

Hypoglycaemia

What is hypoglycaemia?

Hypoglycaemia occurs when the blood glucose levels are below the normal range, around 5 mmol/l. In those without diabetes, the body starts to react to prevent the blood glucose dropping further at levels of around 3.6–3.9 mmol/l. In those with diabetes, hypoglycaemia is defined as a blood glucose below 4.0 mmol/l and this is when you and your child will need to act. An easy way to remember this is ‘Four is the floor’. In ‘mild’ hypoglycaemia the person can treat themselves; in ‘moderate’ hypoglycaemia they will need someone else to help treat their hypo. In ‘severe’ hypoglycaemia they may be unconscious or only partly conscious. Someone needs to give an injection of the hormone glucagon to raise the blood glucose.

Some children may feel that their blood glucose level is low when it is normal or even high if their body, more specifically their brain, has become used to running at higher levels.

What are the causes of hypoglycaemia?

Hypoglycaemia results from an imbalance between insulin, food and exercise. Too much insulin or exercise in proportion to too little glucose-containing food will cause hypoglycaemia (hypo). Exercise such as sport can cause hypos up to 1–2 days later. Your diabetes team will help find ways of dealing with exercise that suits your child, such as by eating a snack before exercise and/or reducing the insulin dose. Exercise is discussed in more detail in Chapter 3.

The symptoms of hypoglycaemia arise for two reasons. The first is the effect of the body’s response to stop or reverse the hypo from happening. Hormones, the body’s chemical messengers, are released into the bloodstream

to try to raise the blood glucose. This is called a counter-regulatory response and in those without diabetes, would normally cause symptoms at a blood glucose level of around 3.0 mmol/l. However, in those with diabetes, this will depend on what the blood glucose normally runs at, any recent low or high blood glucose, exercise, sleep and age. The first hormone released is adrenaline; this produces symptoms such as a fast pounding pulse rate, feeling shaky, sick and sweaty. Adrenaline is normally released to allow the body to respond well to stress – that is why the early hypo symptoms may feel like stress or anxiety. The hormone glucagon is also released to cause a more sustained rise in blood glucose. Glucagon works by breaking down glycogen stores from the liver. This makes people more prone to hypos during the day after a severe hypo as the glycogen stores may be empty.

Parents of children with Type 1 diabetes are given supplies of an artificial form of the hormone glucagon for emergency use (see p. 30). The other cause of hypo symptoms is due to the direct effect of low blood glucose in the brain. In those without diabetes these effects tend to occur at a blood glucose level of around 2.5 mmol/l. The brain, like any other part of the body, needs glucose as an energy supply and if blood glucose levels are low the brain will not work properly. This may cause difficulty in concentrating and hearing, headaches, confusion, drowsiness, blurred vision and slurred speech. The body will try to stop the fall in blood glucose but if the levels are dangerously low and a hypo is untreated a person with diabetes may fall unconscious and even have a fit.

Hypoglycaemia unawareness

If someone runs low blood glucose levels a lot of the time the body may think this is normal for them. They may not then get any warning that they are having a hypo from the effect of the hormones that are released to counteract the hypo. This is called ‘hypoglycaemia unawareness’ and can be dangerous as the person may not know they are hypo and, if their blood glucose falls too low, they may fall unconscious. This is reversible by avoiding hypoglycaemia completely for 2–3 weeks.

How can you tell someone is having a hypo?

How someone looks or feels can also be explained by the body’s response to hypoglycaemia. As the body tries to bring up the blood sugar your

child may be irritable, behaving unusually for them, looking pale, sweaty and trembly. You may notice that they are confused or have slurred speech.

