HYPOGLYCAEMIA

Asymptomatic hypoglycaemia is a common transient problem in most neonates. Symptomatic hypoglycaemia is an emergency and requires intravenous treatment.

Symptoms are non-specific:
- Lethargy
- Pallor
- Hypotonia
- Hypotension
- Poor feeding
- Irritability
- Temperature instability
- Sweating
- Tachycardia
- Apnoea
- Seizures

The fetus under normal conditions derives all its glucose from the mother. At birth all infants must initiate glucose production and absorption. Most are able to mobilise glycogen, initiate gluconeogenesis and produce glucose at a rate of 4 – 6 mg/kg/min. This is usually adequate to maintain euglycaemia - normal blood glucose. A plasma glucose (blood glucose) level (PGL) of 2.5 mmol/L or below is accepted as indicating hypoglycaemia.

CAUSES AND INFANTS AT RISK

1. TRANSIENT - CAN BE ASYMPTOMATIC OR SYMPTOMATIC AND IS GENERALLY DUE TO DEPLETED GLYCOGEN STORES.
   - Preterm (<37 weeks)
   - Intrauterine growth restriction (birth weight <10th percentile)
   - Maternal drug therapy. There is quite a long list of drugs that may cause hypoglycaemia of which beta blockers and oral hypoglycaemics are the most common. Check individual drugs with Pharmacy.
   - Neonatal encephalopathy / asphyxia.
   - Hypothermia.
   - Rhesus haemolytic disease with Hb<10g
   - Erythroblastosis fetalis.
   - Septicaemia
   - Iatrogenic causes, IV tissued, inadequate feeding.
2. PERSISTENT OR RECURRENT – MOSTLY DUE TO HYPERINSULINISM

- Infant of diabetic mother
- Intrapartum administration of excess glucose.
- Endocrine disorders: pituitary, adrenal, glucagon deficiencies.
- Inborn errors of metabolism: carbohydrate, amino-acid or fatty acid metabolism.
- HDN with exchange transfusion

MANAGEMENT OF INFANTS AT RISK OF HYPOGLYCAEMIA

It is important to explain to the parents of at-risk infants that their infant is more likely than others to develop hypoglycaemia, and that their infant will need close monitoring of blood glucose.

EARLY ENERGY PROVISION (WITHIN 1-2 HOURS OF BIRTH).

- Enteral feeding – 3 hourly. Start at 100mL/kg/day or 12.5mL/kg/feed (start 3 hourly) - provides 5.8 mg/Kg/min of glucose.
- Breast-feed – 3 hourly or more frequent if demanding.
- If enteral feeding is not possible then admit to NICU and give IV 10% Glucose of at least 3mL/kg/hour (providing 4.9 mg/kg/min of glucose).

GLUCOSE MONITORING

1. Whole blood glucose (satellite lab) or plasma glucose (biochemistry lab) is first done pre second feed or as indicated.
2. Repeat 6 hourly in first 24 hours (according to progress) MAY NEED MORE FREQUENT CHECKS.
3. When 2 PGLs are ≥ 2.6mmol and full enteral feeds are tolerated, cease monitoring.
4. For infants on enteral feeds and intravenous glucose, the volume of intravenous glucose can be reduced 6-12hrly by half, then half again if PGL is maintained ≥ 2.6mmol. Stop IV glucose if PGL is maintained ≥ 2.6mmol on two occasions. Monitor PGL when on full enteral feeds for at least 24hrs.

INVESTIGATION OF NEONATAL HYPOGLYCAEMIA

If the decision is made to investigate a neonate for unexplained hypoglycaemia then the following investigations may be helpful. The blood samples MUST be collected at the time of hypoglycaemia.

- 1 mL of clotted blood (red top tube). Request insulin, cortisol, and growth hormone.
- 0.2 mL of heparinised blood (green top tube). Request glucose and β-hydroxybutyrate.
- Blood gas analysis, including lactate.
- The NEXT urine passed is important regardless of the volume. Aim for 5 mL urine. Request amino acids and organic acids.

If there are any queries regarding these investigations, please contact the Biochemical Genetics Unit on Ext 8473.
MANAGEMENT OF ASYMPTOMATIC INFANTS WITH PGL 1.5 - 2.5MMOL/L

ENTERALLY FED:
1. Needs paediatric registrar to review. Increase feed volume or supplement volume to 15mL/kg/feed (provides 7 mg/kg/min of glucose). Feeds can be increased in frequency, to continuous feeds, or fortified (if no contraindications) or volume to a maximum of 150 mL/kg/day.
2. Admit to NICU if:
   - Feeds are not tolerated.
   - PGL remains between 1.5-2.5mmol/L despite the increased feeds.
   - Infant becomes symptomatic.
3. If IV infusion is necessary and there is delay or problems in siting IV, consider glucagon IM/IV 100 micrograms/kg.

PARENTERALLY FED:
Increase IV rate, or glucose concentration of fluid, to provide 7.5-8mg/kg/min of glucose i.e. rate to 5mls/kg/hour or concentration to 15%. Max volume 150mL/kg/day.

