Exchange Transfusion Guideline (UHL Neonatal Units)

University Hospitals of Leicester NHS Trust

Trust ref: C21/2010

Contents

1. Introduction and Who Guideline applies to

This guideline is aimed at all Health care professionals involved in the care of infants within the Neonatal Service.

Key Points

- The decision to undertake an exchange transfusion should follow discussions with the consultant neonatologist.
- Babies are classified as requiring intensive care during an exchange transfusion and require a designated doctor / ANNP to perform the procedure as well as 1:1 nursing.
- There are two different procedures discussed in this guideline (dilutional transfusion for polycythaemia and exchange transfusion for haemolytic disease of the newborn).

- Rarely a single exchange transfusion may be indicated for severe anaemia e.g. twin to twin transfusion
- Dilutional transfusion is only performed in particular circumstances for polycythaemia as a consultant decision. This is usually conservatively managed.
- Exchange transfusion should be carried out as directed in this guidance

Background

Jaundice in neonates is common and phototherapy is effective in producing soluble bilirubin and usually sufficient to prevent dangerous accumulation of the molecule in the brain.
All clinically jaundiced babies should have a serum bilirubin level determined either by biochemical assay or by transcutaneous photometry.
Babies who have demonstrated anaemia by fetal cerebral artery Doppler and those whose mothers have high levels of antibodies should be managed on NICU.

For Rhesus D negative (Rh-neg) mothers, red cell antibody titres can be indicative of the risk of an exchange transfusion being required. However, antibody levels do not always correlate with the severity of HDFN and exchange transfusion may be required even if the antibody titre or levels are not very high.
Check the most recent maternal antibody quantitation or titre:

Levels <3 iu/ml Low risk of needing exchange transfusion
Levels 4-15 iu/ml Intermediate risk
Levels >15 iu/ml High risk of needing an exchange transfusion

As soon as possible after birth take blood for:

- Serum bilirubin, full blood count (FBC) and Direct Antiglobulin Test (DAT).

For babies with an intermediate or high risk of needing an exchange transfusion, cord bloods may be taken for rapid screening but NICE guidelines now recommend this should be followed by a sample taken directly from the baby[1].

In the occasions where the rate of haemolysis is so great that phototherapy with adequate hydration cannot reduce bilirubin concentrations or the rate of rise of bilirubin, exchange transfusion is indicated. The exchange transfusion involves the removal of patient blood in aliquots and replacement with donor blood while maintaining sufficient circulating blood volume.

The **aim of the exchange transfusion** is to decrease the rate of haemolysis by reducing the amount of circulating anti fetal blood cell antibodies and also reduce the level of circulating bilirubin and thus reduce the risk of kernicterus.

Aim of this guideline

- Indications for transfusion
- Set out the logistics of organising the procedure
- How to set up the equipment to safely perform the procedures
- Outline the complications that may occur and monitoring that is required during and post procedure

This guideline is written in two parts – Part 1 refers to exchange transfusion for haemolytic jaundice and part 2 refers to dilutional exchange

2. Part 1: Exchange transfusion

A: Indications

1. Measured serum bilirubin levels are on or above the exchange transfusion line (NICE phototherapy charts) and do not respond to intensive phototherapy with hydration.

2. Risk factors that influence the risk of Kernicterus are present, i.e.
    - A rapidly rising bilirubin level of greater than 8.5 micromol/litre per hour.
      AND/OR
    - Clinical features of acute bilirubin encephalopathy.

3. Evidence of acute haemolysis with rapidly falling haemoglobin levels

4. Acute anaemia at birth (Hb <100g/L) with evidence of haemolysis and hyperbilirubinaemia

5. Cord bilirubin > 100umol/L

B: Management

B1. Prenatal management

1. The need for exchange transfusion may be predicted from the antenatal history for example if there are atypical antibodies or known Rhesus D disease. In this instance it is it is helpful to order blood from Sheffield prior to delivery. This may be difficult to source and take several days if mother has rare Rh antibodies.

2. If there is an antenatal suspicion of Haemolytic Disease of the Newborn an antenatal alert should be written and the carers (where possible) should have the opportunity to discuss their baby's care plan with a neonatologist.

3. The transfusion department in Leicester often has maternal antibody records in the laboratory. The responsibility for organising the blood rests with obstetrics but MDT communication between neonatology, haematology and obstetrics about indications and requirements for a possible exchange transfusion is very important.

4. Discussions with transfusion should include an oncall consultant haematologist and backed up with email communication to the wider neonatal consultant team. The lab manager for transfusion should also be informed of the intended delivery plans and what blood will be required.

5. Delivery should be planned if possible and if by caesarean section, ideally take place on a morning list. The caesarean should not go ahead unless absolutely essential until it is confirmed that blood is in the Leicester Blood bank and immediately available.

