Clinical Guideline

MANAGEMENT OF HYPOGLYCAEMIA IN CHILDREN AND YOUNG PEOPLE WITH TYPE 1 DIABETES

SETTING

PATIENTS Children and young people with diabetes mellitus

Guidance

- **Definition of hypoglycaemia**
  In children and young people with diabetes, hypoglycaemia is defined as a plasma glucose concentration sufficiently low to cause signs and/or symptoms. A blood glucose level of ≤ 3.9 mmol/L is recommended as an alert threshold for hypoglycaemia and should prompt timely intervention to prevent progression to clinically significant hypoglycaemia.

- **Signs and Symptoms of Hypoglycaemia ('Hypo')** vary between individuals and may change with age, duration of diabetes, and glycaemic awareness. Some children and adolescents may exhibit multiple or symptoms, while others, particularly those with impaired glycaemic awareness, may have few or no warning symptoms.

  Symptoms and signs can be classified into 3 groups: autonomic, neuroglycopaenic and behavioural. **(The list is not exhaustive and if you suspect a child/adolescent is experiencing a hypo their capillary blood glucose MUST still be checked.)**

Autonomic	Neuroglycopaenic	Behavioural
• Pale • Sweating/clammy • Hungry • Tremor • Restlessness	• Headache • Confusion • Weakness, lethargy • Glazed expression • Visual/speech disturbances • Seizures • Unconsciousness	• Irritability • Mood change • Erratic behaviour • Nausea • Combative behaviour

- **Alcohol and hypoglycaemia**
  Young people with type 1 diabetes should be provided with clear, age-appropriate education regarding the effects of alcohol consumption on blood glucose levels. Particular emphasis should be placed on the increased risk of hypoglycaemia, including delayed and nocturnal hypoglycaemia, due to alcohol induced suppression of hepatic glucose production. Strategies to reduce risk should be discussed as part of routine diabetes education.

- **Treatment of Hypoglycaemia:**
  The management of hypoglycaemia depends on severity, which ISPAD 2022 classifies as Level 1, Level 2, and Level 3 combining glucose thresholds with clinical impact, providing international consistency and reducing ambiguity between "mild" and "moderate."

Level	Glucose / Clinical Impact	Recommended Treatment
Level 1	Glucose **<3.9 mmol/L but ≥3.0 mmol/L**	**Self-treat orally** with fast-acting carbohydrate (glucose tablets, etc) see page 3
Level 2	Glucose **<3.0 mmol/L**	**Immediate treatment required**; patient may need help; use fast-acting oral carbohydrate see page 3
Level 3	**Severe event**: altered consciousness, seizure, unconsciousness	**Emergency intervention**: parenteral therapy (IV glucose or IM glucagon); urgent medical attention See page 3

Remember:

- Early recognition of Level 1 hypoglycaemia prevents progression to more severe levels.
- Do not leave a child/adolescent with hypoglycaemia alone.
- Level 3 always requires urgent medical intervention, similar to “severe” hypoglycaemia in NICE NG18.

Hypoglycaemia Management

Detection of Hypoglycaemia

STEP 1. Level 1 and 2 Hypoglycaemia
Conscious and able to tolerate oral fluids

Treat orally

- **Give 0.3g/Kg fast acting carbohydrate**

Approximate carbohydrate dose
9 g of glucose for a 30 kg child
15g glucose for 50kg child
20 g glucose adult size child

The exact amount of fast acting carbohydrate required depends on multiple factors such as size of the child, type of insulin therapy, active insulin on board, timing and intensity of exercise

Insulin Pump users/HCL system

- Treat orally with smaller carbohydrate doses (5-10g) as standard treatment can cause rebound hyperglycaemia

Insulin pumps not on HCL system

- Treat orally with smaller doses or carbohydrates and suspend basal insulin if glucose < 3 mmol/l until hypo resolved

