

# Inpatient Management of Hypoglycaemia in Adults with Diabetes Mellitus

## Guideline

### Table of Contents

Introduction .....	2
Hypoglycaemia in Diabetes .....	2
Risk Factors for Hypoglycaemia .....	2
Potential causes of inpatient hypoglycaemia .....	3
Symptoms of Hypoglycaemia.....	3
Hypoglycaemia Unawareness .....	3
Hypoglycaemia Treatment .....	4
50% Glucose Solution .....	4
A. <i>Adults who are conscious, orientated and able to swallow safely</i> .....	4
B. <i>Adults who are conscious but confused, disorientated, unable to cooperate, aggressive or has unsteady gait but is able to swallow safely</i> .....	4
C. <i>Adults who are unconscious and/or fitting and/or very aggressive</i> .....	5
D. <i>Adults who are 'Nil by Mouth'</i> .....	5
E. <i>Adults requiring enteral or parenteral feeding</i> .....	6
When hypoglycaemia has been successfully treated .....	6
Hypoglycaemia Audit Form .....	9
Hypoglycaemia Audit Form .....	10
Hypoglycaemia Audit Form (Cont'd) .....	11
Admin Info .....	12

## Introduction

At present, 20% glucose solution is not available but will be included in revisions to this guideline when available to be administered without prescription in severe hypoglycaemia. Glucagon and 50% glucose mininject may be given without prescription in an emergency for the purpose of saving a life.

## Hypoglycaemia in Diabetes

Hypoglycaemia (hypo) is low blood glucose. Treatment for hypoglycaemia should be initiated at a glucose concentration of less than 4mmol/L. It results from an imbalance between glucose supply, glucose utilisation and insulin action resulting in a relative excess of insulin. Hypoglycaemia should be excluded in any person with diabetes who is acutely unwell, drowsy, unconscious, unable to co-operate, presenting with aggressive behaviour or is fitting. If hypoglycaemia is prolonged, it can result in death.

Most insulin treated patients can expect to experience hypoglycaemia at some time, with up to one in seven having a more severe episode each year and 3% suffering recurrent episodes.

Patients treated with Sulphonylureas (gliclazide, and particularly glibenclamide), either alone or in combination with any other diabetes treatment, are at risk of hypoglycaemia, particularly elderly patients and those with renal impairment.

Acute hypoglycaemia provokes an intense autonomic response and may provoke a cardiac arrhythmia, myocardial ischaemia or myocardial infarction in compromised patients.

The brain is dependent on a continuous supply of glucose and its interruption leads to central nervous system dysfunction, impaired cognition and eventually coma. This is called neuroglycopenia.

## Risk Factors for Hypoglycaemia

- ◆ Use of insulin
- ◆ Use of insulin secretagogues (eg Sulphonylureas)
- ◆ Near normoglycaemia (low HbA1c/tight control)
- ◆ Previous history of severe hypos
- ◆ Undetected nocturnal hypos
- ◆ Long duration of diabetes
- ◆ Impaired hypoglycaemia awareness
- ◆ Preceding hypoglycaemia (less than 3.5 mmol/L)
- ◆ Alcohol misuse
- ◆ Increasing age
- ◆ Impaired renal function
- ◆ Early pregnancy (insulin-treated patients)
- ◆ Breast feeding
- ◆ Vomiting and other causes of reduced food intake
- ◆ Food malabsorption (eg gastroenteritis, coeliac disease)
- ◆ Severe hepatic dysfunction
- ◆ Patients on dialysis treatment
- ◆ Terminally ill patients
- ◆ Concurrent use of drugs with hypoglycaemic agents eg warfarin, salicylates, fibrates, sulphonamides (including Septrin), monoamine oxidase inhibitors, NSAIDs

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

### Potential causes of inpatient hypoglycaemia

- ♦ Missed/late meal/reduced carbohydrate portion than normal
- ♦ Change of main meal timing
- ♦ Lack of access to usual snacks between meals
- ♦ Inappropriate use of 'stat' or 'as required' quick acting insulin (eg treating rebound hyperglycaemia)
- ♦ Acute discontinuation of steroid therapy
- ♦ Recovery from acute illness/stress
- ♦ Mobilisation after illness
- ♦ Large limb amputation
- ♦ Inappropriately timed diabetes medication for meal/enteral feed
- ♦ Poor injection technique
- ♦ Incorrect insulin prescribed and administered
- ♦ Patients on IV insulin with/without glucose infusion
- ♦ Patients who are nil by mouth
- ♦ Inadequate re-suspension of mixed or intermediate acting insulins
- ♦ Regular insulin doses being given in hospital when these are not taken routinely at home
- ♦ Co-prescription of drugs alter action of oral hypoglycaemic agents
- ♦ Insulin error (eg misreading poorly written prescription – when 'U' used for units (4U administered as 40 units) or confusing insulin name with dose (Humalog Mix 25 becoming Humalog 25 units).

