CLINICAL GUIDELINE	
Polycythaemia and Hyperviscosity	
Scope (Staff):	Nursing and Medical Staff
Scope (Area):	NICU KEMH, NICU PCH, NETS WA

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Polycythaemia is defined as a venous haematocrit **(Hct) > 65%.** Incidence in healthy neonates is 0.4-5%. Capillary measurements are higher subject to variations in blood flow than venous samples and should be used only as a screening technique.

Hyperviscosity is common and results in increased resistance to blood flow and hence increased risk of circulatory impairment.

Polycythaemia occurs as a result of active erythropoiesis or passive transfusion. The haematocrit increases after birth, peaks at 2-6 hours of life, then drops slowly to cord blood values at 18 hours, thereafter it stays relatively stable (Ramamurthy et al 1987). Because instruments to measure viscosity (microviscosimeters) are mostly not available it is diagnosed by a combination of symptoms and Hct.

Conditions that predispose newborns to hyperviscosity include the following:

- Delayed cord clamping
- Twin to twin transfusions (recipient twin)
- Maternal foetal transfusion
- Prenatal asphyxia
- Intrauterine hypoxia, e.g. SGA (utero-placental insufficiency)
- Maternal diabetes
- Maternal hypertension
- Maternal smoking
- Rare conditions: Beckwith-Wiederman and Trisomies 13, 18 and 21.

Clinical Features

- Lethargy and poor feeding
- RDS (pulmonary capillary sludging), cyanosis, failure of / delayed transition
- CNS depression ~Tremors, jitteriness, seizures, coma
- Hypoglycaemia (12% to 40%)
- Hypocalcaemia
- Poor renal function (renal vein thrombosis)
- Jaundice
- NEC (mesenteric hypoxia)
- Cardiac symptoms such as tachypnoea, cyanosis, tachycardia, cardiomegaly in up to 50% of plethoric infants

- Abnormal coagulation profile, thrombocytopenia

Treatment

Management of hyperviscosity is controversial (Partial exchange transfusion vs. non-invasive management) in neonates.

- Partial exchange transfusion **(PET)** reverses the physiological abnormalities and ameliorates symptoms. It also improves cerebral blood flow and hemodynamic parameters but doesn't improve long term outcomes. PET may be associated with increased risk of NEC (*Mimouni 2011, Black 1985*). PET is recommended for those infants with abnormal signs and should be performed as early as possible under intensive monitoring (*Mimouni 2011, Remon 2011*).
  - The goal is to decrease the haematocrit to 50-55%.
  - Where the blood volume is estimated at 90 mL/kg the following formula is used to calculate the partial exchange volume.

Volume exchanged (mL) =	Wt (kg) x (Blood volume) x (Hct of patient- Desired Hct)
	Hct of patient

  - Normal saline is isotonic and safe as a partial exchange medium. Aliquots should not exceed approximately 5 mL/kg and should be delivered or removed over 2-3 minutes.
- In a small retrospective cohort study, intravenous bolus of normal saline (10-20 ml/kg) followed by increased total fluid intake (by 10-20 ml/kg/day) showed resolution of symptoms in polycythemic infants as compared to normal saline bolus or increased fluid rate or observation without intervention alone, but the differences were statistically insignificant (*Alsafadi et al 2014*).

Related CAHS internal policies, procedures and guidelines
Neonatology Guideline • Exchange Transfusion

References and related external legislation, policies, and guidelines

1. Alsafadi TR, Hashmi SM, Youssef HA, Suliman AK, Abbas HM, Albaloushi MH. Polycythemia in neonatal intensive care unit, risk factors, symptoms, pattern, and management controversy. J Clin Neonatol. 2014 Apr; 3(2):93-8.
2. Watchko JF. Common hematologic problems in the newborn nursery. Pediatr Clin North Am. 2015 Apr;62(2):509-24.
3. Black LV, Maheshwari A. Disorders of the fetomaternal unit: hematologic manifestations in the fetus and neonate. Semin Perinatol. 2009;33:12–19.
4. Brugnara C, Platt OS. The neonatal erythrocyte and its disorders. Nathan and Oski's Hematology of Infancy and Childhood. Vol. 1. 7th ed. Philadelphia, PA: Elsevier; 2009:36–66.
5. Dempsey EM, Barrington K. Short and long term outcomes following partial exchange transfusion in the polycythaemic newborn: a systematic review. Arch Dis Child Fetal Neonatal Ed. 2006; 91:F2–F6.
6. De Waal KA, Baerts W, Offringa M. Systematic review of the optimal fluid for dilutional exchange transfusion in neonatal polycythaemia. Arch Dis Child Fetal Neonatal Ed. 2006;91:F7–F10.

7. Jeevasankar M, Agarwal R, Chawla D, Paul VK, Deorari AK. Polycythemia in the newborn. Indian J Pediatr. 2008;75:68–72.
8. Juan I. Remon, Aarti Raghavan and Akhil Maheshwari. Polycythemia in the Newborn. *Neoreviews* 2011;12;e20.
9. Ozek E, Soll R, Schimmel MS. Partial exchange transfusion to prevent neurodevelopmental disability in infants with polycythemia. Cochrane Database Syst Rev. 2010;1:CD005089.
10. Rosenkrantz TS. Polycythemia and hyperviscosity in the newborn. Semin Thromb Hemost. 2003;29:515–527.

Sarkar S, Rosenkrantz TS. Neonatal polycythemia and hyperviscosity. Semin Fetal Neonatal Med. 2008;13:248–255.

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