

Jaundice - Use of Immunoglobulin and Exchange Transfusion

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, especially where there is aggressive haemolysis. If there is a prior history of HDN, that should be taken into account when choosing the most appropriate treatment.

Exchange transfusions are primarily used to manage severe anaemia, severe hyperbilirubinaemia, or a rapidly rising bilirubin level ($> 7-10 \mu\text{mol/L}$ 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 intensive 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 give immunoglobulin after discussion with consultant. Occasionally it may be decided to perform exchange transfusion regardless if HDN aggressive, but Ig may be considered if any delays in obtaining blood.

3. Immunoglobulin (Privigen®)
 - There is reasonable evidence to suggest that high dose intravenous immunoglobulin can prevent the need for an exchange transfusion for haemolytic disease
 - Total 0.5g/kg – see [appendix 1](#) for prescribing regimen
 - Treatment can be started without prior approval from the Trust Immunoglobulin Board (agreed at DTC on 26/03/09), however an IVIg 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 undertake 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 it 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
- 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 of 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
3. British Committee for Standards in Haematology Transfusion Task Force, British Journal of Haematology, 2004;123, 433-453
4. Murray NA, Roberts IAG, Haemolytic disease of the newborn, Archives of Disease in Childhood, Fetal and Neonatal Edition, 2007; 92:F83-F88
5. Gottstein R, Cooke RWI, Systematic review of intravenous immunoglobulin in haemolytic disease of the newborn, Archives of Disease in Childhood, Fetal and Neonatal Edition, 2003, 88:F6-F10
6. Clinical Guidelines for Immunoglobulin Use, Second Edition, July 2011, Department of Health
7. Privigen®, The Electronic Medicines Compendium,
<http://www.medicines.org.uk/EMC/medicine/21359/SPC/Privigen+100mg+ml+solution+for+infusion/>

Guideline prepared by Dr. Tim. Marr, Neonatal Specialist Registrar
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Review April 2012

October 2012, few amendments including change to Privigen® and clearer prescribing instructions
Feb 2019 Updated dose of IVIg for 2011 update of DH guidelines

Appendix 1

Calculating the infusion rates for Privigen®

Privigen® comes as 5 g/50 mL (please double check in case of product changes)

Infusion is steadily increased, baby is carefully monitored for side effects

First 30 minutes run Privigen at rate of weight (kg) x 0.15 = ml/hr

Next 30 minutes run Privigen at rate of weight (kg) x 0.3 = ml/hr

Next 30 minutes run Privigen at rate of weight (kg) x 0.45 = ml/hr

Then increase to max rate (weight (kg) x 0.6) = ml/hr

Total dose to be given is 0.5g/kg = 5ml/kg

Example

e.g. for 3 kg baby prescribe Privigen® as follows

Total dose of Privigen® is 1.5g = 15 ml

30 minutes run Privigen® at 0.45 ml/hr

30 minutes run Privigen® at 0.9 ml/hr

30 minutes run Privigen® at 1.35 ml/hr

455 minutes (approx 7.6 hours) run Privigen® at 1.8 ml/hr

Then stop once 15 mls have been administered

Volume calculations

Double volume = 180 mL/kg

Aliquots to be removed/Infused

Weight	Volume
<1000 g	5mL
1000-2000 g	10mL
>2000 g	15mL

For 3.5 kg baby – total volume to be exchanged = $3.5 \times 180 = 630$ mL

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

For a 1.3 kg baby – total volume to be exchanged = $1.3 \times 180 = 234$ mL

- 234 mL in 10 mL aliquots
 - $234 \div 10 = 23.4$ aliquots
 - 23.4 aliquots every 5 minutes = $23.4 \times 5 = 117$ minutes = just over 2 hours
- Infusion rate (if using continuous infusion) = $234 \div 2 = 117$ mL/hour

For a 800 g baby – total volume to be exchanged = $0.8 \times 180 = 144$ mL

- 144 mL in 5 mL aliquots
 - $144 \div 5 = 28.8$ aliquots
 - 28.8 aliquots every 5 minutes = $28.8 \times 5 = 144$ minutes = just under 2½ hours
- Infusion rate (if using continuous infusion) = $144 \div 2.5 = 57.6$ 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 know 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

Total				

Time finished: _____