Exchange transfusion replaces withdrawn baby blood with an equal volume of donor blood

**INDICATIONS**

- Anaemia at birth from blood group incompatibilities
- if no transfusion given in-utero, to remove antibodies and correct anaemia when cord Hb <12 g/dL
- after transfusion in-utero, when Kleihauer test shows predominance of fetal Hb and cord Hb <12 g/dL
- Hyperbilirubinaemia with haemolysis, discuss with consultant promptly if bilirubin values approaching guidelines below; senior decision is required
- term infants serum bilirubin >340 micromol/L
- preterm infants serum bilirubin >[(8.5 x gestational age in weeks)/2]
- anticipate need for exchange transfusion if bilirubin rises faster than 10 micromol/L/hr despite phototherapy
- Hyperbilirubinaemia without haemolysis
- inform consultant when serum unconjugated bilirubin >gestational age x 10 (exchange transfusion can be withheld if serum unconjugated bilirubin <510 micromol/L)
- transfuse only if phototherapy failing to bring bilirubin under control
- Chronic feto-maternal transfusion
- Disseminated intravascular coagulation

**COMPLICATIONS**

- Cardiac arrhythmias
- Air embolism
- Necrotizing enterocolitis
- Coagulopathy
- Apnoeas and bradycardia
- Sepsis
- Electrolyte disturbances
- Acidosis owing to non-fresh blood
- Thrombocytopenia
- Late hyporegenerative anaemia

**PROCEDURE**

**Prepare**

- Ensure full intensive care space and equipment available and ready
- Allocate one doctor/practitioner and one other member of nursing staff, both experienced in exchange transfusion, to care for each baby during procedure; document their names in baby's notes
- Obtain written consent when possible, and document in baby's notes
- Phototherapy can usually be interrupted during exchange
- Calculate volume of blood to be exchanged: 160 mL/kg (double blood volume) removes 90% of baby red cells and 50% of available intravascular bilirubin
- Order appropriate volume (usually 2 units) of blood from blood bank, stipulating that it must be:
  - cross-matched against mother’s blood group and antibody status, and (if requested by your blood bank) baby blood group
Exchange Transfusion 2009-11

- CMV-negative
- irradiated (shelf-life 24 hr) for any baby who has had an in-utero blood transfusion
- as fresh as possible, and certainly no more than 4 days old
- plasma reduced for ‘exchange transfusion’ (haematocrit 0.5-0.6), not SAG-M blood, not packed cells

Prepare baby
- Empty stomach using nasogastric tube
- Start intravenous infusion and allow nil by mouth
- Pay attention to thermoregulation, particularly if procedure to be performed under radiant heater
- Commence continuous cardiac, temperature and saturation monitoring

Monitor and document
- Blood pressure every 15 min throughout exchange

If any change in baby’s cardiorespiratory status, pause exchange by priming catheter with donor blood that will not clot. Discuss with consultant

Prepare blood
- Set up blood warmer early (aim for 37°C)
- Check blood units as per hospital policy
- Connect donor blood to filter and prime blood giving set
- Connect to 4-way (if using UVC) or 3-way tap (outside the warmer) as indicated
- Ensure donor blood well mixed before and throughout exchange

Technique
- Ensure working area sterile
  Either
- Insert UVC (see Umbilical venous catheterisation guideline) and confirm position. Use UVC ‘push-pull’ technique below for exchange
  Or
- Insert peripheral venous (‘in route’) and arterial (‘out route’) catheters. Use peripheral venous and arterial catheters ‘continuous’ technique below for exchange
  Umbilical artery catheter may be used as a last resort

UVC ‘push-pull’ technique
- Connect catheter bag (using Vygon connector) and donor blood to 4-way tap and 4-way tap to UVC
- Remove 10 mL baby blood from UVC using syringe
- Send first sample for serum bilirubin, full blood count, blood culture, blood glucose, calcium, electrolytes, coagulation and liver function tests
- when exchange performed for reasons other than known blood group antibodies, send blood for G6PD screening and viral serology
- Replace precise volume removed with donor blood, slowly using a syringe
- Each out-in cycle should replace no more than 8.5 mL/kg and take at least 5 min; start with smaller aliquots (10 mL) and increase to 20 mL (if baby stable and weight allows) only after 30 min. As a guide:
  - birth weight <1000 g use 5 mL aliquots
  - birth weight 1000-2000 g use 10 mL aliquots
  - birth weight >2000 g use 20 mL aliquots
- Discard ‘out’ baby blood into catheter bag
- Continue out-in cycles every 5 min (maximum aliquot with each cycle) until complete
Send last ‘out’ baby blood sample for serum bilirubin, full blood count, blood culture, blood glucose, calcium and electrolytes

**Peripheral venous and arterial catheters ‘continuous’ technique**
- Connect catheter bag, using Vygon connector, to 3-way tap attached to arterial line extension

  **Never leave arterial line open to catheter bag**

- Connect donor blood to venous catheter
- Remove 10 mL of baby’s blood from arterial line and send for tests as listed above under **UVC ‘push-pull’ technique**
- Start venous infusion as fast as peripheral cannula will allow up to maximum flow rate of 10 mL/kg/hr
- Remove ‘out’ aliquots of baby’s blood from arterial line every 5 min to match volume of donor blood being infused into venous line
- Observe limb distal to arterial line at all times and document appearance. **If concerned, pause exchange and discuss with consultant**
- Continue steps as above but note that continuous ‘in’ cycle requires removal of ‘out’ aliquots only every 5 min
- If exchange stopped for >2-3 min, discontinue procedure and ensure all lines are flushed

**AFTERCARE**
**Immediate**
- When Hb and bilirubin in final ‘out’ sample known, check with consultant before removing all lines
- Complete documentation (volumes in/out, and all observations)
- Recommence phototherapy
- Recommence feeds 4-6 hr after completion
- Monitor blood sugar 4 hrly until acceptable on 2 consecutive occasions
- Update parents

**Intermediate**
- In babies receiving antibiotics, a repeat dose may be required: discuss with consultant
- Delayed Guthrie spot collection will be indicated, as directed by regional centre

**Follow-up**
- Neuro-developmental follow-up in all babies who have undergone exchange transfusion