



Insulin Dependent Diabetes Trust

Hypoglycaemia

Updated January 2008

Registered Company Number 3148360
Registered Charity No 1058284



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Hypoglycaemia is not caused by diabetes but by the treatment of it.

What is hypoglycaemia?

In people without diabetes the level of glucose in the blood is controlled by insulin produced by the beta cells in the pancreas. This prevents the level of glucose in the blood from rising too high. In people with Type 1 diabetes, the body does not produce its own insulin and the blood glucose levels rise too high [called hyperglycaemia] and so injections of insulin are given to prevent this.

People with Type 1 and Type 2 diabetes are advised to keep their blood glucose levels as near to the normal blood glucose levels as possible. If the blood glucose levels drop below normal, whatever the cause, then this is called hypoglycaemia [a hypo]. 'Good' control of diabetes is avoidance of both high and low blood glucose levels.

Definitions

Normal blood glucose levels in non-diabetic people range between 4 and 7mmols/l. Hypoglycaemia is usually said to occur at 3.8mmols/l and so the recommended lower level is 4mmols/l – hence the recommendation to people with diabetes that “4 is the Floor”.

Note: Some publications say that hypoglycaemia does not occur until blood glucose levels are below 3.5 or even 3.0mmols/l. However, there is research that shows that the ability to function may be impaired by blood glucose levels of 3.8mmols/l and lower.

Useful definitions of hypoglycaemia

It is important that even mild hypos, or ‘lows’, are recognised as being hypoglycaemia and treated. This is also important so that all hypos can be reported to your doctor to provide a true picture of your diabetic control. Hypos are generally defined as follows:

Mild: a hypo that is easily treated by the patient by the intake of a sugary drink or food, often referred to as ‘being low’.

Moderate: one where someone else, spouse, friend or parent, has to intervene and give the sugary food/drink because the person with diabetes is confused or even losing consciousness

Severe: one that usually means unconsciousness and maybe accompanied by a convulsion/seizure.

Parent comment: I am sure that I under-reported my daughter’s hypos at our clinic visits because I was never sure how to answer the question about how many hypos she had since the last visit. I didn’t know whether to class the lows before meals as a hypo or not.

The causes of hypoglycaemia

The simplistic explanation is that hypoglycaemia is caused by too much insulin hence the statement that hypoglycaemia is not caused

by diabetes but by the treatment of it. The other way of looking at this is that there is not enough food for the exercise taken.

Information packs and leaflets describe the causes of hypoglycaemia as follows:

- Missing or postponing a meal or eating less than the correct allowance of carbohydrate.
- Taking more exercise than usual
- Injecting the wrong dose of insulin
- The risk of severe hypoglycaemia is increased threefold with tight control of blood glucose levels ie keeping blood glucose at near normal levels.
- Emotional upset or stress
- Alcohol consumption
- No apparent reason

From a patient/carer perspective this may seem like an underestimate of the complexities of hypoglycaemia in everyday life. Many leaflets for patients list these causes of hypos in a way that seems to place responsibility and blame on the patient and/or the family carer. All too often this can add to their feelings of guilt and failure for ‘not having managed their diabetes properly’! This is especially the case for parents of children with diabetes.

Treatment of hypoglycaemia

- Hypoglycaemia in its early stages [mild hypo] is treated with a sugary drink or sugary food. This should then be followed with some longer-acting carbohydrate to prevent another hypo.
- If the hypo is not treated at this stage then there may be confusion, behavioural changes, helplessness and an inability to function properly occurs [moderate hypo].
- If not treated at this stage with glucose or GlucoGel [was

called Hypostop] then coma occurs and this may or may not be accompanied by seizures [severe hypo]. Severe hypos need treating with glucagon or intravenous glucose and this may mean admission to hospital.

Note: GlucoGel is a sugary gel that can be squeezed into the mouth around the cheeks and gums. It MUST NOT be given if the person is unconscious or unable to swallow because they could choke. It is available on a doctor's prescription in the UK.

Some Golden Rules for hypoglycaemia:

- Always have some form of quickly absorbed glucose with you.
- Never drive while hypo. If warning signs come on while driving, always stop the car and get into the passenger seat so that you are not seen to be in control of a car while hypoglycaemic.
- When driving always keep glucose or sweets in an accessible place – the glove compartment is not very accessible.
- If it is difficult to make the person eat or drink, then GlucoGel can be used, which is easier than the more old-fashioned method of rubbing jam around the cheeks and gums!
- People with diabetes are renowned for denying that they are hypo when they actually are. If you are suspicious that they are hypo, always treat with sugary food or drink.
- If you are a carer and are unable to treat an unconscious hypo, call emergency services or your GP.
- If the hypo is accompanied by vomiting, drowsiness and difficulty breathing, then a doctor is needed and admittance to hospital.



