

# The Hospital Management of Hypoglycaemia in Adults with Diabetes Mellitus

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## Statement for Inpatient Guidelines

This guideline has been developed to advise the treatment and management of The Hospital Management of Hypoglycaemia in Adults with Diabetes Mellitus.

The guideline recommendations have been developed by a multidisciplinary team led by the Joint British Diabetes Society (JBDS) and including representation from Diabetes UK. People with diabetes have been involved in the development of the guidelines via stakeholder events organised by Diabetes UK.

It is intended that the guideline will be useful to clinicians and service commissioners in planning, organising and delivering high quality diabetes inpatient care. There remains, however, an individual responsibility of healthcare professionals to make decisions appropriate to the circumstance of the individual patient, informed by the patient and/or their guardian or carer and taking full account of their medical condition and treatment.

When implementing this guideline full account should be taken of the local context and in line with statutory obligations required of the organisation and individual. No part of the guideline should be interpreted in a way that would knowingly put people, patient or clinician at risk.

We would like to thank the service user representatives whose input has informed the development of these guidelines.



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# Foreword

Hypoglycaemia is the most feared complication of insulin therapy, presenting an increasingly important problem for hospital services. A growing prevalence of diabetes in the community has been accompanied by an even greater increase of diabetes in hospitalised patients such that one in six inpatients has diabetes. Furthermore, more than half of these are being treated with insulin or an oral agent that may cause hypoglycaemia. Approximately one in four people with diabetes suffers a hypoglycaemic episode during their hospital stay. This has serious consequences as inpatient hypoglycaemia not only increases length of stay but is associated with an increased mortality.

Prevention of hypoglycaemia and its prompt and effective treatment is therefore essential. This is the aim of this guideline. It has been written by practicing clinicians and draws from their experiences of managing hypoglycaemia in UK hospitals. It outlines the risk factors for, and causes of hypoglycaemia in hospital, recognising that these are often quite different from those in the community e.g. a dislodged enteral feeding tube in a patient receiving insulin. It gives comprehensive and detailed advice on the management of hypoglycaemia in a variety of clinical situations from the fully conscious, to the conscious but confused, through to the unconscious patient. There is a recommendation that hypoglycaemic boxes should be available in all hospital trusts and a valuable list of what should be included in such boxes. Audit of the management of hypoglycaemia is encouraged and a useful audit tool is provided.

The guideline is clearly written and accompanied by a practical and easy to follow visual treatment algorithm which many will find useful.

The authors should feel proud of their achievement which I recommend to the diabetes hospital community.

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## Inserts

Traffic light algorithm for the treatment of hypoglycaemia

Flow chart for the treatment of hypoglycaemia



## Introduction

This guideline is for the management of hypoglycaemia in adults (aged 16 years or older) with diabetes mellitus within the hospital setting.

This guideline is designed to be nurse led, however none of the intravenous (IV) glucose preparations suggested can be given by a nurse without prescription (currently under review), or a locally agreed patient group directive (PGD). The authors recommend the IV glucose preparation chosen is prescribed on an 'as required' (PRN) basis for all patients with diabetes. Expert opinion would suggest that the use of hyperosmolar solutions such as 50% glucose increase the risk of extravasation injury. Furthermore, Moore et al (2005) found that the smaller aliquots used to deliver 10% glucose resulted in lower post treatment glucose levels. For these reasons 10% or 20% glucose solutions are preferred to the previous commonplace use of 50% glucose. If agreed locally, glucagon may be given without prescription in an emergency for the purpose of saving a life (Medicines, Ethics & Practice 2009). Please note that intramuscular (IM) glucagon is only licensed for the treatment of insulin overdose, although is sometimes used in the treatment of hypoglycaemia induced by sulphonylurea therapy.

All nurses must work within the Nursing and Midwifery Council (NMC) professional code of conduct and work within their own competencies.

This guideline is designed to enable adaptation to suit local practice where required.

