

Surveillance of diabetes with inpatients on glucocorticoids: are the JBDS audit standards being met?

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Abstract

Glucocorticoids (steroids) are widely prescribed in hospital inpatients but are known to be associated with the development or worsening of hyperglycaemia. Hyperglycaemia in inpatients is associated with adverse outcomes. The Joint British Diabetes Societies (JBDS) for Inpatient Care have produced guidelines on the management of steroid induced diabetes, or steroid worsened diabetes, but it is unknown how well these are followed.

We conducted a single centre cross-sectional survey to assess the prevalence of glucocorticoid use among adult – non-COVID – patients at our institution. We wanted to assess whether glucose measurements were being taken and, if so, how frequently.

We found that 59 (6.8%) of our inpatient population were on glucocorticoids. Of these 59, 14 (23.7%) had a previous diagnosis of diabetes, and only 21 (35.6%) had any glucose monitoring during the prior 24 hours. Thirteen of these 21 people (61.9%) had diabetes, and only half of these had glucose monitored at least four times per day. Only 19 of the 59 people on glucocorticoids (32.2%) had had an HbA_{1c} measured in the preceding three months.

Our data show that the audit standards set in the JBDS guidelines for management of glucose in people on glucocorticoids were generally not met. More work needs to be done to educate ward staff to improve the care for this potentially vulnerable group. Copyright © 2021 John Wiley & Sons.

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Key words

glucocorticoid; glucose; inpatient; management

Introduction

Glucocorticoids (steroids) are widely used across several medical specialties predominantly for their anti-inflammatory properties. While most are prescribed by primary care or hospital outpatients, their use in hospitals is more common with one study showing a prevalence of 12.8% of adult inpatients treated with steroids.¹ Long-term steroid use has many adverse effects, one of which is the development or worsening of hyperglycaemia.^{2–4} In the UK, the Joint British Diabetes Societies (JBDS) for Inpatient Care have published guidelines on the management of hyperglycaemia for inpatients on steroids.⁵ In summary, people without a pre-existing diagnosis of diabetes should have their blood glucose monitored at least once daily, and patients with a pre-existing diagnosis of diabetes

should be monitored four times daily. The well-recognised harms of hyperglycaemia mean it is important for it to be identified and addressed.⁶ This means that when capillary glucose is found to be consistently over 12.0mmol/L, individuals should be treated.⁵

The aim of this single-centre study was to determine the current prevalence of adult inpatients on systemic steroid treatment and to determine if the inpatients prescribed steroids were screened for hyperglycaemia and, if so, were being treated according to the standards set by JBDS.⁵

Methods

A cross-sectional study at Norfolk and Norwich University Hospital was conducted, with the data being collected over two consecutive days in November 2020. Using the electronic

prescribing and medicines administrations system, every adult inpatient on either oral or intravenous steroids was identified. People were excluded (for the safety of the team who were collecting the data) if they were COVID-19 positive. Data from the preceding 24 hours prior to ward attendance were collected on age, steroid type, dose and frequency and if they were on glucose lowering agent and the type and total daily dose of the agent. Data on the number of times a day capillary blood glucose was monitored and the value and time of each reading, taken in the preceding 24 hours were also collected.

Furthermore, our electronic pathology system was interrogated to record if patients had a previous diagnosis of diabetes, and what their previous glycated haemoglobin (HbA_{1c}) was, if it had been done in the preceding three months, and the date this was taken.

This study was registered with our audit department and was deemed to require no patient consent.

Results

A total of 867 adult inpatients were in hospital, in non-COVID areas, during the data collection. We found 6.8% (n=59) were on glucocorticoids. Of these, 23.7% (n=14) had a previous diagnosis of diabetes. A summary of results can be found in Table 1. Of the 59 adult inpatients on glucocorticoids, only 35.6% (n=21) had had their glucose monitored during the previous 24 hours. Of those being monitored, 61.9% (n=13) had a previous diagnosis of diabetes. One person with a previous diagnosis of diabetes, on an insulin regimen, did not have any glucose monitoring. Only 50% (n=7) of those with a previous diagnosis of diabetes were having their blood glucose monitored at the recommended frequency of four times a day. Thirty-seven out of 45 people without a prior diagnosis of diabetes were not having their glucose concentrations checked. Of the 59 inpatients, only 32.2% (n=19) had an HbA_{1c} recorded

