Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

ROYAL COLLEGE OF PHYSICIANS OF IRELAND

PAEDIATRICS

NATIONAL CLINICAL GUIDELINE

Title:

Management of Paediatric Type 1 Diabetes Patient with an intercurrent illness (hospital)

Clinical Design and Innovation
Health Service Executive

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Clinical Design & Innovation
Person-centred, co-ordinated care

Contents

1.0 Aim of Guideline

The aim of this guideline is to provide clear and standardised guidelines for all staff caring for (and advising care givers of) paediatric patients with type 1 diabetes during intercurrent illness

2.0 Purpose and Scope

2.1 The purpose of this guideline is to improve the management of Paediatric Type 1 patients with an intercurrent illness.

2.2 These guidelines are intended for healthcare professionals, particularly those in training, who are working in HSE-funded paediatric and neonatal services.

2.3 They are designed to guide clinical judgement but not replace it. In individual cases a healthcare professional may, after careful consideration, decide not to follow a guideline if it is deemed to be in the best interests of the child or neonate.

3.0 Background and Introduction

When children with Type 1 Diabetes (T1D) are unwell, their blood glucose levels are often affected. Many illnesses, especially with a fever, raise blood glucose levels as a result of relative insulin resistance due to raised stress hormone levels and this may ultimately result in increased ketone body production. In contrast, children with vomiting and diarrhoea (e.g. gastroenteritis) are at risk of hypoglycaemia because of reduced carbohydrate intake/absorption.

4.0 Legislation/Other Related Policies

Model of Care for All Children and Young People with Type 1 Diabetes
http://www.hse.ie/eng/about/Who/clinical/natclinprog/paediatricsandneonatology/paedsmoc.pdf

5.0 Glossary of Terms and Definitions

T1D	Type 1 Diabetes
TDD	Total Daily Dose

6.0 Roles and Responsibilities

6.1 This guideline should be reviewed by each acute hospital senior management team to appropriately plan implementation. This facilitates best practice and standardises the care provided to children in Ireland. This will ensure that the inpatient care of children/neonates

admitted to their facility is optimised irrespective of location.

7.0 Clinical Guideline

7.1 Underlying illness

7.1.1 Treat underlying illness as usual (respiratory tract infection, urinary tract infection, meningitis etc

7.1.2 Remember to use sugar-free paracetamol etc.

INSULIN ADMINISTRATION SAFETY ALERT
INSULIN ERRORS CAN HAVE EXTREMELY SERIOUS CONSEQUENCES-always act on patient/family/HCP concerns re doses and recheck • Overdoses can cause severe hypoglycaemia, seizures, coma and even death • Under dosage can result in diabetic ketoacidosis.
Please INDEPENDENTLY DOUBLE CHECK doses at each stage- • When making up an infusion (an insulin syringe graduated in units to measure insulin must be used) • When infusing via a pump • When administering via pen (pens and cartridges are SINGLE PATIENT USE ONLY)
ALWAYS CHECK PRESCRIPTION: • Reconfirm order with the prescriber if unsure/ concerned about the insulin dose • Avoid abbreviations; insulin should be prescribed in units • Do not administer an unclear prescription-Prescription **MUST** be rewritten • Only use an insulin pen or an insulin syringe graduated in units to measure insulin

7.2 Insulin

7.2.1 Never omit insulin, dose may need to be adjusted see **section 7.6**

7.3 Monitoring

7.3.1 Monitor blood glucose and blood ketone levels more frequently (every 2-4 hours including through the night)

7.3.2 During acute illness, target blood glucose range may be increased to 5-12 mmol/l.

7.3.3 Hourly blood glucose checks may be required if blood glucose levels are borderline low (4-5 mmol/L) and/or child is vomiting

7.3.4 Blood ketone levels should be monitored if blood glucose level >14 mmol/L

7.3.5 Blood ketone levels should be checked intermittently during intercurrent illness even when blood glucose levels are not raised.

7.3.6 If patient is using a pump please also see section 7.8

7.4 Fluids

7.4.1 Fluid requirements are generally increased during intercurrent illness associated with fever, hyperglycaemia and/or vomiting

7.4.2 Fasting or poor carbohydrate intake is associated with ketogenesis

7.5 Poor Appetite or Vomiting

7.5.1 Meals may be replaced with easily digestible foods or sugar containing fluids.

7.5.2 It may be useful to alternate sugar free fluids (for hydration) one hour with sugar containing fluids (which contain carbohydrate like regular (non-diet) 7UP)) next hour (guided by blood glucose levels)**.**

