High prevalence of diabetes mellitus and hospital-related hyperglycaemia in French general wards

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Abstract

Aim. – The study evaluated the in-hospital prevalence of diabetes and hospital-related hyperglycaemia in a variety of French general wards.

Methods. – The multicentre cross-sectional study involving nine French hospitals measured venous fasting plasma glucose (FPG) on a single day in patients hospitalized in adult medical and surgical short-term wards. Diabetes status and length of stay were recorded.

Results. – Of the 2141 inpatients included in the study, 355 (16.5%) had known diabetes, 156 (7.3%) had screened diabetes (FPG ≥ 7 mmol/L with no diabetes history), 515 (24.1%) had impaired fasting glucose (IFG; FPG 5.5–6.9 mmol/L) and 1115 (52.1%) had normal glucose values (FPG < 5.5 mmol/L). Diabetes prevalence varied from 11% in hospitals in the west of France to 21% in hospitals in northern and eastern regions. The highest known diabetes prevalence was observed in units for cardiovascular surgery (33%), infectious diseases (27%) and kidney disorders (26%). In cancer units, one-fifth of patients had screened diabetes and one-sixth had known diabetes. Among the known diabetes patients, 127 (36%) were already being treated with insulin, while an additional 41 (12%) started insulin therapy during their hospital stay. Patients with known and screened diabetes were older (70.8 ± 12.2 and 71.1 ± 15.6 years, respectively) than the normal-glucose patients (65.6 ± 18.9 years; P < 0.001). Average length of stay was no different between known diabetes and normal-glucose patients after adjusting for age (11.3 ± 7.7 vs 10.0 ± 7.4 days; NS).

Conclusion. – Overall, metabolic glucose disorders (known or screened diabetes and IFG) were found in 48% of inpatients in various French hospital general wards.

Keywords: Diabetes; Hyperglycaemia; Hospitalization; Prevalence; Length of stay

Résumé

Forté prévalence de diabète et d’hyperglycémie méconnue dans les hôpitaux français.

Objectif. – Évaluer la prévalence intrahospitalière du diabète et des anomalies glycémiques dans les services hospitaliers français.

Méthodes. – Étude multicentrique transversale dans neuf hôpitaux français. Mesure de la glycémie veineuse à jeun chez les patients hospitalisés dans les services médicochirurgicaux de court séjour dans chaque centre un jour donné. Les patients diabétiques étaient identifiés et la durée de séjour enregistrée.

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Résultats. – Parmi les 2141 patients inclus dans l’étude, 355 (16,5 %) avaient un diabète connu, 156 (7,3 %) une hyperglycéémie avérée (glycémie à jeun ≥ 7 mmol/L en l’absence de diabète connu), 515 (24,1 %) une hyperglycéémie modérée (glycémie à jeun comprise entre 5,5 et 6,9 mmol/L) et 1115 (52,1 %) une glycémie de jeun normale (<5,5 mmol/L). La prévalence intrahospitalière du diabète connu variait de 11 % dans les hôpitaux de la région ouest de la France à 21 % dans ceux des régions nord et est. Elle différerait aussi selon les secteurs hospitaliers avec la plus forte prévalence enregistrée dans les services de chirurgie cardiovasculaire (33 %), de maladies infectieuses (27 %) et de néphrologie (26 %). Dans les unités de cancérologie, un patient sur cinq avait une hyperglycéémie avérée et un sur six avait un diabète connu. Chez les patients diabétiqûes connus, 127 (36 %) étaient préalablement insulinotraités et 41 (12 %) patients supplémentaires ont reçu une insulinothérapie durant leur séjour hospitalier. Les patients diabétiques connus ou avec une hyperglycéémie avérée étaient plus âgés (70,8 ± 12,2 et 71,1 ± 15,6 ans, respectivement) que les patients avec une glycémie normale (65,6 ± 18,9 ans, P<0,001). Après ajustement sur l‘âge, la durée moyenne d’hospitalisation ne différerait pas entre les patients diabétiques connus et ceux ayant une glycémie à jeun normale (11,3 ± 7,7 vs. 10,0 ± 7,4 jours, NS).

Conclusion. – Près de la moitié (48 %) des patients hospitalisés dans les hôpitaux français présentent une anomalie métabolique (diabète connu, hyperglycémie avérée ou modérée).

