

Managing inpatient hypoglycaemia: The introduction of new national guidelines

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Article points

1. The hospital environment presents major obstacles to good glycaemic control because people with diabetes' normal routines are interrupted.
2. Groups working within diabetes care felt it time to rectify this situation, and as a result have produced *The Hospital Management of Hypoglycaemia in Adults with Diabetes Mellitus* guideline, which can be used "off the shelf" or adapted to the needs of individual trusts.
3. This new guideline has been extensively endorsed by interested groups working within diabetes care. If it is implemented well, followed correctly and monitored appropriately it should lead to improved patient care on all wards, and increased patient satisfaction.

Key words

- Guidelines
- Hypoglycaemia
- Inpatient care

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Hypoglycaemia is the most feared complication for people living with diabetes and is the most common side-effect of insulin and sulphonylurea therapy. It presents a major barrier to satisfactory long-term glycaemic control and can be more commonplace among hospital inpatients with diabetes because their usual routine is disrupted. Currently, not all NHS hospitals have a robust guideline for the management of hypoglycaemia; NHS Diabetes therefore commissioned the production of a national guideline that any trust can use "off the shelf" to improve inpatient diabetes services. This article describes the development and content of this guideline, *The Hospital Management of Hypoglycaemia in Adults with Diabetes Mellitus*, designed for use in all hospital trusts, and discusses the implications for general ward staff.

People with type 1 diabetes experience around two episodes of hypoglycaemia per week, and in unselected study populations the annual prevalence of severe hypoglycaemia has been reported consistently at 30–40% (Strachan, 2007).

At least 10% of inpatients in the UK have known diabetes and this increases to 25% in some high-risk groups (Sampson et al, 2007). A study by Turchin et al (2009) showed that hypoglycaemia occurs in 7.7% of people with diabetes admitted to hospital and results in an increased length of stay and higher mortality rates. However, a recent national audit of diabetes inpatients revealed that approximately one in four people with diabetes experiences a hypoglycaemic episode during their hospital stay (Rayman, 2010a; 2010b).

It is not only people with insulin-treated diabetes who are at risk. The UK Hypoglycaemia Study Group (2007) showed equivalent levels of severe hypoglycaemia in those treated with sulphonylureas compared with insulin therapy of less than 2 years' duration.

The hospital environment presents a number of obstacles to good glycaemic control because people with diabetes' normal routines are interrupted and they are not able to make meal choices as they would do at home (Sampson et al, 2009). Diabetes Inpatient Specialist Nurses (DISNs) suggest that knowledge and management of hypoglycaemia varies widely, not only between hospital trusts, but also often between different wards in each individual hospital (Baker et al, 2007; Gashau, 2009). Thus, groups working within diabetes care felt

it time to rectify this situation, and as a result have produced *The Hospital Management of Hypoglycaemia in Adults with Diabetes Mellitus* (Stanisstreet et al, 2010) guideline, which can be used “off the shelf” or adapted to the needs of individual trusts.

Writing group development

There are many groups working to promote improved quality of care for people with diabetes, but often they work in isolation, which can, unfortunately, limit the impact of their output. Frequently, these groups work towards similar goals but the slight variances in the work produced can cause confusion among hospital staff whose specialty is not diabetes. To this end the Joint British Diabetes Societies (JBDS) was formed to unite all of the interested groups in a common purpose: promoting education and a heightened awareness of diabetes in non-diabetes specialist areas. These groups include: Diabetes UK, the DISN UK Group, NHS Diabetes, the Association of Clinical Diabetologists, the Northern Irish Diabetes Group, the Scottish Diabetes Group, and the Welsh Endocrine and Diabetes Society.

After an initial meeting with representatives from each group, it was decided that the hypoglycaemia writing group should be led by DISNs – this is because DISNs work closely with ward nursing staff who are, in the main, responsible for recognising and treating episodes of hypoglycaemia. It can be both difficult and costly to get everybody in one room to write guidelines and therefore an original draft was produced by the DISNs and then disseminated electronically by each representative on the JBDS to their own society’s membership. Comments were then collated and incorporated into the guideline as appropriate, which was then disseminated as previously described. This process continued until, at draft nine, all societies represented on the JBDS were satisfied with the content.