6. Take a fresh cross match sample from the mother within 5 days of delivery to allow blood to be prepared prior to delivery. This is cross matched with the blood for exchange. Blood is then held in the laboratory until a decision is made.

7. Blood for exchange transfusion should be irradiated and CMV negative. Once irradiated, blood only lasts for 24 hours as the risk of haemolysis and hyperkalaemia rises after this time. [1,2] (grade B evidence)

8. Blood less than 5 days old only is used for exchange transfusions [1,2] (grade C evidence)

B2. At birth

The are 3 scenarios where blood may be required at or soon after birth. In certain scenarios where there is known haemolysis and a high risk of need for exchange transfusion OR where a baby has received intrauterine transfusions, specific types of blood are required:

1) Severe anaemia with shock requiring emergency transfusion for resuscitation in delivery suite – Emergency O Negative blood in obstetric blood fridge.
2) Severe anaemia in a baby requiring urgent transfusion as soon as admitted to NICU – if possible, Emergency O Neg, cmv negative irradiated blood is available in the ECMO haematology bank on Level 5 of the Kensington Building
3) Exchange transfusion for severe anaemia and/or hyperbilirubinaemia secondary to significant haemolysis – fully cross matched, CMV negative, irradiated blood from blood bank.

B3. Preparation on NICU

Total serum bilirubin levels at or above the exchange transfusion threshold is a medical emergency. Discuss with the on-call consultant. Admit and start phototherapy and hydration immediately.
If child has been admitted from home this is one of the situations where they could be admitted to the neonatal intensive care unit for the procedure to be carried out.

- **Start double phototherapy and IV fluids** (one day ahead) as soon as possible. Phototherapy must continue throughout the procedure and if exchange transfusion is to be performed, withhold enteral feeds. Recheck bilirubin at start of phototherapy as baseline. Consider the use of 360^{o} phototherapy once IV lines sited.

- Consider **Intravenous Immunoglobulin (IVIG)** if any anticipated delay in obtaining blood for exchange transfusion **– see later section in guideline**

- **Inform parents**, gain written consent and document this conversation. There is a 3 in 1000 risk of death or other morbidity (see later) associated with the procedure.

- Decide on the **type of transfusion** required

    - Double Volume – performed for hyperbilirubinaemia/ kernicterus/ haemolysis
    - Single volume – performed for anaemia

Calculate the required **transfusion volume** and **Contact Blood Bank** to order required blood. This may take up to 4 hrs to arrive so early planning when an unplanned exchange transfusion may be needed is particularly essential.

Normal Neonatal Blood Volume = 90mL/kg therefore,

- Double Volume Exchange (mLs) = 180 x Birth Weight
- Single Volume Exchange (mLs) = 90 x Birth Weight

1. Ensure adequate **staff** available. 1-1 nurse to monitor and document procedure and provide support and at least one doctor or ANNP

2. Obtain access whilst awaiting blood – you will need either;
    a. UVC & UAC (Optimum)
    b. Peripheral Cannula & UAC
    c. Peripheral Cannula x 2 & Peripheral Arterial line
    d. UVC Only

Note arterial lines (umbilical or peripheral should only be used for withdrawal of baby's blood not for the infusion of donor blood.

3. Determine Transfusion Rate and total transfusion time

a. You will be taking aliquots of a set size over 5 minute intervals. The aliquot sizes per gestation are as follows:

- <28 wks – 5mls
- 28-32 weeks – 10mL
- 33-36 weeks – 15mL
- >36 weeks – 20mL

b. Divide the number of mLs by 5 to give your infusion speed

- <28 wks – 1mL/min (60 mL/hr)
- 28-32 weeks – 2mL/min (120mls/hour)
- 33-36 weeks – 3mL/min (180 mls/hour)
- >36 weeks – 4mL/min (240 mls/hour)

c. Divide your calculated total required volume by your mL/min to obtain total transfusion time i.e. 4kg, term baby = 4x90x2 = 720mL @ 4mL/min = 180min

d. Important Safety Point: The volume limit should be set on the pump for each quantity of blood being given. This limit should only be increased after verbal

confirmation between nurse and doctor that the corresponding aliquot volume has been successfully removed.

4. Start baby on prophylactic antibiotics as per unit policy

Use of Intravenous Immunoglobulin- (IV Ig) Treatment

(evidence Grade C)

a. Evidence

The proposed mechanism of action of IVIG is by nonspecific blockade of Fc receptors on macrophages that are thought to mediate destruction of antibody coated red cells. There is some data that the use of IVIG may reduce the need for an exchange transfusion; however the evidence is of low quality and should be interpreted with caution as the studies demonstrating most efficacy were found to be at high risk of bias[3]. A Cochrane review in 2018 also proposed it is possible the volume of an IV Ig infusion (4-16ml/kg) may reduce bilirubin levels slightly through dilution thus allowing time for intensive phototherapy to have more effect.