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Mots clés : Diabète ; Hyperglycémie ; Hospitalisation ; Prévalence ; Durée de séjour

1. Introduction

Type 2 diabetes mellitus (DM) has reached epidemic proportions in many countries around the world and the World Health Organization (WHO) predicts its prevalence will continue to increase over the next 20 years [1]. DM is a frequent condition in hospitalized patients, and hospital-related hyperglycaemia may unmask unrecognized preexisting DM [2]. Hyperglycaemia in patients hospitalized in surgery, cardiology, intensive care and general medical departments is associated with poor clinical outcomes and increased mortality [3–7]. Length of hospital stay and costs are increased for hyperglycaemic and diabetic inpatients, but can be reduced by optimizing the management of hyperglycaemia [8]. Although studies have been conducted in North America, the data are scanty concerning in-hospital hyperglycaemia and its consequences in Europe. Most previous studies were based on one venous or capillary glucose measurement performed at random times, a methodology that can introduce pitfalls in determining the true incidence of hyperglycaemia [9].

In the present study, our aim was to evaluate the prevalence of DM or hospital-related hyperglycaemia among patients hospitalized in various French general wards. For this purpose, the study used a method based on fasting plasma glucose (FPG) levels.

2. Methods

This multicentre cross-sectional study was carried out between November 2008 and September 2009 in nine French hospitals (one teaching university hospital, one national eye centre and seven general hospitals). At each centre, a fasting blood sample for measurement of glucose was collected on a single day from all inpatients within a representative panel taken from adult medical (pneumology, cardiology, gastroenterology, internal medicine, rheumatology, infectious diseases, geriatric, neurology and oncology) and surgical (cardiovascular, ophthalmology, orthopaedic, digestive and general surgery) departments. All patients gave their informed consent to have the procedure. Patients hospitalized in critical care, paediatric, obstetric and diabetes care units were excluded. The patients‘ diabetes history, any previous and hospital diabetes treatments, and status concerning their fasting glucose condition were recorded when the blood sample was drawn. The hospital length of stay was collected retrospectively from the information database system for each centre. Patients with a length of stay greater than 30 days were excluded from the analyses.

Blood samples were collected into fluoride-containing tubes. Venous plasma glucose was measured by the central laboratory for each participating centre using a glucose-oxidase or hexokinase-based method. Presence of diabetes was established from the patient’s past medical history or from what was recorded in a medical diary (known DM). Screened DM was defined as an FPG ≥ 7 mmol/L (126 mg/dL), impaired fasting glucose (IFG) as an FPG between 5.5 and 6.9 mmol/L (100–125 mg/dL), and normal glucose as an FPG < 5.5 mmol/L (100 mg/dL).

Descriptive statistics are given as means ± SD for continuous variables and as percentages for categorical variables. Statistical differences between patient groups were determined using Pearson’s exact Chi² test for qualitative data (male, patients with FPG≥7.8 mmol/L and patients admitted to medical units) and by analysis of variance (variable = length of stay) or Kruskal–Wallis test (variables = age and FPG) for quantitative data, while post-hoc tests were the Ryan–Einot–Gabriel–Welsch (REGW) test and Dunn’s multiple-comparisons test, respectively. All statistical analyses were carried out using IBM SPSS Statistics v19 software.

3. Results

3.1. Description of the study population

Of the 2550 patients enrolled in the study, 348 (13.6%) were excluded due to hospital stays of more than 30 days and 61 (2.4%) because of unavailable blood glucose measurements, no informed consent given, a non-fasted state or unrecorded diabetes status. A final total of 2141 patients were included in the study, with a mean age of 67.5 ± 17.3 years; 1090 patients (51%) were male and two-thirds (n = 1445, 68%) were hospitalized in a medical department. Mean FPG and length of stay...
3.2. Prevalence of glucose disorders

Of the 2141 study patients, 355 (16.5%) had known DM, 156 (7.3%) had screened DM, 515 (24.1%) had IFG and 1115 (52.1%) had normal glucose values. The general characteristics of the inpatient subgroups are shown in Table 1. The highest prevalence (55%) of glucose disorders (known, screened DM and IFG) was observed in middle-aged patients. Among patients with normal glucose values, 34 (3%) had FPG < 3.9 mmol/L (70 mg/dL).