Warning symptoms of hypoglycaemia

When the blood glucose levels start to drop at the stage of mild hypoglycaemia, then there are warnings signs/symptoms of the impending hypo. These are usually:

- Sweating
- Trembling
- Pallor
- Weakness
- Hunger

These are called the adrenergic effects of hypoglycaemia because the body reacts to the low blood glucose level by the production of counter-regulatory hormones, mainly adrenalin and glucagon. These hormones are the 'fight and flight' hormones that the body releases when there is any danger. Hypoglycaemia is a danger and these hormones give the warning symptoms of an impending hypo and trigger the release glucose from the liver.

If the mild hypo is not treated for any reason, then the blood glucose drops further and the symptoms of this are less obvious to the person with diabetes when the signs are usually:

- Confusion
- Irritability
- Behavioural changes such as aggression, excitement or violence
- Sensory changes such as blurred vision

These symptoms are much harder to recognise and can be missed and so remain untreated. This can lead to a severe hypo and unconsciousness.

These are the neuroglycopenic effects of hypoglycaemia because the blood glucose level has dropped to lower levels and the brain is starved of glucose. This results in reduced cognitive function with confusion and behavioural changes. The person who is hypo may well say that they are "definitely not hypo" but in reality this may be part of the confusion caused by the neuroglycopenia. Research has shown that brain function can be impaired when the blood glucose falls below 3.5mmols.

Important to remember:

- The warning symptoms vary from person to person and can vary in the same person at different times. Many people have found that the warnings seem to vary with the rates at which the blood sugars fall. For example after exercise they drop quickly but at other times it may be a gradual, slow drop over a longer period with less obvious warning signs.
- Often the family carer or friend notices the signs of a hypo before the person with diabetes, especially the behavioural changes which can be difficult to handle, especially aggressive and/or violent hypos.
- It is very common for the person with diabetes to deny that they are hypo even though they are. Carers get used to this as one of the signs that their partner or child is actually hypo!
- If the person who is hypo carries out a blood test while hypo the results are not necessarily reliable because of their confused state while doing the blood test.
- The warning symptoms are the body's mechanism for WARNING of an impending DANGER and that danger is hypoglycaemia.

Loss of hypo warnings [or hypoglycaemia unawareness]

Hypoglycaemia itself, or the avoidance of it, is an acute daily problem for people with diabetes but when accompanied by loss or partial loss of warnings, it can have a dramatic effect on the lives of both the person with diabetes and their families. There can be a marked reduction in the quality of life for all concerned.

- **Total loss of warnings** - is a condition where the warning symptoms of an impending hypo are not present and so when the blood glucose levels drop there are no warning signs that the person must eat. This makes the likelihood of severe hypos much greater. People with loss of warnings have to rely on the help of others.

- **Partial loss of hypo warnings** - this means that warning symptoms are present sometimes and not at other times. In some ways this is more difficult than total loss of warnings because the person may not even be aware that they have some loss of warnings and so have unexpected and unheralded moderate or severe hypos. This is particularly dangerous when driving.
- **Reduced warning symptoms** – is where the early warning signs of hypoglycaemia are reduced or missing [sweating, trembling etc] and the blood glucose drops to the stage where the symptoms are less obvious [confusion, behavioural changes etc]. This means that the person often then requires the help of others to treat the hypo.

The effects of loss of warnings

Information gathered from the experiences of people with diabetes and their carers says that loss of warnings may result in the following:

- A feeling of insecurity and loss of independence.
- Embarrassment.
- A fear of leaving the home.
- Being a danger to oneself and others.
- Aggressive or violent behaviour.
- Family conflict, breakdown of relationships.
- Loss of driving licence – it is illegal to drive with loss of warnings.
- Loss of job
- A deliberate raising of blood glucose levels to avoid such situations.

