Introduction of a "hypo box" into an Irish teaching hospital

Jackie Mac Mahon Tone, Diarmuid Smith

Hypoglycaemia is a common side effect of intensive therapy with insulin and with oral hypoglycaemic agents, and is the most feared complication of diabetes management. Individuals with diabetes may experience symptoms of hypoglycaemia when their blood glucose level falls below 4.0 mmol/L, and should be treated without delay. The authors' experience within a teaching hospital found that the management of diabetes, in particular hypoglycaemia, was suboptimal and that staff were treating hypoglycaemia inadequately. To address this, the authors identified that treatment for hypoglycaemia should be readily available on each ward. A "hypo box" was stocked with the relevant equipment to treat hypoglycaemia as well as with a laminated guideline for hypoglycaemia management and was positioned on each ward. Audits have shown that treatment of hypoglycaemia has improved within the hospital, although ongoing education is needed to ensure staff have the necessary skills and knowledge to treat this condition.

Article points

1. Hypoglycaemia constitutes a medical emergency, and treatment should be immediate.
2. The provision of effective treatment for hypoglycaemia in a hospital setting requires staff to be knowledgeable about the condition and to have easy access to equipment.
3. A "hypo box" in each ward provides staff with all the relevant equipment to treat hypoglycaemia as well as guidelines for hypoglycaemia management.

Key words

- Education and training
- Hospital care
- "Hypo box"
- Hypoglycaemia treament

Jackie Mac Mahon Tone is a Diabetes Nurse Specialist with responsibility for inpatient care; Diarmuid Smith is a Consultant Endocrinologist, Beaumont Hospital, Dublin.

Hypoglycaemia is a common side effect of intensive therapy with insulin and with oral hypoglycaemic agents, and is the most feared complication of diabetes management; approximately one in four people with diabetes have a hypoglycaemic episode during their hospital stay (Joint British Diabetes Societies [JBDS] Inpatient Care Group, 2010). This has serious consequences as it delays discharge and is associated with increased mortality; the prevention of hypoglycaemia and its prompt and effective treatment is therefore essential (JBDS Inpatient Care Group, 2010).

Hypoglycaemia constitutes a medical emergency, although most individuals recover completely (Tomky, 2005). The symptoms of hypoglycaemia warn an individual of its onset, and vary considerably between individuals (JBDS Inpatient Care Group, 2010); it 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).

In the short term, hypoglycaemia induces a spectrum of effects, including cognitive impairment, mood changes and the risk of physical injury; it can lead to transient or

permanent cerebral damage (Tomky, 2005). If blood glucose levels fall sufficiently, cognitive dysfunction is inevitable (Evans and Amiel, 2002). Rare but potentially fatal effects of untreated hypoglycaemia include seizures, coma or cardiac arrhythmias (Frier, 2004). Hypoglycaemia should be excluded in any person with diabetes who is acutely unwell, drowsy, unconscious, unable to cooperate, presenting with aggressive behaviour or having seizures (JBDS Inpatient Care Group, 2010). To avoid potential hypoglycaemia, the UK Hypoglycaemia Study Group (2007) recommends 4.0 mmol/L as the lowest acceptable blood glucose level in people with diabetes; the NICE (2004) guidelines recommend the avoidance of hypoglycaemia while maintaining blood glucose control as close to optimum levels as is feasible.

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 individuals experiencing hypoglycaemia should be treated without delay. It is important to try to ascertain the reason for the hypoglycaemia if possible (*Table 1*) and determine if there is a pattern occurring, in which case insulin or oral hypoglycaemic agents may need to be adjusted.

As a result of ward experience in Beaumont Hospital, Dublin, the authors suggested that the management of diabetes, in particular hypoglycaemia, was suboptimal and that staff were treating hypoglycaemia inadequately.