2016 NICE guidelines recommend consideration for the use of intravenous immunoglobulin (IVIG) in cases of rhesus haemolytic disease or ABO incompatibility when the serum bilirubin continues to rise more than 8.5 micromol/ litre per hour *despite continuous intensive phototherapy*. IVIG could also be considered if initial bilirubin results indicate a high likelihood of the need for exchange transfusion or if there is a delay in commencing an exchange transfusion due to availability of suitable blood.

b. Side effects

1. In the evidence available the use of IVIG appeared to be safe with no significant short term adverse effects. However, all babies receiving IVIG should be monitored for adverse effects in a similar way to other blood products. In the event of any suspected reaction during transfusion including fever, vomiting, hyper/hypotension or signs of anaphylaxis the infusion should be stopped immediately and the baby reviewed by the medical team.

2. Live vaccines (e.g. rotavirus and BCG) should be avoided for 3 months following administration of IVIG as the efficacy may be impaired.

3. 360 degree phototherapy and hydration should be in place early and prior to administration of IVIG.

4. Prescribing and dose
   If used, give IVIG 500mg/kg over 4 hours as an adjunct to continuous multiple phototherapy. By whatever proposed mechanism, this may reduce the amount of circulating antibodies while blood for exchange is awaited.

5. The ‘National Clinical Guidelines for Immunoglobulin Use’ specify a formal process for requesting Immunoglobulins.

(https://www.gov.uk/government/publications/clinical-guidelines-for-immunoglobulin-use-second-edition-update).

6. Haemolytic Disease of the Newborn is considered a 'Red' indication, that is to say that immunoglobulin may be ordered urgently without awaiting the approval of the local immunoglobulin panel. However, it is essential that a New Patient Immunoglobulin Request Form is emailed at the time to the UHL Immunoglobulin Mailbox (immunoglobulins.mailbox@uhl-tr.nhs.uk).

7. An Immunoglobulin Order Form must then be sent to pharmacy (in addition to discussing the request with the duty pharmacist). Information on the process in UHL and the relevant forms can be found on the Immunoglobulins page on INsite (http://insite.xuhl- tr.nhs.uk/homepage/clinical/medicines-information/high-cost- drugs/immunoglobulins).

8. Parents
   If a baby required IVIG then parents or carers should be offered information on the following:
   - Why IVIG is being considered
   - The possible adverse effects of IVIG
   - When it will be possible for parents or carers to hold the baby

B4. Pre-Procedure

Prepare:
1. Sterile gown and gloves
2. Several 20ml syringes (depending on aliquot sizes)
3. **Exchange Transfusion Monitoring Chart (**see appendix). At the end of each aliquot the nurse should record observations required and the volumes withdrawn and infused.
4. Appropriate sample bottles at hand. Send blood **at the start, middle and at the end of the procedure.**

Full Blood Count, Urea & Electrolytes, Bilirubin (Split & Total), blood glucose, calcium, blood gas, clotting, DCT (start of procedure only)

A conjugated bilirubin before starting the procedure may help to exclude other possible causes but the total serum bilirubin level should be used to determine the need for exchange

Equipment

(Appendix 2 shows photographs of the equipment - taken from the step-by- step guide to setting up for exchange transfusion).

- Blood warmer
- Infusion pump (e.g. red blood infusion pump)
- Blood administration set
- Packed red blood cells

- Blood warming extension set including air catcher
- adult catheter bag with wide bore tubing for closed collection of blood (see practical guide)
- Sterile drape
- 3-way taps x 2
- Syringes assorted sizes as required
- Arterial transducer
- Blood gas syringes
- Appropriate personal protective equipment and sterile gowns
- Pathology collection tubes as required
- Exchange transfusion recording sheet

B5. Procedure

Aspirate stomach contents prior to starting.
Once set up – always check the 3 way tap settings to ensure blood withdrawal and infusion flows in the correct direction to prevent accidental loss or infusion of blood.

Connecting UAC and UVC:

