SECTION 11: CARE OF THE CHILD WITH DIABETES

11.9 Insulin Pump Management for Inpatients with Diabetes (Continuous Subcutaneous Insulin Infusion)

11.9.3 Hyperglycaemia – Delivering a Correction Bolus

Aims

1. To effectively and accurately detect hyperglycaemia.
2. To promptly and correctly treat hyperglycaemia.
3. To safely and accurately administer a correction bolus.

Key Points

- This document must be read in conjunction with Blood Ketones testing procedure (PNPM 11.2.2).
- A correction bolus is additional insulin given when the BGL is above the patient's blood glucose target set into the pump according to his/her individual needs.
- If the BGL is above the pump target immediately before a meal or snack, the pump calculator will give additional insulin with the food bolus.

Significance of Ketones

As the pump uses only short acting analogue insulin, ketosis can occur within 3 – 4 hours if the insulin flow is interrupted. The presence of ketones is highly significant in a person with type 1 diabetes and must be treated immediately to avoid the progression to diabetic ketoacidosis (DKA).

Check blood ketones if BGL >15 mmol/L, or if the child is unwell.

Causes of Hyperglycaemia

1. Lack of insulin:
    - Bolus: incorrect insulin to carbohydrate ratio. Missed or forgotten dose
    - Basal: rate too low

2. Insulin flow interrupted:
    - Blockage or kink in the infusion set
    - Cannula bent or dislodged
    - Set not connected properly
    - Air bubble in the infusion set
    - Pump is disconnected or suspended for too long
    - Site not absorbing ie. due for cannula resite.
3. Site infection
4. Illness
5. Stress
6. Decreased activity

If Hyperglycaemia is suspected

- Check the accuracy of the last BGL eg. wash and dry hands, recalibrate the meter.
- Review the bolus history to ensure that insulin was given with the last meal or snack.
- Assess the line for leakages, kinks and air bubbles.
- Check the reservoir for air.
- Ensure the pump is connected and not suspended (stopped).
- Check that the pump is programmed correctly.

Management of Hyperglycaemia

A correction bolus is required.

- If a meal or snack is due immediately, the correction bolus will be calculated by the pump and incorporated with the Food Bolus. Refer to PNPM 11.9.2 Delivering a Food Bolus.
- If a Food Bolus is not immediately due and bolus insulin has not been given in the past 2 hours, deliver a correction bolus as described below.

BGL> 15mmol/L:

- Check for blood ketones
- Ketones negative (< 0.6mmol/L): deliver a correction bolus and monitor, as above
- Ketones positive (> 0.6mmol/L): More insulin is required. Advise the medical officer immediately. A pen/syringe injection is required and the subcutaneous cannula requires resiting.

Delivering a Correction Bolus when a meal or snack is not due

Procedure	Additional Information
1. Enter BGL into pump. 2. Enter carbohydrate content as 0 grams.	
3. Deliver bolus amount determined by the pump.	A correction bolus can be delivered without food. The patient is not required to eat in this circumstance. Check the dose as per PNPM 2.1.2 Checking and Administration of Medication
4. Re-check BGL in 2 hours (to ensure BGL has decreased).	The duration of action for Novorapid® and Humalog® is approx 3-5 hours, with the peak action approx 1-1$^{1/2}$ hours.[1,2,3] Checking the BGL after 2 hours allows the insulin time to exert its effect on the BGL.
5. After 2 hours, if the BGL has decreased but remains above the target, another correction bolus may be given as above.	
6. If BGL increases after 2 hours, advise the medical officer immediately. 7. Monitor patient closely.	An increase in BGL 2 hours after a correction bolus may indicate that the flow of insulin has been interrupted, and hyperglycaemia may progress to ketosis. Alternatively, illness and infection can cause insulin resistance. If the patient is unwell, they may require a greater insulin correction dose than usual.

Related policy, procedures and guidelines.
PNPM 11.2.2 Blood Ketones

Useful resources.
AMH Handbook. Endocrine Drugs: Insulins. 2014. Available via the CAHS intranet.

References:

1. Australian Medicines Handbook (AMH). Insulins: comparative information. January 2014
2. NovoNordisk Ltd. Product Information Insulin Aspart. NovoRapid®. 2012. Accessed online 6 May 2014 from: http://www.novonordisk.com.au/media/PIs/NovoRapid_NovoMix_PI3a.pdf
3. Eli Lilly Canada Inc. Product Monograph: Humalog® (insulin lispro injection). 2012. Accessed online 6 May 2014 from: http://www.lilly.ca/humalogpm/en

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