### Symptoms of Hypoglycaemia

Autonomic signs/symptoms	Neuroglycopenic symptoms
Pallor	Loss of concentration
Sense of anxiety	Blurred vision
Sweating	Aggressive behaviour, lack of cooperation, disorientation or confusion
Tremor	Fits
(Tachycardia) Palpitations	Transient neurological deficits
	Reduced level of consciousness
	Ataxia, muscle twitching

### Hypoglycaemia Unawareness

Some patients, particularly those with longstanding diabetes, may lose their awareness of impending or actual hypoglycaemia. Autonomic symptoms may be less obvious in the elderly or patients treated with beta-blockers.

## **Hypoglycaemia Treatment**

All wards must ensure they have the necessary items for the management of hypoglycaemia. These items are listed below and should be kept in a dedicated cupboard or shelf in the clinical room (except glucagon which is stored in the fridge). This dedicated area should also display a laminated copy of the hypoglycaemia algorithm. A copy of the algorithm should also be kept in every bedside patient folder.

Many people with diabetes carry their own supplies of oral hypoglycaemia treatment and should be supported to self-manage when capable and appropriate. Following assessment this should be recorded in their hospital care plan.

### **50% Glucose Solution**

Except in the emergency treatment of severe hypoglycaemia, Glucose 50% should be administered via a central vein after appropriate dilution. When used for the emergency treatment of hypoglycaemia, Glucose 50% may be administered slowly through a large intravenous cannula in the antecubital fossa at a rate not greater than 3mls per minute. There is a risk of phlebitis and, in the event of extravasation, soft tissue damage.

### **Treatment of Hypoglycaemia:**

**Adults who are experiencing hypo symptoms but have a blood glucose level greater than 4 mmol/L – treat with a small carbohydrate snack only (for symptom relief)**

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

- 1) Give 15-20 g quick acting carbohydrate:
  - 90-120 ml of original Lucozade
  - 3 heaped teaspoons Dextrose powder dissolved in water
  - 1 to 2 tubes GlucoGel
- 2) Repeat capillary blood glucose measurement fifteen minutes later. If blood glucose less than 4mmol/L, repeat step 1 up to 3 times
- 3) If blood glucose remains less than 4mmol/L after fifteen minutes or 3 cycles, contact a doctor. Consider 20mls 50% glucose intravenously or 1 mg of Glucagon IM
- 4) Once blood glucose is above 4mmol/L and patient has recovered, give a long acting carbohydrate **eg**:
  - 2 slices of bread/toast
  - Normal meal if due (must contain carbohydrate)

#### **DO NOT omit insulin injection if due but consider reduction of regular treatment**

- 5) Ensure regular capillary blood glucose level monitoring is continued for 24 to 48 hours, whether at home or in hospital. Refer to in-patient diabetes specialist nurse if hypoglycaemia is severe or recurrent.

#### **B. Adults who are conscious but confused, disorientated, unable to cooperate, aggressive or has unsteady gait but is able to swallow safely**

- 1) If patient capable and cooperative, follow **A1**) as above
- 2) If patient is not capable and/or uncooperative, but is able to swallow safely, give **either** 1.5 -2 tubes GlucoGel squeezed into the mouth between the teeth and gums or (if unable to swallow) give 20mls IV 50% glucose
- 3) Monitor blood glucose levels after fifteen minutes. If still less than 4 mmol/L repeat **A1** (up to 3 times)

- 4) If blood glucose level remains less than 4mmol/L after fifteen minutes (or 3 cycles of **A1**), consider 20mls IV 50% glucose or 1mg Glucagon IM
- 5) Once blood glucose is above 4mmol/L and patient has recovered, give a long acting carbohydrate **eg**:
  - 2 slices of bread/toast
  - Normal meal if due (must contain carbohydrate)

**DO NOT omit insulin injection if due but consider reduction of regular treatment**

- 6) Ensure regular capillary blood glucose level monitoring is continued for 24 to 48 hours, whether at home or in hospital. Refer to in-patient diabetes specialist nurse if hypoglycaemia is severe or recurrent.