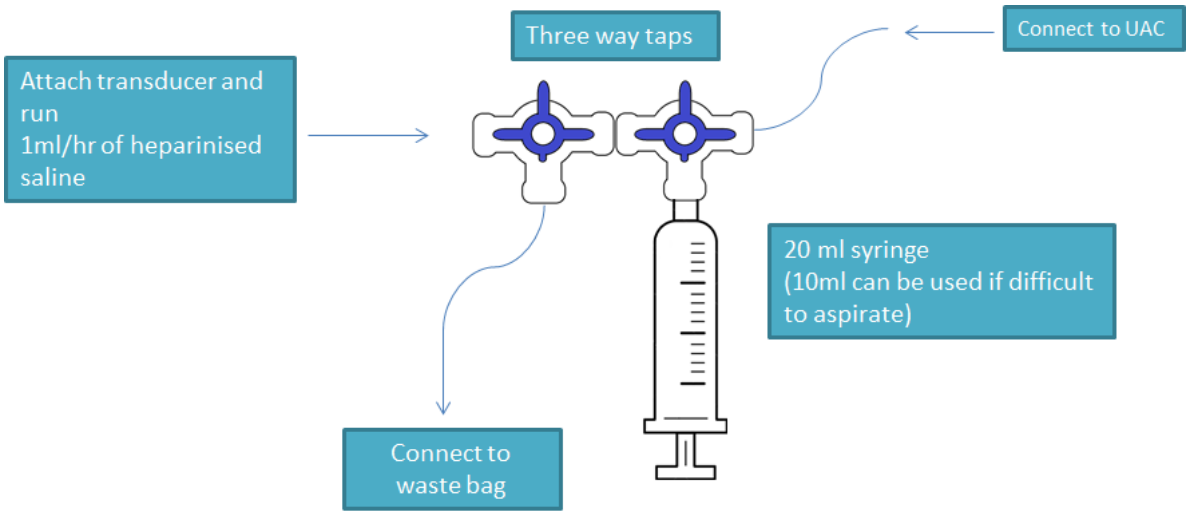
Blood is infused through UVC and simultaneously baby's blood is taken out through UAC.

UVC:

- Connect the blood, via blood warmer, to an infusion pump (e.g.; Baxter pump).
- Connect to the UVC.

UAC:

- Connect 2 X 3-way taps between the UAC and the transducer/fluids.
- Connect a 20ml syringe to one lumen of the three way tap closest to the baby
- Connect a closed blood waste system to the other e.g. adult catheter bag.



Pre-procedure the three way taps should be "closed" to both the collecting system and catheter bag (waste system)

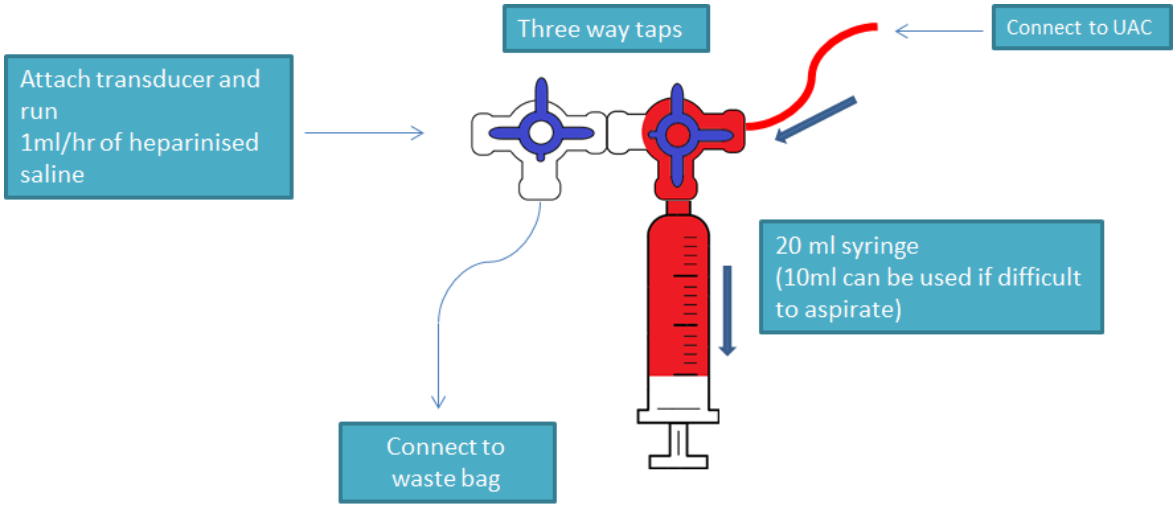
In this configuration it is possible to monitor the blood pressure

The taps should go to this position after each aliquot is taken during the transfusion for monitoring and recording of the arterial BP

Make sure you are comfortable (i.e. have used the toilet, had a drink etc.). The nurse should also be stationed with a view of both a clock and the baby's vital signs.

Withdrawing and infusing each aliquot

- Start the infusion via the Baxter pump and start a timer.
- Turn the 3 way tap nearest to the baby to on.
- Gradually withdraw blood from the UAC into the syringe slowly at exactly the same rate and volume as the calculated infusion rate for each aliquot.