### Hypoglycaemia in Adults with Diabetes

Hypoglycaemia is the commonest side effect of insulin and sulphonylureas in the treatment of diabetes and presents a major barrier to satisfactory long term glycaemic control. Metformin, thiazolidinediones, DPP-4 inhibitors and GLP-1 analogues prescribed without insulin or sulphonylurea therapy are unlikely to result in hypoglycaemia. Hypoglycaemia results from an imbalance between glucose supply, glucose utilisation and current insulin levels. Hypoglycaemia should be excluded in any person with diabetes who is acutely unwell, drowsy, unconscious, unable to co-operate, presenting with aggressive behaviour or seizures.

At least 10% of inpatients in the UK have known diabetes, this increases to 25% in some high risk groups (Sampson et al 2007). The hospital environment presents additional obstacles to the maintenance of good glycaemic control and the avoidance of hypoglycaemia. Hypoglycaemia occurs in 7.7% of admissions and results in increased length of stay and mortality rates (Turchin et al 2009).

### Definition

Hypoglycaemia is a lower than normal level of blood glucose. It can be defined as "mild" if the episode is self treated and "severe" if assistance by a third party is required (DCCT, 1993). For the purposes of people with diabetes requiring hospital admission, any blood glucose less than 4.0mmol/L should be treated.

### Frequency

People with type 1 diabetes mellitus (T1DM) experience around two episodes of mild hypoglycaemia per week. Studies such as the DCCT excluded patients with a history of severe hypoglycaemia and reported lower incidences of hypoglycaemia than would be observed in an unselected group of patients. In unselected populations, the annual prevalence of severe hypoglycaemia has been reported consistently at 30-40% in several large studies (Strachan, 2007).

Severe hypoglycaemia is less common in people with insulin treated type 2 diabetes mellitus (T2DM) but still represents a significant clinical problem. Patients with insulin treated T2DM are more likely to require hospital admission for severe hypoglycaemia than those with T1DM (30% versus 10% of episodes). The risk of hypoglycaemia with sulphonylurea therapy is often underestimated and as a consequence of the duration of action of the tablets, is frequently prolonged. Elderly patients or those with renal impairment are at particular risk of hypoglycaemia. The UK Hypoglycaemia Study showed equivalent levels of severe hypoglycaemia in those treated with sulphonylureas compared with insulin therapy of less than two years duration (UK Hypoglycaemia Study, 2007).

## Clinical Features

The symptoms of hypoglycaemia warn an individual of its onset and vary considerably between individuals. Autonomic symptoms are generated by the activation of the sympatho-adrenal system and neuroglycopenic symptoms are the result of cerebral glucose deprivation.

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 & Amiel, 2002). The 11 most common symptoms were used to form the Edinburgh Hypoglycaemia Scale and are reproduced in the table below (Deary et al 1993).

**Table 1: Edinburgh Hypoglycaemia Scale**

Autonomic	Neuroglycopenic	General malaise
<ul style="list-style-type: none"> <li>• Sweating</li> <li>• Palpitations</li> <li>• Shaking</li> <li>• Hunger</li> </ul>	<ul style="list-style-type: none"> <li>• Confusion</li> <li>• Drowsiness</li> <li>• Odd behaviour</li> <li>• Speech difficulty</li> <li>• Incoordination</li> </ul>	<ul style="list-style-type: none"> <li>• Headache</li> <li>• Nausea</li> </ul>

## Risk Factors for Hypoglycaemia

**Table 2: Risk Factors for Hypoglycaemia**

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

Be aware that the following can also precipitate hypoglycaemia:

- Concurrent use of drugs with hypoglycaemic agents e.g. warfarin, quinine, salicylates, fibrates, sulphonamides (including cotrimoxazole), monoamine oxidase inhibitors,

NSAIDs, probenecid, somatostatin analogues, SSRIs. Do not stop or withhold medication, discuss with the medical team or pharmacist.

