A study of inpatient diabetes care on medical wards

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Article points

1. It is well established that poor glycaemic control is associated with increased mortality, morbidity, hospital length of stay and healthcare costs.
2. Most individuals with diabetes will have sub-optimal glycaemic control when admitted to hospital, making it even more important to monitor glucose levels and achieve good glycaemic control during their stay.
3. This study assessed whether individuals admitted to medical wards have their diabetes appropriately managed during their stay.

Key words

- Blood glucose monitoring
- Education
- Glycaemic control
- Inpatient care

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Improving diabetes management in the hospital environment is usually dependent on having an effective system for monitoring in place, the results of which are significant to all those involved in the care of inpatients with diabetes. This study aimed to establish whether people admitted to medical wards in the authors' institution had their diabetes appropriately managed during their stay, and to establish a system that can assess the adequacy of inpatient diabetes care. This articles describes how the study was undertaken, and outlines the changes in practice that were made as a result.

The most recent estimates suggest that there are around 2.5 million people living with diabetes in the UK, with numbers expected to rise to 4 million by 2025 (Diabetes UK, 2009). Furthermore, diabetes is the most common coexisting condition in people admitted to hospital for any reason, and the treatment of diabetes in hospitalised individuals remains sub-optimal (Bhattacharyya et al, 2002).

It is well established that poor glycaemic control is associated with increased mortality, morbidity, length of stay and cost (Ahmann, 2004); therefore, as numbers rise so too will the burden on the NHS. Optimisation of glycaemic control needs a multidisciplinary team approach, with collaboration of primary and secondary care to aid the prevention of diabetes-related complications (LeRoith and Smith, 2005). In the community, self-care is central to the control of diabetes, and hospitalisation makes this very difficult – particularly when medical and nursing staff project their anxiety about diabetes onto the patient (Bhattacharyya et al, 2002).

Aims

This study aimed to assess whether individuals admitted to medical wards in the authors' institution had their diabetes appropriately managed during their stay.

Methods

Individuals with diabetes admitted to the Royal Preston Hospital during a 4-week period between February and March 2007, for any reason not due directly to diabetes, were included in the study. Admissions to all medical wards were included, and the authors examined the charts of patients with at least 3 days stay, and took information from the most recent 7 days if the individual had been in for longer than this.

Admissions for acute metabolic complications (diabetic ketoacidosis [DKA], hyperosmolar non-ketotic coma [HONK], hypoglycaemia, and acute myocardial infarction), and those within the first 24 hours of admission, were excluded. Surgical patients and those on the medical assessment or critical care units were also excluded.

The following data were retrieved from hospital IT, medical and nursing records:

- Age.
- Sex.
- Type of diabetes.
- Diabetes duration.
- Pre-admission treatment of diabetes.
- Duration of hospital stay.
- Reason for admission.
- Requirement for intravenous (IV) insulin or temporary subcutaneous (SC) insulin.
- Adjustment in dosage of pre-existing insulin or oral antidiabetes drug (OAD) therapy if blood glucose was recorded outside the target range.
- Acute metabolic complications.
- HbA_{1c} levels.

The information was processed in databases designed by the authors, and measured against clinical standards based on the local guidelines and from discussion with consultant diabetologists.

In the UK, there are no published evidence-based standards with regard to blood glucose monitoring or the classification of glycaemic control in inpatients with diabetes. Local guidelines specify that in those patients using standard diabetes treatments (OADs, insulin or both), blood glucose monitoring should normally be performed four times per day: before meals and at bedtime. The target preprandial blood glucose level for inpatient diabetes care is 4–10 mmol/L, but postprandial glucose levels are not investigated.

Good control was defined as 80% or more results within the preprandial target range; sub-optimal control was defined as 40–80%; and poor control as less than 40%. Furthermore, therapy was adjusted if there were two or more readings less than 4 mmol/L on two or more consecutive days, or four or more readings greater than 10 mmol/L on two or more consecutive days.