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

- 1) Check:           **Airway**  
                          **Breathing**  
                          **Circulation**

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

Contact a doctor as an emergency

- 2) If IV access available, give 20ml of 50% glucose (over five minutes). Repeat capillary blood glucose measurement ten minutes later. If blood glucose less than 4mmol/L, repeat as necessary

If IV access is not available, give Glucagon 1 mg IM (may take up to 10 minutes to take effect). Glucagon mobilises glycogen from the liver and will not work if given repeatedly or in starved patients with no glycogen stores or those with severe liver disease. In this situation or if prolonged treatment is required, IV glucose is better.

- 3) Once the blood glucose is greater than 4 mmol/L and the patient has recovered give a long acting carbohydrate **eg**:
  - 2 slices of bread/toast
  - normal meal if due (must contain carbohydrate)

**DO NOT omit insulin injection if due but consider reduction of regular treatment**

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

- 4) Ensure regular continued capillary blood glucose level monitoring for 24 to 48 hours. Refer to in-patient diabetes specialist nurse.

Patients given Glucagon require a larger portion of long-acting carbohydrate to replenish glycogen stores (double the suggested the amount above)

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

- 1) If patient has an intravenous insulin infusion regimen, adjust as prescribed, and seek medical advice
- 2) Follow IV guidance as above.
- 3) Once blood glucose greater than 4 mmol/L and patient has recovered consider 10% glucose at a rate of 100 ml/hr until patient is no longer nil by mouth or has been reviewed by a doctor
- 4) Ensure regular continued capillary blood glucose level monitoring for 24 to 48 hours. Refer to in-patient diabetes specialist nurse.

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

### **Risk factors for hypoglycaemia**

- ◆ Blocked/displaced tube
- ◆ Change in feed regime (note carbohydrate content of feed)
- ◆ Enteral feed discontinued
- ◆ Parenteral nutrition 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 feeding tube:**

- 1) Give 15-20 g quick acting carbohydrate **eg:**
  - 50-60mls of Ensure Plus
  - 90-120 ml of original Lucozade
  - 3-4 heaped teaspoons sugar or dextrose powder dissolved in water
- 2) Repeat capillary blood glucose measurement five to ten minutes later. If blood glucose less than 4mmol/L, repeat step 1 up to 3 times
- 3) If blood glucose remains less than 4mmol/L after fifteen minutes (or 3 cycles), consider 20mls IV 50% glucose or 1mg Glucagon IM
- 4) Once blood glucose is above 4mmol/L and patient has recovered, give a long acting carbohydrate **eg:**
  - Restart feed
  - 10% IV glucose at 100 ml/hr

### **DO NOT omit insulin injection if due but consider reduction of regular treatment**

- 5) Ensure regular continued capillary blood glucose level monitoring for 24 to 48 hours. Refer to in-patient diabetes specialist nurse.

### **When hypoglycaemia has been successfully treated**

- Complete an audit form, replenish stock of used items as appropriate and send audit form to the Diabetes Inpatient Specialist Nurse.
- Consider medical or DISN review if hypo episode was severe or was a recurrent event or if patient has concerns regarding treatment of further recurrence of hypoglycaemia and its treatment
- Identify the cause **eg** omitted meal or snack(s), inaccurate dosage of diabetes medication, inappropriate use of 'stat' or 'as required' doses of rapid acting insulin
- Take measures to avoid hypoglycaemia in the future. The Diabetes Specialist Nurse or Diabetes Medical Team can be contacted to discuss this.
- Please **DO NOT** omit next insulin injection or start IV insulin infusion to 'stabilise' blood glucose. If unsure of subsequent diabetes treatment, discuss with the diabetes team/diabetes specialist nurse
- DSN/ consulting team to consider reducing the dose of insulin prior to the time of previous hypo events. This is to prevent a further hypo occurring

Be aware that 12-24 hours later the patient may experience a rebound hyperglycaemic episode. This is a one off phenomena. **DO NOT TREAT WITH 'STAT' DOSES OF SHORT ACTING INSULIN** or start IV insulin infusion to 'stabilise' blood glucose