Research methodology

In an attempt to address the shortfall in the authors' service, a multidisciplinary insulin prescription committee was set up in 2007 to look at all aspects of care in relation to inpatients with diabetes. One area of diabetes management that was examined was hypoglycaemia, as this was identified as a significant at-risk area. A key risk that was highlighted was the lack of an identified storage area at ward level where the necessary treatment for hypoglycaemia should be readily available. A questionnaire looking at a number of areas relating to hypoglycaemia was developed (*Box 1*) to ascertain current staff knowledge regarding hypoglycaemia. Staff were asked to fill in the questionnaire "on the spot" to ensure that information was not flawed by staff sharing information.

The multidisciplinary team insulin prescription committee outlined comprehensive and detailed advice on the causes and management of hypoglycaemia (*Box 2a*) and developed an algorithm of how to manage hypoglycaemia in a variety of clinical situations (*Box 2b*). A "hypo box" was sourced, which is a box equipped with all the relevant equipment and requirements to treat hypoglycaemia (*Figure 1*). A list of what should be included in the "hypo box" was devised (*Box 3*), laminated and put into the box, as was a laminated copy of the guidelines for hypoglycaemia management (*Box 2b)*; a sticker was developed to put on the outside of the box to indicate what it was. The "hypo box" is an innovative solution for the treatment of hypoglycaemia in Ireland, but has been used for a number of years in the UK (Baker et al, 2007).

Page points

1. People experiencing hypoglycaemia require quick-acting carbohydrate to return their blood glucose levels to the normal range (>4.0 mmol/L).
2. A key risk that was highlighted by the authors was the lack of an identified storage area at ward level where the necessary treatment for hypoglycaemia should be readily available.
3. A "hypo box" containing all the relevant equipment to treat hypoglycaemia as well as guidelines for management was provided to wards and nurses were educated about the contents.

Table 1. Causes of inpatient hypoglycaemia.

Medical issues	Reduced carbohydrate intake
• Inappropriate use of stat or PRN quick-acting insulin	• Missed or delayed meals/enteral feeding
• Incorrect insulin prescribed and administered	• Reduced carbohydrate intake
• Inappropriate time of diabetes medication for meal/enteral feed	• Reduced appetite
• Reduction/discontinuation of steroid therapy	• Fasting for procedure
• Recovery from acute illness	• Nil by mouth
• Inadequate treatment of previous hypoglycaemia	• Vomiting
• Renal impairment	• Mismatch with insulin or oral hypoglycaemic agents and carbohydrate intake
• Tight glycaemic control	• Food malabsorption
• Poor injection technique	• Lack of access to snacks
• Endocrine disorders (Addison's disease)	• Interruption in enteral feeding

From: JBDS Inpatient Care Group (2010).

The hypoglycaemia guidelines and "hypo box" were launched as part of a general diabetes inpatient initiative and all clinical areas in the hospital were allocated a "hypo box". Staff were educated regarding the correct treatment of hypoglycaemia and were familiarised with the "hypo box" and shown how to use the equipment within it. They were supplied with a hypoglycaemia recording booklet and were advised to record any episode of hypoglycaemia and what treatment was given. It was suggested that the "hypo box" should be kept in the drug treatment area and could be either free-standing or wall-mounted. Staff were advised to check the "hypo box" daily and restock it once a hypoglycaemic treatment had been given.

A further audit was carried out 6 months after the introduction of the "hypo box" to assess whether knowledge about management and treatment of hypoglycaemia had improved at ward level.

Box 2a. Hypoglycaemia guidelines for individuals with diabetes – definition, symptoms and reasons for "hypos".

What is hypoglycaemia (a "hypo")?

Hypoglycaemia is when an individual's blood glucose level falls too low (capillary blood glucose <4.0 mmol/L). If the individual is taking certain tablets (e.g. sulphonylureas) or insulin, there is a risk of hypoglycaemia.

What are the symptoms?

The most common symptoms include: shaking, sweating, intense hunger, lack of concentration, pallor or tremor (neurogenic symptoms)

or

headaches, mood changes, aggressiveness, slurred speech, drowsiness or coma (neuroglycopenic symptoms)

or

no symptoms, particularly individuals on insulin (hypoglycaemia unawareness).