Following this process, people with diabetes were invited to attend a meeting to ensure that they felt that the guideline was appropriate and it was adapted again in response to their comments. The guideline was then sent

electronically to representatives from the NHS Institute for Innovation and Improvement, the British Dietetic Association, the UK Clinical Pharmacy Association and the Guild of Healthcare Pharmacists, whose comments were also included. Finally, it was sent to, and gained endorsement from, both the Royal College of Nursing and the Royal College of Physicians.

Purpose of the guideline

The initial treatment of hypoglycaemia is generally the responsibility of nursing staff working at ward level, thus the guideline was designed to be nurse-led. However, it is also hoped that it will be used as an educational tool to improve the knowledge of ward nurses and junior doctors whose specialty is not diabetes. This is a very important issue because people with diabetes are not routinely admitted onto specialist diabetes wards and patients often report a lack of knowledge of diabetes among nursing and medical staff on general wards (Diabetes UK, 2007). Therefore, all healthcare staff should have a good basic knowledge of hypoglycaemia recognition, treatment and avoidance.

Unfortunately, due to current financial and resource pressures, staff are not often released from wards for continuing professional development, and if they are, anecdotal evidence suggests that staff tend to choose studies that are relevant to their specialty. Therefore, this guideline aims to disseminate the relevant information in an alternative, user-friendly format, reducing the time required to teach it.

As well as providing a comprehensive treatment pathway, the guideline discusses frequency, clinical features, causes and risk factors of hypoglycaemia. It also has five sections for treatment, depending on the severity of the hypoglycaemic episode. The guideline concludes with points for consideration after treatment has been successful (i.e. when the patient’s blood glucose level is stable above 4 mmol/L), and provides audit standards as well as an audit tool so that diabetes departments can measure the scale of the problem within their own hospitals and continually adapt and improve services.

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1. Hypoglycaemia can be defined as “mild” if the episode is self-treated and “severe” if assistance by a third party is required.
2. Some people with diabetes may start to experience symptoms of hypoglycaemia at blood glucose levels above 4 mmol/L, however there is no evidence that the thresholds for cognitive dysfunction are reset upwards.
3. When considering the management of hypoglycaemia in a hospital setting it is important to recognise that although the risk factors are the same for people in the wider community, the causes can be very different due to the hospital environment itself.

Defining hypoglycaemia

Hypoglycaemia is a lower than normal level of blood glucose, which can result in a variety of symptoms. The brain is dependent on a continuous supply of circulating glucose as the substrate to fuel cerebral metabolism and support cognitive performance. If blood glucose levels fall sufficiently, cognitive dysfunction is inevitable (Evans and Amiel, 2002).

Hypoglycaemia can be defined as “mild” if the episode is self-treated and “severe” if assistance by a third party is required (Diabetes Control and Complications Trial Research Group, 1993). The guideline includes the 11 most common symptoms using the Edinburgh Hypoglycaemia Scale (Deary et al, 1993).

Normal blood glucose levels are 3.5–7.0 mmol/L, but Diabetes UK recommends a practical policy of treating any results under 4 mmol/L (Diabetes UK, 2010). Therefore, the guideline recommends that all blood glucose readings less than 4.0 mmol/L should be

treated in people with diabetes who are treated with insulin or sulphonylurea therapy.

It is recognised that some people with diabetes may start to experience symptoms of hypoglycaemia at blood glucose levels above 4 mmol/L, however there is no evidence that the thresholds for cognitive dysfunction are reset upwards. Therefore, in this circumstance, the guideline recommends a small carbohydrate snack only for symptomatic relief.

Risk factors for, and causes of, inpatient hypoglycaemia

When considering the management of hypoglycaemia in a hospital setting it is important to recognise that although the risk factors are the same for people in the wider community, the causes can be very different due to the hospital environment itself. While at home, for example, people may not make arrangements over a lunchtime that did not include eating, but in hospital, little consideration of mealtimes is given when

Table 1. Risk factors for hypoglycaemia.