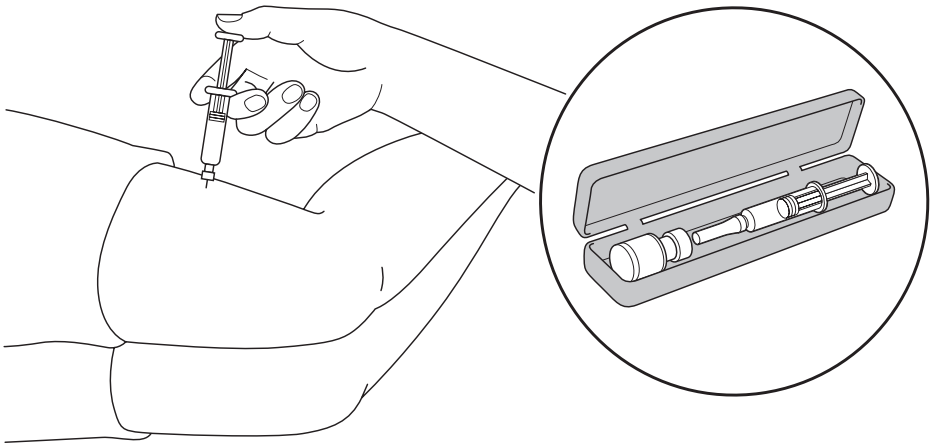
What is the best way to treat a hypo?

The severity of the hypo, your child's age, the type of insulin your child is on, and recent exercise are just some of the factors that will determine how to treat the hypo. The insulin regimen may also explain what time of day they tend to go hypo, although this will also depend on food intake, exercise and injection sites.

In mild and moderate hypoglycaemia, children need a fast-acting sugar, such as glucose tablets. They could have Lucozade, coke or orange juice if they prefer. You will need to wait up to 10–15 minutes before you see the blood glucose start to rise. You may need to give more glucose after this point if the blood glucose hasn't started to rise. Glucose or a sugary drink is preferred to foods such as chocolate and cake which are sweet but fatty, because fat causes glucose to get into the blood less quickly than glucose on its own. This means that the hypo will not be reversed as quickly. Except for those on insulin pumps, who can lower the basal insulin rate, children usually also need a longer-acting starchy food, such as a cereal bar, to stop another hypo happening later.

Children having a hypo may be awake but unable to chew glucose tablets or take a sweet drink. If they can swallow, glucose gels are useful and practical. If your child is not awake or is having a fit, you will need to give them an injection of glucagon into a muscle. It comes in an orange-coloured box, and is given by injection into muscle when a child has a severe hypo and is unconscious, as discussed below. Your diabetes team will show you how to do this. You will need, and probably want, to go to hospital if this occurs. If your child is unconscious, it is important not to give anything by mouth, including glucose gel, because of the risk of choking.

Glucagon can make people feel sick and even vomit, sometimes only after 1–2 hours. Sometimes the glucagon injection does not work to raise the blood glucose. This can happen if the liver's glycogen stores are already depleted, having already been broken down to produce glucose to counteract a hypo during the previous day, or after extreme exercise. If



Injecting glucagon into muscle

this happens, you will need to call an ambulance or go to hospital immediately for intravenous glucose.

It is important not to overtreat hypos, although this is easier said than done because witnessing and experiencing hypos can be frightening. Overtreating hypos occurs frequently, as you feel like eating until your symptoms start to go away, and should not be underestimated. It is worth being clear about your child's hypo treatment with your diabetes team as overtreatment will cause a rapid swing to high blood glucose.

Will hypos cause long-term damage?

Having hypos will affect an individual's ability to concentrate and perform tasks. Most of the effects disappear within minutes. However, with more severe hypos the effects may last up to 24 hours. Mild to moderate hypos will not cause any long-term damage. It is still unclear whether severe and sustained hypos causing unconsciousness may affect brain functioning in the long term. As most brain development occurs in the first five years of life, in particular the first two years of life, it is best if severe hypos are avoided in this age group, although sometimes this is easier said than done.

Will they wake up if they have a hypo at night?

