Chapter D

Low and High Glucose Levels

D: Low and High Glucose Levels

D1: Low blood glucose levels (Hypoglycaemia)

Hypoglycaemia - what is it? How to recognise and treat with confidence.

In someone without diabetes, the body is able to balance the blood glucose (BG) level between 3.5 and 7mmol/L the majority of the time. In Type 1 diabetes, where insulin is injected either by pen or pump it is much harder to keep the BG between this narrow range.

In diabetes we define Hypoglycaemia (Hypo's) if a BG level goes below 3.9mmol/L

What sort of things can cause a hypo?

- Too much insulin - too large a dose or too many doses in a short time
- Being more active
- Missing a meal or loss of appetite due to illness
- Drinking alcohol
- Stress, hot weather
- Lipohypertrophy also referred to as lumpy injection sites

How will you know if your child is having a hypo?

Your child will usually experience some of these sensations first as their body tries to correct the hypo.

This may include:- Shaking, pounding heart, hungry, sweating, dizzy, feeling weak

The effect of low BG levels on the brain means that it may then become:-

More difficult to concentrate or perform skills as well as usual or they may complain of a headache.

Their behaviour may also seem different to usual. You may notice they seem more:-

Irritable, Tearful, Quiet, Drowsy or Uncooperative, Pale

Hypoglycaemia at night time

Some children have hypos at night without it disturbing their sleep, so can be more difficult to detect. If they have a number of hypos this can also affect awareness so identifying and preventing them is important.

Bedtime BG levels do not necessarily predict the BG overnight so checks around 2-3am may be recommended by your diabetes team. If wearing a sensor, alarms can be set.

If your child has exercised in the afternoon or early evening hypos later in the evening or overnight (approx. 7-11 hours later) can be more likely so checking overnight is a good idea.

How to treat a hypo

Take some fast acting glucose. For many children over about 10yrs of age 15g glucose carbohydrate is required.

To calculate this more precisely use 0.3g/kg of body weight

Here is a chart showing the usual amounts of fast acting glucose required for children of different ages and include 2g, 5g, 10g and 15g hypo treatment. This will raise BG level by about 3-4mmols.

	2g glucose Less than 2 years old.	**5g glucose 2-5years old**	**10g glucose 5-10years old**	**15g glucose Over 10years old**
Lift glucose shot	10mls	20mls	40mls	60mls
Lift glucose tablets (1 tablet contains 4g)	-	1 tab	2-3 tabs	4 tabs
Lucozade energy tablets (1 tablet contains 3g)	1	2	3	5
Dextrosol (1 tablet contains 3g)	1	2	3	5
Jelly sweets (average weight)	3g	6g	12g	18g
Dextrogel	¼ tube	½ tube	1 tube	1 ½ tubes

Recheck the BG after 15mins, if still below 3.9mmol/L repeat the hypo remedy as you won't do any harm but will help your child to recover quickly.

If you find you regularly need to repeat the hypo remedy please discuss with your diabetes team.

Dextrogel / Glucogel

This treatment can be used if your child is sleepy or uncooperative and not wanting to eat or drink.

Glucose gel can be placed on fingertip and put in the mouth or squirted in the side of the cheek onto the gums and massaged on the outside.

Chocolate is not recommended for hypos.

This is because it contains fat which slows the absorption of glucose, and lactose which is a more slowly absorbed carbohydrate so your child will likely take longer to recover.

Fructose (fruit sugar) is absorbed slightly slower than glucose but not as slowly as lactose. It may be an option if apple or orange juice is more acceptable, and you find it works quickly enough.

In the case of a severe hypo

This is a rare occurrence which can lead to loss of consciousness and/or seizure and requires assistance by another person to administer Glucagon. There is a short video on how to administer this intramuscular injection on the Digibete essential videos section.

As young children are less able to communicate their needs, they are at risk of severe hypo. With the use of newer technologies including continuous glucose sensors and hybrid closed loop insulin pumps severe hypos have reduced considerably.

Key points to consider

- Prompt treatment can prevent severe hypos
- Make sure there is always a supply of glucose tablets or sugary drinks
- Monitoring blood glucose levels regularly can reduce the risk of hypos
- Encourage children and young people to let their friends know that they have diabetes and know what to do in the event of a hypo
- Wearing some form of identification is a good idea
- Is this a one off event or is there a pattern of low blood glucose levels?
- Try to work out the cause so you can try and prevent hypos in the future
- Monitor more frequently during the next 24 hours following a hypo to prevent a repeat
- Monitor blood glucose and ketone levels 2-4 hourly if hypo and ill
- 2-3 mild hypos per week are not unusual when diabetes is well managed and BG are close to target.

D2: High blood glucose levels (Hyperglycaemia)

Why do I need to treat high blood glucose levels?

If you do not treat a high blood glucose level you may stay high for several hours. This might make you feel unwell in the short term (thirsty, less able to concentrate, irritable) but if happens frequently can contribute to a rising HbA1c.

Common reasons for high glucose (above 9 mmols) may be:

- Mis-match of insulin to food - timing or dose
- Missed Insulin
- Growth / puberty / hormones/ periods
- Sugary foods/ drinks
- Reduced activity
- Stress / exams
- End of honeymoon phase
- Illness

How do I work out how much correction insulin to give?

If glucose levels are above target, your app/pump bolus calculator will automatically calculate the dose of insulin needed to match both carbohydrate eaten and to bring the glucose level back down to target range.

Please see table below for blood glucose levels and the relevant action and treatment advice.

BG level (mmol/L)	Treatment Advice	Insulin	
7.0-8.9	BG level above target if done before a meal.	Give additional insulin if about to eat a meal or snack.	By using a pump/meter/app bolus calculator, the dose of insulin will be automatically increased to match both the carbohydrate eaten and bring BG level back down to target range.
9.0-13.9	BG level too high (hyperglycaemia)	Give additional correction dose of insulin	By using a pump/meter bolus calculator, the dose of insulin will be automatically calculated to bring BG back to target range. Check BG 1 hour later if on pump Check BG 2 hours later if on injections Change insulin cannula (if using an insulin pump) if BG does not come down after initial correction
Above 14	BG level too high (hyperglycaemia) & risk of DKA	Check for ketones Give additional correction dose of insulin	If ketones below 0.6, follow advice above (9.0-13.9 mmols/L) If ketones above 0.6, insulin dose calculated by pump/meter bolus calculator needs to be overridden and increased (see sick day rules section) All correction insulin needs to be given by injection Change insulin cannula if using an insulin pump Check BG and ketones in 1 hour

What is 'Active insulin' or 'insulin on board'?

This refers to how much insulin is still working from previous insulin injections or boluses. It is a safety feature to prevent overcorrection of high glucose levels.

Having high glucose levels immediately after meals does not necessarily mean you need more insulin, as the insulin given may still be working to bring the glucose level down. If your pump suggests that you give a reduced amount of correction insulin or no correction insulin, this may be because you have insulin active in your system from a previous bolus.

If you use an insulin pump or bolus calculator app, these will take active insulin into account every time a correction dose of insulin is calculated. Active insulin is usually set at 3 or 3.5 hours as the majority of the bolus will be used in this time.

If you do not use a bolus calculator app or insulin pump, **you should not give a correction dose within 2 hours of a previous dose of fast acting insulin.**

High glucose level patterns

If you notice a pattern of high glucose levels at a particular time of the day, the usual dose of insulin affecting that time period may need adjustment. Please upload your pump/meter or send a photo of your glucose diary and give the team a call to discuss.