TRANSFUSION OF RED BLOOD CELLS ● 1/3

Introduction

The need for blood transfusion will depend upon the infant's clinical status. The sicker the infant, the greater the need for oxygen carrying capacity. Therefore, target haemoglobin levels for sick ventilated infants will be different to those for healthy preterm infants. Preterm babies may undergo frequent blood sampling, so sample volumes should be kept to a minimum in all cases.

Transfusion itself is not without risk so the decision on whether to transfuse should always include an assessment of the risks and benefits, and whenever possible informed verbal consent should be obtained from the parent(s). If a transfusion is clinically indicated and the parents will not give consent the senior (consultant) paediatrician on call must be informed.

INDICATIONS

- **Acute blood loss** with haemodynamic compromise or ≥10% blood volume loss (e.g. significant feto-maternal transfusion, pulmonary haemorrhage or subgaleal haemorrhage)
  - in emergency, use Group O RhD negative blood
  - transfuse 10 mL/kg over 30 min
  - further transfusion based on haemoglobin (Hb)

- **Top-up blood transfusion**, if Hb below threshold levels quoted in the following situations

Baby	Hb (g/L)		
Postnatal age	**Suggested transfusion threshold Hb (g/L)**		
	Ventilated	Other non-invasive respiratory support (CPAP/BiPAP HFNC/O_2)	No respiratory support
First 24 hr	<120	<120	<100
Week 1 (after first 24hr)	<120	<100	
Week 2 (day 8–14)	<100	<85 <95 if symptoms of anaemia* or poor reticulocyte response †	
≥Week 3 (day 15 onwards)		<75 <85 if symptoms of anaemia* or poor reticulocyte response †	

Adapted from British Committee for Standards in Haematology recommendations

* Symptoms include persistent tachycardia, persistent tachypnoea, poor feeding, frequent apnoeas, and weight gain of less than 10g/day for 4 day

† <4% or count <100 × 10^9/L - suggests an inadequate marrow response

PRE-TRANSFUSION

Communication

- If clinical condition permits before transfusion, inform parents that baby will receive blood transfusion
  - document discussion
- If parents refuse transfusion (e.g. Jehovah's Witness) follow local policy

Consent should include why transfusion is required and the possible risks of transfusion. It should be recorded in the medical notes. Explicit consent can be either written (parents sign a consent form) or verbal (a member of staff records that he/she has had a discussion with the parents about the risks and benefits of transfusion and that the parent has consented to transfusion for their infant).

Risks of transfusion that should be discussed with parents:

- Transfusion reactions
- Transmission of viral and prion infections

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• Necrotising Enterocolitis. Extensive and often fatal NEC has been seen on our unit and reported in the medical literature following top up transfusion in the stable growing neonate. The incidence of this complication is uncertain but low. We have tried to reduce the risk of post transfusion NEC by "resting" the gut over the transfusion period. This intervention is not evidence based and we cannot be confident that it will reduce the risk of NEC.

Parents should also be told that transfusion may or may not improve oxygen requirement, weight gain or frequency of apnoea/desaturation episodes. There is no way of knowing which infants will have improvement in these parameters after transfusion.

Crossmatch

- For top-up transfusions in well baby, arrange with blood bank during normal working hours
- Crossmatch against maternal serum (or neonatal serum if maternal serum not available) for first 4 months providing the maternal antibody screen and the infants Coombs test are negative
- For first transfusion, send samples of baby's and mother's blood

Direct Coombs testing

- Laboratory will perform direct Coombs test (DCT) on maternal serum for any atypical antibodies
- If maternal DCT negative, blood issued will be crossmatched **once** against maternal serum. No further maternal blood samples are necessary for repeat top-up transfusions
- If maternal DCT positive, crossmatching of donor red blood cells against maternal serum is required **every time**
- A positive Coombs test on the baby without a positive antibody screen in the mother would need further investigations to determine the cause

Multiple transfusions

- Local policy requires a repeat group and Coombs test on the baby prior to repeat transfusions.
- In babies <29 weeks who may need multiple transfusions, use paediatric satellite packs ('paedipacks') from 1 donor (if available) to reduce multiple donor exposure

When to use irradiated blood

- Irradiated blood **must** always be given for those:
- who have received intra-uterine transfusion
- Received an exchange transfusion
- with suspected or proven immunodeficiency
- receiving blood from a first- or second-degree relative, or an HLA-selected donor

When to use CMV-free blood

- As CMV seronegativity cannot be guaranteed in untested blood, **use only CMV-seronegative blood for neonatal transfusions**
- blood products in use in the UK are leucodepleted to $<5 \times 10^6$ leucocytes/unit at point of manufacture

