GUIDELINE

Hypoglycaemia

Scope (Staff):	Nursing and Medical Staff
Scope (Area):	KEMH postnatal wards, NICU KEMH, NICU PCH, NETS WA

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CAHS Child Safe Organisation Commitment Statement

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Aim

To facilitate early recognition and management of hypoglycaemia in infants at risk.

Risk

Symptomatic hypoglycaemia is a medical emergency and requires intravenous treatment. Failure to recognise and manage hypoglycaemia early in the newborn period may increase morbidity and mortality.

Background

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

Symptoms include:

- CNS excitation: irritability, jitteriness, seizures.
- CNS depression: Hypotonia, lethargy, poor feeding, apnoea's.
- Non-specific: temperature instability, sweating, tachycardia.

The fetus under normal conditions derives all its glucose from the mother. At birth all infants must initiate glucose production and absorption. Most can 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.

The definition used at KEMH and PCH for hypoglycaemia is a blood glucose level (BGL) < 2.6mmol/L.

Cause /Risk Factors for Hypoglycaemia

The cause/risk factors for hypoglycaemia can be divided into:

Inadequate supply or reduced glycogen stores	Increased utilisation	Hormone/metabolism imbalance
• Prematurity • Small for gestational age • Poor feeding • Peripheral IV tissued	• Infection • Respiratory Distress Syndrome • Hypothermia • Perinatal Asphyxia • Hyperthermia • Erythroblastosis Fetalis	• Infant of a diabetic mother • Persistent hyperinsulinaemic hypoglycaemia of infancy • Inborn errors of metabolism • Syndrome: Beckwith-Wiedemann • Pancreatic tumour • Congenital adrenal hyperplasia • Hypopituitarism

Persistent or recurrent hypoglycaemia (≥ 2 episodes of hypoglycaemia) warrants further investigation. It is commonly caused by hyperinsulinism secondary to maternal diabetes however other differentials should be considered such as Congenital Adrenal Hyperplasia, syndromes, and inborn errors of metabolism.

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 sugar levels. Refer to Quick reference guide for management.

Infants at risk of hypoglycaemia that require early energy provision and BGL monitoring:

- Infants of mothers with diabetes (insulin-dependent, type 2 DM or GDM).
- Infants weighing <2.5kg
- Infants who are small for gestational age (<10th percentile) refer to Appendix 1
- Infants who are large for gestational age (>97th centile) refer to Appendix 1
- Preterm infants (<37 weeks gestation).
- Infants of mothers who received antenatal corticosteroids >34 weeks gestation.
- Infants of mothers who received beta blockers in the 3rd trimester.

Early Energy Provision - Within 1-2 Hours of Birth

- Assist thermoregulation by offering early skin to skin under warm blankets.
- **Within the first hour** after birth offer a breast feed followed by 3hrly feeds/more frequently if demanding.
- If **first** breastfeed is ineffective, consider supplemented enteral feeding (if not contraindicated.) Offer EBM/Term formula at 60ml/kg/day, immediately following the ineffective breast feed.
- If not breast feeding, offer Term formula 7.5ml/kg **within the first hour** of birth followed by 3hrly feeds at 60ml/kg/day.
- If enteral feeding is not possible then admit to Special Care Nursery and give IV 10% Glucose. Start at 60mL/kg/day (providing 4.2 mg/kg/min of glucose).

Glucose Monitoring of at-Risk Infants
• Whole blood glucose (blood gas analyser) or plasma glucose (biochemistry lab) should be performed. Reagent strips should not be used for neonatal BGL monitoring. • For at risk infants, first sample taken pre-second feed (3-4 hours of age). • If infant feeding well and BGL ≥ 2.6mmol then repeat BGL 6 hourly (pre-feed).   ○ If 2 consecutive BGLs are ≥ 2.6mmol/L, then stop regular monitoring and test only if infant becomes symptomatic.

Management of Hypoglycaemia

Asymptomatic Infants with BGL 1.5-2.5mmol/L

Needs paediatric RMO/ registrar review - consider “hypoglycaemia screen” (see below) and need for admission to SCN.
 	