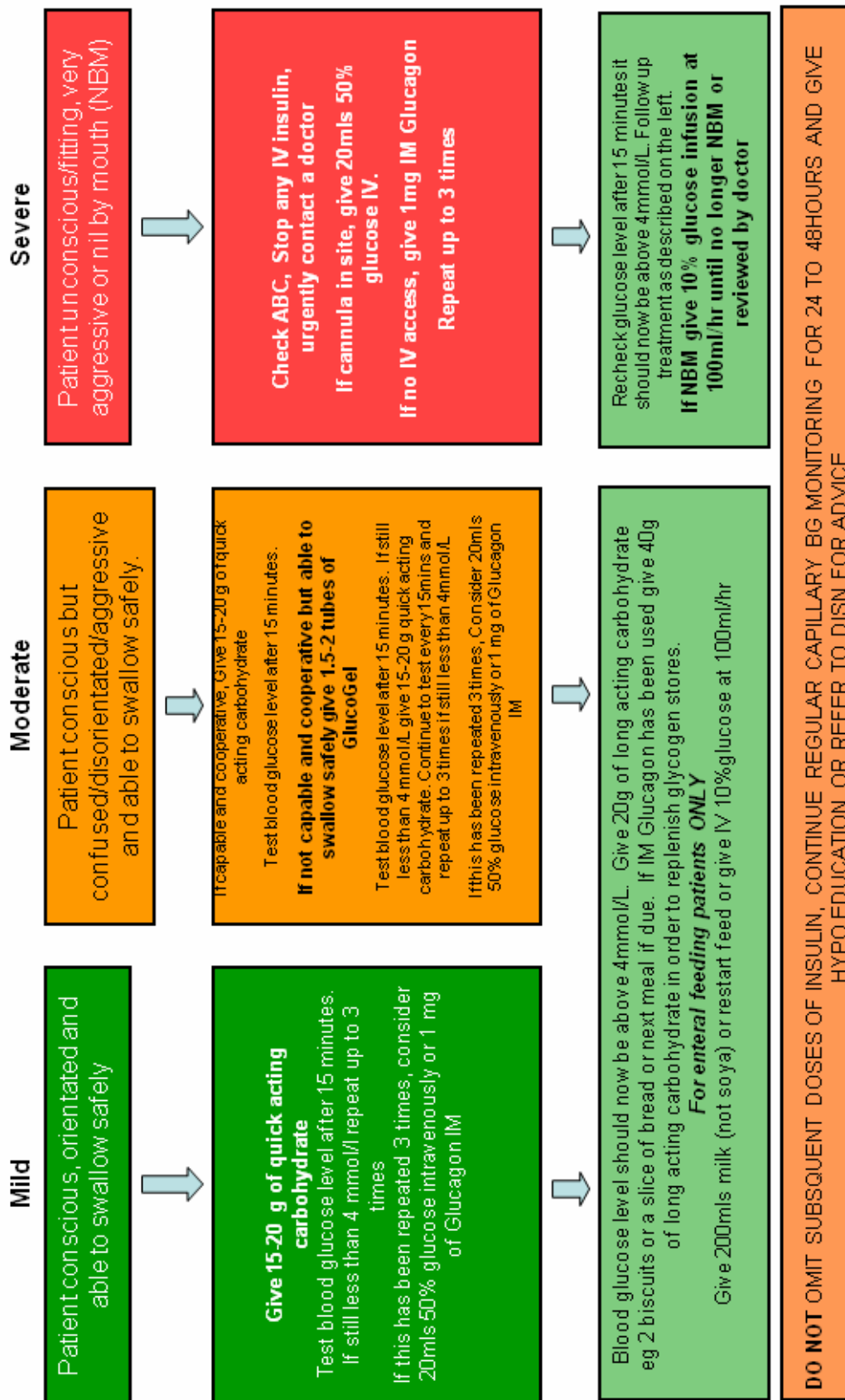
### **Imperial College NHS Trust: Items required for treatment of hypoglycaemia**

- ♦ Copy of hypoglycaemia algorithm
- ♦ 1 x packet of dextrose tablets
- ♦ 3x 23g tubes (1 box) of Glucogel (formerly known as Hypostop)
- ♦ 1x glucose 50% vial (50ml)
- ♦ 1x green venflon 18G
- ♦ 1x grey venflon 16G
- ♦ 1x 10ml sterile syringe
- ♦ 3 x 10ml saline flush
- ♦ 1x green sterile needle 21G
- ♦ Alcohol wipes
- ♦ 1x IV dressing (venflon cover)
- ♦ 1x dressing pack for cannulation
- ♦ 1 x glucose 10% infusion 500ml
- ♦ Audit form
- ♦ Instructions on where to send audit form and replenish supplies
- ♦ 2 x glucagon injecton – to be kept in the nearest drug fridge

Hypoglycaemia treatment stock should be checked on a daily basis to ensure that it is complete and in date. It is the responsibility of the member of staff who uses any contents to replenish them after use.



