

Diabetes-Intercurrent Illness (Sick Day Rules) Full Clinical Guideline

Reference no.: CH CLIN D02

Emergency Management of Illness (Sick Day Rules) - Type 1 Diabetes Mellitus on Injection Therapy (not using Insulin Pumps)

1. Introduction

To support staff in the management of children with Type 1 Diabetes Mellitus during intercurrent illness and ketone development after insulin omitted (sick day rules).

2. Aim and Purpose

The guideline is intended for use in managing illness as well as high blood glucose levels for all children and young people with Type 1 Diabetes Mellitus under the care of University Hospitals of Derby and Burton Paediatric Diabetes Service. The guideline can be used for telephone contact and attendance at the emergency department. It aims to avoid acute complications of Diabetes Mellitus such as ketoacidosis and hypoglycaemia.

3. Main body of Guidelines

The guidelines should be used for children with Type 1 Diabetes Mellitus managed by insulin injections who have

- 1) Intercurrent illness
- 2) Raised blood glucose and raised blood ketones secondary to omission of insulin

If a child is using a continuous subcutaneous insulin pump, please refer to guideline Clin D14

Should Diabetic Ketoacidosis be suspected or identified please refer to the DKA guideline Clin D03.

Please also inform the Diabetes Team, so they can follow up any child who has attended the emergency department.

On weekdays 8 am-6pm, call the Paediatric diabetes specialist nurse-on-call on 01332 786963, selecting option 1 for emergency advice. The call on this number will be redirected to switchboard during out of hours, who will then direct the call to on-call Paediatric Registrar.

Email address dhft.diabetesdietitians.nhs.net (RDH) or bhftpaed.diabetesteam@nhs.net (QHB)

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Section 1 - Common insulin regimes - Please see guideline CH CLIN D01

Section 2 - Interpreting blood ketones

Patients with Type 1 diabetes (on multiple daily injections) should routinely

- Check sensor or blood glucose levels (BG) before meals and at bedtime (minimum 5 times per day).
- If sensor or blood glucose 14 mmol/l or above check ketones
- Check sensor or blood glucose (BG) levels more frequently eg every 2 hours including through the night ¹ if they are unwell
- Check blood ketones whenever the child is ill, regardless of blood glucose levels ¹
- Target blood glucose: 4 - 6.9mmol/l pre meal, and 5-8mmol/l before bed.

Raised blood ketones and high blood glucose:

Non pump patients

Blood ketones \geq 0.6 mmol/l associated with raised blood glucose levels need treatment with extra novorapid to treat the ketones and prevent DKA.

Blood ketones above 3 mmol/l: immediate risk of DKA - consider hospital review.

Pump patients

See guideline CH CLIN D14

Raised blood ketones with normal blood glucose levels- 'starvation' ketones

Like children without Diabetes, children with Type 1 Diabetes make 'starvation' ketones after a period of fasting. They are usually less than 3mmol/l. This is common with gastroenteritis when the issue is low or low normal blood glucose and associated ketones if they are eating little.

DO NOT give extra novorapid if blood glucose is normal but monitor blood glucose every 2 hours along with blood ketones.

Section 3 - Intercurrent Illness with hyperglycaemia

Introduction

Patients with type 1 diabetes are at risk of hyperglycaemia with intercurrent illness. If this is not managed appropriately they are at risk of developing diabetic ketoacidosis (DKA). Omission of insulin due to non-adherence to insulin therapy will also result in hyperglycaemia and raised blood ketones and the risk of DKA.

All children and their families have guidelines to help them manage illness at home and try and avoid admission with DKA. They are supported in this by the paediatric diabetes specialist nurses or the paediatric registrars whom they may phone for advice out of hours.

These guidelines are to help staff to support the families at home with telephone advice or if necessary to arrange hospital review.