Medical issues	<ul style="list-style-type: none"> ● Tight glycaemic control. ● Previous history of severe hypoglycaemia. ● Undetected nocturnal hypoglycaemia. ● Long duration of diabetes. ● Poor injection technique. ● Impaired awareness of hypoglycaemia. ● Preceding hypoglycaemia (less than 3.5 mmol/L). ● Severe hepatic dysfunction. ● Renal dialysis therapy. ● Impaired renal function. ● Inadequate treatment of previous hypoglycaemia.
Lifestyle issues	<ul style="list-style-type: none"> ● Increased exercise (relative to usual). ● Irregular lifestyle. ● Increasing age. ● Alcohol. ● Early pregnancy. ● Breast feeding. ● Injection into areas of lipohypertrophy (lumpy sites). ● Inadequate blood glucose monitoring.
Reduced carbohydrate intake	<ul style="list-style-type: none"> ● Food malabsorption, e.g. gastroenteritis, coeliac disease.

Table 2. Causes of inpatient hypoglycaemia.

Medical issues	<ul style="list-style-type: none"> ● Inappropriate use of “stat” or “<i>pro re nata</i>” quick-acting insulin. ● Acute discontinuation of long-term steroid therapy. ● Recovery from acute illness/stress. ● Mobilisation after illness. ● Major amputation of a limb. ● Inappropriately timed diabetes medication for meal/enteral feed. ● Incorrect insulin prescribed and administered. ● Intravenous insulin infusion with or without glucose infusion. ● Inadequate mixing of intermediate or mixed insulins. ● Regular insulin doses being given in hospital when they are not routinely taken at home.
Reduced carbohydrate intake	<ul style="list-style-type: none"> ● Missed or delayed meals. ● Less carbohydrate than normal. ● Change of the timing of the biggest meal of the day, i.e. main meal at midday rather than evening. ● Lack of access to usual between meal or before bed snacks. ● Prolonged starvation time, e.g. “Nil by Mouth”. ● Vomiting. ● Reduced appetite. ● Reduced carbohydrate intake.

Page points

1. Insulin prescription errors are one of the most serious and common causes of inpatient hypoglycaemia.
2. To ensure prompt treatment without having to wade through the entire guideline the document includes two one-page inserts with all the salient information presented in either a “traffic light” format or a flow-chart for user preference.
3. Some hospitals have successfully implemented the use of “hypo boxes” (Baker et al, 2007), which contain all of the treatments that could be required and are kept in a prominent place such as the resuscitation trolley.

scheduling medical tests and there is not always the same access to food at non-mealtimes. *Table 1* outlines risk factors for hypoglycaemia and *Table 2* highlights the potential causes.

As well as the causes listed in *Table 2* it is important to recognise that insulin prescription errors are one of the most serious and common causes of inpatient hypoglycaemia (Fowler and Rayman, 2010). These errors include: misreading poorly written prescriptions – when “u” is used for units (e.g. 4 u becoming 40 units), confusing the insulin name with the dose, and transcription error (e.g. where someone on animal insulin is inadvertently prescribed human or analogue insulin).

Treatment pathways

The treatment section of the guideline is defined in five clear pathways ensuring that staff know how to treat mild through to

severe hypoglycaemic events. It also includes special situations more common to the hospital environment, such as patients who are “Nil by Mouth” awaiting procedures and appropriate treatments via a feeding tube.

To ensure prompt treatment without having to wade through the entire guideline the document includes two one-page inserts with all the salient information presented in either a “traffic light” format or a flow-chart for user preference. Some hospitals have successfully implemented the use of “hypo boxes” (Baker et al, 2007), which contain all of the treatments that could be required and are kept in a prominent place such as the resuscitation trolley. It is recommended that the one-page inserts are also kept in the boxes if they are used.

The guidelines’ five treatment pathways are:
 1. Adults who are conscious, orientated and able to swallow.

2. Adults who are conscious but confused, disorientated, unable to cooperate, or aggressive but are able to swallow.
3. Adults who are unconscious and/or having seizures and/or are very aggressive.
4. Adults who are “Nil by Mouth”.
5. Adults requiring enteral feeding.

