HYPOGLYCAEMIA MANAGEMENT FOR NON-DIABETIC PATIENTS

PRACTICE GUIDELINE ©

DOCUMENT SUMMARY/KEY POINTS

- Hypoglycaemia is a medical emergency
- Hypoglycaemia = blood glucose level (BGL) < 2.6mmol/L (< 3mmol/L if symptomatic).
- Check initial capillary BGL in any significantly unwell child, do it early.
- Investigation of hypoglycaemia requires 6.5mL blood and 10-20mL urine.
- Powerchart/FirstNet order sets exist for workup of hypoglycaemia
- Treat hypoglycaemia with 2mL/kg of 10% glucose intravenously if not able to treat orally

CHANGE SUMMARY

- Treatment options updated to include glucose gel, 10% glucose via NG for infants, IM glucagon and revised juice dose
- Updated flow chart
- **11/2/21** – title changed from Hyperglycaemia Management in the Emergency Department to Hyperglycaemia Management for Non-Diabetic Patients.

READ ACKNOWLEDGEMENT

- Emergency Clinical staff are to read and acknowledge they understand the contents of this document.

Approved by:	SCHN Policy, Procedure & Guideline Committee	
Date Effective:	1st October 2020	**Review Period**: 3 years
Team Leader:	Consultant	**Area/Dept**: SCH Endocrinology

Date of Publishing: 11 February 2021 6:51 AM Date of Printing:

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Definition

- Hypoglycaemia = blood glucose level (BGL) < 2.6mmol/L (< 3mmol/L if symptomatic).
- Patients should be triaged to an area where they can be closely observed (minimum triage category 2) if BSL at triage < 3mmol/L.
- Check initial finger prick capillary BGL and ketones (by glucometer) in any unwell child who has persistent vomiting, prolonged fasting, symptoms of hypoglycaemia, reduced level of consciousness or there is clinical concern. Check it early.

Symptoms

(may be none of the following; simply an unwell child)

CNS effects

- Apnoea
- Cyanosis
- Hypotonia
- Coma
- Seizures
- Headache
- Irritability
- Confusion
- Blurred vision

Adrenergic Release

- Tremors
- Hunger
- Sweating
- Pallor
- Weakness
- Tachycardia
- Anxiety

Investigations

"**Hypoglycaemia testing kits**"

- in **CHW ED** are found in the Medication Room (in the top row bins on the left side)
- in **SCH ED** does not have a specific kit but all tubes are available in IV trolleys

These investigations should be performed on everyone with a BGL <2.6 mmol/L prior to the administration of glucose, but should not delay treatment in symptomatic patients. If possible, if asymptomatic, ideally check that the BGL is also <2.6mmol/L (or <3 mmol/L if symptomatic) on the venous blood gas (VBG) before sending the additional blood tests.

Blood

Need a minimum of 6.5mL of blood:

Blood volume and tube	Test
1mL Lithium heparin with gel	Glucose, cortisol
1mL Lithium heparin with gel (on ice)	Lactate, pyruvate
2mL Lithium heparin no gel	Insulin, growth hormone, betahydroxybutyrate
1mL Lithium heparin no gel (on ice) - minimum 0.25ml	Acylcarnitine profile
1mL EDTA (purple)	Free fatty acids
0.5mL VBG	

+ **bedside ketone check**
+ usual bloods 1mL green tube for EUC, LFT, formal BSL, consider FBC, blood culture

- If VBG confirms hypoglycaemia or unable to do VBG, send collected samples to lab
- If more blood can be obtained, the following tests (which do not necessarily need to be collected at the time of hypoglycaemia) should be added: Ammonia, CK
- If difficult bleed send 1 lithium heparin (no gel) on ice and 1 EDTA tube, and please indicate priority samples

At CHW

- Order set in PowerChart/FirstNet called "hypoglycaemia - child" or "hypoglycaemia - neonate" (up to 28 days of age)
- All blood tubes must immediately be placed on **ice** and **carried** to lab urgently
- **Do not put specimens in Lamson Tube system**

At SCH

- PowerChart/FirstNet Order sets "Paed ED hypoglycaemia"
- All blood tubes must immediately be placed on **ice** and sent to lab urgently
- **At SCH** specimens on ice in specimen bag can be sent via "Scud" airtube system)

Urine *(CHW & SCH)*

- Bedside urinalysis dipstick test for reducing substances / ketones / glucose
- 10-20mL for urine metabolic screen – collect first urine passed after hypoglycaemic episode. Bag urine or cotton wool in nappy is appropriate.