Night-time hypos are often a parent's biggest fear. Most children will either wake up if they have a night-time hypo or sleep through it and still be all right in the morning. Others may have nightmares or complain of headaches or feeling tired on waking. A hypo at night may cause a blood glucose reading to be high in the morning because normal stress hormones have been released to raise the blood glucose to counteract the hypo. This is called the **rebound phenomenon**. Even if a child has a hypo severe enough to fit, usually this will stop on its own. Diabetic keto-acidosis, due to skipping insulin injections, is a more likely cause of death in diabetes than hypoglycaemia.

I am often asked about the 'Dead-in-Bed' syndrome, the sudden death at night of someone with diabetes. I cannot stress enough how *extremely rare* this is. It is not often discussed in clinic but is a frequent cause of worry and distress for parents. The cause of the syndrome is not known, making it difficult to advise about prevention. Some theories about cause include hypoglycaemia at night causing an arrhythmia (heart rhythm disturbance). Such a hypo may have occurred because of taking the wrong type or amount of evening insulin.

This fear needs to be kept in balance; avoiding hypos at night is important but so is avoiding marked hyperglycaemia. If you are worried about night hypos there are several things you can do.

- Test your child's blood glucose before bed. You could also test occasionally in the night, such as when you get in from a late night out. You could also ask your diabetes clinic if they have a continuous glucose monitor (CGM), to measure the glucose at night over a few days, as described in more detail in Chapter 3.
- Give your child a snack before bed. This advice may depend on the insulin regimen, so discuss this with your diabetes team. Discuss changing the insulin regimen if it is not working for your child.
- Discuss with your diabetes team what bedtime glucose to aim for. Your doctor may advise that you should try to keep the blood glucose at bedtime slightly higher than at other times, depending on the type of insulin your child is on.

Case 1

Paint me a hypo

On a summer camp for young people with diabetes, children were asked to paint a hypo. They were better able to put their thoughts into pictures. In the poem below I imagined what the children were trying to express in their drawings. Each stanza is about one drawing.

*Man trapped in a Caged Cell
Stuck in the mud of a shadow
Somehow dodging the glare
through the bars from
The Other Side.*

*Jekyll and Hyde
A switch to
The Other Me
Which I see as One
Each snippet of time.*

*People dissolving
Smaller
Smaller
Floating up,
Those helium-filled people,
As my head begins to spin and
My BMs drop.*

*A column of blood is all I am
Blood which may be
High
Low
Sometimes just right.*

*Invisible brain
Whose pandemonium is
Inexplicable to those
Outside
My trembling head.*

*A wobbly smile or
Half-misunderstood frown
Tears trickle down my now pale
cheeks.*

*As for me?
I can be all of these and have
been
But still I am me.*

*Originally published in
Diabetic Medicine,
Blackwell 2002; 19:343*

*Seeing her fighting and hitting me when low and
refusing juice is stressful.*

(A mum describes the stress of witnessing a hypo)

Discussion

Hypos can be frightening to experience as well as to witness. The poem above and the picture (on p. 39) explaining how children feel when having a hypo may surprise and upset you. Pictures can capture a lot more than the words can express. They show how scary a hypo can feel.

Although all the experiences are different, the common themes may explain why your child behaves in a certain way – being upset, irritable, agitated, scared or not being ‘there’. Given those feelings, it would be easy to understand why some prefer to run their blood glucose a bit higher just to avoid having a hypo or avoid hypos at all costs. For others, having a mild hypo is no big deal and a great reason to eat some sweets. Some people tell me they enjoy hypos, but perhaps it is the treatment they enjoy.