There are several causes of loss of warnings or hypo unawareness:

- Duration of diabetes – long term diabetes can result in loss of warnings.
- Hypoglycaemia itself can cause loss of warnings and therefore the risk of more hypos. This then becomes a vicious circle of hypos leading to loss of warnings and more hypos!
- Intensive therapy with multi-daily insulin injections and aiming for near normal blood glucose levels, has been shown to cause

a threefold increase in the risk of severe hypoglycaemia. This increased hypoglycaemia can therefore increase the risk of loss of warnings.

- Neuropathy – damage to the autonomic nervous system is a complication of diabetes and this can cause loss of warning symptoms.
- Changing insulin species can cause a loss or change in warning symptoms.
- ‘Human’ insulin can cause loss of warnings of hypos - from the early 1990s, Patient Information Leaflets in ‘human’ insulin packs have included this warning.

Living with the daily risk of hypos

Here are just a few quotes from people with diabetes:

- “Hypoglycaemia is one of the worst parts of having diabetes”
- “Hypoglycaemia screws up your life.”
- “For some of us it is a constant battle that we go through everyday and every night to try to obtain some sort of normality in our blood glucose levels. The fears and experiences, especially of hypoglycaemia comas and seizures that many of us and our carers suffer, are ever present.”

Practical information from people with diabetes for people with diabetes

- One hypo can easily lead to another within the next 72 hours. The first hypo used up much of the body’s emergency store of glucose so leaving the body vulnerable to another hypo.
- Strenuous exercise can lead to low the blood sugars the next day.
- Exercise sufficient to lower blood sugars and cause a hypo is not always the strenuous sporty-type exercise. For example, for people with a sedentary job or the elderly, a trip around the busy

supermarket is exercise and can be sufficient to cause a hypo.

- Sexual intercourse is exercise and can cause hypos in both men and women.
- Alcohol lowers the blood sugars and can cause hypoglycaemia both at the time and up to 48 hours later. Alcohol also masks the warning signs of a hypo. Hypos can be misinterpreted by others as ‘ you being drunk’.
- Good diabetic control means avoiding hypoglycaemia just as much as avoiding hyperglycaemia [high blood sugars].
- Hypoglycaemia itself can lead to loss of warnings.
- Being able to function and walk around with low blood sugars does not mean that you are not hypo – it probably means that you have missed or not had the early warning signs.
- Emotional upset, stress and excitement, which may not always be apparent, can cause hypos.
- Some drugs taken for other conditions may cause hypoglycaemia eg beta-blockers.
- With illness and especially vomiting, it is OK to eat or drink anything that will keep the blood sugars up to avoid hypoglycaemia.
- All long and intermediate acting insulins contain crystals and they settle to the bottom of the vial. They must be re-suspended before drawing up and injecting the insulin. Research has shown that the vial must be rolled or tipped 20 times to achieve a satisfactory mixture. Failure to do this can result in unexpected hypos because there will be less crystals in the insulin and it is the crystals that slow down the action of the insulin.
- A change of insulin type, species and even batch can affect diabetic control and cause hypos.
- Genetically produced synthetic ‘human’ insulin in some people causes more severe hypos, more frequent hypos and reduced or loss of warning symptoms.
- Hypos can occur for no apparent reason and in people who blood test frequently as well as those who don’t.

Hypoglycaemia and family carers

In 1997 IDDT conducted group discussions with people with diabetes and unrelated family carers - both partners and parents. The discussions highlighted that the whole issue of carers and their role in diabetes was a source of conflict and there were some marked disagreements between some of those with diabetes and some family carers.

If any conclusions could be drawn it was that the role of the carer differs according to the circumstances at the time. It was also generally accepted by those with diabetes and by the carers that where long-term complications of diabetes were present, the carer would fit into the 'normal' caring role. The conflicts seemed to be present when the adult/child/teenager is healthy and leading an independent life.

Below is a summary of the discussions and they are important because they perhaps represent views, experiences and conflicts of many families who live with diabetes.

People with diabetes:

- Some fiercely defended their independence and could not see a need for the involvement of their family carer while others seemed quite happy to accept their partners as carers both in the provision of meals and the early recognition of hypos.
- Some expressed resentment that a carer should even consider being included in a hospital visit and could not understand that their partners may have their own fears and needs for information and support.
- Some expressed concerns that an involved partner might be judgmental.
- There was general acceptance that a carer is needed for moderate or severe hypos.