Variables		No. (%)	
Age (years)*		73.2 (15.7)	
Type of steroid	Prednisolone Dexamethasone Hydrocortisone Methylprednisolone Other	45 (76.3) 7 (11.9) 4 (6.8) 1 (1.7) 2 (3.4)	
Previous diagnosis of diabetes present		14 (23.7)	
People with diet controlled diabetes prior to admission		4 (6.8)	
Patients on glucose lowering medication		10 (16.9)	
Name of glucose lowering medication	Metformin Gliclazide Alogliptin Abasaglar Insulatard Humulin I Humulin M3 NovoRapid	3 (5.1) 2 (3.4) 1 (1.7) 1 (1.7) 1 (1.7) 1 (1.7) 2 (3.4) 1 (1.7)	
Glucose monitoring	Total no.	21 (35.6)	
	Patients with previous diagnosis of diabetes being monitored	Total no.	13 (22.0)
		On glucose lowering medication	9 (15.3)
		Monitoring 4 times a day	7 (11.9)
		Patients with 2 or more readings over 12mmol/L	1 (1.7)
	Patients without previous diagnosis of diabetes	Total no.	8 (13.6)
Patients with 2 or more readings over 12mmol/L		1 (1.7)	
HbA _{1c}	No. of patients with a recorded HbA _{1c} in last 3 months	Total no.	19 (32.2)
		With a previous diagnosis of diabetes	8 (13.6)
	42mmol/mol or over	Total no.	12 (20.3)
		With a previous diagnosis of diabetes	7 (11.9)
		No. of patients having their glucose monitored	9 (15.3)
*Mean (Standard Deviation).			

Table 1. Baseline characteristics and glucose monitoring of 59 adult inpatients on corticosteroids

in the last three months, 42.1% (n=8) of whom had a previous diagnosis of diabetes. This means 42.9% (n=6) of patients with a previous diagnosis of diabetes did not have an HbA_{1c} recorded in the last three months; 63.2% (n=12) of the 19 inpatients with a recorded HbA_{1c} had an HbA_{1c} of ≥ 42 mmol/mol. Of those with no prior history of diabetes (n=45), 11 had an HbA_{1c} measured in the three months prior. The HbA_{1c} values were < 43 mmol/mol in seven people, 43–47mmol/mol in three people, and one person had an HbA_{1c} of 90mmol/mol. Of those with an HbA_{1c} of ≥ 42 mmol/mol, only 75% (n=9) had their glucose level monitored.

Of the 21 individuals who had glucose monitoring, 23.8% (n=5) had glucose readings over 12.0mmol/L, of which three people had only one reading over 12.0mmol/L, and the remaining two had two or more readings over 12.0mmol/L. One of those with consecutive glucose readings over 12.0mmol/L was not on any glucose lowering medication.

Figure 1 shows the glucose concentrations of the nine inpatients on glucose lowering medication. Five of these patients did not have any readings that exceeded 12mmol/L.

Discussion

Our data show that over two consecutive days in November 2020 the prevalence of adult inpatients on glucocorticoids at our institution was 6.8%. However, despite the evidence that steroid use is associated with hyperglycaemia, and that hyperglycaemia is associated with harm, we found that glucose monitoring and appropriate treatment escalation guidelines were generally not being followed. The audit standard set by JBDS for inpatients on steroids screened for hyperglycaemia with blood glucose monitoring is 90%.⁵ This standard, at 35.6%, was not met. The JBDS standard for individuals with steroid induced hyperglycaemia with adequate glucose control (blood glucose ≤ 12.0 mmol/L on two occasions within 24 hours) was partially

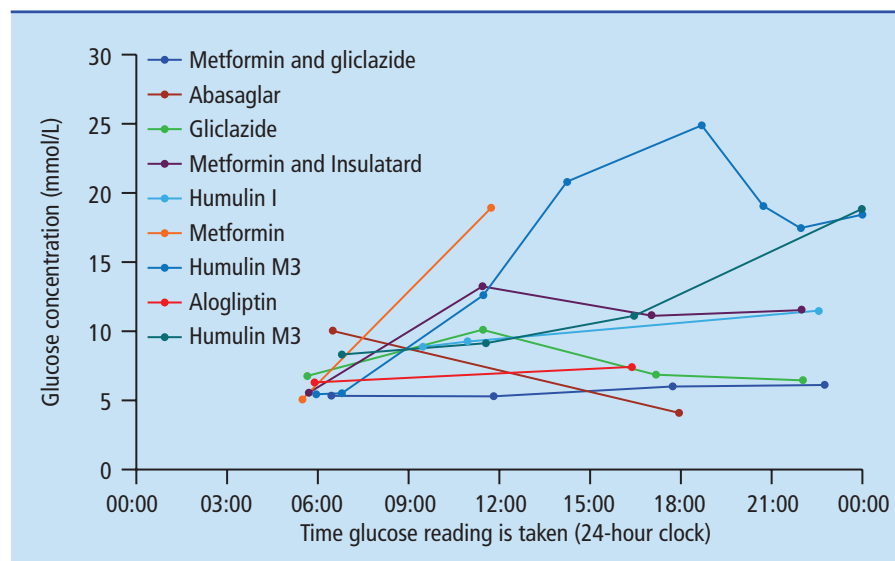


Figure 1. Patients on glucose lowering medication and their glucose readings over the preceding 24 hours