- Loss of anti-insulin hormone function (Addison's disease, growth hormone deficiency, hypothyroidism, hypopituitarism)



## Potential causes of Inpatient Hypoglycaemia

Common causes of inpatient hypoglycaemia are listed in table 3. One of the most serious and common causes of inpatient hypoglycaemia is insulin prescription error including:

- Misreading poorly written prescriptions – when ‘U’ is used for units (4U becoming 40 units)

- Confusing the insulin name with the dose (e.g. Humalog Mix25 becoming Humalog 25 units),
- Transcription error (e.g. where patient on animal insulin is inadvertently prescribed human insulin).

**Table 3: Potential causes of Inpatient Hypoglycaemia**

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

### Morbidity and Mortality

Hypoglycaemia can cause coma, hemiparesis and seizures. If the hypoglycaemia is prolonged the neurological deficits may become permanent. Acute hypoglycaemia impairs many aspects of cognitive function, particularly those involving planning and multitasking. The long term effect of repeated exposure to severe hypoglycaemia is less clear.

The ACCORD study highlighted a potential risk of intensive glycaemic control, after 3.5 years of treatment an excess of deaths was observed in the intensive treatment arm. The intensive treatment arm experienced a threefold increase in severe hypoglycaemia compared with the conventional treatment arm (ACCORD, 2008).

### Impaired Awareness of Hypoglycaemia

Impaired awareness of hypoglycaemia (IAH) is an acquired syndrome associated with insulin treatment. IAH results in the warning symptoms of hypoglycaemia becoming diminished in intensity, altered in nature or lost altogether. This increases the vulnerability of affected individuals of progression to severe hypoglycaemia. The prevalence of IAH increases with duration of diabetes and is more common in T1DM than in T2DM (Graveling & Frier, 2009).

## Management of Hypoglycaemia

### Introduction

People experiencing hypoglycaemia require quick acting carbohydrate to return their blood glucose levels to the normal range. The quick acting carbohydrate should be followed up by giving long acting carbohydrate either as a snack or as part of a planned meal. All patients experiencing hypoglycaemia should be treated without delay. Where it is safe to do so, a blood glucose measurement should be taken to confirm hypoglycaemia. If measurement is difficult (e.g. in a patient undergoing a seizure) then treatment should not be delayed.

After acute treatment, consideration should be given to whether the hypoglycaemia is likely to be prolonged, i.e. as a result of long acting insulin or sulphonylurea therapy, patients may require a continuous infusion of dextrose to maintain blood glucose levels. Normal blood glucose levels in the person without diabetes are 3.5-7.0mmol/L. To avoid potential hypoglycaemia Diabetes UK recommends a practical policy of "make four the floor", i.e. 4.0mmol/L the lowest acceptable blood glucose level in people with diabetes. Regular blood glucose monitoring enables detection of asymptomatic biochemical hypoglycaemia.

### "Hypo" boxes

Areas of good practice have successfully used "hypo boxes" for the management of hypoglycaemia (Baker et al 2007). These boxes are often in a prominent place e.g. on resuscitation trolleys and are brightly coloured for instant recognition. They contain all the equipment required to treat hypoglycaemia from cartons of fruit juice to IV cannulas. Suggested contents of a "hypo box" can be found in Appendix 2.

### Conclusion

This is a general guideline for the treatment of hypoglycaemia but each patient should be individually assessed and management altered where necessary. You may want to agree local guidance for the self management of hypoglycaemia in conjunction with certain other medical conditions (e.g. renal impairment, heart failure). Many people with diabetes carry their own supplies of oral carbohydrate and should be supported to self manage when capable and appropriate. Following assessment this should be recorded in their hospital care plan. Patients capable of self care should alert nursing staff that an episode of hypoglycaemia has occurred so that their management plan can be altered if necessary. Many episodes of hypoglycaemia are avoidable so every preventable measure should be taken.

Easily accessible quick and long acting carbohydrate must be available in your clinical area and all staff should be aware of its location.