Carers, partners and parents expressed the following:

- Feelings of being excluded and uninformed.
- Fears of hypos especially severe ones and those occurring during the night. Fears of the responsibilities and making decisions eg when to call the doctor in emergency.
- Resentments that as a carer they have to deal with hypos but are often excluded from having any involvement in diabetes or its management by the independent partner and the hospital diabetes team.
- Difficulties of carrying on a normal life after aggressive, abusive or violent hypos in their partner despite knowing that they were not responsible for their actions because they were hypo.
- Fears for the effects on their children when a parent is having a moderate or severe hypo or 'behaving strangely'.

Quote from a carer: *"It's as if it is OK for me to sort out the hypo but all the rest has nothing to do with me. I feel used and trapped."*

Parents expressed many of the same feelings, especially during the teenage years. But they also had additional fears about the psychological impact of hypoglycaemia on their child with diabetes and any other children in the family. They also said that diabetes caused marital and family conflicts and that the worry about hypos, especially at night, was a major problem.

Quote from a sibling: *"My memories of my sister's hypos are of us arguing and getting angry – she was given sugar and was fine in 10 minutes while I was left still feeling angry."*

Is hypoglycaemia dangerous?

Hypoglycaemia can affect people's work, relationships, ability to drive and their whole quality of life but there are two main aspects to the question of whether it is actually dangerous:

- Severe untreated hypoglycaemia leads to coma with or without an accompanying seizure and this can occasionally lead to death. A study in the UK analysed the records of 23,752 people with Type 1 diabetes between the ages of 1 and 84 who had been diagnosed before the age of thirty to ensure that they really had Type 1 diabetes. They entered the study between 1972 and 1993 and were followed until 1997. By 1997, 949 people had died and hypoglycaemia was responsible for 18% of deaths in men and 6% of deaths in women. [BDA Cohort Study, Presented at the BDA Medical Conference, April 1999] Similar research in the US has shown the estimated deaths from hypoglycaemia to be between 4 and 13% of the total number of deaths in insulin treated people.
- There is growing evidence that repeated moderate/severe hypoglycaemia can cause a reduction in cognitive function. This is of special concern in children where the brain is still developing. Some research has suggested that repeated hypoglycaemia in children can reduce the IQ by 5 or 6 points which does not sound very much but one researcher suggested that this could mean the difference between getting a university place and not. [See Useful Research item 8 of contents]
- Loss of warnings of an impending hypo can be classed as dangerous because it can result in more episodes of hypoglycaemia with all the consequent risks.

Hypoglycaemia and alcohol

Alcohol can cause delayed hypos in people with Type 1 diabetes - low blood sugars the day after drinking even modest amounts of alcohol the previous evening. Research carried out at the Royal Bournemouth Hospital [Diabetes Care, July 2005] has shown that alcohol has been implicated in up to one fifth of hospital visits for hypoglycaemia, low blood sugars. The researchers investigated the effect of evening alcohol in 16 people with Type 1 diabetes who had

normal hypo warnings and who drank alcohol on a regular basis. The participants were evaluated with continuous blood glucose monitoring on two occasions - after taking orange juice and vodka or just orange juice followed by the same meal and same dose of insulin. They experienced 1.3 episodes of hypoglycaemia per day during the 24 hours after the alcoholic drink compared to 0.6 episodes after a non-alcoholic drink. The researchers suggest that this research may encourage people to be more 'proactive' in adjusting their insulin appropriately if they are drinking alcohol.

Just a few words of warning:

- Try to learn how alcohol affects you and learn the best ways to cope with it.
- It is always best to drink with a meal and to tell someone you are with that you have diabetes.
- You should not assume that because some drinks contain carbohydrate that this will counteract the hypo risk because it doesn't.
- Low carb alcoholic drinks such as Pils contain more alcohol - so not a good idea!
- The warning signs of hypos can be missed with too many drinks and other people may mistakenly think that you are drunk rather than you are hypo.
- Carry out more blood glucose tests to check for hypos for at least the next 24 hours

Useful research

HOW TO AMELIORATE THE PROBLEM OF HYPOGLYCAEMIA IN INTENSIVE AS WELL AS NONINTENSIVE TREATMENT OF TYPE 1 DIABETES

Intensive therapy in Type 1 diabetes has been shown to increase the frequency of severe hypoglycaemia. This study asks the questions