Management

Do not delay management in order to collect specimens if symptomatic.

- If conscious and tolerating oral intake then treat with age appropriate oral glucose:
    - <12months: 1mL/kg 40% oral glucose gel (gives 0.4g/kg glucose)
        - Gel can be administered into buccal cavity, orally or via NG with flush
    - 1-5 years: 60mL juice (7.2g glucose)
    - >5 years: 125mL juice (15g glucose)
    - Note: 10% glucose IV solution can also be given via NG tube at 2mL/kg if unable to gain IV access but will tolerate NG feeds
- **If impaired consciousness or not tolerating oral intake then bolus 2mL/kg of 10% glucose IV (do not bolus with 50% glucose).**
    - **Following IV bolus, commence maintenance intravenous fluids made up to 5-10% glucose (max 10% peripherally) aiming for BGL 4-8mmol/L.**
- If impaired consciousness and not able to gain IV access, consider IM glucagon
    - Neonate: 0.1mg/kg (0.1mL/kg)
    - <25kg: ½ vial (0.5mL = 0.5mg)
    - >25kg: full vial (1mL = 1mg)
- Treat the underlying cause if known – e.g. sepsis, hypothermia, dehydration.
- Recheck the BGL frequently (e.g. every 15 minutes, then 30 minutes, then hourly) until BGL stabilises.
- **ALL children** presenting to the ED with hypoglycaemia require admission.
    - At SCH this will be a ward admission usually under the General Medical Team.
    - At CHW, discuss with ED Consultant or Fellow if they are suitable for an Emergency Medical Unit (EMU) admission or require ward admission usually under the General Medical Team.

If continuing hypoglycaemia or infusion rate of glucose above 8mg/kg/min, discuss with Endocrinologist on call, as may require hydrocortisone (particularly in the neonatal period) or IV glucagon infusion with monitoring in ICU.

Glucose infusion rate (GIR)

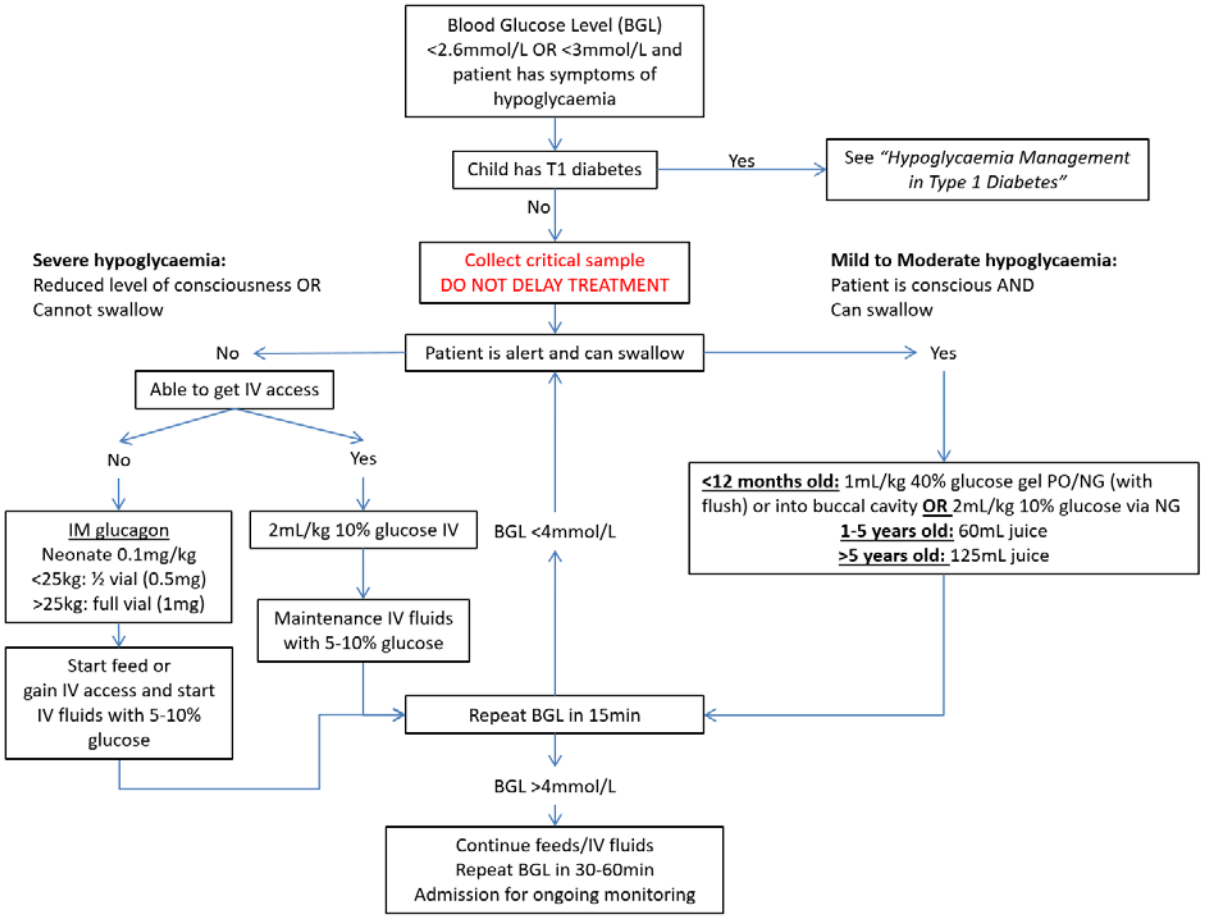
$$GIR = \frac{(\text{Glucose Concentration, } \%) \times (\text{Infusion rate, } mL/hr) \times (1000\ mg/g)}{(\text{Weight, } kg) \times (60\ min/hr) \times 100}$$