7.6 Insulin Adjustment

7.6.1 General considerations:

- Do not stop insulin in illness although the dose may need to be adjusted, increased or decreased if child is not eating or is vomiting
- **The presence of ketones increases insulin resistance (i.e. the same dose of insulin will have less effect on blood glucose levels when ketones are present).**
- Therefore when ketones are present, children may **require additional insulin supplements or corrections (using fast acting insulin ONLY). These are termed "correction boluses".**
- As fast acting insulin action peaks between 60-90 minutes after administration, correction doses are not generally recommended more often than 2 hourly (allow 4 hours between correction doses if correcting for high glucose levels without high ketones levels (i.e. ketones < 0.6 mmol/L)
- **Elevated ketone level with normal to low blood sugar** level may indicate insufficient carbohydrate intake and should improve after taking carbohydrate e.g. food or sweetened fluids

7.6.2 Correction Boluses (see also Insulin Adjustment Table on page 6)

- **Calculate the Total Daily Dose (TDD)**: This refers to the usual total number of units (of all insulin) that the child normally is given per day (i.e. fast acting and long/intermediate acting insulins added together).

> **Example :** 12 year old boy on multiple daily injections:
> Usual doses are Novorapid 8 units pre breakfast, lunch and dinner (three times daily) and 26 units Lantus pre bed
>
> **TDD** = 50 units (8+8+8+26)

- **Calculate the "correction" boluses (of fast acting insulin) as a percentage of TDD.**

> This boy is unwell but going to eat breakfast and will require a 10% TDD correction (see insulin adjustment table below)
>
> **TDD** = 50 units (8+8+8+26)
>
> **Correction Bolus as a % of TDD**
> 5% of TDD is 2.5 units 10% of TDD is 5 units
>
> The usual pre breakfast insulin dose is 8 units PLUS 5 units (correction dose) = **13 units of insulin**

- After advising patients to have correction bolus, it is very important to monitor and recheck blood glucose and ketones levels every 2 hours until normal.
- It may be necessary to repeat extra correction in 2 hours if Ketones > 1.5 or in 4 hours if blood glucose high but ketones 0.6-1.0.
- If ketone levels have not normalised or continue to rise after 2 corrections have been given, the patient likely needs to be assessed in ED

Table 1. Insulin Adjustment Table

Blood Ketones	Blood glucose				
	< 5.5 mmol	**5.5 – 10 mmol**	**10 – 14 mmol**	**14 - 22 mmol**	**> 22 mmol**
<0.6		No action	Extra insulin at next meal if remains high	5% **extra** of TDD	10% **extra** of TDD
0.6 - 0.9	Starvation ketones. Carbs needed	Starvation ketones. Carbs needed	5% **extra** of TDD	5-10% **extra** of TDD	10% **extra** of TDD Repeat if needed
1.0 - 1.4	Starvation ketones. Carbs needed	Starvation ketones. Carbs needed	5-10% **extra** of TDD	10% **extra** of TDD	10% **extra** of TDD Repeat if needed
1.5 - 2.5	High starvation ketones. Carbs needed. May need IV glucose **Risk of ketoacidosis** Check hourly	High starvation ketones. Carbs needed. *plus* 5% **extra** of TDD	10% **extra** of TDD	10% **extra** of TDD	10% **extra** of TDD Repeat after 2 hours if Ketones remain high Likely require assess in ED
> 2.5	Very high Starvation ketones. Carbs needed. May need IV glucose	High starvation ketones. Carbs needed. *plus* 5% **extra** of TDD	10% **extra** of TDD	10% **extra** of TDD	10% **extra** of TDD Assess in ED
> 3	**There is an immediate risk of ketoacidosis with ketones > 3. Insulin needed urgently. The child very likely requires evaluation in the Emergency Dept.**				

TDD = Total Daily Dose

7.6.3 Long acting insulin

- Long acting insulin (Lantus, Levemir, Tresiba) or intermediate acting insulin (insultard) can be continued at usual dose.
- Doses may need to be modified where illness persists for more than 24 hours**.**

7.7 Pump patients

7.7.1 The key points of sick day management are the same for pump users as for those on injections but pump patients deserve special mention as they use only rapid acting insulin with no depot of long acting insulin. DKA can therefore develop rapidly in pump patients in the setting of either intercurrent illness or interruption of insulin delivery.

7.7.2 In a patient on a pump with BG >14 mmol/L and ketones ≥ 1 mmol/L, it should be assumed that the pump is not delivering insulin

7.7.3 The correction bolus dose of insulin (or 10% of total daily dose discussed above) should be administered by s/c insulin pen (not through the pump).

7.7.4 The pump set should be changed and the pump checked to ensure it is working appropriately.

7.7.5 Experienced pump users can often manage diabetes during intercurrent illnesses associated with hypoglycemia/hyperglycaemia by using temporary basal rates to reduce/increase insulin delivery-based on blood glucose readings while still avoiding ketosis. These adjustments may require support from the hospital team unless the parents are experienced and competent. Ongoing close monitoring (as above) is required to ensure that the adjustments are working. If the pump adjustment strategies are not maintaining blood glucose in target range without ketosis, the child with diabetes and an intercurrent illness can be managed with s/c or IV insulin and IV fluids as per standard care until stabilised.

