

The extensive inpatient burden of diabetes and diabetes-related foot disease in Barbados

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ABSTRACT

In this study, we evaluated the burden and quality of adult inpatient diabetes care in Barbados. Inpatients were reviewed over 2 days to identify those with diabetes. Data were collected and analysed from identified patients, their notes and management charts using an audit methodology developed in the UK. Inpatient diabetes prevalence was found to be 42.5% (111 of 261 beds audited). Insulin-treated type 2 diabetes affected 41.8% of the patients. Diabetic foot disease accounted for 30% of admissions and 89% of diabetes-related admissions. Of the patients admitted without diabetic foot disease, 13.9% had their feet examined and 2.8% developed foot lesions during their stay. Medication errors were experienced by 41.4% of patients. We recorded the prevalence of inpatient diabetes in the English medical literature (42.5%) and this was significantly driven by diabetic foot disease. Care needs were complex and areas of potential improvement were identified.

KEYWORDS: Inpatient diabetes, diabetes education, foot disease, inpatient audit

Introduction

Improvements to the quality of inpatient diabetes mellitus (DM) care require not only the utilisation of available guidance, but also an understanding of disease burden and areas of care that might be particularly deficient. This is especially so in regions or countries with a high prevalence of DM and related complications, such as the Caribbean island of Barbados.

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The number of people with DM admitted to the Queen Elizabeth Hospital (QEH), the only public hospital in Barbados, is likely to be increasing, given the epidemic of DM and the high incidence of related foot disease. However, there are few data on the prevalence and features of inpatient DM care. In Barbados, the prevalence of DM is 17.5% in individuals over 40 years of age in the general population¹ and there is an annual incidence of DM-related lower limb amputations of 936 per 10⁵ population.² As a result, several inpatients will have DM even if it is not the primary reason for their admission.

DM-associated admissions are often complex with an increased length of stay. Inpatient DM is frequently not a focus of undergraduate or postgraduate training. However, junior doctors and nurses are expected to be knowledgeable on several aspects of care, such as insulin adjustment, the management of hyper- and hypoglycaemia, and diabetic foot care. The education of healthcare professionals and the implementation of care pathways have been shown to improve the quality of care and reduce the length of hospital stay.^{3–5} Therefore, the implementation of appropriate strategies holds potential for improving standards while reducing cost.

There are now several internationally published recommendations on standards of care. In 2009, the American Association of Clinical Endocrinologists and the American Diabetes Association published a consensus statement on inpatient glycaemic control.⁶ The American Diabetes Association annually publishes a section on DM care in the hospital as part of its Standards of Medical Care guideline.⁷ In the USA, The Endocrine Society published detailed recommendations on inpatient DM and suggested that all hospitals should have a committee targeting a systems approach to improvement of care.⁸ The UK has also been the source of several guidelines, such as those addressing the hospital management of hypoglycaemia,⁹ diabetic ketoacidosis in adults¹⁰ and foot disease.^{11,12}

Therefore, there is a relative abundance of guidance, but optimising improvements ideally requires an understanding of institutional challenges. Measurement of standards of care can expose the full extent of deficiencies that were not previously recognised. It also generates data against which planned changes can be evaluated. Thus, we aim to gain an understanding of issues related to inpatient care of DM in Barbados, including the DM burden.

Research design and methods

The care of adult patients with DM at QEH was audited over 48 hours to assess the burden and quality of care. The QEH is the only public hospital on the island, which has a population of over 270,000

An inpatient diabetes audit methodology that was developed by NHS Diabetes was modified for local use. This methodology is utilised annually for the National Diabetes Inpatient Audit in the UK, which is managed by the Health and Social Care Information Centre.¹³ All medical, surgical, gynaecology, high dependency and intensive care beds were audited with approval from the QEH ethics committee. Following consent, data were collected from patients, their notes and management charts. In addition to data on demography, DM history and admission assessment, several aspects of care were reviewed during the previous 7 days of their hospital stay. The audit team met before data collection to ensure standardisation. The team comprised two DM specialists and one DM specialist nurse.

