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Original Article

Hyperglycemia management in patients admitted to internal medicine in Spain: A point-prevalence survey examining adequacy of glycemic control and guideline adherence

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ABSTRACT

Aims: Despite the increasing prevalence of hospitalized diabetic patients, there are few studies that evaluate the glycemic control and the rate of adherence to clinical practice guidelines for glucose monitoring and management in the hospital setting.
Methods: : Crossover study using one-day surveys of all inpatients admitted to internal medicine wards from voluntary participating hospitals across Spain. Retrospective review of medical records was used to identify patients with hyperglycemia, causes for hospitalization, patients' demographic characteristics, appropriateness of glycemic monitoring and treatment during hospitalization.
Results: Among 5439 hospitalized patients studied there were 1000 (18.4%) with hyperglycemia in 111 participating hospitals. Patients mean age was 76.0 ± 8.5 years (51.6% male). On admission, 91% had known diabetes (disease duration of 10.9 ± 8.5 years), 5% had unknown diabetes and 4% had stress hyperglycemia. The comorbidity index (Charslon score) was 4 (interquartile range: 2 to 6) and 31% showed a high level of disability (Rankin scale). Main infringement in the process of care included lack of a recent HbA1c value (43.7%), use of sliding scale insulin therapy (20.7%), use of oral antidiabetic agents (8.9%), and less than three bedside point-of-care (POC) blood glucose test per day (17%). Glycemic target pre-meal and bedtime were achieved in 47% to 79.5% of POC. The rates of hypoglycemia (<70 mg/dL and <50 mg/dL) were 10.3% and 2.4%, respectively.
Conclusions: Our results suggest that there is an important gap between the clinical guidelines and both the management and the grade of glycemic control of diabetic inpatients.

1. Introduction

Diabetes is one of the fastest growing pandemics in human history. It has been estimated that 14% of the Spanish adult population has diabetes, and this prevalence may double in the coming decades [1]. In parallel, the percentage of patients with diabetes requiring hospitalization has doubled in recent years. Approximately one in four patients admitted to the hospital has a known diagnosis of diabetes [2,3] and about 30% of patients with diabetes require two or more hospitalizations in any given year [3]. The prevalence of diabetes is higher in elderly patients and residents of long-term-care facilities, in whom diabetes is reported in up to one third of adults aged 65–75 yr and in 40% of those older than 80 yr [4,5].

Patients with diabetes are more likely to require hospitalization than subjects without diabetes, mostly due to cardiovascular diseases, but

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also by other processes (cancer, infections, pancreatitis or hip fractures, etc.) [6]. In addition, patients with diabetes have a worse overall prognosis and a higher risk of complications, extended hospitalization and mortality [7,8].

Different studies have shown that both hyper- and hypoglycemia are associated with more complications and increased mortality in hospitalized patients [9]. In order to guide ongoing glycemic management it is recommended to perform bedside capillary testing before meals and at bedtime in patients who are eating, or every 4–6 h in patients who are receiving nothing by mouth. Treatment should be addressed to a premeal glucose target of less than 140 mg/dL (7.8 mmol/L) and a random blood glucose of less than 180 mg/dL (10.0 mmol/L) for the majority of hospitalized patients in non-critical areas. Due to the risk of severe hyper or hypoglycaemia, the use of sliding scale as the sole method for glycemic control in patients with diabetes has been considered as non-appropriate. The use of subcutaneous insulin therapy consisting on basal or intermediate-acting insulin given once or twice a day in combination with rapid- or short-acting insulin administered before meals in patients who are eating has been considered as the standard of care due to its safety. In addition, a standardized hospital-wide, nurse-initiated hypoglycemia treatment protocol should be implemented to prompt immediate therapy of any recognized hypoglycemia, defined as a blood glucose below 70 mg/dL (3.9 mmol/L). All these standards have been included in a recently published evidence-based guideline and rated as strong recommendations [10].

Few studies have analyzed how are patients with diabetes managed in the hospital and the degree of diabetes control. We carried out the present study to evaluate care based on individualized performance measures and appropriateness of hyperglycemia management in hospitalized patients in the non-critical care setting.

2. Methods

2.1. Survey design

A mail was sent to the members of the Diabetes and Obesity Study Group from the Spanish Society of Internal Medicine inviting to participate in the study. The survey was considered to be a public health surveillance activity and therefore it was approved with a waiver of the requirement for informed consent. Information obtained was recorded such that subjects could not be recognized, directly or through identifiers linked to the subjects. Patients were included in surveys performed between June 23rd and July 8th, 2014.