### Treatment of Hypoglycaemia

Adults who have poor glycaemic control may start to experience symptoms of hypoglycaemia above 4.0mmol/L. There is no evidence that the thresholds for cognitive dysfunction are reset upwards, therefore the only reason for treatment is symptomatic relief. **So adults who are experiencing hypoglycaemia symptoms but have a blood glucose level greater than 4.0mmol/L – treat with a small carbohydrate snack only** e.g. 1 medium banana, a slice of bread or normal meal if due. All adults with a blood glucose level less than 4.0mmol/L with or without symptoms of hypoglycaemia should be treated as outlined below.

**A. Adults who are conscious, orientated and able to swallow**

- 1) Give 15-20g quick acting carbohydrate of the patient's choice where possible. Some examples are:
  - o 150-200 ml pure fruit juice e.g. orange
  - o 90-120ml of original Lucozade® (preferable in renal patients)
  - o 5-7 Dextrosol® tablets (or 4-5 Glucotabs®)
  - o 3-4 heaped teaspoons of sugar dissolved in water
- 2) Repeat capillary blood glucose measurement 10-15 minutes later. If it is still less than 4.0mmol/L, repeat step 1 up to 3 times
- 3) If blood glucose remains less than 4.0mmol/L after 45 minutes or 3 cycles, **contact a doctor**. Consider 1mg of glucagon IM (may be less effective in patients prescribed sulphonylurea therapy) or IV 10% glucose infusion at 100ml/hr. Volume should be determined by clinical circumstances (refer to Appendix 4 for administration details)
- 4) Once blood glucose is above 4.0mmol/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:

- o Two biscuits
- o One slice of bread/toast
- o 200-300ml glass of milk (not soya)
- o Normal meal if due (must contain carbohydrate)

**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)

- 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 (DISN)

***B. Adults who are conscious but confused, disorientated, unable to cooperate, aggressive but are able to swallow***

- 1) If the patient is capable and cooperative, follow section **A in its entirety**
- 2) If the patient is not capable and/or uncooperative, but is able to swallow give **either** 1.5 -2 tubes GlucoGel®/ DextroGel® squeezed into the mouth between the teeth and gums **or** (if this is ineffective) give glucagon 1mg IM (may be less effective in patients prescribed sulphonylurea therapy)
- 3) Repeat capillary blood glucose levels after 10-15 minutes. If it is still less than 4.0mmol/L repeat steps 1 and/or 2 (up to 3 times)
- 4) If blood glucose level remains less than 4.0mmol/L after 45 minutes (or 3 cycles of **A1**), **contact a doctor**. Consider IV 10% glucose infusion at 100ml/hr. Volume should be determined by clinical circumstances (refer to Appendix 4 for administration details)

- 5) Once blood glucose is above 4.0mmol/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:

- o Two biscuits
- o One slice of bread/toast
- o 200-300ml glass of milk (not soya)
- o Normal meal if due (must contain carbohydrate)

**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)

- 6) 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 DISN

**C. Adults who are unconscious and/or having seizures and/or are very aggressive**

- 1) Check: **Airway (and give oxygen)**  
**Breathing**  
**Circulation**  
**Disability (including GCS and blood glucose)**  
**Exposure (including temperature)**

If the patient has an insulin infusion in situ, **stop immediately**

Fast bleed a doctor

- 2) The following three options (i-iii) are all appropriate; local agreement should be sought:
- i) Glucagon 1mg IM (may be less effective in patients prescribed sulphonylurea therapy). Glucagon, which may take up to 15 minutes to take effect, mobilises glycogen from the liver and will be less effective in those who are chronically malnourished (e.g. alcoholics), or in patients who have had a prolonged period of starvation and have depleted glycogen stores or in those with severe liver disease. In this situation or if prolonged treatment is required, IV glucose is better
  - ii) If IV access available, give 75-80ml of 20% glucose (over 10-15 minutes). (Preparation is a ready to use 100ml small volume infusion that will deliver the required amount after being run through a standard giving set). If an infusion pump is available use this, but if not readily available the infusion should not be delayed (see Appendix 4 for administration details). Repeat capillary blood glucose measurement 10 minutes later. If it is still less than 4.0mmol/L, repeat

