

# Glycaemic management in patients with diabetes in hospital

Rajesh Rajendran

Gerry Rayman

## Abstract

The prevalence of diabetes mellitus in the inpatient population is three times greater than in the general population. A significant proportion of inpatient expenditure in the UK is spent on the care of patients with diabetes. Despite this, patients with diabetes stay longer in hospital than patients without diabetes and have increased mortality and morbidity. The emerging evidence is in favour of good glycaemic control, which requires control of hyperglycaemia and avoidance of hypoglycaemia. Although insulin is the preferred therapy in the inpatient setting, there remain serious concerns about its safe use. Newer agents such as incretin-based therapies appear promising in the context of inpatient diabetes care but more research is required before they can be recommended in the inpatient setting. Healthcare professionals caring for inpatients with diabetes continue to demonstrate sub-optimal expertise and their training needs to be addressed.

**Keywords** Hyperglycaemia; hypoglycaemia; inpatient diabetes; insulin; safe discharge

## Introduction

The most recent English National Inpatient Diabetes Audit (NaDIA) has shown a prevalence of diabetes mellitus in the hospital inpatient population to be 15.8%.<sup>1</sup> People with diabetes are twice as likely to be hospitalized and have longer hospital stays than people of the same age without diabetes. It is estimated that the NHS in England spends more than £2 billion a year on inpatient care for people with diabetes alone – around 11% of total inpatient care expenditure.<sup>2</sup>

Importantly, the large majority of inpatients with diabetes (>90%) are admitted because of other illnesses rather than diabetes per se, often under specialty teams that may not have the expertise to manage diabetes in the complex inpatient setting. Driven by evidence of sub-optimal hospital management of diabetes, inpatient diabetes care including management of diabetic emergencies, glycaemic control in inpatients and peri-operative diabetes care, is now a major focus of attention in the UK. In

**Rajesh Rajendran** AHEA MRCP is a Clinical Research Fellow in Diabetes and Endocrinology at The Ipswich Hospital NHS Trust, Ipswich, UK. Competing interests: none declared.

**Gerry Rayman** MD FRCP is the Lead for National Diabetes Inpatient Audit (NaDIA) and Consultant Physician in Diabetes and Endocrinology at The Ipswich Hospital NHS Trust, Ipswich, UK. Competing interests: none declared.

## What's new?

- Good glycaemic control in hospital requires control of hyperglycaemia and avoidance of hypoglycaemia; both are associated with increased morbidity, mortality and increased length of stay
- Staff inexperience, hospital meals and medication errors are major barriers to achieving good glycaemic control
- Insulin remains the preferred method of achieving good glycaemic control though serious concerns exist about its safe use in hospitals
- Newer agents such as incretin-based therapies appear promising in the inpatient setting but more research is required before they can be recommended

this article we discuss the control of hyperglycaemia and the avoidance of hypoglycaemia in adult inpatients with diabetes. The specific requirements of children and pregnant women will not be covered here.

## Types of hyperglycaemia in hospital

Hyperglycaemic patients in hospital may have pre-existing diabetes, hospital-related diabetes (stress hyperglycaemia) that resolves after discharge, or newly diagnosed diabetes that persists after discharge. Glycated haemoglobin (HbA<sub>1c</sub>) reflects glycaemia over the previous 6–12 weeks and may be of use in distinguishing the latter two categories: HbA<sub>1c</sub> ≥48 mmol/mol (6.5%) is diagnostic of diabetes. Measuring HbA<sub>1c</sub> in hospital also predicts clinical outcomes in surgical patients,<sup>3</sup> and can inform the choice of diabetes therapy at discharge. All three categories of hyperglycaemia influence outcome of hospital stay and should be managed with equal care. Poorly managed inpatient hyperglycaemia or insulin omission can lead to diabetic ketoacidosis (DKA) in type 1 diabetes; the English NaDIA over 5 years shows that around 60 inpatients with type 1 diabetes develop DKA after admission every week.<sup>1</sup>

## Hypoglycaemia in hospital

Hypoglycaemia is widely defined as a blood glucose concentration <4.0 mmol/L, which is the level at which most people with diabetes develop hypoglycaemic symptoms. Self-treated hypoglycaemic episodes are classified as 'mild', whereas those requiring assistance by a third party are classified as 'severe'.<sup>4</sup> This classification is blurred in the inpatient setting as most patients do not have access to glucose-increasing therapies and therefore require assistance even if well enough to treat themselves. The Joint British Diabetes Society (JBDS) recommends that all adults with diabetes with a blood glucose <4.0 mmol/L in hospitals should be treated, whether symptomatic or not.<sup>5</sup> One of the key concerns highlighted by the English NaDIA over 5 years has been the unacceptably high rates of hypoglycaemia in hospital, affecting up to one-fifth of all inpatients with diabetes and up to half of all insulin-treated inpatients.<sup>1</sup>

### Evidence in favour of controlling glycaemia in hospitalized patients

A wealth of observational evidence associates both hyperglycaemia and hypoglycaemia in hospitalized patients with increased length of stay and higher morbidity and mortality.<sup>6–12</sup> However, the promise of reduced morbidity and mortality with tight glycaemic control in critically ill inpatients implied by intervention trials early in this century<sup>13,14</sup> has been disputed by subsequent trials and meta-analyses, some of which have found higher mortality rates.<sup>15–17</sup> In all these trials patients with tight glycaemic control had more hypoglycaemia, which may have led to poorer outcomes. Good glycaemic control in hospital should avoid both excessive hyperglycaemia and hypoglycaemia.

