Hypoglycaemia

Aim(s) and objective(s)

Hypoglycaemia (a “hypo”) can occur as a consequence of diabetes treatment. It is a common problem among people with diabetes particularly those who are treated with insulin. As well as being unpleasant and inconvenient to the person hypoglycaemia can have serious and potentially life threatening consequences. It can also lead to physical injury to the person or even to a third party (for example if person is driving or operating heavy machinery, see NHSL guidelines on Driving and Diabetes and Employment and Diabetes).

Recurrent hypoglycaemia can lead to loss of warning symptoms of hypoglycaemia (reduced hypoglycaemic awareness) which, as well as presenting a danger to the person, may mean that they are no longer able to drive or work in certain environments. It can also lead to deterioration in long-term glycaemic control either from inappropriate/“over treatment” of the hypos or as a result of having to maintain higher glucose values in order to avoid hypoglycaemia.

The known benefits of long-term tight glycaemic control particularly in terms of reducing microvascular complications mean that people, particularly with type 1 diabetes, on intensive insulin regimes and during pregnancy, where very tight glycaemic control is recommended (see NHSL guidelines on Diabetes and Pregnancy 2014) are at particular risk of hypoglycaemia.

The avoidance of hypoglycaemia is therefore the key but it is important that when hypoglycaemia does occur it is recognised and treated appropriately.

This guideline will focus on:

- Definition of hypoglycaemia
- Recognition of hypoglycaemia
- Immediate management of hypoglycaemia in community, and hospital settings
- Subsequent management and considerations following hypoglycaemia

N.B. Less commonly hypoglycaemia can occur in patients who are not known to have diabetes and are as a result not on treatment for diabetes. The treatment and investigation of hypoglycaemia in these situations is out with the scope of this guideline and may require specialist involvement.

This guideline refers to adult patients with diabetes

This guideline is not intended to serve as a protocol or standard of care. That is best based on all clinical data available for an individual case and may be subject to change as scientific knowledge and technology advances and patterns of care evolve. Adherence to guideline recommendations will not ensure a successful outcome in every case, nor should it be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same result. Ultimately a judgement must be made by the appropriate healthcare professional(s) responsible for a particular clinical procedure or treatment plan following discussion with the patient, covering the diagnostic and treatment options available. It is advised that any significant departure from the guideline should be documented in the patient’s medical record at the time the decision is taken.

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User group

- People with diabetes on therapy which can potentially cause hypoglycaemia
- Carers, relatives, friends or colleagues of people with diabetes who are on treatment which can cause hypoglycaemia
- Any health care professional in primary or secondary care who has contact with people with diabetes who may be required to recognise, treat or give advice on hypoglycaemia
DEFINITION

Hypoglycaemia (a hypo) is a low plasma glucose. There is no universally agreed absolute cut off value for diagnosing hypoglycaemia.

In people without diabetes hypoglycaemia is usually defined as a lab measured plasma glucose (not a finger-prick blood glucose with a home testing meter) of less than 2.5mmol/L with symptoms or signs suggestive of hypoglycaemia which are reversed after the plasma glucose is raised.

In most (non-hospital) settings a home monitor measuring capillary blood glucose is used to determine the current level of glycaemia.

In practice, for patients with diabetes who are on treatment that can cause hypoglycaemia, we generally use the value of <4mmol/L as criteria for treating as a hypo.

Mild versus severe hypoglycaemia:
A mild hypo is defined as a hypo that the person is able to deal with him/herself whereas a severe hypo is defined as one requiring the assistance of another person.

RECOGNITION

Symptoms: (Symptoms are clinical features the person complains or is aware of)
Symptoms of a hypo can be divided into autonomic (adrenergic) symptoms and neuroglycopenic symptoms. In people with normal hypoglycaemic awareness autonomic symptoms usually appear first at plasma glucose levels of less than approximately 3.6mmol/L and include tremor, palpitations, sweating, nausea, anxiety, hunger and dry mouth. At lower levels of glucose neuroglycopenic symptoms including difficulty concentrating, headache, incoordination, tiredness, difficulty speaking and confusion.

Signs: (Signs are clinical features that an observer notices about a person)
Signs of Hypoglycaemia again relate to autonomic and neuroglycopenic features. Autonomic signs include: sweating, pallor, tremor and tachycardia. Neuroglycopenic signs include: confusion, agitation or aggression, altered speech, drowsiness, coma and seizures. Sometimes hypoglycaemia can cause focal neurological deficits which can mimic stroke or transient ischaemic attack (TIA).

Hypoglycaemic awareness
Patients with impaired hypoglycaemic awareness may lose the early autonomic “warning” symptoms (or they may be masked by drugs such as beta blockers) and therefore the first sign of a hypo can be confusion. If this progresses rapidly the patients may not have time, or due to the confusion lack the ability, to act to treat the hypo. The main cause of reduced hypoglycaemic awareness in patients with diabetes is having had recurrent episodes of hypoglycaemia.

