

## EXCHANGE TRANSFUSION

### Introduction

- Exchange transfusion (ET) is indicated for severe hyperbilirubinaemia.
- neonates with significant jaundice should be monitored closely and treated with intensive phototherapy

### Indications

- Blood exchange transfusion to lower the serum bilirubin level and reduce the risk of kernicterus
- Partial exchange transfusion
  - to correct polycythaemia with hyperviscosity
  - to correct severe anaemia without hypovolaemia.

### Preparation of infant

- informed consent from parents
- keep resuscitation equipment on standby
- maintain stable temperature, pulse and respiration.
- place a peripheral line for maintenance intravenous fluid.
- proper gentle restraint.
- continue feeding the child and *omit only the last feed* before the procedure. If < 4 hrs from last feed, empty gastric contents using a nasogastric tube aspiration prior to ET

### Grouping of Blood to be used

Rh isoimmunisation:	ABO compatible, Rh negative blood
Other conditions:	cross-match with baby and mother's blood
Emergency (rarely):	'O' Rh negative blood

### Procedure (Exchange Transfusion)

- volume to be exchanged is twice blood volume (2x80mls/kg)
- use fresh whole blood preferably less than 5 days old
- place a cardiac monitor and record baseline observations on the neonatal exchange blood transfusion sheet. The following observations are recorded every 15 minutes: heart rate, respiration, oxygen saturation.
- strict aseptic technique with gown and mask
- cannulate umbilical vein to depth *not* > 5-7cm (for push-pull technique through an umbilical venous catheter). (*see chapter on Procedures for umbilical vein cannulation*)
- use 5-8 mls/kg aliquots of blood for removal and replacement (< 10% of blood volume) Maximum volume per cycle - 20 mls for term infants
- the assisting nurse keeps a record of the amount of blood given or withdrawn, and medication given.

### *Isovolumetric or continuous technique*

- indication: when umbilical vein cannulation is not possible e.g. umbilical sepsis, failed cannulation
- blood is replaced as a continuous infusion into a large peripheral vein while removing small amount blood from an arterial catheter at regular intervals.
  - in smaller infants, e.g. 1.5 kg baby, total volume for exchange is 240 mls. Delivering 120mls / hour, allowing 10 ml of blood to be removed every 5 mins for 2 hours.

## Points to note

- blood volume to exchange = 160mls/kg body weight {2 x blood volume (80 mL/kg)}
- pre-warm blood. Do not overheat blood.
- rate of exchange is 4-5 minutes per cycle:  
*1 min 'out', 1 min 'in', 1-2 min 'pause'; excludes time to discard blood and draw from blood bag*
- total exchange time should be about 90 - 120 mins.
- start exchange with removal of blood, so that there is always a deficit to avoid cardiac overload
- dilute and give:
  - 1 ml of 4.2% sodium bicarbonate for every 100mls of blood exchanged
  - 1 ml of 10% calcium gluconate for every 160mls of blood exchanged
  - *never give the two (NaHCO<sub>3</sub> & Ca gluconate) solutions together. Use a peripheral vein and not the umbilical vein (UVC).*
- shake blood bag gently and frequently to prevent settling of red blood cells
- remove UVC after procedure unless a second ET is anticipated and the UVC insertion was difficult
- continue intensive phototherapy after the ET
- repeat ET may be required in 6 hours for infants with high rebound of serum bilirubin
- feed after 4-6 hours if patient is well and a repeat ET not required.
- if child is anaemic (pre-exchange Hb <12 g/dL) give an extra aliquot volume of blood (10 mls/kg) at the end of transfusion at a rate of 5 mls/kg/hr after the ET

**Table 1. Complications of ET**

<i>Catheter related</i>
infection
haemorrhage
necrotizing enterocolitis
air embolism
portal and splenic vein thrombosis (late sequelae)
<i>Haemodynamic problems</i>
overload cardiac failure
hypovolaemic shock
arrhythmia (catheter tip near sinus node in right atrium)
bradycardia with calcium bolus
<i>Electrolyte imbalance</i>
hyperkalemia
hypocalcemia
hyper- and hypo-glycaemia
metabolic acidosis, alkalosis (late breakdown of citrate)

## Investigations

### Pre-exchange (1st volume of blood removed)

- serum bilirubin
- full blood count
- blood cultures as indicated (through peripheral venous blood)
- others as indicated if patient is unwell

### 4 to 6 hour post-exchange

- serum bilirubin

### Post-exchange

(always discard the blood remaining in the UVC first before sampling)

- serum bilirubin
- full blood count
- dextrostix
- serum electrolytes
- serum calcium
- others as indicated

### Partial Exchange Transfusion

- to correct *hyperviscosity due to polycythaemia*

(central haematocrit or packed cell volume, PCV of > 65%)

$$\text{Volume exchanged (in mL)} = \frac{\text{Blood volume} \times (\text{PCV initial} - \text{PCV desired})}{\text{PCV initial}}$$

- to correct *anaemia without hypovolaemia*

$$\text{Volume exchanged (in mL)} = \frac{\text{Blood volume (mL)} \times (\text{Hb desired} - \text{Hb initial})}{(\text{Hb donor} - \text{Hb initial})}$$

*Where blood volume for term infant is 80 ml/kg body weight*

## Follow-up

- long term follow-up to monitor hearing and neurodevelopmental assessment