2.2. Patient selection

Inpatients aged greater than 15 years old, with known diabetes, stress hyperglycemia or diabetes in hospital-diagnosed that were admitted to internal medicine units in acute care hospitals were eligible for inclusion. Patients in outpatient areas, emergency departments, and skilled nursing units were excluded.

2.3. Data collection

We collected information about the hospital regarding size, location, number of beds, number of patients admitted in internal medicine wards during the survey day and university affiliation status.

Patient information included age, sex, smoking status, type of diabetes, duration of diabetes since diagnosis, last value of glycated hemoglobin A1c (HbA1c), estimated glomerular filtration rate (eGFR) according to Modification of Diet in Renal Disease (MDRD-4) formula, degree of disability measured by the modified Rankin scale [11], the Charlson comorbidity index [12], type of treatment for diabetes prior to admission, cause of hospitalization, length of hospital admission up to the survey date, treatment for diabetes administered during hospitalization, use of enteral or parenteral nutrition, treatment with systemic glucocorticoids, point-of-care (POC) glucose values on the day previous to the survey and presence of hypoglycaemia during hospitalization.

Hyperglycemia was defined as an admission or in-hospital fasting blood glucose level ≥ 140 mg/dL (7.7 mmol/L) or a random blood glucose level of ≥200 mg/dL (11.1 mmol/L) on 2 or more determinations [10]. Patients with hyperglycemia were subdivided in those with known diabetes (previous diagnosed diabetes), unknown diabetes (hyperglycemia without a previous history of diabetes and HbA1c ≥ 6.5%) and stress hyperglycemia (hyperglycemia and HbA1c ≥ 6.5%).

2.4. Reference standard

We compared the data obtained with the standards of care for management of hyperglycemia in hospitalized patients in non-critical care setting recommended by the Endocrine Society Clinical Practice Guideline (Addendum). Only those recommendations classified as strong were considered from the reference standard [10].

2.5. Statistical analysis

Continuous variables are summarized as mean (standard deviation) when normally distributed and median (interquartile range) when asymmetrically distributed. Categorical variables are presented as numbers (percentage). Statistical analyses were performed using the SPSS version 15.0.

3. Results

3.1. Hospitals and patients

A total of 111 (14%) out of 789 hospitals located in Spain participated in the study. Of the 111 hospitals, 34 (30.6%) were small (<200 beds), 36 (32.4%) were medium-sized (201–500 beds), and 41 (36.9%) were large (>500 beds). Fifty hospitals were university affiliated, 28 hospitals were non-university affiliated, 8 hospitals were private institutions and 25 did not provide information.

A total of 5439 hospitalized patients were surveyed and 1000 (18.4%) had hyperglycemia or known diabetes. The medical records of patients with known diabetes ($N = 902$), diabetes recently diagnosed ($N = 49$) or with stress hyperglycemia ($N = 38$) were reviewed for demographic characteristics, glucose management and presence of hypoglycaemia during hospitalization.

The characteristics of the patients with hyperglycemia are summarized in Table 1. Patients' mean age was 76.0 ± 8.5 years, 51.6% of them were male. The median number of conditions included in Charlson comorbidity score that were present upon admission was 4 (interquartile range: 2 to 6). The extent of disability according the Rankin scale showed that more than 30% of patients had a moderate–severe or severe disability that required assistance (were unable to attend to own bodily needs without assistance or required constant nursing care). Patients' median duration of diabetes was 10 years (interquartile range: 5–15). A recent value (i.e. less than preceding three-month) of HbA1c was available in 56.3% of patients, with a median value of 7.1%. The most common oral therapies before admission were metformin (42.9%), dipeptidyl peptidase-4 (DPP4) inhibitors (19.8%) and sulphonylurea (10.6%), while a 47.5% of patients were treated with insulin, mostly (54%) with basal insulin analogues. Diabetes related complications accounted only for 3.1% of the causes of hospitalization. On the other hand, the main reasons for hospital admission were diseases of the circulatory system (25.6%), infectious diseases (21.8%) and respiratory system diseases (11.2%). The 55.6% of patients had an eGFR rate below 60 mL/min/1.73 m^2. The median hospital stay was 6 days (interquartile range: 3 to 11) until the date of survey.