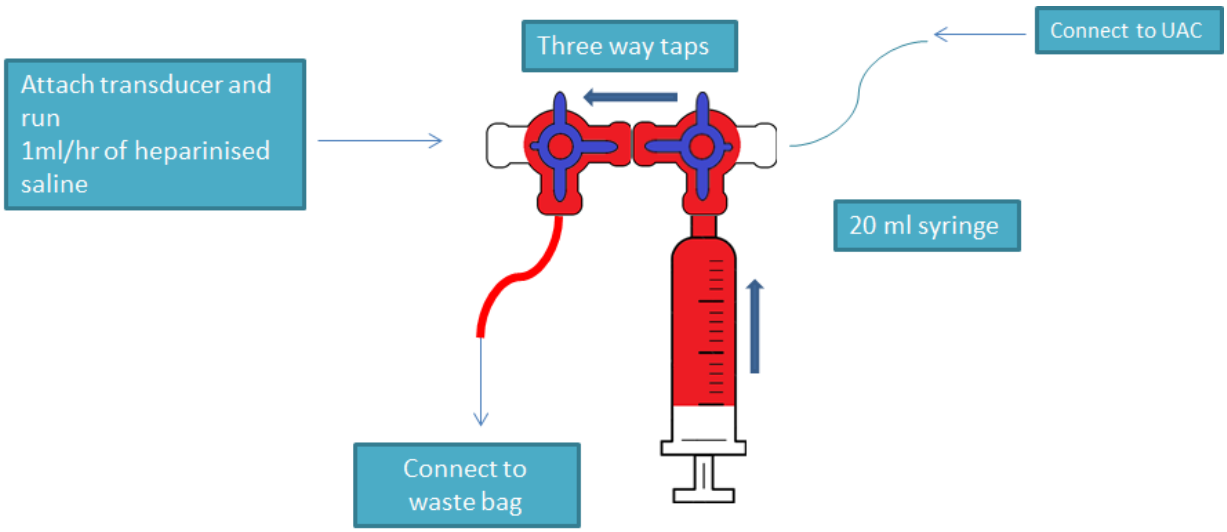


Sampling:

The three way tap should be closed to the waste bag and heparinised saline infusion

Discarding each aliquot

- Discard the blood by flushing into the closed waste system through the 3 way tap.
- Where samples are required mid exchange, withdraw just less than the aliqot required and take the final part of the aliquot into a clean 10ml syringe ensuring the total volume withdrawn is correct.
- Replace the 20ml syringe with a clean one.
- It may become necessary during the procedure to replace the 3 way connector due to clot.
- Intermittently flush the arterial line with a normal saline to ensure it remains patent recording the volume of all flushes



To waste:

One three way tap is connected to a 2000 ml catheter bag

The taps should be orientated closed to baby and the heparinised saline solution and open to the waste bag and 20 ml syringe

Blood can then be injected to flow into the bag

Peripheral Cannula & UAC:
This procedure is the same as the above procedure but with the blood connected to the peripheral cannula not the UVC. Particular care must be taken to check for tissuing of the cannula.

Peripheral Cannula & Arterial Line:
Similar to UAC/UVC procedure but three way tap is connected to art-line.

UVC Only:
This requires withdrawal of aliquots of blood from the UVC, disposal, and then administration of new blood via the UVC. As this method depletes and repletes total volume repeatedly it is not recommended. However, this may be used if arterial access is not able to be obtained and would delay exchange.

Blood warming equipment:
Blood warmers can be found in the main theatres or contact PICU at LRI.

The blood warming extension set should be threaded into the blood warmer while it is not primed. If you fill it before it will NOT go in and with force it will pop.

If, exceptionally, the blood warming equipment is unavailable, blood should be placed in the incubator (for no longer than 30 minutes, in order to minimise the risk of bacterial growth), to allow it to adjust to the baby's ambient temperature.

In order to reduce the risk of bacterial contamination, ensure that the transfusion of a unit of blood is complete within 4 hours after its removal from the blood fridge.

B5. After The Procedure

- Phototherapy should continue after the procedure with 4-6hrly checking of bilirubin concentrations. It may be necessary to repeat the exchange transfusion if bilirubin continues to rise.
- Do not remove the lines until no further exchanges are likely.
- Consider keeping nil by mouth for 12 hours after the procedure, as the risk of Necrotising Enterocolitis is increased by alteration of gut perfusion.
- Monitor blood sugars for 4 hours as exchanged blood may have high dextrose levels and can cause rebound hypoglycaemia following the exchange.
- Calcium and other electrolyte levels should be checked. As transfusion blood contains citrate to prevent clotting it binds free calcium and so levels can fall dangerously low. Prophylactic administration of calcium gluconate is, however, not currently common practice.

The baby must receive irradiated blood for 6 months post transfusion to eliminate the risk of graft vs. host disease.

B6. Monitoring and treatment of side effects

Exchange transfusion is not without risk of morbidity and mortality. If a baby experiences significant complications during exchange then the duty consultant neonatologist should be contacted and an incident form reported.

