



Blood glucose homeostasis in the neonate

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Glucose homeostasis in the neonate

- Constant supply is vital
- Requirements are high in utero and in the neonatal period compared with adult
- Rate of glucose stores increases in third trimester of pregnancy
- Birth – shift from intra-uterine to neonatal state – ‘energy crunch’

GLUCOSE

- Essential for cellular respiration
- Newborn infant performs.....
- 1 -glucogenolysis (glucose is obtained from glycogen stores)
- 2 -the production of energy from other sources
- Homeostasis is controlled by insulin and glucagon – opposing actions
- Brain also relies on alternative fuels – lactate, fatty acids and ketones

NORMAL VALUES

- NO UNIVERSALLY ACCEPTED DEFINITION OF NORMAL VALUE
- Values are influenced by gestation, birthweight, postnatal age and feeding practice
- Current evidence – 2.6 mmol/L
- This continues as a general rule of thumb
- (Cornblath, 2000; Hawdon, 2000; Hawdon, 2005; UNICEF, 2013)

HYPOGLYCAEMIA

- *Symptomatic OR asymptomatic?*
- Symptomatic ---
- Apnoea
- Cyanosis
- Jittery
- Abnormal cry
- Convulsions
- Associated with adverse outcome
- Treat immediately
- (Deshpande and Ward Platt, 2005)

Causes of hypoglycaemia

- **REDUCED STORES**
- Prematurity
- IUGR
- Inborn errors of metabolism
- **INCREASED UTILISATION**
- Hypoxia
- Sepsis
- Hypothermia
- IDM
- Conditions that cause hyperinsulinaemia or malfunction of pancreatic islet cells

Management

- **PREVENTION**
- Avoid cold stress
- Early feeding (healthy / at-risk, well)
- OR 10% Dextrose if enteral feeds are contraindicated
- Check capillary glucose regularly for 24 hours, according to local policy

Asymptomatic

- Send the test to lab
- Feed
- Correct precipitating factors
- Hourly testing
- If <1.5 , treat as for symptomatic
- Regular measurements

Symptomatic

- EMERGENCY
- Commence 10% glucose IV – bolus followed by infusion
- Glucagon (IM) or Hypostop can be given if IV access not possible
- Adjust rate of infusion
- May change to 15% glucose (central)
- Reduce gradually

Infant of a Diabetic mother (IDM)

- The metabolic changes in diabetic pregnancy can adversely affect the developing fetus
- Abnormal metabolic environment results in higher congenital malformations
- In pregnancy (3rd trimester) – mother may become insulin resistant resulting in hyperglycaemia
- Excess glucose and amino acids are delivered to fetus but NO insulin
- Fetal pancreas produces insulin to use excess fuels leading increased release of insulin.
- High rate of fetal growth and increased fat ensues as well as a high risk of hypoglycaemia after birth

Clinical presentation

- *IDM- Potential for....*
- Hypoglycaemia
- Macrosomia
- Respiratory distress
- Cardiomyopathy
- Polycythaemia
- Congenital malformations more likely
e.g. cardiac, neural tube

HYPERGLYCAEMIA (>8 MMOLS)

- **CAUSES:**
- Stress (eg asphyxia, surgery)
- Drug therapy (e.g.- dexamethasone)
- Excess glucose (Total Parenteral Nutrition)
- Intolerance to normal glucose load – e.g. prematurity (immature insulin and regulatory mechanisms)
- Diabetes mellitus – early onset

Management

- Reduce glucose
- Insulin
- Be aware of potential complications – osmotic diuresis AND neurological injury from the effects of osmolarity of fluid in the brain

Further Reading

- Cornblath M, Hawdon JM, Williams AF, Aynsley Green A, Ward Platt MP, Schwartz R and Kalhan SC (2000) Controversies regarding definition of neonatal hypoglycaemia; suggested operational thresholds *Pediatrics*, 105, 5, 1141-1145.
<http://pediatrics.aappublications.org/content/105/5/1141.long>
- Cowett RM and Longhead JL (2002) Neonatal glucose metabolism; differential diagnoses, evaluation and treatment of hypoglycaemia *Neonatal Network*, 21,4, 9-19
- Deshpande S and Ward Platt M (2005) The investigation and management of neonatal hypoglycaemia, *Seminars in Fetal and Neonatal Medicine* 10(4):351-362
- Hawdon JM (2000) Controversies regarding definition of neonatal hypoglycaemia : Implications for neonatal nursing *Journal of Neonatal Nursing* 6,5, 169-171
- Hawdon JM (2005) Blood Glucose levels in infancy- clinical significance and accurate measurement *Infant*, 2, 2, 24-27. http://www.neonatal-nursing.co.uk/pdf/inf_001_bgl.pdf
- Petty, J. (2010). Fact Sheet: Adaptation of the Newborn to Extra-uterine life Part 2; Thermoregulation and glucose homeostasis. *Journal of Neonatal Nursing*, 16 (5), 198-199.
- UNICEF Baby Friendly Initiative (2013) Hypoglycaemia Guidance
http://www.unicef.org.uk/Documents/Baby_Friendly/Guidance/hypo_policy.pdf?epslanguage=en
- Williams AF (2005) Neonatal Hypoglycaemia; clinical and legal aspects *Seminars in Fetal and Neonatal Medicine*, 10, 4, 363-368