The prevalence of inpatient DM was calculated by dividing the number of audited hospital beds containing a person with DM by the total number of audited beds. Mean age and standard deviation were calculated for men and women, and kernel density estimates were calculated to graph a smooth distribution of age among men and women separately. Linear regression was used to formally compare mean age between men and women. The length of hospital stay between admission and the audit date was reported using median stay with an associated interquartile range. Descriptive statistics were utilised for other aspects of analysis.

Results

Inpatient diabetes prevalence

Two hundred and sixty-one beds were audited, of which 111 were occupied by patients with DM. Therefore, the prevalence of inpatient DM was 42.5% (95% confidence interval [CI] 36.4% to 48.8%). The prevalence of DM on medical and surgical wards was 40.6% (39/96 beds, 30.7% to 51.1%) and 46.8% (65/139 beds, 38.3% to 55.4%), respectively.

Length of hospital stay

The median length of stay among patients with and without foot disease was 19 (interquartile range 4 to 31 days) and 8 days (interquartile range 4 to 36 days, $p=0.64$), respectively.

Patient characteristics

Fifty-two percent (58/111) of patients were male. Mean age for men was 64.6 (standard deviation [SD] 12.2) years. Mean age for women was 70.4 (SD 15) years, which was 5.8 years greater than that of men ($p=0.03$). One hundred and ten of the 111 patients (99%) were Afro-Caribbean.

Diabetes characteristics

Of the 111 inpatients with DM, 110 (99%) had a recorded DM type. Among these, one (0.9%) had type 1 DM (T1DM), 46 (41.8%) had type 2 DM (T2DM) treated with insulin (with or without tablets), 48 (43.6%) had T2DM treated with tablets

alone and 15 (13.6%) had T2DM treated with diet alone. Of those with T2DM treated with insulin, T2DM treated with tablets alone, and T2DM treated with diet alone, 51.5%, 44.4% and 28.6%, respectively had had DM for 15 years or longer.

Reasons for admission

Of 107 patients with a recorded reason for admission, 36 (33.6%) were admitted specifically for DM management (diabetic ketoacidosis, hyperglycaemic hyperosmolar syndrome, active diabetic foot disease, hypoglycaemia or hyperglycaemia with established DM). Of the 36 patients who had been admitted specifically for the management of their DM, 32 patients (89%) were admitted for active diabetic foot disease, one (2.8%) for hyperglycaemia with established DM, one (2.8%) for diabetic ketoacidosis, one (2.8%) for hyperglycaemic hyperosmolar syndrome (HHS) and one (2.8%) for hypoglycaemia.

Foot disease

Eighty-nine percent (32 of 36) of patients admitted specifically for DM management were admitted for the management of diabetes-related foot disease. Thirty percent of all recorded reasons for admission (32/107) were due to diabetic foot disease.

Forty-six of 107 (43%) inpatients were at high risk of ulcers developing while in hospital by virtue of being admitted with active foot disease (32 patients) or having a past history of foot disease (14 patients). However, this represents an underestimation of the total number of patients at high risk, because other risk factors, such as the presence of peripheral arterial disease, peripheral neuropathy and limited mobility, were not assessed.

Only one in seven patients (13.9%) without active foot disease had a documented foot examination within 24 h of admission. A total of three (2.8%) inpatients with DM developed a new foot complication during their hospital stay.

Medication errors

Forty-six (41.4%) inpatients with DM experienced one or more medication errors (prescription and management errors) during their hospital stay (Table 1). The most common medication errors were unit abbreviated to 'u' or written unclearly (64.7% of insulin-treated patients), insulin not signed as given (16.2%), and not altering medication appropriately to address hyperglycaemia for insulin-treated (15.2%) or oral medication-treated (10.3%) patients.

Hypoglycaemic episodes

One hundred inpatients had recorded data on the occurrence of hypoglycaemia during their inpatient stay (90.1%). Of these, 23.0% had at least one minor hypoglycaemic episode (3–4 mmol/l) and 7.0% had at least one episode of a measure capillary glucose of <3 mmol/l.