- iii) If IV access available, give 150-160ml of 10% glucose (over 10-15 minutes). If an infusion pump is available use this, but if not readily available the infusion should not be delayed. Repeat capillary blood glucose measurement 10 minutes later. If it is still less than 4.0mmol/L, repeat (refer to Appendix 4 for administration details)

- 3) Once the blood glucose is greater than 4.0mmol/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:
- o Two biscuits
  - o One slice of bread/toast
  - o 200-300 ml glass of milk (not soya)
  - o Normal meal if due (must contain carbohydrate)

**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)

If the patient was on IV insulin, continue to check blood glucose every 30 minutes until above 3.5mmol/L, then re-start IV insulin after review of dose regimen

- 4) 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 DISN

N.B. Patients who self manage their insulin pumps may not need a long acting carbohydrate



#### **D. Adults who are 'Nil by Mouth'**

- 1) If the patient has a variable rate intravenous insulin infusion, adjust as per prescribed regimen, and seek medical advice
- 2) Options ii and iii (intravenous glucose) as above in section C(2) are both appropriate treatment options. Again local agreement should be sought
- 3) Once blood glucose is greater than 4.0mmol/L and the patient has recovered consider 10% glucose at a rate of 100ml/hr (refer to Appendix 4 for administration details) until patient is no longer 'Nil by Mouth' or has been reviewed by a doctor
- 4) 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 DISN

### **E. Adults requiring enteral feeding**

Patients requiring total parenteral nutrition (TPN) should be referred to a dietitian/nutrition team and diabetes team for individual assessment

#### **Risk factors for hypoglycaemia**

- Blocked/displaced tube
- Change in feed regimen
- Enteral feed discontinued
- TPN or IV glucose discontinued
- Diabetes medication administered at an inappropriate time to feed
- Changes in medication that cause hyperglycaemia e.g. steroid therapy reduced/stopped
- Feed intolerance
- Vomiting
- Deterioration in renal function
- Severe hepatic dysfunction

#### **Treatment – To be administered via feed tube:**

Do not administer these treatments via a TPN line.

- 1) Give 15-20g quick acting carbohydrate of the patient's choice where possible. Some examples are:
  - o 25ml original undiluted Ribena®
  - o 50-70ml of Ensure® Plus Juice or Fortijuice®
  - o 3-4 heaped teaspoons of sugar dissolved in water

- 2) Repeat capillary blood glucose measurement 10 to 15 minutes later. If it is still less than 4.0mmol/L, repeat step 1 up to 3 times
- 3) If blood glucose remains less than 4.0mmol/L after 45 minutes (or 3 cycles), consider IV 10% glucose infusion at 100ml/hr. Volume should be determined by clinical circumstances (refer to Appendix 4 for administration details)
- 4) Once blood glucose is above 4.0mmol/L and the patient has recovered, give a long acting carbohydrate. Some examples are
  - o Restart feed
  - o If bolus feeding, give additional bolus feed (read nutritional information and calculate amount required to give 20g of carbohydrate)
  - o 10% IV glucose at 100ml/hr. Volume should be determined by clinical circumstances (refer to Appendix 4 for administration details)

#### **DO NOT omit insulin injection if due**

(However, dose review may be required)

- 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 DISN. Ensure patient has been referred to a dietitian

## When hypoglycaemia has been successfully treated

Complete an audit form, and send it to the DISN (see Appendix 3 for Audit form). Consider completing an incident form if appropriate. If "hypo boxes" are used replenish as appropriate.

Identify the risk factor or cause resulting in hypoglycaemia. (see tables 2 and 3)

Take measures to avoid hypoglycaemia in the future. The DISN or diabetes medical team can be contacted to discuss this.

Unless the cause is easily identifiable and both the nursing staff and patient are confident that steps can be taken to avoid future events then a medical or DISN review should be considered. If the episode of hypoglycaemia was severe or recurrent, or if the patient voices concerns, then a review is indicated.