The principle of the management is as follows:

- If the child is unwell the parents are advised to check the blood glucose and blood ketones every 2 hours.
- **NEVER STOP OR OMIT INSULIN**
- High blood glucose with associated ketosis requires additional fast acting insulin (eg novorapid) to reduce the blood glucose and reverse the ketosis.
- The amount of fast acting insulin given depends on the usual dose of insulin, the blood glucose, the blood ketone level and the usual insulin regime. (Please follow green / amber / red table for dosage advice.)
- The fast acting insulin used (eg novorapid) acts immediately, peaks by 1 hour and is usually out of the system by 4 hours.
- Blood or sensor glucose and blood ketones should therefore be checked every 2 hours. The dose of novorapid may be repeated every 2 - 4 hrs if hyperglycaemia and ketosis persists.
- Indications for urgent hospital review are:
 - o Symptoms suggestive of DKA:
 - ♣ Breathing is laboured or rapid.
 - ♣ Vomiting is large and persistent.
 - ♣ There is severe or unusual abdominal pain.
 - ♣ The child becomes confused.
 - o There are increasing levels of ketones in the blood (especially >3mmol/l: high risk of DKA).
 - o Blood ketone levels remain high despite giving extra novorapid.
 - o The child is less than 3years old .
 - o The child or their carer is exhausted.
 - o The underlying problem is unclear.
- If there are concerns about DKA, a blood gas must be checked and if confirmed the DKA guideline must be followed (see guideline CH Clin D 03)

Management of blood glucose above 11 mmol/l with raised blood ketones (non pump patients).

Caution with newly diagnosed (see below)

(TDD = Total Daily Dose of Insulin)

<p>Blood glucose > 11mmol/l</p> <p>Blood ketones: 0.5mmol/l or less</p>	<p>Blood glucose > 11mmol/l</p> <p>Blood ketones: 0.6-1.5mmol/l</p> <p>If symptoms of DKA develop must attend hospital for assessment</p>	<p>Blood glucose > 11mmol/l</p> <p>Blood ketones: 1.6 mmol/l or more</p> <p>If symptoms of DKA develop or ketones above 3mmol/l must attend hospital for assessment</p>
<p>Give normal bolus for carbohydrate eaten + usual 'correction dose' before meals</p>	<p>Give a dose of fast-acting insulin (eg novorapid) by injection immediately:</p> <p>Give 10% TDD of insulin</p> <p>eg TDD 50 units , 10% = 5 units</p> <p>If eating, work out bolus for carbohydrate and give this dose of insulin by injection in addition</p>	<p>Give a dose of fast-acting insulin (eg novorapid) by injection immediately:</p> <p>Give 20% of TDD of insulin</p> <p>eg TDD 50 units , 20% = 10 units</p> <p>If eating, work out bolus for carbohydrate and give this dose of insulin by injection in addition</p> <p>When advising large doses over the phone always ensure continuing communication during evening and overnight</p>
<p>Re-check blood glucose and ketones in 2 hours</p>	<p>Drink sugar free fluids</p> <p>Re-check blood glucose and ketones in 2 hours</p>	<p>Drink sugar free fluids</p> <p>Re-check blood glucose and ketones in 2 hours</p>
<p>Ensure injecting into a non-lumpy site and vial in date.</p> <p>Check blood glucose and ketones in 2 hours</p> <p>If blood ketones 0.6-1.5mmol/l follow orange column</p> <p>If blood ketones 1.6mmol/l or more follow red column</p>	<p>Recheck blood glucose every 2 hours, including throughout the night</p> <p>If blood ketones still 0.6-1.5mmol/l, continue to give 10% of TDD by injection 2-4 hourly, depending on blood glucose.</p> <p>If blood ketones 0.5mmol/l or less, follow green column advice</p> <p>If blood ketones 1.6mmol/l or more, follow red column advice</p>	<p>Recheck blood glucose every 2 hours, including throughout the night</p> <p>If blood ketones are still 1.6 mmol/l or more, give another 20% TDD via injection</p> <p>If blood ketones reduce to 0.6 -1.5mmol/l, then follow orange column advice</p> <p>If blood ketones 0.5mmol/l or less, follow green column advice</p> <p>If after 2nd 20% TDD correction, ketones are still above 1.6mmol /l or more and not decreasing at all then advise to attend hospital immediately to assess for DKA</p>

