Exchange Transfusion Clinical Guideline V1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Issued/Approved:</td>
<td>21(^{st}) February 2018</td>
</tr>
<tr>
<td>Date Valid From:</td>
<td>21(^{st}) February 2018</td>
</tr>
<tr>
<td>Date Valid To:</td>
<td>21(^{st}) February 2021</td>
</tr>
<tr>
<td>Directorate / Department responsible (author/owner):</td>
<td>Sarah Tabrett ANNP, Paul Munyard Consultant Paediatrician</td>
</tr>
<tr>
<td>Contact details:</td>
<td>01872252681</td>
</tr>
<tr>
<td>Brief summary of contents</td>
<td>Guide to management of exchange transfusion</td>
</tr>
<tr>
<td>Suggested Keywords:</td>
<td>Neonatal, Exchange Transfusion, blood, antibodies, Rhesus disease, DAT</td>
</tr>
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</table>
| Target Audience:               | RCHT  
|                               | CFT  
|                               | KCCG |
| Executive Director responsible for Policy: | Medical Director |
| Date revised:                  |                                             |
| This document replaces (exact title of previous version): | Exchange Transfusion – Guideline for the care of a neonate receiving |
| Approval route (names of committees)/consultation: | Neonatal Guidelines Group |
| Divisional Manager confirming approval processes | Tunde Adewopo |
| Name and Post Title of additional signatories | Not Required |
| Name and Signature of Divisional/Directorate Governance Lead confirming approval by specialty and divisional management meetings | {Original Copy Signed}  
| Name: Caroline Amukusana      |                                             |
| Signature of Executive Director giving approval | {Original Copy Signed} |
| Publication Location (refer to Policy on Policies – Approvals and Ratification): | Internet & Intranet  
|                               | Intranet Only |
| Document Library Folder/Sub Folder | Clinical / Neonatal |
Links to key external standards

RCOG Green Top guideline no. 65 May 2014
NICE guidance on neonatal jaundice no. 98 2010

Related Documents:

Training Need Identified? Neonatal unit staff

Version Control Table

<table>
<thead>
<tr>
<th>Date</th>
<th>Version No</th>
<th>Summary of Changes</th>
<th>Changes Made by (Name and Job Title)</th>
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<tr>
<td>21/02/2018</td>
<td>V1.0</td>
<td>Initial Issue</td>
<td>Sarah Tabrett ANNP, Paul Munyard Consultant Paediatrician</td>
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</table>

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This document is to be retained for 10 years from the date of expiry.
This document is only valid on the day of printing

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### Appendix 2. Initial Equality Impact Assessment Form

This assessment will need to be completed in stages to allow for adequate consultation with the relevant groups.

<table>
<thead>
<tr>
<th>Name of the strategy / policy / proposal / service function to be assessed</th>
<th>Exchange Transfusion V1.0</th>
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</thead>
<tbody>
<tr>
<td>Directorate and service area:</td>
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<tr>
<td>Child Health</td>
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<tr>
<td>Is this a new or existing Policy?</td>
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<tr>
<td>Name of individual completing assessment:</td>
<td>Dr Paul Munyard</td>
</tr>
<tr>
<td>Telephone:</td>
<td>01872252681</td>
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</tbody>
</table>

1. **Policy Aim***
   - **Who is the strategy / policy / proposal / service function aimed at?**
   - To guide clinical neonatal staff to the management of exchange transfusion

2. **Policy Objectives***
   - As above

3. **Policy – intended Outcomes***
   - Audit

4. **How will you measure the outcome?**
   - Audit

5. **Who is intended to benefit from the policy?**
   - Neonatal unit staff

6a **Who did you consult with**
   - Workforce
   - Patients
   - Local groups
   - External organisations
   - Other
     - X
   - Neonatal Guidelines Group

b). Please identify the groups who have been consulted about this procedure.

What was the outcome of the consultation?

- **Ratified**
7. The Impact
Please complete the following table. If you are unsure/don’t know if there is a negative impact you need to repeat the consultation step.

Are there concerns that the policy **could** have differential impact on:

<table>
<thead>
<tr>
<th>Equality Strands</th>
<th>Yes</th>
<th>No</th>
<th>Unsure</th>
<th>Rationale for Assessment / Existing Evidence</th>
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<tbody>
<tr>
<td>Age</td>
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<td>Sex (male, female, trans-gender / gender reassignment)</td>
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<td>Race / Ethnic communities /groups</td>
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<td>- Learning disability, physical impairment, sensory impairment, mental health conditions and some long term health conditions.</td>
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<td>Religion / other beliefs</td>
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<td>Marriage and Civil partnership</td>
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<td>Sexual Orientation, Bisexual, Gay, heterosexual, Lesbian</td>
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</table>

You will need to continue to a full Equality Impact Assessment if the following have been highlighted:

- You have ticked “Yes” in any column above and
- No consultation or evidence of there being consultation- this **excludes** any policies which have been identified as not requiring consultation.  **or**
- Major this relates to service redesign or development

8. Please indicate if a full equality analysis is recommended.  

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
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<tr>
<td></td>
<td>X</td>
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</table>

9. If you are **not** recommending a Full Impact assessment please explain why.

No areas indicated
Keep one copy and send a copy to the Human Rights, Equality and Inclusion Lead
c/o Royal Cornwall Hospitals NHS Trust, Human Resources Department, Knowledge Spa, Truro, Cornwall, TR1 3HD

This EIA will not be uploaded to the Trust website without the signature of the Human Rights, Equality & Inclusion Lead.

A summary of the results will be published on the Trust’s web site.

Signed __PF Munyard ____________
Date ___________21/02/2018_________
Appendix 3

Example of a table that can be used in the notes to document in and out volumes

<table>
<thead>
<tr>
<th>Time</th>
<th>In</th>
<th>Total in</th>
<th>Out</th>
<th>Total out</th>
<th>Heart rate</th>
<th>Temp</th>
<th>BP</th>
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</table>

**Exchange transfusion recording chart**

160ml/kg = double exchange  
Start with positive balance  
*Take blood spot before exchange  

**Rate max** 3-5 mins in: 3-5 mins out

**Aliquots** =10ml for term baby  
5ml for preterm

*Check U&Es, SBR,  
Calcium, Glucose, Magnesium and gas at midway and finish points