If no symptoms, repeat the blood glucose test, and if <4.0 mmol/L take a venous glucose sample and treat for hypoglycaemia (as per the Beaumont Hospital policy document) **[see Box 2b].**

Why do individuals have "hypos"?

- Eating inadequate carbohydrate or poor appetite.
- Missing a meal or snack.
- Timing of medication (insulin or sulphonylurea).
- Too high a dose of insulin or sulphonylurea.

Box 1. Beaumont Hospital hypoglycaemia questionnaire.

The insulin prescription committee in Beaumont Hospital is currently preparing new guidelines for the management of inpatients with diabetes. To help with the task please complete the following questionnaire – all questionnaires are anonymous. Please tick the correct answer:

1. What is your post/position?

Doctor ❑
Clinical nurse manager 2 ❑
Clinical nurse manager 1 ❑
Staff nurse ❑
Student nurse ❑
Medical student ❑
Pharmacist ❑

2. Where do you currently work?

Medical ward ❑
Surgical ward ❑
Outpatient department ❑
Accident and emergency department ❑
Other location ❑

3. What blood sugar level do you regard as being hypoglycaemic (a "hypo")? _____

4. How should you treat a hypoglycaemic event?

a) Lucozade or other sweet drink ❑
b) Milk and biscuits ❑
c) Chocolate ❑
d) Diet fizzy drink ❑

5. If an individual on insulin therapy is hypoglycaemic at mealtimes, what should you do?

a) Should you give the person his or her insulin dose? ❑
b) Should you not give the person his or her insulin dose? ❑
c) Other _____

6. Do you know where to find emergency treatment on your ward or outpatient department for an individual having a hypoglycaemic event?

a) Yes ❑
b) No ❑

Box 2b. Hypoglycaemia guidelines for individuals with diabetes – treatment of hypoglycaemia.