Enteral Feeding
• Start enteral feeding at 60-80mL/kg/day if no contra-indications.
• Consider oral glucose gel 0.5ml/kg
• If there is insufficient breast milk and parents decline formula, escalate rapidly to senior neonatal staff to avoid delays in treatment.
• If persistent or recurrent hypoglycaemia, then increase feed volume to 80-100ml/kg/day.
• Consider more regular feeds (2 hourly)
• Admit to SCN for IV dextrose if:
  ○ BGL remains between 1.5-2.5mmol/L despite the increased feeds.
  ○ Infant is symptomatic (lethargic with inadequate feeds, seizure).
 	
Parenteral Supplementation
• If unable to obtain IV access, consider glucagon (IM 100 micrograms/kg) and consider siting a UVC.
• Commence IV supplementation with 10% glucose at 60-80-mL/kg/day.
  ○ Consider bolus of 2-4mL/kg of 10% glucose.
• Monitoring
  ○ Repeat BGL after 30 minutes of IV glucose, if normal then check again at 3 hours.

- If 30 minute and 3-hour BGL is normal, monitor BGL 3-6 hourly.

Asymptomatic Infants with BGL < 1.5mmol/L

Admit to SCN immediately for IV supplementation.

- Take hypoglycaemia screen (see below) if it does not delay treatment significantly.
- Consider bolus of 2-4ml/kg of 10% glucose
- Consider IM glucagon (100micrograms/kg)
- Commence IV supplementation with 10% dextrose at 60-80mL/kg/day
  - If hypoglycaemia continues, then aim to increase GIR by 2-3mg/kg/min (Increase total fluids by 20-30mL/kg/day or increase glucose concentration by 2.5-5%). Be aware of potential hyponatraemia with higher volumes of fluids.
  - If needing > 12.5% glucose, then central access (UVC) is required.
- Monitoring
  - Recheck BGL at 30 minutely intervals until BGL is ≥ 2.6mmol/L.
  - Once BGL is ≥ 2.6mmol/L then check 3 hourly.
  - If 2 consecutive 3 hourly BGLs are normal, monitor BGL 6 hourly.

Symptomatic Infants – Seizures, Reduced Consciousness

- **If on the post-natal ward, access and use the hypoglycaemia kit in the emergency trolley**
- **Admit to NICU for urgent IV supplementation**
- Take hypoglycaemia screen (see below) if it does not delay treatment significantly.
- Commence IV supplementation with 10% dextrose at 80-100mL/kg/day.
  - If unable to obtain IV access, give glucagon (IM 100 micrograms/kg) and consider siting UVC.
  - Give bolus of 2-4mL/kg of 10% dextrose; repeat until seizure has stopped.
- Monitoring
  - Recheck BGL at 15-30 minutely intervals until BGL is ≥ 2.6mmol/L.
  - Once BGL is ≥ 2.6mmol/L then check 3 hourly.
- If 2 consecutive 3 hourly BGLs are normal, monitor BGL 6 hourly.

Investigation of Neonatal Hypoglycaemia – "Hypoglycaemia Screen"

If hypoglycaemia is persistent/recurrent (≥ 2 episodes), resistant to treatment, or glucose delivery rate is > 10mg/kg/min then investigate further with a hypoglycaemia screen.

Hypoglycaemia Screen
The critical blood samples **MUST** be collected at the time of hypoglycaemia, wherever safe, prior to commencing supplementation. **DO NOT** administer sucrose before heel stab/ venepuncture.

• 1 mL of clotted blood and 1 mL of heparinised blood (2 small red top and 2 small green top tubes).
  ○ Request insulin, cortisol, growth hormone, glucose, ketones or β-hydroxybutyrate.
• Blood gas analysis: lactate.
• The NEXT urine passed is important (aim for 5 mL urine).
  ○ Request ketones, amino acids, and organic acids.