Having hypos is part of having diabetes. Some hypos are avoidable by understanding a child’s own routine. Others will just happen and often without a good explanation. Having no hypos at all may mean that your child’s blood glucose levels are running high a lot of the time, which can bring its own problems (see Chapter 6: Hyperglycaemia, ketoacidosis and complications). The opposite is also true – having too many hypos is also not a good thing, both because of the inconvenience they bring but also because severe hypos can be dangerous and may lead to the body feeling as if hypos are ‘normal’, resulting in lack of awareness. Whether or not having hypos with diabetes is a ‘normal’ or even a ‘good thing’, for the person who has to experience them, it can be embarrassing, inconvenient, frightening or just a darned nuisance.

Most children will remember being woken, or waking themselves, because of a hypo during the night. It can be horrid – it’s dark, and they are not feeling right. Some children might wake up and be confused, and wander about for a bit getting more confused. Being tired or having more hypos the next day can feel like a punishment.

Young children often do not recognise when they are hypo. You will learn how to recognise hypos for them. This will be particular to each individual. It may be because of a change in their behaviour, such as becoming quiet, more active or aggressive, or a change in their appearance, such as becoming pale or sweaty.

Ultimately your child will need in time to learn about their own hypos and how to recognise and treat them themselves, in order to lead an independent life.

Case 2

Hypo memories

Introducing Jeffrey, 9, diagnosed aged 4

Sometimes I have bad dreams that something bad has happened. I take too much insulin and then I'm in hospital.

When you're hypo your belly hurts and you're sweating a bit. If you take [eat] something it takes a while. Your belly still hurts so you think it's not working so you take a bit more [food]. But then you do your sugar level and it's high.

If you have a hypo in front of other people they might crowd around you – too many voices.

I kind of feel a bit bad and a bit funny. When I was 7 I wasn't sure what it felt like. I started to get the idea when I was 8.

Discussion

Jeffrey describes the fear experienced when having a hypo. He has been hospitalised before due to a severe hypo and carries this memory with him. He also describes his experiences of a hypo and why it is easy for those with diabetes, as well as for those treating hypos, to overtreat them. It is easy to give advice about waiting some minutes before seeing the effect of the hypo reversed with treatment. In practice, it is easier said than done. For your child who is experiencing the hypo, they just want it to go away. Witnessing hypos can also be frightening and you may want to give your child more and more food to get them out of it. However, they may then go high later just because of overtreating the hypo rather than due to rebound (see p. 31). It is important not to treat any rebound with extra insulin otherwise your child may go into another hypo and blood glucose will be rising and falling so unpredictably that you won't know where you are. You will work out what's best with a little trial and error.

The other issue Jeffrey raises is that when he is having a hypo people crowd around him. There are 'too many voices'. Many of us who have hypos do not like people talking to us. It is too much to cope with whilst having a hypo. Even worse than talking, is when people talk loudly: they do it because they are afraid. People tend to ask others they see in distress, loudly, 'ARE YOU ALL RIGHT?' Generally, we want to be left quietly and not talked to

whilst we eat our glucose until we start to feel better. My advice would be to sit quietly next to your child offering them their hypo treatment and waiting for them to initiate conversation. Of course this will not apply to very young children who often do not recognise what is going on.

Case 3

Different types of hypos

Introducing Jason, 27, diagnosed aged 7

I often mistreat a hypo and eat too much. It's a survival instinct – your body tells you that you need to eat, you open the fridge and gorge. Something makes you feel really hungry.

There are different types of hypos. I feel really tired and sleepy. Then I realise I'm hypo and I'm back to my normal self. Self-doubt. I'm trying to do something and I start questioning everything. I feel really strange. You're falling into a hypo but you're not thinking. So you can overlook that you're having a hypo.

It can be dangerous. Sometimes at night I can't sleep worrying about things irrationally. Suddenly I realise that I'm having a hypo. Hollow, something's missing and you want to curl up into a ball. Other times, my brain can function well but I lose control of my limbs and actions. I can see where I want to go but I'm falling over, like when I did my injection and was watching the cricket on television, which is a really slow game. Suddenly I realised I was hypo and I was trying to get to the garage to get the Lucozade. My brain knew where I wanted to get to but I couldn't get there. Once I started fighting people when out playing golf with friends and then collapsed. It was the first time my friends had seen me like that.