Please **DO NOT** omit next insulin injection or start variable rate intravenous insulin infusion to 'stabilise' blood glucose. If unsure of subsequent diabetes treatment, discuss with the diabetes team/DISN.

Consulting team (or DISN if referred) to consider reducing the dose of insulin prior to the time of previous hypoglycaemia events. This is to prevent further hypoglycaemia episodes occurring.

Please **DO NOT** treat isolated spikes of hyperglycaemia with 'stat' doses of short/rapid acting insulin. Instead maintain regular capillary blood glucose monitoring and adjust normal insulin regimen if a particular pattern emerges.



# Audit Standards

<b>Processes</b>	
<b>Protocol</b>	Availability of diabetes management guidelines based on national examples of good practice including management of patients who are nil-by-mouth or enterally fed
<b>Implementation</b>	<p>Availability of hospital-wide pathway agreed with diabetes speciality team.</p> <p>Defined rolling education programme for ward staff and regular audit of key components including staff knowledge of correct treatment targets, blood glucose meter calibration, and quality assurance.</p> <p>Percentage of wards with “hypo boxes” (or equivalent)</p> <p>Percentage of people with diabetes able to access treatments to manage their own hypos</p>
<b>Specialist review</b>	People with diabetes who are admitted to hospital with hypoglycaemia are reviewed by a specialist diabetes physician or nurse prior to discharge
<b>Outcome measures</b>	
<b>Incidence</b>	Benchmark incidence of severe hypoglycaemia against equivalent national and regional data for admissions using widely available local and national datasets
<b>Income</b>	Percentage of hospital discharges delayed by inpatient hypoglycaemia episode
<b>Identification &amp; prevention</b>	<p>Cause of hypoglycaemia identified &amp; recorded</p> <p>Percentage of appropriate insulin/ anti-hyperglycaemic medication dose adjustment regarding prevention of hypoglycaemia (snap shot audit different areas of Trust on monthly basis)</p>
<b>Resolution</b>	Time to recovery



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We would like to thank Debbie Stanisstreet and the Department of Diabetes and Endocrinology, East and North Hertfordshire NHS Trust whose original hypoglycaemia guideline gave us a starting point for this document.

We would like to thank Dr Rifat Malik for producing the Audit Standards for hypoglycaemia.

We would like to thank Dr Clare Crowley for her ongoing work to produce a suitable individual use IV 20% glucose preparation.

## Guideline update

This guideline should be updated regularly.

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# Appendix 1: List of insulins currently available