met. The JBDS standard is 75%, but was achieved in 90.5% (n=19) in those who were being tested.

Previous work has suggested that just under 1% of the outpatient population is on oral glucocorticoids, with the proportion rising to 3% in those over 50 years, with short-term courses being very common.^{7–9} The proportion of inpatients on these agents, however, has not been well studied, with one report, also from our institution, suggesting that the prevalence during a cross-sectional study was 12.8%.¹ Why it was lower in the current study is not known, but as part of the study protocol, to ensure the safety of the individual collecting the data (VL), they did not go onto the wards with known COVID-19 positive patients. Many of those are likely to have been on dexamethasone, and so we suggest that our data are likely to have been an underestimate of the true prevalence of inpatient glucocorticoid use. This is because the use of glucocorticoids is likely to be more widespread because of the publication of the RECOVERY trial which showed the benefits of using dexamethasone in patients hospitalised with COVID-19.¹⁰

The management and correction of steroid induced hyperglycaemia are important because of the data to

suggest that outcomes are poorer when compared to those who are on steroids but who maintain appropriate glucose concentrations.^{11,12} The treatment algorithm for steroid induced hyperglycaemia/diabetes that is available recommends that in those who develop steroid induced hyperglycaemia sulphonylureas are an appropriate choice.⁵ This is based on their mode and duration of action, which match and lower the glucose rise seen with once-daily (morning) prednisolone. However, for other glucocorticoid regimens there is not enough evidence to suggest which is the most effective glucose lowering regimen in managing hyperglycaemia for patients on steroids and once- or twice-daily isophane insulin may be needed.⁵ There has been some work to show that implementing a short education programme for medical and nursing staff can help to improve the glucose concentrations in those at risk of developing steroid induced hyperglycaemia.¹³

Hyperglycaemia in hospitalised patients with and without diabetes is associated with harm, e.g. increased length of stay, increased readmission rates and increased 30-day mortality.¹⁴ There are also a large number of studies suggesting a similar association between hyperglycaemia and

poor postoperative outcomes in people undergoing surgery, and questions have been raised previously about the role of dexamethasone as a postanaesthetic anti-emetic.¹⁵ Most of the guidelines written by the JBDS address these issues in an attempt to maintain inpatient euglycaemia, and thus prevent harm.¹⁶

Our data have several limitations. Firstly, it is a cross-sectional analysis and thus we have a relatively small sample size. This is reflected in Figure 1 which shows the glucose control of the nine people on glucocorticoids and on different glucose lowering regimens. Because of the small numbers, we did not have enough data to determine if a certain glucose lowering regimen is more effective at controlling blood glucose levels. Because this was not a longitudinal data collection, we did not collect data on whether people with known diabetes were admitted on diabetes medications, or whether they had the dose adjusted while in hospital – possibly as a result of being on steroids or other causes for dysglycaemia developing in hospital. More work needs to be done to answer these questions.

In summary, we have shown that despite the awareness that glucocorticoid use is associated with a rise in glucose concentration, and that high glucose is associated with harm, monitoring for glucocorticoid hyperglycaemia remains poor. More work needs to be done to educate ward staff on the importance of glycaemic control in this potentially vulnerable group.

KEY POINTS

- Hyperglycaemia in hospitalised inpatients is associated with harm, however that harm is measured. Glucocorticoid use is very common in hospitalised inpatients, but previous work has shown that glucose monitoring is poor
- We undertook a cross-sectional survey of all adult inpatients in our hospital and found that 6.8% were on glucocorticoids, some of whom were known to have a prior diagnosis of diabetes. However, despite the knowledge that hyperglycaemia is associated with harm, and guidance from the Joint British Diabetes Societies on glucocorticoid induced hyperglycaemia being available, glucose monitoring was poor
- Our data suggest that there is room for improvement in the glucose monitoring of inpatients on glucocorticoids

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Declaration of interests

There are no conflicts of interest declared.

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