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<th>EXCHANGE TRANSFUSION IN A NEONATE WITH HYPERBILIRUBINEMIA</th>
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<td>Document Reference/Register no:</td>
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<td>Document type: (Policy/ Guideline/ SOP)</td>
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<td>17th December 2018</td>
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<tr>
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<td>Intrapartum NICE Guidelines, RCOG guideline</td>
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<tr>
<td>Contributes to HSC Act 2008 (Regulated Activities) Regulations 2014 (Part 3); and CQC Regulations 2009 (Part 4) CQC Fundamental Standards of Quality and Safety:</td>
<td>10, 11</td>
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<td>Issuing Division/Directorate:</td>
<td>Women’s, Children’s</td>
</tr>
<tr>
<td>Author/Contact: (Asset Administrator)</td>
<td>Sharon Pilgrim, ANNP</td>
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<td>Hospital Sites: (tick appropriate box/es to indicate status of policy review i.e. joint/ independent)</td>
<td>✓ MEHT</td>
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<td>Dr. Hassan (Consultant Lead for Risk Management)</td>
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<tr>
<td>Anita Rao</td>
<td>Clinical Director for Women's, Children's Division</td>
<td>October 2018</td>
</tr>
<tr>
<td>Alison Cuthbertson</td>
<td>Head of Midwifery</td>
<td>October 2018</td>
</tr>
<tr>
<td>Miss Joshi</td>
<td>Consultant for Obstetrics and Gynaecology</td>
<td>October 2018</td>
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<td>Joyce McIntosh</td>
<td>Neonatal Ward Manager</td>
<td>July 2018</td>
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<tr>
<td>Nicola Waterson</td>
<td>Practice Facilitator Neonatal Unit</td>
<td>July 2018</td>
</tr>
<tr>
<td>Deborah Lepley</td>
<td>Warner Library</td>
<td>2nd November 2018</td>
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### Related Trust Policies (to be read in conjunction with)

- 04071 Standard Infection Prevention
- 04072 Hand Hygiene
- 04225 Examination of the Newborn
- 09094 Management of Hyperbilirubinemia
- 04184 Blood Transfusion policy
- East of England Insertion of UAC guideline
- East of England Insertion of UVC guideline

### Document Review History:

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<td>Full Review</td>
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2. Equality Impact Assessment
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10. During the Procedure
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13. Infection Prevention
14. Staff and Training
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19. Appendices
   A. Appendix A - Threshold table
   B. Appendix B - Exchange transfusion Pathway
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   D. Appendix D –Exchange circuit with 1 lume
1.0 Purpose

1.1 To ensure that infants requiring exchange transfusion are identified early and the correct blood is ordered to ensure the transfusion can be commenced as quickly as possible.

1.2 To provide guidance for nursing and medical staff as to equipment and observations required and observations required prior to and during the exchange transfusion

1.3 To minimise the incidence of complications of exchange transfusion.

2.0 Equality Impact Assessment

2.1 Mid Essex Hospitals Services NHS Trust is committed to the provision of a service that is fair, accessible and meets the needs of all individuals. (Refer to Appendix E)

3.0 Indications for Exchange Transfusion

3.1 Infants whose serum bilirubin level indicates its necessity (refer to Appendix A - threshold table and treatment threshold graphs) despite intensive phototherapy. Blood should be ordered as the level is approached as it may take some time to arrange.

3.2 Clinical features and signs of acute bilirubin encephalopathy.

3.3 Infants with a serum Bilirubin above the exchange line should have blood sent for group and save and be commenced on intensive phototherapy. If after 6 hours of intensive treatment the bilirubin level remains above the exchange level should have blood ordered for transfusion, (Refer to Appendix B)

3.4 Infants with a history of significant Rhesus isoimmunisation (indicated by high or rising maternal antibody levels) and the baby has not received in utero blood transfusion send cord blood sample for Hb and Bilirubin. Consider transfusion if the Hb is <10g/dl or cord blood serum bilirubin is >80 micromol/l.

3.5 Sepsis or DIC (only rarely indicated) an exchange transfusion may be used to remove bacteria, toxins and accumulated lactic acid. It may also provide Immunoglobulins, complement and coagulating factors

3.6 Inborn errors of metabolism.
4.0 Type Blood Required

- O or ABO compatible with maternal and neonatal plasma
- RhD negative or identical with the neonate
- Negative to any red cell antigens to which the mother has antibodies
- Cross-match compatible with maternal plasma
- Blood is less than five days old
- CMV negative
- Irradiated and transfused within 24 hours of irradiation
- Haematocrit 0.50 to 0.60
- Warmed prior to administration.