– is it possible to maintain long-term HbA1c levels of less than 7.0% without increasing the frequency of severe hypoglycaemia and secondly is it possible to do this without increasing the frequency of mild, recurrent hypoglycaemia? The author maintains that the answer is 'yes' and the key factors are use of a physiological model of insulin replacement and the education of patients so that they are able to make the appropriate decisions about insulin dose based on blood monitoring and eating patterns. He goes on to point out that whenever the HbA1c is less than 6.0 [where the upper normal limit is 5.5%] and the patient does not report autonomic warning symptoms [classic early warning symptoms] when their blood glucose is less than 3.0mmol/l, then hypoglycaemia unawareness should be suspected. Patients with hypo unawareness should be treated with short-term meticulous avoidance of hypos which reverses the abnormalities of responses of symptoms, hormonal counter-regulation and brain cognitive function and therefore decreases the risk of severe hypoglycaemia. This does not result in a loss of long-term near normal blood glucose levels.

Diabetes Care 1999 Mar; 22 Suppl 2: B43-52

FREQUENCY AND MORBIDITY OF SEVERE HYPOGLYCAEMIA IN INSULIN-TREATED DIABETIC PATIENTS

This study surveyed 600 randomly selected patients from a large diabetic clinic in a teaching hospital to estimate the frequency and morbidity of insulin-induced hypoglycaemia.

- Morbidity (hypoglycaemia-related injuries, convulsions, and road traffic accidents) was ascertained in 302 patients. 175 (29.2%) of the 600 patients reported a total of 964 episodes of severe hypoglycaemia in the preceding year.
- The frequency of severe hypoglycaemia, which was documented in 544 Type 1 (ketosis prone) diabetic patients, was double that observed in a subgroup of 56 Type 2 diabetic patients who were being treated with insulin.
- 20 patients (6.6%) reported a total of 37 convulsions associated with hypoglycaemia, 5 of which had occurred in the preceding year.
- 5 patients reported road traffic accidents in the preceding year

which had been caused by hypoglycaemia.

The authors concluded that the only reliable predictors of severe hypoglycaemia were a history of previous severe hypoglycaemia, a history of hypoglycaemia-related injury or convulsion and the duration of insulin therapy.

Diabet Med 1993 Apr;10(3):238-45 MacLeod KM; Hepburn DA; Frier BM

PHYSICAL AND PSYCHOLOGICAL WELL-BEING IN ADULTS WITH TYPE 1 DIABETES.

This study looked at the physical and psychological wellbeing of 397 people with Type 1 diabetes by using a series of questionnaires. Diabetes complications and HbA1cs were also measured. The results showed that older people, those with complications, women, the less physically active and those on lower incomes were more likely to experience a poorer quality of life. People that reported at least one hypoglycaemic episode per month also had a poorer quality of life. The authors point out that it is of particular interest that hypoglycaemia is associated with a poorer quality of life, especially given the importance of reducing blood glucose levels to avoid complications. They also point out that with the emphasis on reducing blood glucose levels, the impact that hypoglycaemia may have on quality of life may be overlooked.

Diabetes Res Clin Prac 1999 Apr; 44[1]:9-19

ALCOHOL, DRIVING AND HYPOGLYCAEMIA

Alcohol can interfere with all aspects of the normal physiological, cognitive and symptomatic responses to hypoglycaemia. In otherwise healthy individuals, the net effect of alcohol on glucose metabolism is neutral, provided that liver glycogen stores are replete. For insulin treated people, the influence of hypoglycaemia is more relevant.

A study conducted in 1990 found that moderate alcohol consumption of 100-120mg/100ml blood, markedly reduced awareness of hypoglycaemia and slowed down reaction time. The loss of awareness occurred despite the presence of the usual symptoms such as facial flushing, blurred vision, pounding heart and sweating. The patients felt hypo after alcohol when blood alcohol levels were within the normal

range but by contrast, the clinical features of low blood glucose can be mistaken for alcohol intoxication.

Even at very low levels of blood alcohol it is possible that there may be a deleterious effect on cognitive performance which may be aggravated if blood glucose levels fall below the threshold which has been shown to impair cognitive performance. It is therefore better not to take any risks with driving and better not to drink at all if driving.

Diabetologia 33: 216-21Kerr et al

HYPOGLYCAEMIC COUNTERREGULATORY RESPONSES DIFFER BETWEEN MEN AND WOMEN

This study was carried out in the US using 8 men and 8 women with Type 1 diabetes and 16 matched non-diabetic control subjects. After overnight normalisation of blood glucose levels, they all underwent a 2 hour clamp study to lower their blood glucose levels to 3.0mmols/l. The results showed that the counter-regulatory responses to fixed hypoglycaemia were different in men and women with Type 1 diabetes in the following ways, described by the authors as “differing markedly”:

- The sympathetic nervous system – growth hormone and endogenous glucose production responses were significantly reduced in the women with Type 1 diabetes
- Autonomic symptom awareness appear to be relatively increased in Type 1 diabetic women.