7.7.6 Patients that use Pump Bolus Wizard or Expert Meter

- Remember that Pump Bolus Wizard or Expert Meters which use a correction or sensitivity factor will UNDERESTIMATE the insulin needed when ketones are elevated as the calculator works on the basis of blood glucose levels alone.
- Additional fast acting insulin given by injection (see dose adjustment table) to correct ketones will not be accounted for as active insulin, by your pump or meter, when it calculates the next dose of insulin for food.
- You may have to override the suggested dose of insulin if less than 3 hours have elapsed since you injected the correction dose as residual insulin in your circulation, which is still working, will not be counted. Ongoing monitoring of blood glucose

levels and ketones is required to ensure that dose adjustments are appropriate.

7.8 Admission is likely to be required when

- Child is under 5 years
- Vomiting is persistent (>2 vomits especially in young children)
- Blood glucose stays high despite correction dose of insulin
- Hypoglycaemia is persistent
- Ketonaemia is persistent (blood ketones >1.5)
- Child is exhausted, confused, dehydrated or has severe abdominal pain.
- Child is unable to eat or drink
- Parents are exhausted and or unable to cope (may be reflected in frequent phone calls)
- **Always see urgently any child with diabetes who is vomiting with high blood glucose and ketones.**

7.9 Phone Advice

If advice is given to parent over the phone:

- Ask parents to call back in 2-4 hours to ascertain that all is well
- Ask parents to contact the diabetes nurse specialist on the next working day to follow up.

8.0 Implementation, Revision and Audit

8.1 Implementation via CEO of each Hospital group and senior management team of each acute hospital

8.2 Distribution to other interested parties and professional bodies

8.3 The guideline development group has agreed that this guideline will be reviewed on 3 yearly basis.

8.4 Regular audit of implementation and impact of this guideline through outcome and process measures is recommended to support continuous quality improvement. It is the responsibility of each unit providing care for children with diabetes and intercurrent illness to audit the unit practise regularly in order to ensure that care in being provided in line with guidelines and that any deviations are clinically justified. The audit process should be coordinated in each paediatric unit under local paediatric clinical governance and should be taken from a multidisciplinary perspective where appropriate. Where the audit identifies areas for practise improvement, it is the responsibility of each individual unit to implement changes and re-audit to support continuous quality improvement.

9.0 References

International Society for Paediatric and Adolescent Diabetes (2014) ISPAD Clinical Practice Consensus Guidelines 2014. http://www.ispad.org/?page=ISPADClinicalPract

Irish Medication Safety Network (2020) Best Practice Guidelines for the Safe Use of Insulin in Irish Hospitals https://imsn.ie/wp-content/uploads/2020/07/insulin-best-practice-March-2020-with-appendices.pdf

10.0 Qualifying Statement

10.1 These guidelines have been prepared to promote and facilitate standardisation and consistency of practice.

10.2 Clinical material offered in this guideline does not replace or remove clinical judgement or the professional care and duty necessary for each child.

10.3 Clinical care carried out in accordance with this guideline should be provided within the context of locally available resources and expertise.

10.4 This Guideline does not address all elements of standard practice and assumes that individual clinicians are responsible for:

- Discussing care with the child, parents/guardians and in an environment that is appropriate and which enables respectful confidential discussion.
- Advising children, parents/guardians of their choices and ensure informed consent is obtained.
- Meeting all legislative requirements and maintaining standards of professional conduct.

11.0 Appendices

11.1 Appendix 1 Acknowledgements

This guideline has been developed by the National Clinical Programme for Paediatrics and Neonatology Diabetes Working Group. The members of this group include medical, nursing and dietetic representatives from paediatric diabetes services. The Diabetes Working Group also wish to thank those who provided input and feedback on draft versions of this guideline throughout development, and those who provided valuable input during the consultation process and revision of the guideline including Ms. Ciara Kirke, Clinical Lead, National Medication Safety Programme, HSE and Mr. Donal Burke, Clinical Pharmacist, CHI, Crumlin.

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11.2 Appendix 2 Approval Process

Sign Off

Sign off by Paediatric Diabetes Working Group	November 2018
Sign off by Paediatric Clinical Advisory Group	December 2018
Sign off by HSE CSPD Senior Management Team	January 2019
Guideline update approved by Paediatric Working Group	November 2020
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Guideline update approved by National Clinical Advisory Group Lead	April 2021

11.3 Appendix 3 Guideline Update November 2020

1. Addition of insulin safety alert
2. Change of wording to units rather than iu for insulin
3. Dextrose changed to glucose