

## EXCHANGE TRANSFUSION

A procedure by which severe anaemia is corrected and toxic metabolites, bilirubin and drugs are removed from the circulation.

### Indications:

1. Severe haemolytic anaemia: eg rhesus iso-immunisation (**double volume exchange transfusion of semi-packed RBCs**)
2. Severe non-haemolytic anaemia eg twin to twin transfusion causing chronic anaemia with heart failure (**single volume exchange of packed RBCs**)
3. Severe hyperbilirubinaemia (**double volume exchange of packed or semi-packed RBCs**)
4. Severe coagulopathies and DIC (**double volume exchange of whole blood**)
5. Removal of toxic metabolites eg. Ammonia in amino-acidopathies and drug poisoning (**single volume with semi-packed RBCs**)
6. Polycythaemia: **partial** exchange transfusion may be indicated using **0.9% saline**

$$\text{Partial exchange (ml)} = \frac{80 \times \text{weight (kg)} \times (\text{Observed Hct} - \text{Desired Hct})}{\text{Observed Hct}}$$

- **Single volume exchange (ml) = 80 x weight (kg)**
- **Double volume exchange (ml) = 2 x 80 x weight (kg)**

### Donor Blood:

1. ABO compatible. CMV, HIV, Hepatitis B and rhesus negative.
2. <48 hours old, citrate phosphate dextrose (CPD) is preferred, it has higher PH, more 2,3 diphosphoglycerate and lower potassium.
3. Infants with Rh incompatibility: the blood must be O Rh negative crossed matched with the mother's blood.
4. Infants with ABO incompatibility: the blood must be O Rh compatible (with the mother and the infant) or Rh negative and cross-matched with the infant's and the mother's blood.
5. Other blood group incompatibilities: (eg anti-Rh-C, anti-Kell, anti-Duffy), blood must be cross-matched with the mother's blood.

### Technique:

**Iso-Volumetric** (preferred method): Use umbilical artery and umbilical vein or peripheral artery and peripheral vein. Iso-volumetric exchange transfusion needs two operators; one for withdrawing and the other for infusing blood at the same time at the same rate (**see diagram 1**).

**Non-Volumetric:** A single umbilical vein is used. One operator is needed using two 3-way taps (**diagram 2**).

**Equipment:**

1. Radiant warmer and equipment for respiratory support and resuscitation.
2. Monitoring of HR, RR, Temperature, Sat O<sub>2</sub>, BP and CVP.
3. Umbilical artery and venous catheterisation sets.
4. Exchange transfusion set, connections and blood warmer.
5. NGT to evacuate stomach before the procedure and keep it in-situ.
6. An assistant for iso-volumetric exchange transfusion and a third person to monitor the vital signs, check blood gases and record the exchanged volumes.

Exchange transfusion is an intensive care procedure performed under aseptic conditions.

**Procedure:**

- ❖ Inform parents about the procedure, which may take 60-90 minutes to perform.
  - ❖ Complications (see later) may arise especially if the procedure is not strictly adhered to.
  - ❖ The baby will have an IV dextrose infusion with calcium supplement. Enteral feeds will be stopped and not re-started until 24 hours after the procedure.
  - ❖ If deemed necessary, the procedure may need to be repeated.
1. Insert a NGT and aspirate the stomach contents.
  2. Aseptically cannulate umbilical artery (UAC) and umbilical vein (UVC).
  3. Take blood for:
    - ❖ Group & direct Coomb test
    - ❖ FBC, Hct, film, coagulation screen
    - ❖ U&E, LFTs, Ca, bilirubin, glucose
    - ❖ ABG
  1. Check the blood pack information: group, rhesus status, expiry date. The blood pack is connected to a giving set which will coil in a blood warmer to keep it's temperature at **37°C** before it is given to the baby.
  2. Connect 3-way tap and 10ml syringe to the UAC and waste bag. Blood withdrawn from the infant is pushed via a sterile waste pipe into a sterile waste bag.
  3. Connect 3-way tap and 10ml syringe to the UVC and transfusion giving set. Withdraw blood from the transfusion bag and give to the baby.
  - Aliquots of 5mls in preterm and 10-15mls in full term babies are withdrawn and infused over no faster than 3-minute cycles.
  - For a partial exchange, follow the same principles only the volume of exchange will be less and with a 0.9% saline.

### **During** the procedure:

- Monitor BM and ABG every 30 minutes.
- Monitor ECG trace, HR, RR, BP, CVP every 15 minutes.
- Observe for any evidence of hypocalcaemia eg twitching, prolonged Q-T interval.
- Look for any cyanosis, pallor, abdominal distension, and vomiting or bloody diarrhoea. If any of these develop, stop the procedure, do a blood gas, BM, Ca, K and treat accordingly. If CVP is >8mmHg and you are sure the catheter tip is in the right atrium, remove 5-10ml of blood slowly until the VP is 3-6mmHg. Start again when stable.