Confirmation
If hypoglycaemia is suspected, ideally and where there is time, it should be confirmed by glucose testing. In the community and for patients and carers this will usually be with a home blood glucose monitor. In the hospital setting a capillary blood glucose level will also usually suffice but if the patient is admitted to hospital with hypoglycaemia or where there is doubt about the diagnosis e.g. the patient is admitted with a collapse, funny turn, seizure or possible focal neurological event then a formal laboratory plasma glucose should be sent to confirm the diagnosis although treatment should not be delayed waiting for the laboratory results.
Where it is not possible to confirm hypoglycaemia or there is doubt about the diagnosis (particularly in the unconscious diabetic patient) it is safer to treat for hypoglycaemia than to avoid or delay treatment.

For most patients taking insulin or a sulphonylurea a glucose value of <4mmol/L would normally be indication for treating as a hypoglycaemic event.

**IMMEDIATE MANAGEMENT**

Hypoglycaemia should initially be treated using rapidly absorbable glucose given via the oral route where possible.

The usual recommended amount is around 15-20g of carbohydrate (CHO) for an adult but this will vary from person to person.

Examples of **suitable** treatments include:

- 100ml lucozade (original lucozade NOT lucozade sport which contains less glucose)
- 150-200ml fresh fruit juice e.g. orange/apple or 150-200ml of regular (non-diet) fizzy drink e.g. irn-bru/coca-cola
- 4-6 dextrose tablets (depending on CHO content e.g. if each tablet 3g CHO then 5 tablets)
- 3-4 jelly-babies
- 1 tube of Hypostop®/Glucogel®

**Unsuitable**/non-ideal treatments for immediate management of hypoglycaemia include:

- A cup of tea and a biscuit/toast
- Chocolate
- A sandwich

These items may not contain enough rapidly available glucose and the presence of other ingredients such as complex carbohydrates/fats can slow down the absorption of available glucose.

In certain situations it may be appropriate to apply Hypostop®/Glucogel® (or jam, honey or treacle) to the inside of the patients cheeks followed by gently massaging the outside of the cheeks but it is not generally recommended that this is attempted if the person is unconscious, fitting or cannot swallow due to the risk of aspiration or injury.

**Unconscious patient**

If the patient is unconscious or unable to swallow the best treatment is with intravenous glucose (dextrose). Generally this is only available in a medical environment.

- 100ml of 20% glucose should be administered via an intravenous cannula
- Traditionally 50ml of 50% glucose was used and is effective but this is highly viscous making it difficult to draw up and inject and is more toxic to the veins increasing the risk of phlebitis and local soft tissue/skin reaction

Where the intravenous route is not available 1mg of intramuscular glucagon should be given. This stimulates glucose release from the liver. It does not work as quickly as intravenous glucose and can cause nausea and abdominal pain. It can however be administered by appropriately trained carers/friends/relatives of the patient prior to or immediately after phoning 999. It is also suitable for use by paramedics and in the hospital setting where intravenous access is not immediately available.

**NB:** **For the unconscious patient in the community call 999 and place the patient in the recovery position (on side with head tilted back).**

Glucagon may not be effective in situations where the patients has depleted glycogen stores e.g. where there is a history of starvation/alcohol excess.
SUBSEQUENT MANAGEMENT & CONSIDERATIONS

After treating a hypo people should be advised to wait for approximately 15 minutes* before repeating the glucose test. If the glucose is $\geq 4$mmol/L they should “back up” their treatment with 10-20g of longer acting carbohydrate e.g.:

- 2 biscuits
- A sandwich (two slices of bread)
- Piece of fruit e.g. a banana
- Large glass of milk or yoghurt
- The next meal if due

If after initial treatment the glucose remains below 4mmol/l the treatment should be repeated every 15 minutes until the glucose is $\geq 4$mmol/l before moving on to “backing up” the treatment.

* The reason for waiting 15 minutes before repeating treatment is that it may take this long for the glucose level to rise following oral treatment. It will also help to avoid over treating hypoglycaemia resulting in subsequent hyperglycaemia.

If insulin is due with the next meal it should normally still be given (once the hypoglycaemia has been properly treated) although a dose reduction may be considered.

The risk of further/ recurrent hypoglycaemia should also be considered. Were the hypo was due to excessive insulin dose/ sulphonylurea therapy people may require admission to hospital/ intravenous dextrose infusion. Reduction of insulin or sulphonylurea dose may be required and other people may be able to carry on with usual therapy.