Discussion

Even though Jason is an adult, he admits to still overtreating hypos. He is aware that he does it but he still tends to overtreat them. It highlights really well the instinctual feeling that a hypo brings and the feeling of needing to get your blood glucose level up *up*, now now *now*.

It is easy to overreact to a hypo, both by the person having the hypo and the person treating it. Many people feel a 'hunger rage' and want to devour

everything in their sight. As the body's natural defence reactions to having a hypo will also kick in, overtreating the hypo in combination with this effect may cause high blood glucose hours later (see rebound phenomenon on p. 31). The hunger is not a real hunger, but a desire and urgent need for food.

With some discussion, thought and planning, it is possible to make a decision not to overtreat hypos. If you think you or your child are prone to overtreating hypos it would be worth asking your diabetes team to remind you how much is needed to treat a hypo. This will depend on the age of your child.

Jason also describes how he can have different types of hypos. This may depend on other distracting things that are going on, or the rate of fall of the blood glucose level. A slow fall in blood glucose can cause a sudden realisation of already being in a hypo. If the blood glucose falls rapidly it can also be really sudden and make you feel off-kilter. Some of us may feel hypo just because the blood glucose is falling rapidly even if you check the level and it is normal. Many also confuse the symptoms of being low and high, so it is always worth doing a blood test to confirm a hypo before starting treatment. If your child thinks they are having a hypo in this situation, sit them down and recheck their blood glucose again in a few minutes. Your child will often be correct and they are now having a hypo, rather than just wanting some sweets.

Case 4

Hypo fear

Introducing Daniel, 17, diagnosed aged 12

Sometimes I forget or miss my injection. At the beginning I was told to give 30 units of long-acting [insulin] at night. It was too much, I kept having hypos and getting up in the night and not sleeping.

Before I didn't know how to adjust my insulin so I stopped taking it for several months and just took fast-acting.

It was mostly a deliberate thing so I didn't ever go into a hypo. For me, when I'm hypo I feel weak. If I don't eat something now I'm going to fall and go to sleep. I feel safer if I'm a bit higher and not too low. If you're too low it's too drastic.

Case 4 *continued*

One time I had given my injection but I didn't feel like eating. That time I was out of it. They phoned my diabetes specialist nurses who told Mum to give me sugar in hot water. I remember waking up and being given lots of sweet drinks. I didn't feel like eating and drinking.

Discussion

Daniel has such big hypo fear that he doesn't feel he has time to test his blood glucose level to confirm he is hypo. However, he may not be. Daniel did tell me about one or two major hypos that he had in the past. He may now be having symptoms of anxiety, which can mimic hypos. Alternatively, following on from these big hypos he decided to run his blood glucose levels high to avoid having them. As a result his body may have adjusted to a higher blood glucose level and 'think it is normal' for him to experience blood glucose at a higher level. He then may experience hypo symptoms at a blood glucose level which is not low. Doing a blood test is the only way of confirming whether your child is having a hypo or not. There is usually time, except in the rare circumstance that they are not fully awake. It will also allow you and them to learn at what blood glucose level they feel hypo. This may change with time depending on their awareness, which may change with age, as well as the blood glucose levels that they are running at the time.

Case 5

Learning from mistakes

Introducing Mike, 27, diagnosed aged 11

I used to play the violin at school. When I was 17 it was my first time leading the school orchestra. I came on stage and did my bow. I played the first note and knew that I was low. I didn't know what to do. I couldn't just walk off stage and I didn't have any Dextrose in my pockets. I carried on but by the interval I was pouring with sweat and I had played the first half of the concert really badly. I sorted myself out in the interval and played a good second half. At the end I told the conductor I had had

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Case 4 *continued*

a hypo and he said, 'I thought you weren't on form'!