**Hypoglycaemia is defined as blood glucose of less than 4mmol/l (if not less than 4mmol/l but symptomatic give a small carbohydrate snack for symptom relief )**



For enterally fed patients please see section E of the Hypoglycaemia Guideline

## Hypoglycaemia Audit Form

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

### Patient Details/Sticker:

Hosp No: .....	DoB: .....
Surname: .....	
Forename(s): .....	
. . . [ ] - . [ ]	

### 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 unsteady gait but is able to swallow**
- C. Patient was unconscious and/or fitting and/or very aggressive
- D. Patients was conscious, orientated but 'Nil by Mouth'
- E. Patients requiring enteral feeding

Blood Glucose (BG) at time of event:

BG - 5 minutes after treatment:

BG - 10 minutes after treatment:

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

\*If No, please give details:

Hypoglycaemia Audit Form (Cont'd)

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

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

\*If No, please give details:

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

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 re how it could be improved.

Thank you

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

## Admin Info

### 6) IMPLEMENTATION

Training required for staff	<b>Yes</b>
If yes, who will provide training	<b>Carol Jairam</b>
When will training be provided?	<b>2010, rolled out to all in-patient areas</b>
Date for implementation of guideline	

### 7) MONITORING / AUDIT

When will this guideline be audited?	<b>1/1/2011</b>
Who will be responsible for auditing this guideline?	<b>Dr. Jonathan Valabhji, Clinical Lead, Diabetes</b>
Are there any other specific recommendations for audit?	

### 8) REVIEW

When will this guideline be reviewed?	<b>June 2013</b> <b>Nick Oliver</b>
Please indicate frequency of review:  As a guide: <ul style="list-style-type: none"><li>• Drug related guidance should be reviewed every 2 years</li><li>• Therapy related guidance should be reviewed every 5 years</li><li>• Clinical treatment guidance should be reviewed every 3 – 5 years</li></ul>	<b>3 yearly</b>
Date of next review	<b>June 2013</b>

## 10) GUIDELINE DETAIL

Start Date: (date of final approval by CPG)	
Dates approved by:	<b>Divisional Guidelines Group (if applicable)</b>
	<b>CPG1 Guidelines Committee</b>
Have all relevant stakeholders (Trust sites, CPGs and departments) been included in the development of this guideline?	<b>Imperial College Healthcare NHS Trust Diabetes Team</b>  <b>Professor D Johnston</b> <b>Dr A Dornhorst</b> <b>Dr J Valabhji</b> <b>Dr E Hatfield</b> <b>Dr N Martin</b> <b>Dr T Tan</b> <b>Dr D Gable</b> <b>Dr M Yee</b> <b>Dr N Oliver</b>  <b>Sarah Allen</b> <b>Carol Jairam</b> <b>Mary Joyce</b> <b>Barbara Muzenda</b> <b>Clare Poulter</b> <b>Jo Reed</b> <b>Carmel Ryan</b> <b>Anna Sackey</b> <b>Inez Walkes</b>  <b>Sarah Menezes</b> <b>Nicola Bandaranayake</b> <b>Louisa Fearnley</b>
Who will you be notifying of the existence of this guidance?	<b>Please give names/depts</b>
Related documents:	<b>If applicable</b>
Author/further information:	Nick Oliver / Carol Jairam Diabetes Dept CPG1 – Medicine St. Mary's Hospital 0203 312 1073
Document review history:	<b>If applicable – version number; dates of previous reviews</b>
Next review due	
THIS GUIDELINE REPLACES:	Diabetes – Hypoglycaemia Management SMH Diabetes – Hypoglycaemia algorithm HH/CXH

## 11) INTRANET HOUSEKEEPING

Key words	<b>Diabetes, hypoglycaemia, glucose</b>
Which CPG does this belong to?	<b>Medicine</b>

Which subdivision of the guidelines spine should this belong to?	Diabetes and Endocrinology
Title for the intranet if different from the document ( <i>please note that documents sit alphabetically so should <b>not</b> start with "guideline for..."</i> )	Hypoglycaemia – Adult Inpatients