All of the pathways follow a similar structure, giving treatment advice, repeat blood glucose monitoring instructions, further advice if treatment has not brought the blood glucose level above 4 mmol/L and information for maintaining blood glucose levels once results are above 4 mmol/L. This structure promotes treatment with a specified amount of quick-acting carbohydrate, followed by a suitable time period to ensure absorption before administering a long-acting carbohydrate which should prevent the over-treatment of hypoglycaemia that can be common. *Table 3*

provides an example of one of the pathways.

During the writing process it became clear that many diabetes experts were no longer satisfied with the previously commonplace practice of using 50% intravenous glucose for the treatment of severe hypoglycaemia. Their opinion was that use of such hyperosmolar solutions increases the risk of extravasation injury. Furthermore, Moore and Woollard (2005) found that smaller aliquots used to deliver 10% glucose resulted in lower post-treatment glucose levels. For these reasons the guideline advises the use of intramuscular glucagon or either 10% or 20% glucose solutions for the treatment of severe hypoglycaemia.

Implications for nurses

Although most of this information is not new to people working within diabetes, it will be to some staff working on the wards and the

Table 3. Guideline Pathway A – Adults who are conscious, orientated and able to swallow.

<p>1. Give 15–20 g quick-acting carbohydrate of the patient’s choice where possible. Some examples are:</p> <ul style="list-style-type: none"> ● 150–200 mL pure fruit juice, e.g. orange. ● 90–120 mL of original Lucozade® (preferable in renal patients). ● 5–7 Dextrosol® tablets (or 4–5 Glucotabs®). ● 3–4 heaped teaspoons of sugar dissolved in water.
<p>2. Repeat capillary blood glucose measurement 10–15 minutes later. If it is still less than 4.0 mmol/L, repeat Step 1 up to three times.</p>
<p>3. If blood glucose remains less than 4.0 mmol/L after 45 minutes or three cycles, contact a doctor. Consider 1 mg of glucagon intramuscularly (may be less effective in patients prescribed sulphonylurea therapy), or intravenous 10% glucose infusion at 100 mL/hour. Volume should be determined by clinical circumstances.</p>
<p>4. Once blood glucose is above 4.0 mmol/L and the patient has recovered, give a long-acting carbohydrate of the patient’s choice where possible, taking into consideration any specific dietary requirements. Some examples are:</p> <ul style="list-style-type: none"> ● Two biscuits. ● One slice of bread/toast. ● 200–300 mL glass of milk (not soya). ● Normal meal if due (must contain carbohydrate).
<p>DO NOT omit insulin injection if due (however, dose review may be required). N.B. Patients given glucagon require a larger portion of long-acting carbohydrate to replenish glycogen stores (double the suggested amount above).</p>
<p>5. Document event in patient’s notes. Ensure regular capillary blood glucose monitoring is continued for 24 to 48 hours. Ask the patient to continue this at home if they are to be discharged. Give hypoglycaemia education or refer to diabetes inpatient specialist nurse.</p>

guideline allows all diabetes teams to deliver the same message without having to write a guideline themselves. However, if it is to be successful in improving the management of hypoglycaemia on the wards it will need to be implemented properly by diabetes teams rather than just being placed on the wards.

It should be the responsibility of DISNs to introduce the guideline with education for all ward staff within their hospitals and to follow up on audit forms that demonstrate variance from recommended practice and eventually make improvements in patient care.

People with diabetes will often bring their preferred choice of hypoglycaemia treatments into hospital, particularly if their admission is planned, and it is common for such people to feel disempowered when they are admitted to hospital (Diabetes UK, 2007). It is not the intention of this guideline to be prescriptive without consideration of the patients' views or preferences. Therefore, it is also suggested that a full assessment is made of all patients individually and that self-management is promoted where appropriate and possible.

Conclusion

This new guideline has been extensively endorsed by interested groups working within diabetes care. If implemented well, followed correctly and monitored appropriately, this guideline should lead to improved patient care on all wards, and increased patient satisfaction. This is a big step forward in standardising inpatient care and it is hoped that the guideline will be widely implemented throughout the UK. ■

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For a full copy of the guideline please email diabetes@leicester.prontaprint.com or telephone 0116 275 3333, quoting DIABETES 122. To access a PDF of the guideline please visit the NHS Diabetes website at <http://www.diabetes.nhs.uk/>

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