REMEMBER THAT IF BLOOD GLUCOSE ARE NORMAL WITH RAISED KETONES, YOU DO NOT NEED TO GIVE EXTRA INSULIN AS THESE ARE STARVATION KETONES. Consider carbohydrate

If sensor or blood glucose is increasing above 11 mmol/L, but ketones less than 0.6 mmol/L 2 hours post meal, and sensor arrows are rising then consider correction dose using Novorapid pen¹

Newly Diagnosed patients may have raised blood ketones in the first few days while establishing the correct dose of insulin. If well, do not usually need extra novorapid in between meal doses and overnight. Meal doses can be increased if ketones persist. If unwell, check blood gas.

Section 4 -Gastroenteritis in Type 1 Diabetes

Diarrhoea and vomiting can prevent absorption of food and drink, causing a fall in blood glucose levels (hypoglycaemia). In this situation, parents are advised to check blood glucose and blood ketones at least every 2 hours¹ and ring the paediatric diabetes nurses or the paediatric registrar.

The following interventions may be necessary:

1) Insulin dose adjustment (Insulin must never be stopped)

If the symptoms of gastroenteritis are associated with hypoglycaemia, then a reduction in regular fast-acting insulin dose (50% and then according to the glucose monitoring) may be required whilst symptoms persist.

Once oral intake is tolerated again and blood glucose levels are normal, then advise patient to return to usual doses of insulin.

2) Carbohydrate substitutes

Once insulin has been given, it is important to have some form of carbohydrate in order to reduce the risk of hypoglycaemia.

If the child is unable to tolerate a normal diet then small, frequent amounts of carbohydrate fluids are advised, as large quantities can lead to nausea or vomiting.

The child should continue drinking water as there will be body water loss through diarrhoea and vomiting.

3) Hospital admission

If the child vomits within 10 minutes after drinking, medical review is advised, as they are at high risk of becoming dehydrated and hypoglycaemic.

- If on assessment, child is unable to tolerate oral fluids and becomes hypoglycaemic, admission will be needed for iv fluids and possibly iv insulin.
- Once oral fluid is tolerated, start usual insulin and stop infusions.

Multiple daily injections (eg novorapid with meals, glargine at bedtime)

If the child has already had a dose of novorapid, commence the child on intravenous fluids to maintain normoglycaemia.

If the child still requires iv fluids when it is time for next dose of novorapid, this insulin should be omitted and an insulin infusion should be prescribed (see below), in addition to the iv fluids.

Continue to give basal insulin (eg Glargine, Detemir, Degludec) at the usual time.

IV Maintenance fluid guide:

10% glucose 0.9% saline with 10mmol added potassium chloride per 500ml bag. A small stock is kept on Dolphin ward (RDH) and ward 1 (QHB). Further supplies will need to be ordered from pharmacy.

Body weight	Fluid requirement
First 10kg	100mls/kg/day
Second 10kg	50mls/kg/day
Subsequent kg	20mls/kg/day
e.g. for a 30kg child:	10 x 100 = 1000mls
	10 x 50 = 500mls
	10 x 20 = 200mls
	= 1700mls for a 24 hour period

Therefore, run fluids at 70 mls/hour

Additional fluid may be required to correct for dehydration, if present.

Monitoring: Glucose levels 2 hourly, electrolytes 12 hourly

Insulin infusion: A solution of insulin in 0.9% saline at a concentration of 1unit/ml should be used.

Please refer to Insulin infusion guide 7g on Insulin management during Surgery guideline as below:

7g. Insulin Infusion Guide (Insulin infusion sliding scale Ref CH CLIN D06/May 21/v008.1)

- Derby: Use 30 units soluble insulin (Actrapid) in 30 ml of 0.9% sodium chloride, giving 1 unit per ml.
- Burton: Add 50 units soluble insulin (Actrapid) to 49.5mls of 0.9% sodium chloride, giving 1 unit per ml.
- Start infusion at
 - 0.01 ml/kg/hour if BG is between 5–6mmol/l,
 - 0.025 ml/kg/hour (i.e., 0.025 U/kg/hour) if BG is between 6–8mmol/l,
 - 0.05 ml/kg/hour if 8–12mmol/l,
 - 0.075 ml/kg/hour between 12–15mmol/l
 - 0.1 ml/kg/hour if > 15mmol/l.
- If BG <5mmol/l, stop the IV insulin infusion but only for 10–15 min. Give bolus of IV 10% glucose 2ml/kg; recheck BG 15 minutes later.