## Diabetes Update Insulin wallchart

Name	Manufacturer	Source	Delivery system	Taken	Onset, peak and duration
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34					
<b>RAPID-ACTING ANALOGUE</b>					
NovoRapid	Novo Nordisk	Analogue	Vial, cartridge, pre-filled pen	Just before / with / just after food	
Humalog	Lilly	Analogue	Vial, cartridge, pre-filled pen	Just before / with / just after food	
Apidra	Sanofi-Aventis	Analogue	Vial, cartridge, pre-filled pen	0-15 minutes before, or soon after, a meal	
<b>SHORT-ACTING INSULINS/NEUTRAL INSULIN</b>					
Actrapid	Novo Nordisk	Human	Vial	30 mins before food	
Humulin S	Lilly	Human	Vial, cartridge	20-45 mins before food	
Hypurin Bovine Neutral	Wockhardt UK	Bovine	Vial, cartridge	30 mins before food	
Hypurin Porcine Neutral	Wockhardt UK	Porcine	Vial, cartridge	30 mins before food	
Insuman Rapid	Sanofi-Aventis	Human	Cartridge, pre-filled pen	15-20 mins before food	
<b>MEDIUM AND LONG-ACTING INSULINS</b>					
Insulatard	Novo Nordisk	Human	Vial, cartridge, pre-filled insulin doser	About 30 mins before food or bed	
Humulin I	Lilly	Human	Vial, cartridge, pre-filled pen	About 30 mins before food or bed	
Hypurin Bovine Isophane	Wockhardt UK	Bovine	Vial, cartridge	As advised by your healthcare team	
Hypurin Bovine Lente	Wockhardt UK	Bovine	Vial	As advised by your healthcare team	
Hypurin Bovine PZI	Wockhardt UK	Bovine	Vial	As advised by your healthcare team	36hrs
Hypurin Porcine Isophane	Wockhardt UK	Porcine	Vial, cartridge	As advised by your healthcare team	
Insuman Basal	Sanofi-Aventis	Human	Vial, cartridge, pre-filled pen	45-60 mins before food	
<b>MIXED INSULINS</b>					
Mixtard 30	Novo Nordisk	Human	Vial, cartridge, pre-filled insulin doser	30 mins before food	
Humulin M3	Lilly	Human	Vial, cartridge, pre-filled pen	20-45 mins before food	
Hypurin Porcine 30/70 Mix	Wockhardt UK	Porcine	Vial, cartridge	As advised by your healthcare team	
Insuman Comb 15	Sanofi-Aventis	Human	Pre-filled pen	30-60 mins before food	
Insuman Comb 25	Sanofi-Aventis	Human	Vial, cartridge, pre-filled pen	30-45 mins before food	
Insuman Comb 50	Sanofi-Aventis	Human	Cartridge, pre-filled pen	20-30 mins before food	
<b>ANALOGUE MIXTURE</b>					
Humalog Mix 25	Lilly	Analogue	Cartridge, pre-filled pen	Just before / with / just after food	
Humalog Mix 50	Lilly	Analogue	Cartridge, pre-filled pen	Just before / with / just after food	
NovoMix 30	Novo Nordisk	Analogue	Cartridge, pre-filled pen	Just before / with / just after food	
<b>LONG-ACTING ANALOGUE</b>					
Lantus	Sanofi-Aventis	Analogue	Vial, cartridge, pre-filled pen	Once a day, anytime (but at same time each day)	
Levemir	Novo Nordisk	Analogue	Cartridge, pre-filled pen, pre-filled insulin doser	Once or twice daily	

**Company contacts**  
**Novo Nordisk:** 0845 600 5055 **Lilly:** 01256 315999 **Wockhardt UK:** 01978 661261 **Sanofi-Aventis:** 01483 505515

Registered charity no. 215199 Code: 641352

## Appendix 2: Example of contents of hypo box

- Copy of hypoglycaemia algorithm
- 1x 200 ml carton fruit juice (or 120 ml Lucozade® original for renal patients)
- 1 x packet of dextrose tablets
- 1x mini pack of biscuits
- 3x vials (1 box) Glucogel® (formerly known as Hypostop)
- 20% glucose IV solution
- 1x green venflon 18G
- 1x grey venflon 16G
- 1x 10ml sterile syringe
- 3 x 10ml sodium chloride 0.9% ampoules for flush
- 1x green sterile needle 21G
- Chlorhexidine spray/alcohol wipes
- 1x IV dressing (venflon cover)
- 1x dressing pack for cannulation
- 10% IV glucose infusion 500ml bag
- Treatment pathway
- Audit form
- Instructions on where to send audit form and replenish supplies
- 1x Glucagon pack – to be kept in the nearest drug fridge or labelled with reduced expiry date of 18 months if stored at room temperature

“Hypo box” contents should be checked on a daily basis to ensure it is complete and in date. It is the responsibility of the member of staff who uses any contents to replenish them after use.

## Appendix 3

# Hypoglycaemia Audit Form

(To be completed by a Healthcare Professional after each hypoglycaemic episode)

### Patient Details/Sticker:

Hosp No: .....	DoB: .....
Surname: .....	
Forename(s): .....	
Male <input type="checkbox"/>	Female <input type="checkbox"/>
NHS No .....	

### Healthcare Professional Details:

Name: .....

Grade/Band: .....