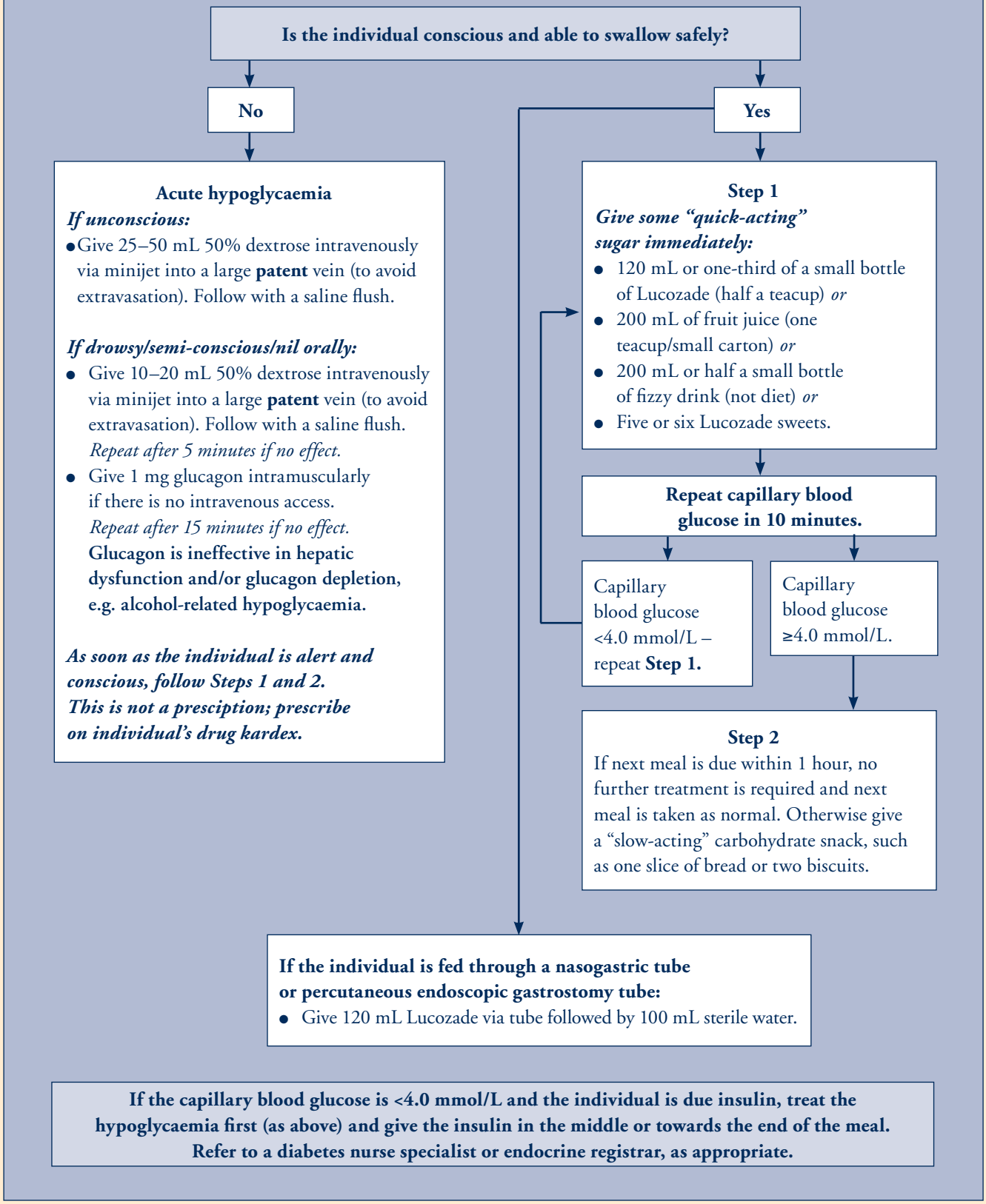

Figure 1. A "hypo box" should be well stocked, labelled and placed on each ward for immediate access to treatment for hypoglycaemia.

Box 3. Contents of a "hypo box".

- Lucozade
- Lucozade sweets
- Tourniquet
- Alcohol wipes
- Pink 20 g intravenous cannula
- Intravenous bung/connection
- Intravenous dressing
- 10 mL syringe (x 2)
- Needles (21 G x 1/2″/25 G x 5/8″) (x 2)
- Saline solution 10 mL (x 2)
- Glucose 50% pre-filled miniject
- Glucagon "hypo kit"

Table 2. Audit of staff knowledge of hypoglycaemia in 2009.

"What blood glucose level is regarded as hypoglycaemic?"

mmol/L	Doctors	Medical student	CNM	Staff nurse	Student nurse	Pharmacist	Total
≤3.0	11	7	8	7	2	2	37 (30.0%)
≤4.0	14	6	15	26	3	6	70 (57.0%)
>4.0	4	9	3	–	–	–	16 (13.0%)

CNM=clinical nurse manager.

Treatment of hypoglycaemia in Beaumont Hospital in 2009

Appropriate treatment	102/129	79.1%
Inappropriate treatment	27/129	20.9%

Findings

The results of the initial hypoglycaemia audit performed in 2009 (*Table 2*) indicated that staff knowledge regarding management of hypoglycaemia was inadequate; in total, 30% of staff thought a blood glucose of ≤3.0 mmol/L indicated a hypoglycaemic episode and 57% stated that ≤4.0 mmol/L indicated hypoglycaemia. Despite the fact that 79.1% of staff indicated that they were aware of the correct treatment for hypoglycaemia, this had not been the clinical experience of the ward diabetes nurse specialist.

The audit carried out 6 months after the introduction of the "hypo box" in 2010 (*Table 3*) indicated that knowledge about treatment of hypoglycaemia had somewhat improved: 86.2% of staff were aware how to treat a hypoglycaemic episode correctly compared with 79.1% in 2009. In addition, 65% of staff were aware that they should treat a hypoglycaemic episode when the blood glucose was ≤4.0 mmol/L.

An audit was done to ascertain whether the "hypo box" was being used correctly and checked on a daily basis (*Table 4*), and the results were disappointing; only 20% of wards were checking their "hypo box" on a daily basis, and only 40% of "hypo boxes" were stocked properly. However, one positive finding was that 93.3% of staff were aware where the "hypo box" was stored on their ward.

