

EXCHANGE TRANSFUSION • 1/3

Exchange transfusion replaces withdrawn baby blood with an equal volume of donor blood

*Discuss all cases with **neonatal consultant***

INDICATIONS

Haemolytic anaemia

- A newborn who has **not** had an in-utero transfusion (IUT) with a cord Hb <120 g/L and is haemolysing, may require urgent exchange transfusion to remove antibodies and correct anaemia:
- if Hb <100 g/L: discuss **urgently** with consultant and proceed to exchange transfusion; avoid simple packed cell transfusions
- if Hb 100–120 g/L: obtain 6-hrly bilirubin values and, if rapidly rising or close to exchange transfusion level (see **Jaundice** guideline), use intravenous immunoglobulin (IVIg)
- A newborn who has had IUTs and whose Kleihauer test (this test may not be available in your hospital) demonstrates a predominance of adult Hb, anaemia can be managed using a top-up transfusion of irradiated, CMV-negative blood

Hyperbilirubinaemia

- Discuss promptly with consultant. If bilirubin values approaching guidance below; senior decision required:
- guidance as determined by exchange transfusion line on gestation-specific NICE jaundice chart (see **Jaundice** guideline)
- if bilirubin rises faster than 8.5 micromol/L/hr despite phototherapy, anticipate need for exchange transfusion

Other indications

- Chronic feto-maternal transfusion
- Disseminated intravascular coagulation (DIC)

COMPLICATIONS

- Cardiac arrhythmias
- Air embolism
- Necrotising 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 1 doctor/practitioner and 1 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 and document in baby's notes
- Phototherapy to be continued during exchange
- Calculate volume of blood to be exchanged: double volume exchange removes 90% of baby's red cells and 50% of available intravascular bilirubin. Use:
 - term babies: 160 mL/kg
 - preterm babies: 200 mL/kg
- Order appropriate volume (usually 2 units) of blood from blood bank, stipulating that it must be:
 - crossmatched against mother's blood group and antibody status, and (if requested by your blood bank) baby's blood group
 - CMV-negative
 - irradiated (shelf-life 24 hr) for any baby who has had an in-utero blood transfusion
 - as fresh as possible, and certainly ≤4 days old
 - plasma reduced red cells for 'exchange transfusion' (haematocrit 0.5–0.6), not SAG-M blood and not packed cells

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Prepare baby

- Empty stomach using nasogastric tube (see **Nasogastric tube insertion** guideline) and keep baby nil-by-mouth
- Start IV infusion
- Pay attention to thermoregulation, particularly if procedure to be performed under radiant heater
- Commence continuous cardiac, temperature and saturation monitoring

Document

- Blood pressure, respiratory rate, temperature, SpO₂ and heart rate every 15 min throughout exchange
- Volume of blood in and out with each cycle, and keep a running total

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)
 - do not use if:
 - intermittent bolus infusion i.e. single catheter exchange
 - blood is exposed to a radiant heater (risk of haemolysis)
 - **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

- Single catheter push-pull technique
- Sequential withdrawal of baby's blood and infusion of donor blood via a UVC (see **Umbilical venous catheterisation and removal** guideline)

Or

- Isovolumetric or continuous technique
- Continuous infusion of donor blood via a venous line with intermittent removal of baby's blood via an arterial line
- Use umbilical venous or peripheral venous line for infusion and umbilical arterial or peripheral arterial line for removal of blood (see **Umbilical arterial catheterisation and removal**, **Umbilical venous catheterisation and removal** and **Arterial line insertion** guidelines)

Single catheter or '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 ≤ 8.5 mL/kg and take ≥ 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

Isovolumetric or continuous technique

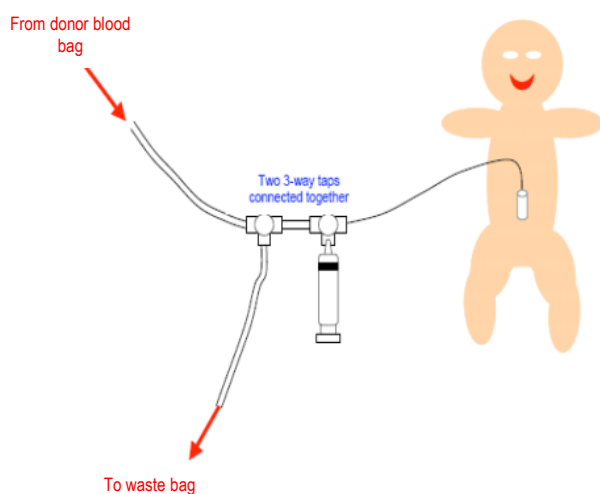
- Connect catheter bag, using Vygon connector, to 3-way tap attached to arterial line extension

Never leave arterial line open to catheter bag

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- Connect donor blood to venous catheter
- Remove 10 mL of baby's blood from arterial line and send for tests as listed above under **Single catheter or 'push-pull' technique**
- Start venous infusion at rate to match withdrawal rate e.g. 120 mL/hr for a 10 mL volume withdrawal every 5 min
- 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

Equipment diagram for 'Push-Pull' Exchange Transfusion



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 feeds 4–6 hr after completion
- Monitor blood sugar 4-hrly until acceptable on 2 consecutive occasions ([see Hypoglycaemia guideline](#))
- 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

- Neurodevelopmental follow-up in all babies who have undergone exchange transfusion
- Repeat full blood count at intervals (likely 1–2 weekly but to be determined individually) for ≥ 6 weeks, to detect anaemia secondary to ongoing haemolysis