Section 5 - Carbohydrate Substitutes**Recommended carbohydrate substitutes to be given at mealtimes if you are unable to eat**

- Glass of milk
- Milkshake
- Drinking chocolate made with milk
- Fruit smoothie
- Natural fruit juice
- Ice cream or ice lollies
- Fruit
- Horlicks or Ovaltine made with milk
- Full sugar yoghurts, puddings or mousse
- Toast
- Cereal

- Full sugar jelly

Follow-up routine

- Keep in regular contact with the diabetes team or the Children's Emergency Department.
- Continue extra blood sugar and ketone monitoring during the night as well as during the day.
- Maintain hydration with clear fluids eg. water.
- If there is concern about a child's condition at any time, he/she should be reviewed in the Children's Emergency Department (RDH) or Paediatric Assessment Unit (QHB).

If the child has a stomach upset, choose from clear fluids rather than milky fluids or puddings. Choose a variety of fluids or food that the child will take.

Section 6: -informing the diabetes team

RDH - Discuss any concerns with the Consultant on call. If the consultant on call is still concerned, he/she may contact Dr Smith, Dr Tinklin or Dr Kumar at RDH via switchboard.

QHB - Discuss any concerns with the Consultant on call. If the consultant on call is still concerned, he/she may contact Dr Vasista or Dr Lloyd-Nash via switchboard.

If they are unavailable, use the Regional network Paediatric Endocrine rota (copy available in CED or via QMC Nottingham switchboard).

If you give advice to a patient please let the diabetes team know.

On weekdays 8 am-6pm, call the Paediatric diabetes specialist nurse-on-call on 01332 786963, selecting option 1 for emergency advice. The call on this number will be redirected to switchboard during out of hours, who will then direct the call to on-call Paediatric Registrar.

Email address dhft.diabetesdietitians.nhs.net (RDH) or bhftpaed.diabetesteam@nhs.net (QHB)

Section 7: Documenting advice given

It is essential that medical advice given is documented. This should be done in an email (as above) with the subject "OUT OF HOURS ADVICE GIVEN". Please give as much detail as possible, as your email will be copied and pasted into V6 / Twinkle (diabetes nursing notes database) as a permanent record (email addresses as above)

Section 8: Examples and Scenarios

**Examples of insulin dose adjustment with raised blood glucose and ketones in an unwell child
Multiple Daily Injections**

Blood glucose 15mmol/l and Blood ketone 1.1mmol/l

To give 10% of child's total daily dose (TDD) as novorapid immediately

Calculation of 10% = Total Daily Dose (TDD) ÷ by 10

e.g. For a child usually taking 10 units / 9 units / 9 units of novorapid and 28 units of glargine

Total Daily Dose (TDD) = 10 + 9 + 9 + 28 = 56 units

10% of Total Daily Dose = 56 ÷ 10 = 5.6 units (round to 6 units)

If at a meal time you would advise to give:

6 units of extra insulin as novorapid in addition to usual meal dose

Reassess blood glucose and ketone levels before next mealtime before recommending any further extra insulin.

Section 9 : References

- 1 Management of Type 1 Diabetes Mellitus during illness in children and young people under 18 years (Sick Day Rules): BSPED / ACDC Endorsed Diabetes guidelines Version 5, March 2021
- 2 Patient Advice for Management of Type 1 Diabetes Mellitus during illness in children and young people under 18 years (Sick Day Rules) : ACDC Endorsed Diabetes Guidelines
- 3 ISPAD Clinical Practice Consensus Guidelines 2018: Sick day management in children and adolescents with diabetes
- 4 Diabetes (type 1 and type 2) in children and young people: diagnosis and management NG18, last updated 9th June 2022

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