Conclusions

Treatment of hypoglycaemia at ward level has improved since the introduction of a "hypo box" onto each ward, but further improvements are needed. Currently education sessions are ward-based and run with small groups of staff, but this is not done on a regular basis. The education covers both management of hypoglycaemia and maintenance of the "hypo box". Staff are encouraged to re-stock after the "hypo box" has been used, and to check it daily when checking the cardiac arrest trolley. Education sessions need to be prioritised to ensure that

staff have the necessary skills to recognise and treat hypoglycaemia. In addition, education needs to be ongoing and repeated at regular intervals to aid the retention of information. The authors plan on delivering education sessions every 6 months to improve the management of hypoglycaemia at ward level. Attendance at education sessions at ward level in the past has been poor because of a high turnover of staff, staff shortages and increased workload; the aim would be to liaise with the ward sisters about the education sessions, involve the clinical practice support nurses and possibly introducing diabetes link nurses.

Continuous audit of practice is vital to ensure that inpatients with diabetes receive the appropriate standard of care and to ensure that retention of knowledge regarding hypoglycaemia management is maintained. In the near future, the authors plan to re-audit both knowledge regarding management of hypoglycaemia and whether the "hypo box" is being used properly. ■

Table 3. Audit of staff knowledge of hypoglycaemia after the introduction of the "hypo box" in 2010

"What blood glucose level is regarded as hypoglycaemic?"

mmol/L	Doctors	CNM	Staff nurse	Student nurse	Pharmacist	Dietitian	Total
≤3.0	12	7	13	–	1	–	33 (29.5%)
≤4.0	16	9	37	10	–	1	73 (65.0%)
>4.0	3	1	2	–	–	–	6 (5.5%)

CNM=clinical nurse manager.

Treatment of hypoglycaemia in Beaumont Hospital in 2010

Appropriate treatment	100/116	86.2%
Inappropriate treatment	16/116	13.8%

Acknowledgement

The authors would like to thank the Beaumont Hospital Insulin Prescription Committee for their contribution to this article and for helping to manage diabetes more efficiently in our hospital.

Baker H, Hammersley M, Stephenson S, Sumner J (2007) Managing hypoglycaemia in hospital. *Journal of Diabetes Nursing* **11**: 108–11

Diabetes Control and Complications Trial Research Group (1993) The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin dependent diabetes mellitus. *N Eng J Med* **329**: 977–86

Evans M, Amiel S (2002) Hypoglycaemia. In: Wass J, Shalet S, Gale E, Amiel S (eds). *Oxford Textbook of Endocrinology and Diabetes*. Oxford University Press, Oxford

Frier BM (2004) Morbidity of hypoglycaemia in type 1 diabetes. *Diabetes Res Clin Pract* **65**(Suppl 1): S47–52

Joint British Diabetes Societies Inpatient Care Group (2010) *The Hospital Management of Hypoglycaemia in Adults with Diabetes Mellitus*. NHS Diabetes, London. Available at: http://bit.ly/r8glZL (accessed 16.07.12)

NICE (2004) *Diagnosis and Management of Type 1 Diabetes in Adults*. Clinical Guideline 15. NICE, London

Tomky D (2005) Detection, prevention and treatment of hypoglycaemia in the hospital. *Diabetes Spect* **18**(1): 39–44

UK Hypoglycaemia Study Group (2007) Risk of hypoglycaemia in types 1 and 2 diabetes: effects of treatment modalities and their duration. *Diabetologia* **50**: 1140–7

Table 4. "Hypo box" audit performed on 30 wards within Beaumont Hospital.

Wards (*n*=30)	Is the "hypo box" in a clearly visible position?	Do staff know where the "hypo box" is kept on the ward?	Is the "hypo box" stocked properly?	Has the "hypo box" been used?	Is the "hypo box" being checked daily?
No	7 (23.3%)	2 (6.7%)	18 (60%)	9 (30%)	24 (80%)
Yes	23 (76.7%)	28 (93.3%)	12 (40%)	21 (70%)	6 (20%)