Documentation

People should be advised to document episodes of hypoglycaemia in their blood glucose diary and to record if there was any particular reason that they feel for it’s occurrence e.g. alcohol, exercise or miscalculating the dose of insulin. This will enable them to discuss these episodes with their diabetes health care professional in order to try and help them avoid future episodes. Similarly in hospital situations staff should clearly document hypoglycaemic episodes (and its treatment) in the appropriate section of medical notes and/or blood glucose/insulin prescription charts.

Considering the cause

After hypoglycaemia has been treated it is always important to consider why it occurred. Significant hypoglycaemia in people with diabetes is almost wholly confined to those on insulin or sulphonylurea therapy. People with diet controlled diabetes are very unlikely to suffer from hypoglycaemia. Metformin, Acarbose, the Thiazolinediones (pioglitazone), DPP-IV inhibitors (‘gliptins) and GLP-1 analogues (non-insulin injectables) are unlikely to cause significant or serious hypoglycaemia when used alone. When used in combination this risk increases slightly and obviously when added to or used in conjunction with insulin or sulphonylureas the risk is increased.

So common causes include:

- Wrong insulin dose in relation to carbohydrate ingestion/ taking insulin then forgetting to eat/not eating as much as they predicted
- Exercise
- Alcohol
- Faulty injection e.g. given intramuscularly or into area of lipohypertrophy
Sometimes the cause may be obvious to the person. Sometimes it is less obvious, however, and at virtually every visit to the diabetes team hypoglycaemia should be discussed paying particular attention to:

- hypoglycaemic warning symptoms
- the frequency of hypoglycaemia
- reasons hypoglycaemia occurred
- treatment of a hypo
- considering whether friends/relatives/carers should be educated in administration of glucagon and checking the patient has an up to date supply of glucagon available
- the avoidance of hypoglycaemia in relation to exercise (e.g. reduced insulin dosing/taking extra carbohydrate snacks as appropriate
- alcohol and hypoglycaemia
- injection sites, technique, needles and devices, mixing of insulin preparations.
- insulin dosing in relation to carbohydrate intake

Appropriately educating people and their carers should help them to avoid hypoglycaemia in the future. Some patients appear to have particularly “labile” blood glucose levels and can therefore be prone to rapid changes in blood glucose and hypoglycaemia. It is important to also look at overall glycaemic control and review HbA1c target to ensure that these are appropriate for the individual.

Subsequent referral to a health care professional more experienced in dealing with hypoglycaemia/diabetes control (e.g. hospital/community DSN or consultant diabetologist) may be appropriate particularly where hypoglycaemia is frequent/severe or there is loss of warning symptoms.

Other Causes
Occasionally there are other medical reasons for hypoglycaemia. For people with diabetes who are experiencing recurrent hypoglycaemia, particularly when these occur despite taking appropriate measures, then conditions such as Addison’s disease, Coeliac disease and thyrotoxicosis should be considered (these are all notable for being autoimmune diseases and are more common in people with type 1 diabetes than the general population).

With in-patients care is required to ensure the correct dose of insulin has been prescribed and given (errors such as “u” for units or “iu” for international units can be misread as numbers: 0, 1 unit, 10 etc. Therefore specifically designed insulin prescription charts should be used and the use of abbreviations u/ iu should be avoided altogether. It is also relatively common for the wrong type of insulin to be given where nurses/ doctors are not familiar with the different types of insulin products and the names are relatively similar e.g. novorapid v novomix(30); humalog v humalog mix 25; Humulin I v Humulin S.
**SPECIAL CIRCUMSTANCES**

**Driving**
There is a separate guideline on diabetes and driving but in short people with diabetes should be advised they must test blood glucose before driving and must not drive if they are hypoglycaemic or for 45 minutes following a hypo. People with impaired hypoglycaemic awareness should be advised not to drive and to inform the DVLA.

**Elderly people with diabetes**
The long term benefits of tight glycaemic control in frail/elderly people with diabetes are less and the risk of adverse events such as falls, injury, seizures and cardiovascular events due to hypoglycaemia is great. As such avoiding hypoglycaemia is of paramount importance when adjusting treatment and deciding on glycaemic control targets.

Consider admission to hospital for elderly people presenting with hypoglycaemia particularly where there is concern that they are at risk of a further hypo e.g. reduced oral intake (and having taken usual insulin); wrong insulin dose administered; hypoglycaemia caused by sulphonylurea therapy (due to potential long duration of action especially if renal impairment).

**Cardiovascular disease and hypoglycaemia**
Hypoglycaemia can increase cardiovascular events. Hypoglycaemia causes increases sympathetic nervous system stimulation increasing heart rate and systolic blood pressure which could theoretically precipitate angina or myocardial infarction. It also causes ECG changes such as prolonged QT interval increasing the risk of arrhythmia.
Therefore the risk of hypoglycaemia needs to be considered when treating people with known cardiovascular disease or who are at high risk of cardiovascular disease including the elderly.