Persistent Hyperinsulinaemic Hypoglycaemia of Infancy (PHHI)

PHHI is commonly seen in infants born to a mother with gestational diabetes, however, can occur in mothers with a normal glucose tolerance test. It is diagnosed by finding an elevated insulin level during a period of hypoglycaemia. Infants with PHHI may require a significantly higher glucose delivery rate of up to 10-12mg/kg/min.

Infant with PPHI requiring short term diazoxide:

- If glucose delivery rate > 10mg/kg/min and has unstable BGLs then consider diazoxide.
- Please discuss with endocrinology if patient is to commence on diazoxide.
- Infant's on diazoxide that are ready for discharge may require a prolonged fast (6 hours).
- Endocrinology must be informed of all babies ready for discharge home on diazoxide as they will organise both a continuous glucose monitor (CGM) and a 6-week follow-up in their outpatient clinic.

Congenital Hyperinsulinism of Infancy (CHI)

Infants that cannot be weaned off diazoxide or have unstable BGLs on diazoxide may require further investigations to exclude CHI.

CHI is a clinically and genetically heterogeneous disease, is characterized by the unregulated secretion of insulin from pancreatic beta-cells.

The most common and severe forms of CHI are caused by inactivating mutations in ABCC8 and KCNJ11 genes, encoding the two subunits of the pancreatic beta-cell ATP-sensitive potassium channel (KATP). Discuss further with endocrinology.

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. An MRI of the brain should be considered for all infants with severe and/or prolonged hypoglycaemia, or who developed hypoglycaemic seizures.

QUICK REFERENCE GUIDE FOR AT – RISK INFANT

GDM, PRETERM < 37 weeks, SGA, LGA, BW<2.5kg, antenatal steroids >34 weeks, maternal beta blockers
Early enteral feed (within 1hr of age)

- Breastfeed within 1st hour OR term formula 7.5mL/kg if not planning to breastfeed
- If first breastfeed ineffective, offer EBM/Term formula 60mL/kg/day **immediately** post breast feed.
- Feed 3 hourly or more frequently if demanding.
- Perform first BGL pre-second feed. BGL MUST be taken within 3-4 hrs of age.

RANDOM BGL < 2.6mmol/L AND NO RISK FACTOR

Contact RMO, reg, SR or ward consultant for individual plan

*Seizures/ reduced consciousness: access & use hypoglycaemia kit in emergency trolley.

** If there is insufficient breast milk & parents decline formula, escalate rapidly to senior neonatal staff to avoid delays with treatment.

PRE-FEED BGL

BGL< 2.0mmol/L or symptomatic*

- Contact RMO, Reg, SR or ward consultant for individual plan
- Consider admission to SCN
- If BGL<1.5mmol/L, then admit to SCN

BGL < 2.6 mmol/L

- Contact RMO, reg, SR or consultant for individual plan
- Consider increasing feeds to 10-12.5mL/kg.
- If <2.0mmol/L, consider admission to SCN

BGL 2.0-2.5mmol/L

Breastfed Baby
Glucose gel 0.5mL/kg and BF

If inadequate breastfeeding, then give 7.5mL/kg EBM or term formula**

Formula fed Baby

Give 7.5mL/kg of term formula.

Repeat BGL in 30 minutes | *Repeat BGL in 1 hour*

BGL ≥ 2.6mmol/L

Continue with current management

Pre next feed BGL

BGL ≥ 2.6mmol/L

BGL prior to every 2nd feed (6 hourly)

BGL ≥2.6mmol/L on 2 consecutive occasions

Cease monitoring

Related CAHS internal policies, procedures, and guidelines

Neonatal Medication Protocols

- Diazoxide
- Glucagon

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Appendix 1:

Centile Chart for Hypoglycaemia

Birth weight of term babies at the **10th centile**		**Gestation (weeks)**	Birth weight of term babies at the **97th centile**	
Male (weight)	Female (weight)		Male (weight)	Female (weight)
1900	1800	**35**	3280	3200
2170	2050	**36**	3550	3500
2400	2300	**37**	3800	3800
2600	2500	**38**	4020	4020
2800	2650	**39**	4280	4250
3000	2800	**40**	4500	4450
3200	3000	**41**	4750	4680
3400	3150	**42**	5020	4920