The authors followed their hospital guidelines for referring patients to a DSN, and *Figure 1*, the

only form correlating meal times with blood glucose checks, was used as the standard blood glucose monitoring form.

Results

A total of 49 consecutive people with diabetes who fulfilled the inclusion criteria were admitted to the hospital during the study period. Baseline data, blood glucose monitoring, diabetes management and complications of treatment of these individuals are shown in *Tables 1* and *2*.

All people with type 1 diabetes were on insulin only prior to admission. For those with type 2 diabetes, 55% (27/49) were on OADs, 22% (11/49) were using diet alone, 12% (6/49) were on insulin and 10% (5/49) were using a combination of insulin and OADs. One individual was diagnosed with type 2 diabetes on admission, therefore there is no pre-admission control data. Pre-admission glycaemic control was good in only 33% (16/49) of patients.

Only 10% (5/49) of patients had four preprandial blood glucose measurements taken every day. Reassuringly, however, the average number of daily preprandial blood glucose checks was 3.2. There were no patients who had no blood glucose checked at all, but there were three patients who on at least 1 day had no blood glucose measurements taken.

Two patients had poorly controlled hypoglycaemia, with one treated appropriately by changing the timing of their insulin. The other person received no change to their treatment, and displayed erratic glycaemic control with subsequent hyperglycaemia. Although hyperglycaemia was prevalent, there were no cases of DKA or HONK.

Four patients developed hypoglycaemia, two of which had multiple episodes. None required glucagon or IV dextrose,

Table 1. Inpatient diabetes management – baseline data.

Baseline characteristic	Value
Number of inpatients	49
Mean age (years)	73.6 (34–93)
Sex (male/female)	27 / 22
Type 1 diabetes	7
Type 2 diabetes	42
Mean diabetes duration (years)	10 (0–30)
Pre-admission treatment (people with type 2 diabetes):	
Diet	11
Oral antidiabetes drugs (OADs)	27
Insulin	6
Both insulin and OADs	5

Page points

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2. Sub-optimal management of diabetes is continued through hospitalisation, with a large majority of patients not achieving good glycaemic control.

and all were managed by oral dietary measures. However, in those with multiple episodes, no action had been taken to prevent recurrence. Fourteen patients received IV insulin, with eight receiving it for appropriate reasons. The correct glucose monitoring forms were being used in only 53% of patients.

Discussion

Most individuals with diabetes will have sub-optimal glycaemic control when admitted to hospital, making it even more important to monitor glucose levels and achieve good glycaemic control during their stay. The most likely reason for sub-optimal HbA_{1c} levels is a lack of understanding by the patient (Nesbeth et al, 2009), and it is prudent that the healthcare community provides an environment to allow people with diabetes to empower themselves and increase understanding and concordance.

Importantly, admission to hospital may uncover poor glycaemic control in a person with type 2 diabetes treated with OADs, in which case the option of insulin initiation should be discussed. Furthermore, sub-optimal management of diabetes is continued through hospitalisation, with a large majority of patients not achieving good glycaemic control. These patients are not having their management tailored to optimise control, despite having preprandial blood glucose levels checked adequately – although, in the authors' experience, this may be because it is often difficult to achieve normoglycaemia in the acute setting.

Anecdotal evidence suggests that junior medical staff often regard the insulin dose as "standard" and write a whole week's insulin dose at a time. These members of staff need to be trained to aim for optimal glucose control, to re-prescribe insulin on a daily basis while a patient is on SC insulin, to discuss the use of insulin for those on OADs when glycaemic control is poor, and to seek help when unsure of treatment adjustments. In some patients, treatment also continued unchanged at discharge, despite sub-optimal glycaemic control. Ideally these

