Management of Polycythaemia

Polycythaemia (Pct) occurs in 1.5%-4% of newborn infants and can be defined as a central venous haematocrit (Hct) >65% for both term and preterm infants. Neonates are at higher risk of polycythaemia as neonatal red blood cells are less filterable and deformable: however Pct occurs rarely in premature infants less than 34 weeks gestation. The Hct peaks at 4-6 hours of age, then slowly drops and stabilises by 24 hours of age. Peripheral samples taken by heel pricks usually demonstrate higher Hct due to poor blood flow, when compared to free flowing central samples taken from an artery or vein. At Hcts of 60-65% there is a linear relationship between blood viscosity and Hct, but this relationship increases exponentially at Hct above 65%.

Causes/risk factors:
Aetiology can be broadly divided into 2 areas, either increased erythropoietin production secondary to intrauterine hypoxia OR due to increased blood volume. Chronic fetal hypoxia leads to increased neonatal erythropoiesis, e.g. IUGR, infant of diabetic mother, placental insufficiency due to maternal hypertension, maternal smoking and fetal hyperthyroidism. Acute hypoxic conditions like perinatal asphyxia can also cause polycythaemia. Increased blood volume due to placental transfusion is often seen following delayed cord clamping, recipient of twin-twin transfusion, maternal-fetal transfusion and also due to fluid shift in fetal hypoxia. Rarer caused include trisomies, hypothryoidism, Beckwith-Wiedemann syndrome.

Symptoms/Signs:
Most neonates are asymptomatic. Symptoms are related to increased blood viscosity (Hct>65%) and alterations in organ blood flow. They usually become evident within first 24-48 hours. Symptoms and signs include lethargy, poor feeding, vomiting, respiratory distress, tachyypnea, apnoea, hypoglycaemia, hypotonia, jitteriness and irritability. Some of the above symptoms and signs are secondary to hypoglycaemia.

Possible complications:

Treatment:
Whilst managing Pct always consider the underlying cause which may need further investigation and/or treatment. There is no consensus for how best to manage polycythaemia. The usual management approach is a partial exchange transfusion (PET) which results in haemodilution. PET has been shown to decrease pulmonary vascular resistance, increase cerebral blood flow, correct hypoglycemia, and improve renal function. It does not correct neurologic abnormalities in the newborn period or prevent long-term neurologic dysfunction, as they depend on the underlying condition.
If capillary Hct >65%, obtain a central Hct. Make all management decisions based on central Hct. Exclude dehydration. If symptomatic and central Hct >65%, consider performing a PET.

If asymptomatic and central Hct 65%-69%, maintain hydration and increase fluids by 20-30ml/kg, watch for symptoms, repeat a Hct in 4-6 hours. If asymptomatic and central Hct >70% central and not decreasing following a repeat sample, perform a PET.

Co-existing low platelet counts also favour the decision to perform a PET.

**Always discuss with consultant before deciding for PET.**

**PET is a shorter and less invasive procedure than a double volume exchange transfusion. Hence, requires less onerous nursing care.**

- **Central Hct >65%**
  - **Symptomatic (>65%)** Perform PET
  - **Asymptomatic (65-70%)** Increase hydration
  - **Asymptomatic (>70%)** Perform PET

**Partial Exchange Transfusion:**

The goal of PET is to reduce the hematocrit and blood viscosity while maintaining circulatory volume.

*Volume to be transfused:* In ml = \( \text{Observed Hct} - \text{Desired Hct} \times \text{weight (in kg)} \times 80 \times \text{Observed Hct} \)

* circulating blood volume in term baby in ml/kg
This usually works out to be @20-30 ml/kg.
The aim is to bring Hct down to 50-55%.

**Fluid:** normal saline, there is no evidence to support better outcomes with human albumin solution or FFP.

**Procedure of PET:** Withdraw blood from umbilical venous line / umbilical arterial line / peripheral arterial line in 5 to 10 ml aliquots slowly. Simultaneously, infuse normal saline by peripheral canula at the same rate. Aim is to complete the exchange over 30-60 minutes. Do not allow the infant to get cold; check blood glucose, calcium, U/E, bilirubin after the procedure. Consider stopping feeds briefly.

**References:**

Nitin Goel and S Barr July 2013, to be updated July 2016