### **After** you finish, take blood for:

- ❖ FBC, Hct and coagulation screen
- ❖ U&E, Ca, glucose, bilirubin
- ❖ Blood culture
- ❖ ABG

- If a further exchange transfusion is likely, leave the lines in otherwise remove.
- Commence phototherapy.

### **Complications of exchange transfusion:**

1. Metabolic acidosis
2. Hypoglycaemia
3. Hypocalcaemia
4. Hyperkalaemia
5. Thrombocytopenia
6. Coagulopathy
7. Circulatory overload
8. Cardiac arrhythmias
9. Air embolism
10. Acute dilatation of stomach
11. Ischaemia of intestine, perforation and necrotising enterocolitis
12. Infection: Usually staphylococcal, hepatitis, CMV, HIV reported but rare nowadays.

### References:

1. A manual of Neonatal Intensive Care. NRC Robertson. Edward Arnold – 3<sup>rd</sup> edition – 1993
  2. Neonatology Management, procedures, on-call, problems, diseases and drugs. TL Gomella, MD Cunningham, FG Eyal, KE Zenk. Apple & Lange – 3<sup>rd</sup> edition – 1994
  3. Handbook of Neonatal intensive Care. HL Halliday, G McClure, M Reid. Bailliere Tindall – 3<sup>rd</sup> edition 1989.
- (Feb 2002 - PA/KE, review Feb 2006)

### Diagram 1: Isovolumetric exchange transfusion

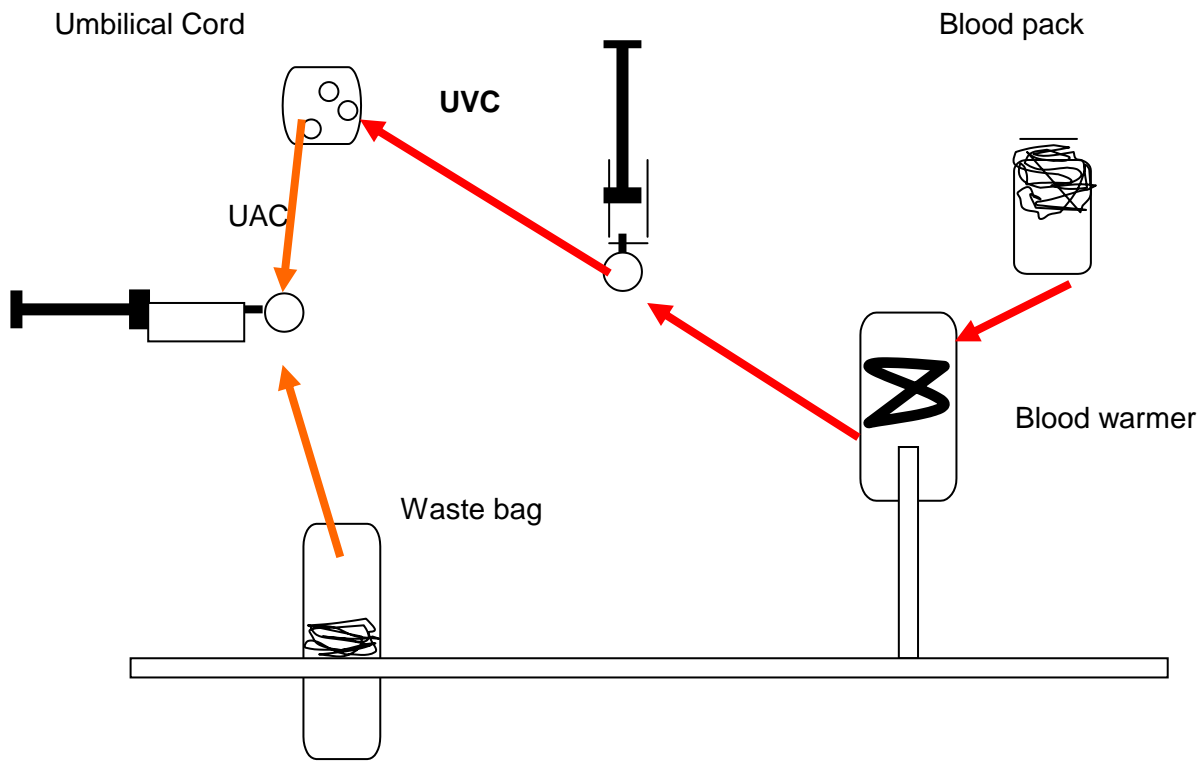


Diagram 2: Single vessel exchange transfusion