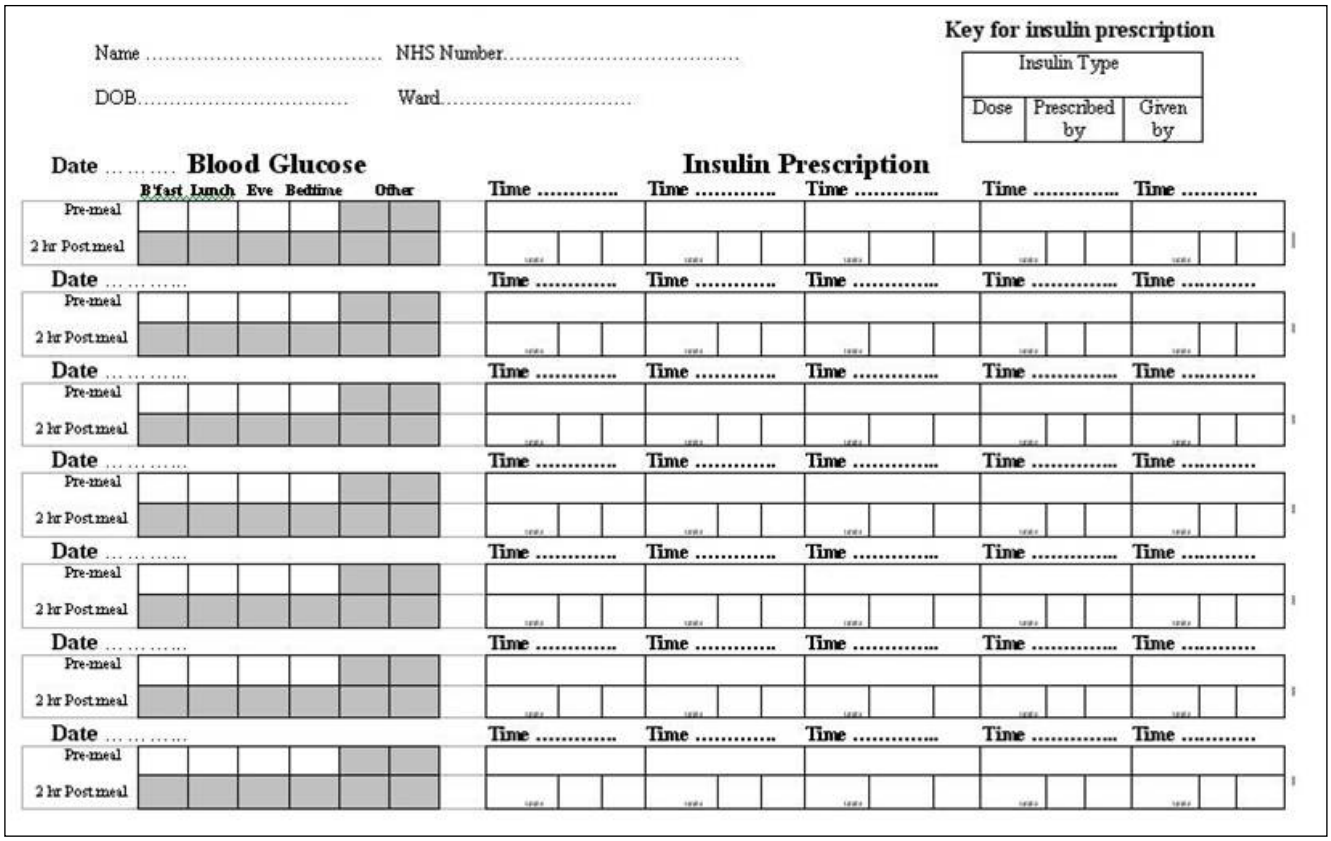

Figure 1. Insulin prescription and blood glucose monitoring form.

individuals need to have their glycaemic control optimised during admission, and then followed-up in primary care.

Surprisingly, individuals with diabetes admitted with serious conditions, such as chest pain, reduced levels of consciousness and infection, are not having their blood glucose levels checked on admission. Doctors and nurses need to be encouraged to check blood glucose levels for all people with diabetes on admission to hospital, as this is fundamental to managing both their diabetes and the underlying medical condition.