Diabetes 2000 Jan;49[1]:65-72

THE IMPACT OF SEVERE HYPOGLYCAEMIA ON SPOUSES OF PATIENTS WITH DIABETES

23 wives and 38 husbands of IDDM patients took part in this study to compare spouses with and without a history of recent severe hypoglycaemia. Results showed no difference in spouses of patients with and without a history of severe hypoglycaemia or depression, anxiety and general marital conflict, but spouses with a recent history of severe hypoglycaemia showed significantly more fear of it, marital conflict about diabetes management and sleep disturbances. There were no differences between husbands and wives except that husbands showed more sleep disturbance.

The authors point out that severe hypoglycaemia may be associated with other forms of distress which are not easily measured.

Diabetes Care 1997; Vol 20:No10

ANGER STATE DURING ACUTE INSULIN-INDUCED HYPOGLYCAEMIA

This study was carried out in Edinburgh and its purpose was to look at the effects of hypoglycaemia, induced by insulin in laboratory conditions, on anger. The participants were 18 non-diabetic and 30 people with Type 1 diabetes. Blood glucose levels were controlled by glucose clamp. Participants underwent both hypoglycaemic and normal glucose conditions separated by 2 weeks and during each study condition were asked to fill in a questionnaire on anger state. The results showed that hypoglycaemia caused both those people with and without diabetes to report a significant increase in feelings of anger even though they were not in a confrontational situation. However, there were no clear associations between change in reported anger and measures of anger trait and anger expression. No association was found between the change in anger state and the intensity of a person's symptom response to hypoglycaemia.

Physio Behav 1999 Aug; 67[1]:35-9

CHANGES IN ATTENTION WITH HYPO- AND HYPERGLYCAEMIA IN CHILDREN WITH IDDM

Researchers in Austria compared the results of a computerised attention test in 38 children with IDDM in relation to various spontaneously occurring blood glucose levels. The attention varied significantly with blood glucose levels, those used being <3.3mmols/l, 3.3-8.3mmols/l and >8.3mmols/l. The highest number of errors and the longest response time was observed during the test run for hyperglycaemia.

The results showed that the attention in children with diabetes was significantly reduced compared to the norms for the test used especially during mild hypoglycaemia. Age, sex, age at diagnosis, metabolic control and the results of the intelligence test had no influence on the results. The authors conclude that in children with diabetes a significant reduction in attention was found at mild hypoglycaemia but

also at low normal blood glucose levels. This shows that attention deficits may occur in children with diabetes before they are aware of any hypo symptoms.

Eur J Paed 1998 Oct; 157[10]: 802-5

NOCTURNAL HYPOGLYCAEMIA AND YOUNG PEOPLE

Doctors at from the John Radcliffe hospital in Oxford visited the homes of 29 children with diabetes aged between 5 and 13 to measure their overnight blood sugars. They also looked at 15 children without diabetes as a control group. They then carried out tests to see if low blood glucose levels during the night had any effects on the children's cognitive abilities and mood the next day.

The results showed that 20 of the 29 children had a hypo during the two-night study period. There were no effects on cognitive function the next day but the children had a decrease in wellbeing and low mood. The doctors concluded that children with Type1 diabetes should have a bedtime snack and if parents are suspicious that there are further hypos during the night, then a midnight blood test may be advisable.

Archives of Diseases in Childhood 1999; 81:138-42

THE EFFECT OF HYPOGLYCAEMIC SEIZURES ON COGNITIVE FUNCTION IN CHILDREN WITH DIABETES: A 7-YEAR PROSPECTIVE STUDY

This study was carried out in Canada and 16 children with IDDM were evaluated at diagnosis and after 1, 3 and 7 years. They showed significant declines in verbal but not visuospatial abilities particularly if they had any seizures from hypoglycaemia. At the 7-year assessment those with hypoglycaemic seizures showed deficits on perceptual, motor, and attention tasks.