5.0 Ordering Blood Products

5.1 Doctors order blood for exchange transfusion from the haematology laboratory clearly stating that the blood is for exchange transfusion.

5.2 Blood is collected from the infant as per Blood Transfusion Policies and Procedures 04184.

- Label the sample with all details including date, patient’s full name, date of birth, registration number and location
- Sign the sample and request form
- Samples must be labelled at the bedside immediately after collection of the blood.
- Do not pre-label samples
- Pre-printed sticky labels are not acceptable.

5.3 Paediatric packs for exchange transfusion are stored at Brentwood, therefore need to be ordered in advance of the infant’s delivery if expecting to perform an exchange transfusion soon after birth.

5.4 The blood used for exchange transfusion should be fresh (less than five days old). The blood should be irradiated by NHSBT as close to the start of the transfusion. Once irradiated, if not used the blood cannot go back into the NHSBT stock. As time is a factor if an unexpected exchange transfusion is required, the blood will have to be ordered as an emergency but may take up to four hours to arrive from Brentwood.

6.0 Equipment Required

- Blood warmer (available from equipment library)
- Disposable blood warmer cartridge
- Irradiated donor blood
- Alaris CC infusion pump
- Alaris MFX2207E closed neonatal blood set
- 2 X 3 way taps
• Selection of syringes
• Vygon flexible funnel connector ref 800.11
• Adult bile collection or urine collection container
• Sterile gloves and Gown
• Normal saline ampoules
• Blood gas syringes/tubes
• Blood bottles for pre, midway and post exchange laboratory tests.

7.0 Prior to Exchange
(Refer to Appendix B)

7.1 Parents should be informed about the need for the procedure and verbal consent obtained, though in an emergency if the parents are not available this should not delay the procedure. If parents have objections to the exchange follow the Trust policy on refusal of a blood transfusion. (is this referring to 04184 Blood Transfusion Policies and Procedures OR 07040 Management of pregnant and postnatal patients refusing blood products?)

7.2 Apply monitoring equipment including blood pressure cuff and ensure alarms limits have been set.

7.3 Ensure that base line observations including blood sugar are recorded and within normal limits for the gestation. Take a blood gas sample to analyse for U&E, calcium, PCV, bilirubin and blood sugar. A further 2 ml of blood is required for FBC and clotting.

7.4 Ensure that the airway is stable and can be maintained throughout the procedure.

7.5 Check the Neopuff and resuscitation trolley and equipment.

7.6 Maintain the infant in a neutral thermal environment.

7.7 Ensure that the infant is normoglycaemic before the procedure starts.

7.8 Insert a nasogastric tube and ensure that stomach contents are withdrawn to maintain gastric depression and prevent aspiration.

7.9 Ensure that the infant is comfortable before starting the procedure (nappy change, mouth care, nested).

7.10 Where possible, phototherapy should continue during the exchange transfusion. The infants colour must continue to be regularly assessed under normal lighting.

7.11 Ensure that the infant has received vitamin K.

7.12 Check the blood when it arrives on the unit according to administration of blood and blood products policy.

7.13 Ensure that lines are clearly labelled (UAC/ UVC).

7.14 Where possible, an additional PVL should be sited in case additional IV access is required during the procedure.


8.0 Preparation for the Procedure

8.1 An isovolumetric exchange is the preferred method.

8.2 It is preferable to use one line only for the exchange eg double lumen UVC – when both an artery and vein are used the risk of adverse events is increased. (Refer to Appendix C)

8.3 Prepare for insertion of UAC/ UVC or peripheral access (see insertion of UAC guideline and insertion of UVC guideline.) Correct position of UAC/ UVC needs to be confirmed with X-ray prior to use. A double lumen UVC will allow for isovolumetric exchange without having to use separate access. Once inserted ensure that the catheter is kept open with saline flush if necessary.

8.4 Call a porter to collect blood from laboratory.

8.5 Check blood against prescription chart and patient details. Refer to the Trust’s administration of blood and blood products by transfusion. 04184?

8.6 Only spike the bag of blood once the doctor is ready to proceed and the lines are in situ.

8.7 Attach the blood to the Alaris MFX2207E closed neonatal blood set as per standard neonatal blood administration procedure.

8.8 Prime set to 50 ml syringe and then draw blood into 50mls into syringe and prime line.

8.9 Preparing the blood warmer

- Mount the blood warmer below syringe pump on bed side system
- Attach the 50ml syringe to the Alaris CC syringe pump. Connect the blood primed giving set to the warmer cartridge
- Slot the cartridge into the warmer and prime the system with blood. (May require the pump to be set with high pressures due to resistance)
- Set correct infusion rate and alarm limits on Alaris IV pump
- Blood will now be warmed and is ready to be used.