Hypos always happen at the wrong time – the only time you need a good sleep you wake up at 2 a.m. having a hypo or if you're in a rush.

It taught me a good lesson, to test before I do anything important.

Discussion

Mike learnt two valuable lessons: to always do a blood test before doing anything important and to always carry glucose tablets with him. As Mike is now an adult and one who drives, this has stood him in good stead as he knows the importance of checking his blood glucose before he gets behind the wheel of a car and always has something to treat a hypo if he does have one when driving.

Daniel in the previous case also learned the hard way that giving insulin and not eating results in an unwanted hypo. There's a lot to be said from learning from one's own mistakes. However, for Daniel the experience of the hypo made him want to avoid another one at all costs. This is a bit extreme and in most cases children will learn that they need to eat after injecting, what they need to treat their hypo and what to do. Most know they need to sit and be still and let their blood glucose come up before rushing around again.

Most modern insulins may allow you to do the injection during or even after a meal. However, for those on two injections a day, this may not be possible. You may find yourself trying to force your child to eat to avoid a hypo. This can become an ongoing battle. It can be particularly difficult to persuade young children to eat when they don't want to. Speak with your diabetes team if this is your problem, as your child may benefit from changing insulin regimen, such as to a basal bolus regimen or an insulin pump (see Chapter 4).

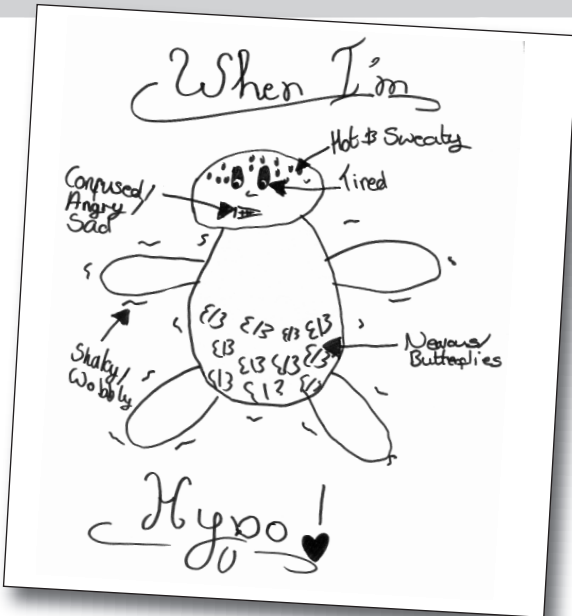
However, for young children or those who are 'fussy eaters' discuss this with your diabetes team: it may be possible to inject after you have seen what they have eaten. This works well on a basal bolus regimen (see Chapter 4). Even if your child hasn't eaten anything they will still need some insulin on board. If they are on a long-acting insulin injection lasting 24 hours, this might be enough without any short-acting if they haven't eaten. You will need to discuss this scenario with your diabetes team.

Q What does it feel like to have a hypo?

A If you ask ten people with diabetes what it feels like to have a hypo, you are likely to get ten different answers. There are symptoms common to hypos, such as feeling wobbly, shaky, vacant, hungry and sweaty; tiredness, a racing heart; feeling sick and having blurry vision. Even though some of those feelings may be similar, in each person with diabetes those feelings in their body will be different. Feeling wobbly to one person may be like floating up like a balloon, but to another like trying to balance on an inflatable raft on a rough sea. Some also find it hard to differentiate between being high and low.

Many young people get cross when those without diabetes say they know what a hypo feels like, thinking its like when they have missed a meal or feel hungry. Few people without diabetes experience hypos because the body is able to regulate their blood glucose instantly and stop it dropping too low.

You will only come close to knowing what your child feels like when they have a hypo if you ask them. The words that children use may only touch the surface of how it makes them feel. Drawing pictures is one way of allowing, in particular, young children, to express their feelings.



A girl aged 12 drew what it feels like to be hypo.