Special considerations

Iron supplements

- Premature babies receiving breast milk – commence oral iron supplementation at aged 28days (see **Nutrition and enteral feeding** guideline)

Babies with necrotising enterocolitis (NEC)

- Transfuse using red cells in sodium chloride 0.9%, adenine, glucose and mannitol (SAG-M), preferably, as it is relatively plasma-free. This may not be available in all units
- Any unexpected haemolysis associated with transfusion in a baby with NEC should be investigated for T-cell activation in consultation with local haematology department and with close involvement of consultant neonatologist

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Exchange transfusion

- See **Exchange transfusion** guideline

ORDERING BLOOD

Request packed cells 15ml/kg PLUS 20ml (required for priming of the infusion set)

Withholding feeds during transfusion

Feeds should be stopped for a total of 11 hours, i.e. 4 hours before the transfusion, for the duration of the transfusion and for 4 hours afterwards.

If baby is not already on intravenous fluids this should be commenced with 0.9% saline + 5% glucose for 4 hours before transfusion commences, and stopped when the transfusion commences. Feeds should be stopped. If the blood sugar half way through the transfusion is low (<2.6) a separate I.V. cannula should be sited to allow concomitant administration of blood and 10 % glucose. If the blood sugar is satisfactory, simply recommence I.V. 0.9% saline + 5% glucose for 4 hours after completion of the transfusion. As long as the baby remains well, 4 hours after the transfusion finishes, feeds can be restarted at pre transfusion rates and volumes.

If baby is already on intravenous fluids (crystalloid or TPN) then this can continue to be given without change in infusion rate for the duration of the blood transfusion. A change to 0.9% saline + 5% glucose is not necessary. Blood must be given through a different cannula to the maintenance fluid. The important point is that feeds are stopped for the whole 11 hour period. If venous access is limited to one cannula then current IV fluid can be continued for the 4hrs NBM prior to transfusion, stopped for the duration of transfusion and then restarted post transfusion.

The baby should be monitored closely throughout the transfusion, which should be discontinued if there is any sign of a reaction (e.g. tachycardia, pyrexia). Monitoring should include continuous ECG, oxygen saturation and hourly temperature.

TRANSFUSION

Where clinically safe to do so, the transfusion should be prescribed and administered within normal working hours (09.00-17.00 hrs). This will improve the availability of medical support should an adverse reaction occur.

Volume of transfusion

- Give 15 mL/kg of red cell transfusion for non-bleeding neonates irrespective of pre-transfusion Hb
- Give 20 mL/kg of red cell transfusion in case of massive haemorrhage (see **Massive haemorrhage** guideline)

A paediatric pack contains approximately 50 mL blood. Use 1 pack if possible

Rate of administration

- Administer blood at 15 mL/kg over 3hr to ensure the infusion is completed within 4 hours of leaving the fridge.
- Increase rate in presence of active haemorrhage with shock (see **Massive haemorrhage** and **Subgaleal haemorrhage** guidelines)
- Via peripheral venous or umbilical venous line (**not** via long line/arterial line)

Use of furosemide

- Routine use **not** recommended
- Consider half way through blood transfusion at dose of 0.5 to 1 mg/kg I.V for babies:
  - with chronic lung disease
  - with haemodynamically significant PDA
  - in heart failure
  - with oedema or fluid overload

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DOCUMENTATION AND GOOD PRACTICE

- Clearly document indication for transfusion and consent in the notes
- Ensure positive identification of baby using accessible identification
- Ensure blood transfusion volume and rate is prescribed in appropriate infusion chart
- Observations, including:
- continuous ECG
- SpO_2
- hourly temperature and BP (recorded before, during and after transfusion)
- Appropriate labelling of syringes to ensure compliance with current best practice
- Unless clinically urgent, avoid transfusion out-of-hours
- To reduce need for blood transfusion, minimise blood sampling in babies (micro-techniques, non-invasive monitoring) and avoid unnecessary testing
- Delay cord clamping in accordance with the resuscitation council guidelines (see **Resuscitation guideline)**
- Ensure donor exposure is minimised by using satellite packs from same donor
- After transfusion, record benefit (or lack thereof)
- Document pre- and post-transfusion Hb levels

Hazards of transfusion

- Most important are:
- infections – bacterial/viral
- hypocalcaemia
- volume overload
- citrate toxicity
- rebound hypoglycaemia (following high glucose levels in additive solutions)
- thrombocytopenia after exchange transfusion

Any serious adverse reaction should be reported to the serious hazards of transfusion (SHOT) local co-ordinator