### Barriers to achieving good glycaemic control in hospital

The stress of illness worsens hyperglycaemia by stimulating release of counter-regulatory hormones, which increase hepatic gluconeogenesis and glycogenolysis and inhibit peripheral glucose uptake.<sup>18</sup> Controlling hyperglycaemia and avoiding hypoglycaemia is particularly difficult in hospitalized patients due to both patient factors, such as comorbidity (renal and liver disease), sepsis, abnormal nutritional states and changing drug therapies; and hospital environment factors, such as meal quality and timing, staff expertise and confidence in treating people with diabetes, and medication errors. It has been consistently reported that there is a high degree of dissatisfaction among patients with diabetes with the quality, quantity and timing of hospital meals<sup>1,19</sup> and those who reported higher dissatisfaction were significantly more likely to experience severe hypoglycaemia in hospital.<sup>19</sup> Moreover, one of the largest surveys of junior doctors in the UK found that a majority felt their diabetes training did not allow them to manage inpatients with diabetes safely, and that only 40% would take the initiative to optimize glycaemic control for patients under their care >80% of the time.<sup>20</sup> Inpatients experiencing medication errors are also twice as likely to experience hypoglycaemia.<sup>1</sup>

### Recommended glycaemic targets in hospitalized patients

Due to the conflicting evidence on tight glycaemic control, the American Diabetes Association (ADA) expert panel now recommend the following blood glucose targets:

- critically ill inpatients – range 7.8–10.0 mmol/L
- non-critically ill inpatients – pre-meal <7.8 mmol/L, random <10.0 mmol/L
- less stringent targets for those with severe comorbidities.<sup>21</sup>

The UK JBDS recommend an ideal blood glucose target range of 6.0–10.0 mmol/L (acceptable range 4.0–12.0 mmol/L) in the peri-operative period.<sup>3</sup> It is possible that these targets may be revised in future when new evidence emerges.

### Treatment strategies: non-insulin or insulin therapy?

Use of insulin to control inpatient hyperglycaemia remains a subject of debate. The UK JBDS currently does not recommend a preferred method of achieving good glycaemic control in non-critically ill inpatients. The ADA, however, recommends insulin therapy for both critically and non-critically ill inpatients as the

preferred method of achieving and maintaining glycaemic control.<sup>21</sup>

### Non-insulin therapy in the hospital setting

In the hospital setting, oral anti-hyperglycaemic agents may not be the best option for achieving good glycaemic control, especially when glucose concentrations are changing rapidly due to patient factors described earlier. Metformin may need to be discontinued temporarily due to declining renal function and administration of intravenous contrast for imaging procedures. The effects of sulfonylureas are unpredictable in critically ill patients, especially in the elderly and those with renal impairment, and they may lead to prolonged and recurrent hypoglycaemia. Oral incretin-based therapies appear to achieve similar glycaemic control to insulin therapy in a sub-group of inpatients with diabetes, with lower rates of hypoglycaemia,<sup>22</sup> but larger trials in a wider inpatient population are required to confirm this.

### Insulin therapy in the hospital setting

Insulin therapy, either subcutaneous or intravenous depending on the situation, is often the most effective method of controlling blood glucose in hospital, even in insulin-naïve patients. Subcutaneous insulin is preferred in most inpatients who are able to eat and drink normally. It is often difficult to optimize control using twice daily pre-mixed insulin in the hospital setting because of patient and hospital factors described above, though this approach is still widely used. There is now good evidence that better glycaemic control and lower rates of hypoglycaemia are associated with the use of basal bolus or basal plus correction regimens.<sup>23,24,25</sup> Figure 1 is an example of a subcutaneous insulin therapy regimen in hospital for hyperglycaemic patients. In the US, basal bolus insulin therapy is recommended for all hospitalized patients with diabetes. In the UK, it would not be possible to advocate this as first-line therapy for those taking oral therapies on admission, as up to a third of all NHS hospitals in England still do not have a dedicated inpatient diabetes nurse to facilitate this.<sup>1</sup>

Of note, the term ‘sliding scale’ is used loosely in the literature with no specific definition and should be abandoned altogether to avoid confusion. In the US, it refers to the use of a pre-defined subcutaneous insulin bolus regimen according to the prevailing blood glucose, whereas in the UK it refers to a variable rate intravenous insulin infusion (VRIII). Subcutaneous ‘sliding scale’ insulin regimens are now widely considered by most experts to be inappropriate for achieving good glycaemic control as they can result in a high degree of glycaemic variability.<sup>26</sup>

Intravenous insulin has a half-life of only a few minutes and must be administered continuously either as a fixed-rate intravenous insulin infusion (FRIII) or a variable-rate intravenous insulin infusion (VRIII). FRIII is used in management of diabetic emergencies such as DKA and hyperosmolar hyperglycaemic state (HHS) and is discussed in the article on Diabetic ketoacidosis and hyperosmolar crisis on pages 723–726 of this issue. In some situations, as shown in Table 1, VRIII is often the only appropriate therapy for achieving good glycaemic control. However, if used inappropriately – as in the treatment of isolated hyperglycaemia in a patient who is otherwise well and able to eat and drink, or in the treatment of hyperglycaemia following

Download English Version:

<https://daneshyari.com/en/article/6152015>

Download Persian Version:

<https://daneshyari.com/article/6152015>

[Daneshyari.com](https://daneshyari.com)