NB: Glucagon will only elevate blood glucose acutely in hyperinsulinism if there are good glycogen stores.

Glucose Homeostasis

During fasting, several metabolic systems (glycogenolysis, proteolysis, gluconeogenesis, lipolysis and ketogenesis) are activated to convert energy stores (glycogen, protein and triglycerides) into fuels (glucose, ketones and fatty acids) that other tissues can use. Growth hormone (GH), cortisol, adrenaline and glucagon activate whilst insulin inhibits these fasting systems.[1-3]

Do not delay management in order to collect specimens if symptomatic.



Causes of Hypoglycaemia

Hypoglycaemia	Cause
Idiopathic ketotic hypoglycaemia / accelerated starvation	• age between 1-6 years, more commonly in Caucasian children • hypoglycaemia with elevated blood and urine ketones • hypoglycaemia occurs after fasting (early AM, intercurrent illness) • thought to be due to a lower rate of endogenous glucose production
Defects in glycogenolysis	• Glycogen storage disease
Defects in gluconeogenesis	• Hereditary fructose intolerance • Ethanol intoxication • Fatty acid oxidation disorders • Glutaric acidemia type 2 • Carnitine deficiencies
Counter-regulatory hormone defects	• GH deficiency • Cortisol deficiency • Hypopituitarism • B blocking agents
Hyperinsulinism (absence of ketones)	• Infants of diabetic mothers • Hyperinsulin syndrome • Beckwith-Wiedemann syndrome • Dumping syndrome • Liver disease
Exogenous	• Drugs eg diabetes medications, beta blockers
Substrate deficiency	• Prolonged fasting (includes prolonged vomiting illness) • Restrictive eating • Sepsis • Malnutrition

Ketotic hypoglycaemia is the most common cause of hypoglycaemia under 2 year of age. **This diagnosis requires ketonuria or ketonaemia**. However, the presence of ketones does not exclude a different cause so the above investigations are still required.

Reference

1. Hoe F, Hypoglycaemia in Infants and Children, Advances in Pediatrics 2008 55; 367-384
2. Thornton PS, Stanley CA, De Leon DD, Harris D, Haymond MW, Hussain K, et al. Recommendations from the Pediatric Endocrine Society for Evaluation and Management of Persistent Hypoglycemia in Neonates, Infants, and Children. J Pediatr. 2015;167(2):238-45
3. Achoki R, Opiyo N, English M. Mini-review: Management of hypoglycaemia in children aged 0-59 months. J Trop Pediatr. 2010;56(4):227-34.