The most commonly reported adverse events during or soon after exchange transfusion:

- Catheter related complications; air emboli; thrombosis; haemorrhage
- Haemodynamic (related to excess removal of injection of blood): hypo or hypertension, intraventricular haemorrhage (preterm)
- Hypo or hyperglycaemia
- Hypocalcaemia, hyperkalaemia, acidaemia

Potential complications related to exchange transfusion:

- Arrhythmias
- Bradycardia
- Neutropenia, dilutional coagulopathy
- Feed intolerance, Necrotizing enterocolitis
- Septicaemia, blood born infection
- Hypo- or hyperthermia
- Cause of death 3/1000 procedures

Warning signs:

Vomiting or crying during infusion	Too rapid? Stop and review
Cyanosis or pallor	Too rapid? Altered circulation? Stop and review Check temp, pH, PaCO2, HR, BP
Aspirated blood becomes dark	UVC in portal vein? Adjust catheter Patient unwell? Stop and review Check temp, pH, PaCO2, HR, BP
Tachycardia and bradycardia	Volume, pH or electrolyte abnormality? Stop and review Check temp, pH, PaCO2, HR, BP, K+, Ca+
ECG abnormalities	Cold blood or altered K+/Ca+? Stop and review Check temp, pH, PaCO2, HR, BP, K+, Ca+ Manage hyperkalaemia, Hypocalcaemia
Cardiac arrest	Air embolism? Cold blood or altered K+? Rapid injection of calcium gluconate? Hypovolaemia?
Convulsions	Stop and manage seizure Check pH, glucose, calcium and magnesium

Calcium correction threshold
Hypocalcaemia is a known side effect of exchange transfusion. Calcium gluconate treatment should be given in cases of symptomatic hypocalcaemia (as per neonatal formulary) or when the ionised calcium is <0.8 at any time during the exchange. Routine administration of calcium gluconate during exchange transfusion is not advised.

Hypoglycaemia
This should be managed promptly with intravenous fluid, as an affected baby will not be able to receive enteral feeds during the exchange and for 24 hours post completion

Thrombocytopaenia
It is very common for a baby to become thrombocytopaenic during an exchange transfusion. Discuss with the duty consultant regarding the threshold to transfuse.

B7. Follow up

- To go home on Folic Acid (dose as per neonatal formulary) for 3 months
- Repeat check Hb at two weeks and six weeks (risk of late onset anaemia).
- If the Hb is < 65g/dL it is likely the baby will need a top up transfusion especially if symptomatic (lethargy, breathlessness, tachycardia etc)

- **If requiring further transfusion, the baby must receive irradiated blood for 6 months post transfusion to eliminate the risk of graft vs. host disease.**
- Audiology brain stem response testing
- Neonatal outpatient follow up and two-year neurodevelopmental follow-up

3. Part 2: Dilutional exchange

Management of polycythaemia

1. If a capillary blood sample has identified a haematocrit >0.75 repeat venous full blood count sample to identify "true" haematocrit. If this sample is not free flowing then an arterial sample will be required.
2. Polycythaemia is associated with jaundice – check bilirubin level
3. Assess the baby's hydration status and review the current fluid management for the baby. Give fluids at "one day ahead" volume if possible; if that volume of enteral feeds is not tolerated then give intravenous fluids.
4. Consider dilutional exchange if persistent raised haematocrit (>0.75) or clinical symptoms related to polycythaemia **(consultant decision)**

Outline of dilutional exchange procedure

It is ideal to infuse fluid at the same time as removing blood as per the exchange transfusion process described in part 1 of this guideline

1. Site umbilical lines using appropriate aseptic precautions (alternative access as described in part 1 may be used if this is unsuccessful)
2. Connect 20ml/kg of 0.9% sodium chloride[a] to the umbilical venous line via an infusion pump to run over 1 hour
3. Calculate aliquots to remove the same volume of blood in 5 minute intervals[b]
4. The first blood should be drawn at 5 minutes into the procedure.

a – A systematic review found that crystalloid solutions are as effective as colloid solutions for partial exchange transfusion in newborn babies with polycythaemia. The authors' conclusions are in line with the evidence presented, but should be treated with caution given that they were based on a few small studies 94 studies involving 200 patients).

b – Worked example;

for a 3 kg term baby;

Volume of 0.9% sodium chloride to infuse is 3 x 20ml/Kg = 60 mls
Infusion rate = 1ml/hr to run over 60 minutes
Aliquots of blood = 5 mls (12 aliquots)

Time (minutes)	Aliquot to remove over 5 minutes (mls)	Total blood removed (mls)
5	5	5
10	5	10
15	5	15
20	5	20
25	5	25
30	5	30
35	5	35
40	5	40
45	5	45
50	5	50
55	5	55
60	5	60

4. Education and Training

None

5. Audit Standards:

1. Exchange transfusion will be done using blood that is less than 5 days old (100%)
2. There will be documented evidence that the need for exchange transfusion has been authorised by consultant neonatologist (100%)
3. The baby's neurological status should be documented pre and post-exchange transfusion (100%)
4. The transfusion should commence within 1 hour of blood arriving on the neonatal unit (100%)
5. The fluid balance should be accurately recorded during the exchange transfusion using the proforma in appendix 3 and this should be filed in the baby's notes post procedure (100%)

Evidence Criteria

Evidence according to RCPCH

Grade A	At least 1 randomised controlled trial addressing specific recommendation
Grade B	Well conducted clinical trials but no randomised trial on specific topic
Grade C	Expert committee report or opinions

6. Supporting References

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7. Key Words

Anaemia, Haemolytic Disease of the Newborn, Jaundice, Serum bilirubin, Kernicterus, Intravenous immunoglobulin, Phototherapy, Polycythaemia

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The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs.
As part of its development, this policy and its impact on equality have been reviewed and no detriment was identified.