If child refuses to drink, but able to swallow, conscious and not fitting

- Give Glucogel® or Dextrogel® (formerly known as Hypostop®). This is a fast-acting sugary gel, in an easy twist top tube. Each tube contains 10g glucose. Squirt tube contents in the side of each cheek (buccal) evenly and massage gently from outside enabling glucose to be swallowed and absorbed quickly. **DO NOT use Glucogel in an unconscious or fitting child.**

STEP 2. Level 3 Hypoglycaemia
Unconscious/unable to swallow/seizures

DO NOT TREAT ORALLY

- **Administer glucagon SC or IM**

Dose:
Neonate: 20 micrograms/Kg
Child < 25 Kg 500 micrograms
Child > 25 Kg 1 mg
Refer to BNFc formulary for advice on dosing
Always check glucagon expiry date and if any doses of glucagon have already been given at home or in ambulance

Glucagon is a fast-acting drug, and the child/adolescent should respond after 5 minutes. Common side effect is nausea/vomiting, keep child in recovery position to avoid aspiration

If no response within 10 minutes intravenous glucose must be given as per step 7

Fast acting carbohydrate Formulation	Examples	Notes
Glucose drinks	Glucojuice, Glucose Liftshot	Rapid absorption
Glucose tablets	Lift Glucose Tablets, Dextrose tablets	Convenient, accurate dosing
Sugary drinks	Lucozade (not sugar-free or isotonic)	Only suitable forms for hypos

Step 3. Recheck blood glucose 15 minutes after first treatment:

1. If blood glucose <3.9 mmol/L and able to take oral fluids repeat **step 1**
2. If blood glucose <3.9 mmol/L and unresponsive. Escalation is needed, if no IV access, repeat **step 2,** if IV access, **follow step 6.**
3. If blood glucose > 3.9 mmol/L follow **step 5** (see below)

Step 4. Recheck blood glucose 15 minutes after second treatment:

1. If blood glucose <3.9 mmol/L and able to take oral fluids repeat **step 1.** Repeat oral treatment every 15 minutes as needed until blood glucose is >3.9 mmol/L.
2. If persistent hypoglycaemia and clinical concerns, child unresponsive or drowsy, confused, uncooperative, unable to swallow or having seizures, escalation is required**. Follow Step 6.**
3. If blood glucose > 3.9 mmol/L follow **Step 5** (see below)

Step 5. If blood glucose level > 3.9 mmol/L

Consider retest or recheck on the CGM **20-30 minutes** later to confirm target glucose (>3.9 mmol/L) is maintained.

(*Patients on insulin pumps may have differing local policy guidelines as to the need for adjustment of basal insulin rates following correction of a hypoglycaemic episode.
In patients on Hybrid Close Loop systems half oral hypoglycaemic treatment may be given. Please refer to your local policy guideline*.)

Treatment of hypoglycaemia should increase the blood glucose by approximately **3–4 mmol/L**

If hypo is **just before** a mealtime (when insulin is usually given) the hypo should be treated first and once the blood glucose is > 3.9 mmol/L the insulin should be given as usual. **DO NOT OMIT INSULIN,** especially important with an early morning hypo.

Review history of hypo: If possible, the cause should be identified and if necessary, the insulin dose or pump settings adjusted, e.g. for early morning/night-time hypo ask about extra exercise the evening

Treatment of Level 3 Hypoglycaemia

If the child is unconscious or fitting (or has not responded to treatment highlighted on **page 3**)

CHECK CAPILLARY BLOOD GLUCOSE AND CONFIRM HYPOGLYCAEMIA (<3.9 mmol/l)

- Do involve medical assistance by this stage:
  Outside hospital: call emergency services**. Inside hospital**: bleep paediatric registrar
- Place in the recovery position if possible and assess Airway Breathing Circulation Disability (A,B,C,D)
- **DO NOT attempt to give any oral fluid or Glucogel® in an unconscious child**
- If no IV access present, follow instructions as per **step 2**
- If IV access present, follow instructions as per **step 6**

Step 6. Intravenous 10% Dextrose

If recovery is not adequate after a dose of glucagon or IV access is readily available **AND** BG <3.9 mmol/l, administer a recommended dose of 0.2g/Kg of glucose equating to 2 mls/Kg of intravenous 10% dextrose with a maximum dose of 0.5g/Kg (5 ml/Kg) as a slow Intravenous bolus. (*NICE 2022)

Note: If alcohol causes or contributes toward hypoglycaemia, glucagon may be ineffective (as hepatic stores of glycogen depleted) and intravenous glucose will be required.