9.0 Method

9.1 There are two different methods of exchange transfusion depending on the type of access.

- Exchange transfusion with two lumen access (double lumen UVC or single lumen UAC and UVC.
- Exchange transfusion with single lumen access (single lumen UVC or UAC)

9.2 Double Lumen
(Refer to Appendix C)
• Removal of blood is synchronised with the infusion of blood therefore there is no reduction in blood volume. The UVC double lumen exit ports are proximal (yellow) distal (green).

• To minimize mixing the proximal port should be used for withdrawal and the distal port should be used for transfusion.

• The speed of isovolumetric exchange transfusion should be 1 ml/kg/min. With this rate, 160 ml/kg double volume exchange transfusion can be performed within three hours.

• However, the maximum speed the Alaris IV pump can deliver is 99 ml/hour; therefore, in larger babies the isovolumetric exchange transfusion will last longer.

• In hypoxic babies reducing the speed to 0.5 ml/kg/hour should be considered.

• Ensure the alarm limits on the Alaris pump are correctly set for pressure.

• Set the volumetric pump to deliver the required volume and start the infusion on the second lumen (eg set pump to deliver 90ml over one hour for a 1.5 kg baby).

• Withdraw blood from the catheter at a pace to match the infusion pump (eg withdraw 9ml of blood over six minutes in the above case) and flush down the waste system.

Note: It is also possible to perform an isovolumetric exchange via two separate lines – artery-vein or vein-vein. In the case of arterial-venial exchange transfusion, the artery should be used to withdraw the blood and the transfusion should be given into the vein. Of note, the risks of complications are greater where two lines are used compared with the double-lumen catheter method.

9.3 Single Lumen
(Refer to Appendix D)

• This should be an umbilical venous catheter (UVC) for preference or where necessary the umbilical artery.

• The umbilical venous catheter should be sited above the diaphragm for this procedure. To minimize mixing the proximal port on the 3 way tap should be used for withdrawal and the distal port should be used for transfusion.

• The aliquots should be adjusted for the weight of the infant (Appendix C). The blood should be withdrawn blood slowly, though the infusion time can be faster but the cycle should take at least three to five minutes.

• Withdraw the desired volume of blood slowly from the catheter and flush this down the waste system.

• Turn the three-way tap off to the syringe and on to the infusion line.

• Set the volumetric pump to deliver the set aliquot over 3–5 minutes.

• Put the pump on hold and turn the three-way tap off to the infusion.
• Turn the three-way tap on to the syringe and repeat withdrawal and continue in this manner.

10.0 During the Procedure

10.1 During exchange transfusion do not:
• stop continuous multiple phototherapy
• perform a single-volume exchange
• use albumin priming
• Routinely administer intravenous calcium.

10.2 Observations of heart rate, respiration rate, blood pressure, temperature, colour and perfusion of the infant should be recorded every 15 minutes.

10.3 The exchange should continue in cycles no faster than 3-5 minutes slowing if the infant appears to not tolerate the rate.

10.4 The nurse will document the time and volume of each aliquot. At the same time she will record the input via the pump. These must be accurate to ensure blood circulating volume.

10.5 Blood should be taken prior to the procedure, mid-way through and at the end of the transfusion for FBC, blood gas, U&E, clotting, PCV, bilirubin, blood sugar and calcium.

11.0 Post Exchange Transfusion

11.1 Following exchange transfusion
• maintain continuous multiple phototherapy
• measure serum bilirubin level within 2 hours and manage according to threshold table and treatment thresholds graphs
• Blood collected after exchange transfusion has no value when investigating rarer causes of hyperbilirubinaemia, therefore blood for these tests should be done before the exchange transfusion takes place.
• The waste bag and its contents are disposed of in a clinical waste bin double bagged.

12.0 Potential Complications

• Infection

• Vascular complications:
  • Clot
  • Embolism
  • Arteriospasm
  • Thrombosis
Exchange Transfusion In A Neonate With Hyperbilirubinemia

- Infarction
- Metabolic acidosis
- Arrhythmia
- Coagulopathy:
  - <Coagulation factors
  - <Platelets after double volume exchange
- Electrolyte abnormalities:
  - Hyperkalaemia
  - Hypocalcaemia
  - Hypoglycaemia
- Necrotising enterocolitis
- Apnoea/ bradycardia

13.0 Infection Prevention

13.1 All staff should follow Trust guidelines on infection control by ensuring that they effectively ‘decontaminate their hands’ before and after undertaking any patient contact.

14.0 Staff and Training

14.1 All medical, and nursing staff involved in the care of infants at risk of hyperbilirubinemia will be trained to identify the symptoms of hyperbilirubinaemia and its treatment. This will be recorded as part of their appraisal.