Ward: ..... Consultant: .....

Date of Event: \_\_\_ / \_\_\_ / \_\_\_ Time of Event: \_\_\_\_: \_\_\_\_ hrs (24 hr clock)

Hypoglycaemic episode type please insert letter from key below:

### Key:

- A. Patient was conscious, orientated and able to swallow
- B. Patient was conscious but confused, disorientated, aggressive or had an unsteady gait but was able to swallow
- C. Patient was unconscious and/or having seizures and/or was very aggressive
- D. Patients was conscious, orientated but 'Nil by Mouth'
- E. Patients requiring enteral feeding

### Treatment administered

Blood Glucose (BG) at time of event:

BG - 10 minutes after treatment:

or

BG - 15 minutes after treatment:

Was Hypoglycaemia Treatment Guideline followed? Yes  No\*  (Please tick appropriate box)

\*If No, please give details:

## Hypoglycaemia Audit Form (Cont'd)

Did the patient self-manage?    Yes     No\*     *(Please tick appropriate box)*

Patient recovered?    Yes     No\*     *(Please tick appropriate box)*

\*If No, please give details:

What steps were taken to identify the reason for the hypoglycaemia?

Please give details:

What steps were taken to prevent a recurrence?

Please give details:

Please comment on the ease and effectiveness of the Treatment Guideline and make any suggestions on how it could be improved.

**Thank you**

**Please return completed form to the DISN or diabetes department**



## Appendix 4

written by Dr Clare Crowley, Medicines Safety & Vascular Surgery Pharmacist, Oxford Radcliffe Hospitals NHS Trust

### Sample injectable monograph

To provide healthcare staff with essential technical information in clinical area at point of use, in accordance with NPSA Patient Safety Alert 20 'Promoting safer use of injectable medicines'

### MEDICINE: GLUCOSE 10% & 20% INFUSION

**Indication:** Management of adult hypoglycaemia, where dose should be prescribed by volume & concentration to minimise confusion

**Available as:** 10% glucose 500ml solution for IV infusion (0.1g/ml)  
20% glucose 100ml solution for IV infusion (0.2g/ml) (*Preparation currently under development*)  
20% glucose 500ml solution for infusion (0.2g/ml)

### Example calculations

Should not be required if prescribed via concentration and volume as advised

**Usual adult dose:** see guidelines

### Administration:

IV injection: Not recommended

### IV infusion:

20% glucose - central access preferred where available and essential if 20% infusion is continued after initial dose. Short term peripheral use via a secure cannula into a large vein is acceptable for the emergency management of hypoglycaemia with close monitoring of the infusion site for thrombophlebitis (unlicensed route)

10% glucose - central access (preferred where available) or peripherally via a secure cannula into a large vein. If peripheral infusion continues for more than 24 hours change infusion site to minimise thrombophlebitis (unlicensed route)

IM injection: Contraindicated

Subcutaneous injection: Contraindicated

### Preparation & final concentration

Ready to use infusion. If only part of the infusion is needed discard any unused portion

### Rate of administration

Give 75-80 ml of 20% glucose (or 150-160ml 10% glucose) over 10-15 minutes. For the initial emergency management of hypoglycaemia this may be administered via a giving set alone.

In all other situations, an infusion pump is required.

### Flush

Sodium chloride 0.9%, glucose 5% - flush well to reduce vein irritation

Do not administer blood through the same infusion equipment

### Compatible infusions

Not applicable

### Storage and handling

Do not use unless solution is clear and container undamaged

High strength solution – packaging looks similar to other infusion fluids take care to confirm correct strength selected

### Cautions and side effects

Hyperglycaemia, monitor blood glucose

Avoid extravasation – may cause tissue damage

Pain and phlebitis may occur during administration as the solution is hypertonic. This is a particular risk if infused too quickly. Monitor the infusion site, if any signs of phlebitis, stop infusion, remove cannula and resite

Fluid and electrolyte disturbances including oedema, hypokalaemia and hypomagnesaemia

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