The results of the present study show that many patients were also receiving IV insulin inappropriately. For example, a junior doctor called by the nursing staff to review a patient with a high blood glucose level may view the commencement of IV insulin as an easy, guideline-supported option. Doctors and nurses may not have the necessary experience to interpret the significance of the observation. However, it takes time to seek specialist advice and tailor patient management, and they may not consider fully the implications for the patient of frequent invasive and sleep-depriving blood glucose monitoring required for IV insulin.

The use of correct blood glucose monitoring forms remains poor, therefore their use should be encouraged to highlight the importance of preprandial blood glucose levels. It was reassuring for the authors to learn that most patients were being referred to a DSN for appropriate reasons, making their service more efficient and effective.

The results of this study were presented at a regional diabetes meeting with consultant diabetologists, junior doctors, DSNs and senior nursing staff in attendance. The study was well received, with constructive discussion on optimising glycaemic control, and, following overwhelming support, a number of recommendations were implemented.

Page points

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2. Healthcare professionals need to educate people with diabetes to encourage empowerment, which is central to self-care.

Study outcomes

Following the regional meeting, the hospital guidelines were updated to cover a range of diabetes topics, and are issued to all medical and nursing staff during induction; they are also readily accessible via the intranet. Regular diabetes education for junior doctors has been implemented, helping them to become self-sufficient by covering a range of topics including:

- The value of written guidelines.
- Calculating insulin doses.
- What action to take when seeing a patient with hyper- or hypoglycaemia.
- What level of glycaemic control to aim for.
- Transition from IV to SC insulin.
- When to use IV insulin.
- How to prescribe insulin on a daily basis.
- When to ask for help and from whom.

Table 2: Inpatient diabetes management – inhospital data (*n*=49).

Characteristic	Value
HbA_{1c} level:	
<7.0% (<53 mmol/mol)	15
>7.0% (>53 mmol/mol)	30
Not done	4
Good glycaemic control	19
Sub-optimal glycaemic control	25
Poor glycaemic control	5
Admission VG and/or CG	27
Hypoglycaemia	4 (8 episodes)
DKA/HONK	0
Steroids	8
Four pre-prandial blood glucose checks	5
Treated with IV insulin	14
Treated with SC insulin	21
Treated with oral antidiabetes drugs	18
Treated with diet alone	7
Treatment changed at discharge	20
Correct glucose monitoring form used	26
Referral to DSN:	15
Appropriate	13
Inappropriate	2

CG = Capillary glucose; DKA = Diabetic ketoacidosis; HONK = Hyperosmolar non-ketotic coma; IV = Intravenous; SC = Subcutaneous; VG = Venous glucose

Junior doctors are encouraged to approach a patient with diabetes by considering the impact of the underlying medical condition, its treatment and the stress of hospitalisation on glycaemic control in addition to the impact of glycaemic control on the underlying medical condition.

Regular education for nursing staff, principally through the DSN, has improved monitoring and recognition of poor glycaemic control. Prior to discharge, all medications are reviewed and patients referred to primary care if appropriate. At the very least, patients continue to see the DSN if they have received input.

Conclusion

Most individuals with diabetes admitted to hospital have sub-optimal glycaemic control, reflected by their HbA_{1c} values. This is continued through their hospital stay, with a large majority of patients not achieving good glycaemic control. Furthermore, diabetes management is not tailored to optimise control despite taking preprandial blood glucose measurements adequately. Therefore, the authors believe better education for all staff regarding diabetes and treatment adjustment is required.

Healthcare professionals need to educate people with diabetes to encourage empowerment, which is central to self-care. Furthermore, reporting on the value of information sent back to primary care could be a follow-on study assessing implementation of secondary care guidance. The authors will try to address these points and use the same system annually to monitor change, recognising that resource and time constraints may impact on ideal models of inpatient education. ■

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