Further Monitoring after a Severe Hypoglycaemia:

- Check blood glucose after 5 minutes, 15 minutes and then half hourly until BG stable
- Continue to monitor baseline observations: oxygen saturation, pulse, blood pressure, temperature
- Record presence of or absence of ketones.
- Document management
- Inform diabetes team if during the day, or if concerns during the night.
- **Do not omit normal insulin unless instructed to do so by diabetes team.**

When blood glucose > 3.9 mmol/l and child able to tolerate oral fluids:

- Offer clear fluids, and once tolerating clear fluids offer complex carbohydrates, such as toast, crackers
- Try to identify the cause of hypoglycaemia and discuss this with the patient/family
- Refer to diabetes team for review of treatment, advice or education.

Child not improving:

- If patients have protracted vomiting and are unable to tolerate oral fluids, hospital admission and intravenous glucose infusion must be considered, especially if a child has returned to the emergency department with further hypoglycaemia during the same intercurrent illness.
- If a child/Adolescent remains unconscious on correction of BG consider cerebral oedema, head injury, adrenal insufficiency or drug overdose.

Continuous Glucose Monitor (CGM)

CGM-derived Glucose Management Index metrics can be considered a standalone method for evaluating glycaemic outcomes. CGM may particularly benefit those with hypoglycaemic unawareness, as the devices will alarm when glucose is below a specified level or with a rapid rate of fall of glucose.
When using CGM, capillary blood glucose measurements may need to be checked with a finger prick (although this is less often):

- to check the accuracy of the CGM device
- when blood glucose levels are changing quickly
- if the device stops working

Time in range (TIR)

Children and adolescents with diabetes should strive for the following % of time spent in the following glycaemic ranges:

>70% between 3.9 and 10 mmol/L
<4% <3.9 mmol/L
<1% <3.0 mmol/L
<25% >10 mmol/L
<5% >13.9 mmol/L

It is also recognised that an emerging metric requiring additional validation of >50% **time in tight range** (TITR) (3.9–8 mmol/L) may allow for greater sensitivity for assessing changes in mean glucose and glucose variability.

Additional information

If frequent hypoglycaemia and /or recurrent seizures especially if at young age, diabetes team should consider referral for assessment of cognitive function.
If frequent unexplained hypoglycaemia, consider evaluation for other causes such as unrecognised coeliac disease or Addison's disease.
Glucagon should be readily accessible to all parents and caregivers, especially when there is a high risk of severe hypoglycaemia. Education on administration of glucagon is essential
Blood glucose monitoring should be performed prior to exercise, and extra carbohydrates should be consumed, or insulin adjustments should be recommended based on the blood glucose level and the expected intensity and duration of the exercise

REFERENCE

1. ISPAD Clinical Practice Consensus Guidelines 2018: Glycemic control targets and glucose monitoring for children, adolescents, and young adults with diabetes. DiMeglio et.al. Pediatr Diabetes. 2018 Oct;19 Suppl 27:105-114. doi: 10.1111/pedi.12737. PMID: 30058221.
2. ISPAD Clinical Practice Consensus Guidelines 2022: Assessment and management of hypoglycemia in children and adolescents with diabetes. Abraham M et al.Pediatr Diabetes. 2022 Dec;23(8):1322-1340. doi: 10.1111/pedi.13443.
3. ISPAD Clinical Practice Consensus Guidelines 2024: Glycemic Targets. De Bock et.al. Horm Res Paediatr. 2024;97(6):546-554. doi: 10.1159/000543266.
4. NICE (2022) Diabetes (type 1 and type 2) in children and young people. NICE guideline NG18 www.nice.org.uk/guidance/ng18.