Contact and review details			
Guideline Lead (Name and Title) J Preece – Consultant N McMullan - Doctor			**Executive Lead** Chief Medical Officer
Details of Changes made during review:			
Date	**Issue Number**	**Reviewed By**	**Description Of Changes (If Any)**
May 2010	**1**		Original guideline (Marie Hubbard / SA Sutton)
April 2016	**2**	Guidelines lead (REM) Neonatal Guidelines Meeting Neonatal Governance Meeting	no significant changes 1 year – pending review and information regarding new equipment)
Feb 2017	**3**	(JM, Jasmine Farzan) Neonatal Guidelines Meeting	
2018	**4**	Authors (JB, JM, MA) and Guidelines lead (RM).	New equipment and updated teaching package.
Jan – Feb 2019	**5**	Neonatal Guidelines Meeting Neonatal Governance Meeting	
April – June 2022	**6**	J Preece N McMullan Neonatal Governance meeting	Added – Maternal antibody titre levels risk Indication for transfusion changed from cord bilirubin >80umol/L to >100umol/L New section A/N communication when haemolytic disease of the new born is suspected, preparation to have blood available prior to delivery, taking of maternal cross match within 5 days of prior to birth. Added at birth section which includes reasons blood transfusion may be required at that point. Added to withhold enteral feeds if exchange is to be performed. Advice on how to sample blood during transfusion added. Specified how long blood can be warmed in the incubator if warmer not available. Follow up management updated

Appendix 1: Quick reference guide to the exchange transfusion guideline

- Indications for Exchange
  - Bilirubin at or above Exchange transfusion line
  - Rapid Rise of Bilirubin >8.5 micromol/litre/hr
  - with clinical features and signs of acute bilirubin encephalopathy.
  - Anaemia at birth Hb <100g/L (consider)

- Inform Consultant on call
- Order urgent blood at the above volume
- Start 360 degree phototherapy
- Start IV fluids (one day ahead)
- Consider IV immunoglobulin (500mg/kg over 4 hours)
- Obtain consent from parents

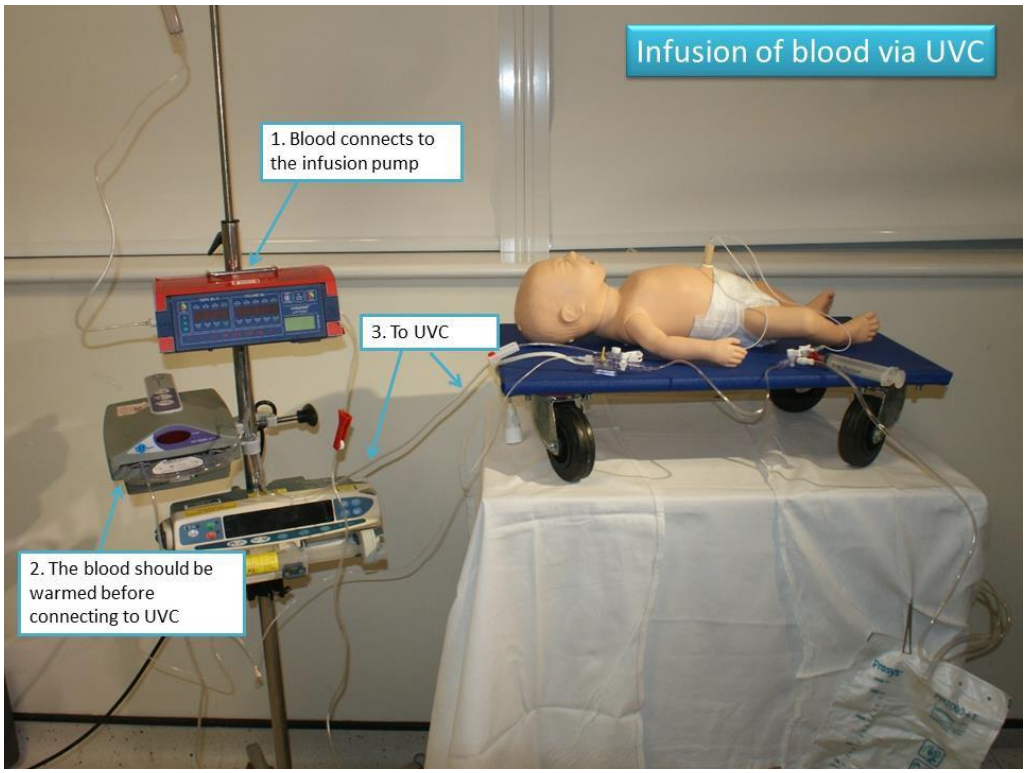
- Obtain access (Ideally UVC to infuse blood and UAC to withdraw blood)
- Send initial bloods – FBC, UE, Split Bilirubin, Blood Glucose, calcium, Blood gas and Clotting screen
- Initial observation – BP, HR, Sats, temperature (and also after every aliquots)