MANAGEMENT OF ASYMPTOMATIC INFANTS WITH PGL < 1.5MMOL/L
1. Admit to NICU stat, take sample for accurate PGL and insulin bloods (as above) but do not wait for the results. Supplemental intravenous glucose therapy is to be commenced. A mini-bolus of 2mL/kg of 10% Dextrose IV may be given immediately prior to commencing continuous infusion. A recent audit demonstrated that this group of infants require IV glucose to normalise their blood glucose levels.
2. Provide 6-8mg/kg/min of glucose and infuse at a minimum rate to maintain blood glucose ≥2.6mmol/L.
3. If PGL remains below 2.6 mmol/L, increase glucose intake rate in steps of 2 mg/kg/min every 15-30 min with repeat checks on blood glucose till the values are > 2.6 mmol/L.
4. Recheck after 30minutes.
5. If well above 2.6 mmol/L, reduce frequency of checking to hourly and then gradually to 4-6 hourly.
6. Once PGL ≥2.6mmol/L for at least 12 hours, and preferably 24 hours, then IV supplemental glucose may be gradually reduced over 24-48hrs. Continue PGL monitoring 6-12hrly until PGL ≥2.6mmol on 2 occasions on full enteral feeds of EBM or standard formula.

SYMPTOMATIC INFANTS (SEIZURES, REDUCED CONSCIOUSNESS)
1. Admit to NICU stat, contact paediatric registrar.
2. Take sample for accurate PGL and insulin bloods (as above) but do not wait for the results. If problems siting IV, give glucagon IM, 100 micrograms/kg.
3. Mini-Bolus of 2mL/kg of 10% Dextrose IV may be given followed by an IV 10% dextrose infusion at 6-8 mg/kg/min.
4. Re-check PGL after 15-30 min.
5. If well above 2.6 mmol/L, reduce frequency of checking to hourly and then gradually to 4-6 hourly.
6. If PGL remains below 2.6 mmol/L, increase glucose intake rate in steps of 2 mg/kg/min every 15-30 min with repeat checks on blood glucose till the values are > 2.6 mmol/L.
7. Taper infusion at 2 mg/kg/min every 6 hours once the blood glucose values stabilize above 2.6 mmol/L, for about 24 hours, the infusion can be stopped once a GIR of 4 mg/kg/min is reached, if the neonate is euglycemic.

If hypoglycaemia is persistent, recurrent, or resistant to treatment, or >10 mg/kg/min glucose delivery is required to maintain adequate plasma glucose levels then investigate further.

FOR SUCCESSFUL BREASTFEEDING AND TO AVOID PROLONGED HYPOGLYCAEMIA

1. Offer infant to mother for skin to skin cuddle under warm blankets.
2. Offer the mother the option and assist with breastfeeding in theatre.
3. Offer 3 hourly breastfeeds until lactation established as women with diabetes may have delayed onset of lactation.

Note: All efforts are made to avoid prolonged hypoglycaemia (PGL < 2.6 mmol/L). Management in NCCU may include nasogastric feeding, IV glucose, and/or IM glucagon.

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SEE QUICK REFERENCE GUIDE NEXT PAGE FOR POSTNATAL WARD FEEDING MANAGEMENT OF INFANTS ≥37/40 OF WOMEN WITH DIABETES.

FOLLOW-UP FOR INFANTS WITH EVIDENCE OF HYPOGLYCAEMIA

All infants who have been symptomatic or had persistent asymptomatic hypoglycaemia need follow up, the intensity of which needs to be graded to the severity. Discuss with neonatologist.

REFERENCES

QUICK REFERENCE GUIDE
POSTNATAL WARD FEEDING MANAGEMENT OF INFANTS ≥37/40 OF WOMEN WITH DIABETES

BREAST FEED BEFORE 1 HOUR OF AGE (WHO)²,⁴

1. If mother unable to breastfeed, or infant not interested in breast feeding, give expressed breast milk or infant formula 12mL/kg by bottle

2. Plasma Glucose Level* (PGL) and temperature pre 2nd feed (within 4 hours of age)³

3. If pre 2nd feed PGL is 2.0 – 2.5 mmol/L, infant is asymptomatic and exclusively breast feeding/expressed breast milk feeding*, administer the 1st dose of glucose gel at 0.5mL/kg and offer breast or expressed breast milk feed at 12mL/kg. (*see point 8 if mixed feeding or formula feeding).

4. PGL 15 mins after the administration of glucose gel.

5. Give 2nd dose of glucose gel (0.5mL/kg) if PGL at 15mins remains <2.6 mmol/L

6. If repeat PGL at 15mins remains <2.6 mmol/L notify paediatric registrar

7. *If mixed feeding or formula feeding give 12mL/kg infant formula by bottle and repeat PGL 1 hr post feed. If repeat PGL <2.6 mmol/L notify paediatric registrar.

8. PGL prior to each subsequent feed until 2 consecutive PGLs ≥2.6 mmol/L¹

Symptomatic infant (jittery, lethargic) page the Special Care Nursery (SCN) Paediatric Registrar - 3249 for urgent review

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PGL < 2 MMOL/L
- Notify Paediatric Registrar page 3249
- Transfer to SCN stat
- Feed baby breast milk or Infant formula 12mls/kg per feed

PGL 2 – 2.5 MMOL/L
- Breast feeding
  - Administer glucose gel 0.5mL/kg and offer BF or EBM feed (12mL/kg)
  - 15 min post gel check PGL
  - If PGL <2.6mmol/L give 2nd dose of gel and repeat PGL in 15mins
  - If PGL remains <2.6mmol/L notify paediatric registrar

PGL 2 – 2.5 MMOL/L
- Formula feeding
  - Feed infant formula or EBM/formula at 12mL/kg by bottle
  - Check PGL 1hr post feed.
  - If PGL <2.6mmol/L notify paediatric registrar

PGL ≥ 2.6 MMOL/L
- Feed 3 hourly
- PGL prior to each feed
- Cease PGL monitoring when two successive PGL’s ≥2.6mmol/L

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Section: 10 metabolic Management
Hypoglycaemia
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