14.2 All staff siting central lines will have undertaken the necessary training and be competent in the procedure.

14.3 All medical and nursing staff involved in taking blood for transfusion and commencing blood transfusions with have undertaken the trust training and competencies.

15.0 Audit and Monitoring

15.1 Audit of compliance with this guideline will be considered on an annual audit basis in accordance with the Clinical Audit Strategy and Policy.

15.2 The findings of the audit will be reported to and approved by the Multi-disciplinary Risk Management Group (MRMG) and an action plan with named leads and
timescales will be developed to address any identified deficiencies. Performance against the action plan will be monitored by this group at subsequent meetings.

15.3 Key findings and learning points from the audit will be submitted to the Patient Quality and Safety Committee (PSQC) within the integrated learning report.

15.4 Key findings and learning points will be disseminated to relevant staff.

16.0 Guideline Management

16.1 As an integral part of the knowledge, skills framework, staff are appraised annually to ensure competency in computer skills and the ability to access the current approved guidelines via the Trust’s intranet site.

16.2 Quarterly memos are sent to line managers to disseminate to their staff the most currently approved guidelines available via the intranet and clinical guideline folders, located in each designated clinical area.

16.3 Guideline monitors have been nominated to each clinical area to ensure a system whereby obsolete guidelines are archived and newly approved guidelines are now downloaded from the intranet and filed appropriately in the guideline folders. ‘Spot checks’ are performed on all clinical guidelines quarterly.

16.4 Quarterly Clinical Practices group meetings are held to discuss ‘guidelines’. During this meeting the practice development midwife can highlight any areas for future training needs that will be met using methods such as ‘workshops’ or to be included in future ‘skills and drills’ mandatory training sessions.

17.0 Communication

17.1 Approved guidelines are published monthly in the Trust’s Staff Focus that is sent via email to all staff.

17.2 Approved guidelines will be disseminated to appropriate staff quarterly via email.

17.3 Regular memos are posted on the guideline and audit notice boards in each clinical area to notify staff of the latest revised guidelines and how to access guidelines via the intranet or clinical guideline folders.

18.0 References

This guideline was updated in 2016:


New edition of this book:


Available at: https://www.transfusionguidelines.org/transfusion-handbook


https://b-s-h.org.uk/guidelines/guidelines/use-of-irradiated-blood-components/

This guideline has been replaced by:


Available at:


### Threshold table

Consensus-based bilirubin thresholds for management of babies 38 weeks or more gestational age with hyperbilirubinaemia

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| Action       | Repeat bilirubin measurement in 6–12 hours | Consider phototherapy and repeat bilirubin measurement in 6 hours | Start phototherapy | Perform an exchange transfusion unless the bilirubin level falls below threshold while the treatment is being prepared |
Appendix B

Exchange transfusion pathway

Offer information to parents and carers about exchange transfusions including:

- why the treatment is being considered
- anticipated duration of treatment
- usual side effects of exchange therapy
- that it might be possible to transfer the baby to another hospital for treatment
- that they need to ask the baby to another hospital for treatment (if needed)

During exchange transfusion do not:

- stop continuous phototherapy
- reduce transfusion volume
- exchange transfusion routinely
- administer intravenous calcium

Exchange transfusion

Prepare for exchange transfusion

- Haemoglobin<br>
- plasma chemistry<br>
- coagulation screen
- serology
- bilirubin level that remains above threshold for exchange transfusion
- cholestasis

Continue multiple phototherapy and perform exchange transfusion

Continue multiple phototherapy and measure bilirubin level within 2 hours according to threshold table and treatment threshold graphs

Go to 'Manage hyperbilirubinemia' box in 'Investigation pathway' (see pages 10-11)
Setting up for an exchange transfusion using 2 lumens

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Setting up for an exchange transfusion using 1 lumen

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Appendix E: Preliminary Equality Analysis

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Questions | Answers
---|---
1. What are you proposing to change? | Review of guideline
2. Why are you making this change? (What will the change achieve?) | 3 year review of guideline
3. Who benefits from this change and how? | Clinicians and patients
4. Is anyone likely to suffer any negative impact as a result of this change? If no, please record reasons here and sign and date this assessment. If yes, please complete a full EIA. | no
5. a) Will you be undertaking any consultation as part of this change? b) If so, with whom? | Yes
   Refer to pages 1 & 2

Preliminary analysis completed by:

<table>
<thead>
<tr>
<th>Name</th>
<th>Sharon Pilgrim</th>
<th>Job Title</th>
<th>ANNP</th>
<th>Date</th>
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<tr>
<td></td>
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