Hospital for Sick Children and The University of Toronto, Canada

NEUROCOGNITIVE FUNCTIONING IN CHILDREN DIAGNOSED WITH DIABETES BEFORE THE AGE OF 10 YEARS

This study was carried out in California with 55 children who were diagnosed with diabetes before the age of 10 years and had an average age of 7.9 years. They were given a series of tests to evaluate memory/attention, visual-perception, broad cognitive function, academic

achievement and fine motor speed/co-ordination. 15 siblings non-diabetic siblings acted as controls. 27 of the children were less than 5 years old when diagnosed. The average duration of diabetes was 2.6 years. 18 children had a history of severe hypoglycaemia, 8 of them had hypos with seizures.

The results showed that there was no association between neurocognitive test scores and severe hypoglycaemia but that the children with a history of seizures had lower scores on tests assessing memory skills including short term memory and memory for words. They also found lower HbA1cs and an increase in the number of blood tests were associated with higher scores in some areas of academic achievement and memory. The authors conclude that specific aspects of neurocognitive functioning may be adversely affected by having hypos with seizures but not by severe hypos without seizure. They also suggest that stable blood glucose levels may influence some aspects of academic achievement. They recommend that there should be investigation into ways of avoiding the risks of seizures with hypoglycaemia.

J Diabetes Complications 1999 Jan-Feb; 13[1]:31-8

HYPOGLYCAEMIA IN CHILDREN WITH TYPE 1 DIABETES. RISK FACTORS, COGNITIVE FUNCTION AND MANAGEMENT

This paper examines the relationship between hypoglycaemia and brain function in children with Type 1 diabetes. It points out that hypoglycaemic episodes in the first 5 years of life may permanently disrupt cognitive function in a sub-group of children with diabetes and that a single acute episode may produce a transient reduction in mental efficiency, alter the electrocephalogram and increase regional cerebral blood flow. It further points out that because hypoglycaemia unawareness, induced by the treatment of diabetes and autonomic response failure to hypoglycaemia are the most likely causes of severe hypoglycaemia, the paper recommends that medical management should be directed at the prevention of frequent recurring, mild hypoglycaemia.

Endocrin Metab Clin North AM 1999 Dec;28[4]:883-900

CONVENTIONAL VERSUS INTENSIVE DIABETES THERAPY IN

CHILDREN WITH TYPE 1 DIABETES

This study was carried out because severe hypoglycaemia may impair medial temporal-mediated cognitive skills, such as the ability to recall past events [delayed declarative memory]. The aim of this study was to find out whether this delayed declarative memory is present in children with diabetes who have an increased risk of severe hypoglycaemia – those on intensive therapy, defined as those using 3-4 injections a day. 34 children at the time of diagnosis were randomised to either intensive or conventional therapy so that an accurate assessment of the number of severe hypoglycaemic episodes could be made. The importance of avoidance of hypoglycaemia was emphasised in both groups. A control group of non-diabetic children was also set up to carry out the various memory tests as well.

The results showed that:

- the intensively treated group had a threefold higher rate of severe hypoglycaemia than the conventionally treated group.
- They performed less accurately on the spatial declarative memory task [recalling of past events] than the conventionally treated group or the controls.
- They performed more slowly, but not less accurately, on the pattern recognition task than the conventionally treated group or the controls.
- In both groups of children with diabetes there was significant impairment on a motor speed task compared to the non-diabetic children.

The results indicate that there is selective memory impairment associated with intensive therapy and this is consistent with the effects of severe hypoglycaemia and medial temporal [this is an area of the brain] damage or dysfunction. The authors suggest that if larger prospective studies show that severe hypoglycaemia does cause memory impairment then extreme caution should be taken before imposing strict glucose levels on children with diabetes because of the associated risk of hypoglycaemia with intensive therapy. However the editorial in the same journal by Christopher Ryan suggests that we should build on the existing studies which would be more cost

effective before going as far as setting up a large prospective study. He suggests that in the meantime there needs to be prevention of hypoglycaemia in children with diabetes to “avoid the very small risk that the treatment of diabetes could affect memory and other cognitive processes in the child.”

Diabetes Care, Vol 22, No 8, Aug1999

It is for all these reasons, and more, that IDDT believes that natural pork and beef insulin must remain available indefinitely. The most common reported adverse reaction to ‘human’ insulin is loss of warnings of hypoglycaemia, which in many people regresses with a change to natural pork or beef insulin. For this sub-group of people it is essential that the choice of animal insulins remains available to ensure that they do not suffer unnecessary and avoidable hypoglycaemia.

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