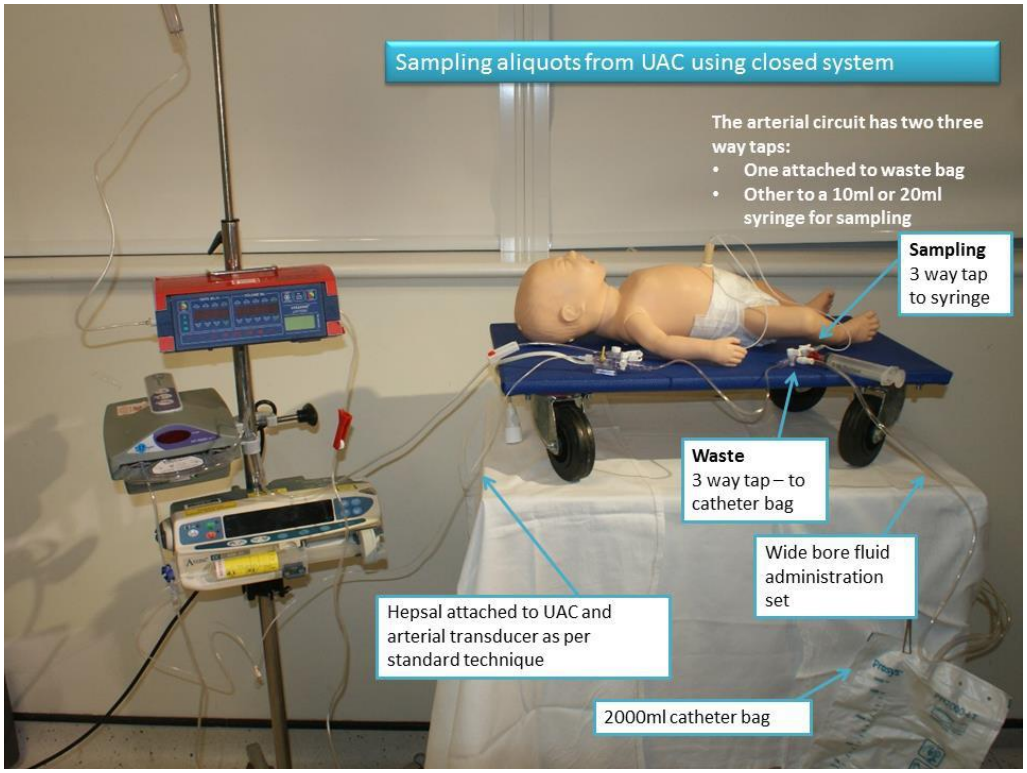
Determine the aliquots. For example: <u>A term baby weighing 4kg</u>
Total volume for Double exchange=4x180mls = 720mls
UVC - Infuse 720mls over 180min (4mls/min) – review guidelines to calculate this
UAC - Withdraw 20mls every 5min via UAC

- Do Observations after every aliquots (every 5 min)
- Continue double phototherapy during the procedure
- Ensure the volume infused equals blood taken out
- Repeat bloods (FBC, UE, Split Bilirubin, Blood Glucose, calcium, Blood gas) in the middle and at the end of the procedure

- Continue phototherapy
- Do Bilirubin within 2 hrs and then every 4- 6 hours
- Monitor Blood glucose and calcium and treat if abnormal
- Start folic acid 250 microgram/Kg/day for 3 months
- Repeat check Hb at two weeks and six weeks (risk of late onset anaemia)
- Arrange outpatient clinic appointment and formal Audiology testing

Appendix 2: Equipment Overview Photographs (please see separate step-by-step PowerPoint guide - SettingUpExchange.pptx)





Appendix 3: Exchange transfusion record

Exchange Transfusion Record

Name of baby _____ Baby's Hospital No. _____

Name of mother _____ Mother's Hospital No. _____

Date and time of delivery_____ Birth weight _____

Apgar scores _____ Blood group – baby _____

Date & time commenced _____ Initial Haemoglobin _____

Date & time completed _____ Pre-exchange Bilirubin _____

Age of baby in hours_____ Post-exchange Bilirubin _____

Time	Out		In		Pulse	Resps	BP	Bloods taken	Comments
	Amount	Total	Amount	Total					