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May 2014

**Review date**
May 2017
**Summary – Hypoglycaemia (Hypo)**

**DEFINITION**

Hypoglycaemia in diabetes is a plasma glucose <4mmol/l
Mild hypoglycaemia – the person can deal with it themselves
Severe Hypoglycaemia – the help of another person is required to manage the event

Significant hypoglycaemia in people with diabetes is almost wholly confined to those on insulin or sulphonylurea therapy. People with diet controlled diabetes are very unlikely to suffer from hypoglycaemia. Metformin, Acarbose, Pioglitazone, DPP IV inhibitors (‘gliptins) and GLP-1 analogues are unlikely to cause significant or serious hypoglycaemia when used alone. When used in combination this risk increases only slightly unless combined with insulin or sulphonylureas.

**Symptoms**

- Autonomic (adrenergic) – appear first at plasma glucose levels of less than approximately 3.6mmol/L if normal hypoglycaemic awareness - tremor, palpitations, sweating, nausea, anxiety, hunger and dry mouth
- Neuroglycopenic symptoms – appear next at lower plasma glucose levels - difficulty concentrating, headache, incoordination, tiredness, difficulty speaking and confusion

**Signs**

- Autonomic signs - sweating, pallor, tremor and tachycardia
- Neuroglycopenic - confusion, agitation or aggression, altered speech, drowsiness, coma and seizures

Where it is not possible to confirm hypoglycaemia by blood testing or there is doubt about the diagnosis (particularly in the unconscious diabetic patient) it is safer to treat for hypoglycaemia than to avoid or delay treatment.

**IMMEDIATE MANAGEMENT**

Oral rapidly absorbable glucose

- 100ml lucozade (original Lucozade®)
- 150-200ml fresh fruit juice or 150-200ml of regular (non-diet) fizzy drink
- 4-6 dextrose tablets
- 3-4 jelly-babies
- 1 tube of glucose gel (this can be applied to the inside of the cheek with gentle massage on the outside) by a third party, provided the person is not unconscious, fitting or cannot swallow due to the risk of aspiration or injury

Unconscious patient - in the community call 999 and place the patient in the recovery position

- 100ml of 20% glucose administered via an intravenous cannula
1mg of intramuscular glucagon (may not be effective in situations where the patients has depleted glycogen stores e.g. starvation/alcohol excess)

**SUBSEQUENT MANAGEMENT & CONSIDERATIONS**

- After immediate treatment wait for approximately 15 minutes before repeating the glucose test
- If the glucose is still <4mmol/l repeat the initial treatment and recheck in a further 15 minutes
- If the glucose is >= 4mmol/L they should “back up” their treatment with 10-20g of longer acting carbohydrate e.g. 2 biscuits, a sandwich, piece of fruit, large glass of milk or yoghurt, the next meal if due
- If insulin or sulphonylurea is due with the next meal it should still be given (once the hypoglycaemia has been properly treated), a dose reduction may be considered.
- Consider the risk of further/recurrent hypoglycaemia. If due to excessive insulin dose/sulphonylurea therapy admission to hospital may be required for intravenous dextrose infusion.
- It is important to also look at overall glycaemic control and review HbA1c target to ensure that these are appropriate for that individual
Documentation
- Record the occurrence and possible reason for the hypo – blood glucose monitoring diary
- In hospital situations staff should clearly document hypoglycaemic episodes (and its treatment) in the appropriate section of medical notes and/or blood glucose/insulin prescription charts

Consider the cause
- Wrong insulin dose in relation to carbohydrate ingestion/ taking insulin then forgetting to eat/not eating as much as they predicted
- Exercise
- Alcohol
- Faulty injection e.g. given intramuscularly or into area of lipohypertrophy
- Exclude errors in the insulin prescription chart in hospital/community setting

Educate people with diabetes and their carers to help them to avoid hypoglycaemia in the future
- warning symptoms
- frequency
- reason(s)
- treatment of a hypo
- education of friends/relatives/carers in administration of glucagon and check the supply of glucagon available
- avoidance of hypoglycaemia in relation to exercise
- effect of alcohol
- injection sites, technique, needles and devices, mixing of insulin preparations.
- insulin dosing in relation to carbohydrate intake
- “labile” blood glucose levels - prone to rapid changes in blood glucose and hypoglycaemia
- Other causes - Addison’s disease, Coeliac disease and thyrotoxicosis

Referral to a health care professional more experienced in dealing with hypoglycaemia/diabetes control (e.g. hospital/community DSN or consultant diabetologist) may be appropriate where hypoglycaemia is frequent/severe or there is loss of warning symptoms.

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- test blood glucose before driving
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- people with impaired hypoglycaemic awareness should be advised not to drive and to inform the DVLA.

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