Conclusion

We recorded national data on inpatient DM prevalence in Barbados. This was found to be the highest in the English medical literature (42.5%). The methodology used has proven reliable and has consistently identified a prevalence of

Table 1. Frequency of medication errors among patient treated with insulin and oral agents with available charts.

Type of medication error	Number*	%	
Insulin prescription errors	Insulin not written up	2/34	5.9
	Name of insulin incorrect	1/34	2.9
	Number (dose) unclear	1/34	2.9
	Unit abbreviated to u or written unclearly	22/34	64.7
	Insulin or prescription chart not signed	1/34	2.9
	Insulin not signed as given	6/37	16.2
	Insulin given and/or prescribed at wrong time	3/35	8.6
Oral hypoglycaemic agent (OHA) prescription errors	OHA not signed as given	1/71	1.4
	OHA given and/or prescribed at wrong time	6/71	8.5
	Wrong dose	2/71	2.8
Insulin management errors	OHA not written up	2/71	2.8
	Insulin not increased when blood glucose was persistently >11 mmol/l and better glycaemic control appropriate	5/33	15.2
	Insulin not reduced if unexplained blood glucose <4 mmol/l	1/27	3.7
OHA management errors	Inappropriate omission of insulin after episode of hypoglycaemia	0/29	–
	No action taken when persistent blood glucose >11 mmol/l and better glycaemic control appropriate	6/58	10.3
	OHA not reduced if unexplained blood glucose <4 mmol/l	2/57	3.5
	Inappropriate omission of OHA after episode of hypoglycaemia	0/56	–

*The numerator represents the number of patients indentified with prescription or management errors, and the denominator represents the number of patients with available data in the category.
OHA = oral hypoglycaemic agent.

approximately 15% in the UK.¹³ The recorded prevalence is also consistent with observed, unofficial, patterns in medical admissions at the QEH.

The development of strategies to prevent and effectively manage DM foot disease in the community is of great importance. Nearly one in three patients with DM had active foot disease; a staggering statistic that relates to a largely preventable problem. Europeans have been found to have a higher age-adjusted prevalence of foot disease compared with Afro-Caribbeans (5.5 vs 2.7, respectively; $p < 0.0001$) in a UK hospital-based community study.¹⁴ However, a higher prevalence and rate of amputation is seen in the Caribbean. This increase risk in the region is particularly related to inadequate footwear and care,¹⁵ which has been found to triple the risk in Barbados.² Therefore, professional and patient education is imperative if this is to be improved.

Community- and hospital-based measures to limit hospitalisation and length of hospital stay are urgently needed. Community-based screening services are available, but the audit exemplifies the need for universal access. Additionally, there is a need for a multidisciplinary team to support admission avoidance and limiting the duration of hospital stay of those who are admitted.

It is also essential that other deficiencies in care are addressed. Patients had complex care needs with frequent hypoglycaemia and use of insulin, in addition to many patients having had DM for over 15 years. There was a high prevalence of medication

errors in the form of prescription or management errors (41.4%) as shown in other studies,^{16,17} and this level was higher than expected. Feet were infrequently examined, despite the fact that over 43% of inpatients were at high risk of ulceration.

The Endocrine Society recommends that hospitals should have an inpatient DM steering committee to lead on improvements.⁸ Simple interventions such as educational programmes for medical students, nurses and postgraduate doctors, improvement of the design of charts used in management (such as glucose monitoring and prescription charts), and the use of protocols (such as for the treatment of hypoglycaemia) can make a significant difference if effectively introduced. The formation of a dedicated inpatient DM team would likely be impactful.¹⁸

This evaluation has clarified the extent of the burden of inpatient DM in Barbados as well as areas where improvement is needed. It has also provided a baseline against which the effectiveness of changes can be measured. The audit methodology was initially designed for use in the UK, but this audit exemplifies both its local value and translational nature. Similar benefits might be derived at other clinical centers. ■

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