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 (e.g. 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

- Williams AF (2005) Neonatal Hypoglycaemia; clinical and legal aspects *Seminars in Fetal and Neonatal Medicine*, 10, 4, 363-368