3.3. Patients with known DM

Known DM in-hospital prevalence ranged from 11% in hospitals in the French west region to 21% in hospitals in the north and east regions, with a significant difference seen across regions (P = 0.005). This gradient was similar to that reported in data on French diabetes prevalences [10]. Also noted was a clear disparity in known DM prevalence among hospital departments (P = 0.001), with the highest prevalences observed in units for cardiovascular surgery (33%), infectious diseases (27%) and kidney patients (26%; Fig. 1). In addition, 57 (16%) patients with known DM had FPG > 10 mmol/L (180 mg/dL) and 18 (5%) had levels less than 3.9 mmol/L (70 mg/dL).

Among the known DM patients, 127 (36%) were already being treated with insulin and an additional 41 (12%) started insulin therapy during their hospital stay. Also, antihyperglycaemic regimes were modified during the hospital stay in 28% of known DM patients (either reduced or stopped in 12 patients and intensified or initiated in 21 patients).

3.4. Patients with screened DM

The mean FPG level was significantly higher in screened DM compared with those known to have DM (8.9 ± 3.9 vs 7.4 ± 2.9 mmol/L; P < 0.001). As shown in Fig. 1, the screened DM prevalence varied significantly across departments, with the highest number observed in cancer units, where one-fifth of patients had screened DM.

3.5. Comparison of patients according to glucose disorders

Known and screened DM patients were older compared with patients with normal glucose (70.8 ± 12.2 and 71.1 ± 15.6 years vs 65.6 ± 18.9 years, respectively; P < 0.001). Also, known DM patients were more likely than normal-glucose patients to be admitted to a medical than surgical unit (n = 263 [74%] vs n = 752 [67%]; P < 0.05) and to have a longer length of stay (11.3 ± 7.5 vs 10.0 ± 7.4 days; P < 0.01). Nevertheless, after age adjustment, the length of stay for known DM cases was no different than that for normal-glucose patients.

4. Discussion

To the best of our knowledge, our study is the first to report a high prevalence of known and screened DM in patients hospitalized in French general wards. For every two patients with known DM, an additional patient was identified through screening for DM. Similar prevalences were reported by Umpierrez et al. [11], who found that 26% of inpatients had known DM while 12% had screened DM in a single-centre study in the United States. According to other North American studies and the sole European study, DM prevalence in hospitalized adults is estimated to be between 12% and 25%, depending on the methods and criteria used for its detection [3,12]. Most authors performed random plasma or capillary glucose tests and therefore mixed fasting
and non-fasting sampling conditions. Data were usually cross-analyzed with diabetes status from hospital-discharge records, which generally underestimated the prevalence of DM [12]. In the present study, our methodology was developed to overcome these biases and produce more reliable data — FPG values and information on glycaemic status came from the patients themselves, their families and/or their medical records.

In addition, this cross-sectional study was performed on different single days at each participating centre, and at different times of the year to avoid any seasonal bias. Patients were not selected and the recruitment procedure was exhaustive, with greater than 95% of patients participating in each department from different areas across France.

However, Kosiborod et al. [13] showed that the time of glucose measurement during hospitalization is an important issue, as they demonstrated that persistent hyperglycaemia rather than initial hyperglycaemia at the time of admission best predicted in-hospital mortality. In our study, FPG was collected on a single day, but shortly after admission in some patients and during recovery in others, thereby representing one limitation of our study. Another was the inability to discriminate among the screened DM patients between previously unknown diabetes and hospital-related hyperglycaemia. Measurements of HbA1c might distinguish between the two conditions, but this was not done in our study [14]. In any case, the use of HbA1c to assess inpatient diabetes and hyperglycaemia has been questioned by several authors with conflicting results: two studies found prevalences of 10% and 51%, respectively, of elevated HbA1c among in-hospital hyperglycaemic patients with no previous diagnosis of diabetes at a cut-off level of 7% and 6%, respectively [15,16].

In conclusion, our exhaustive sample of patients admitted to French hospital general wards revealed a 24% prevalence of known or screened DM and another 24% prevalence of IFG. These data emphasize the need to identify glucose disorders in patients hospitalized in France and to address the question of whether intensive treatment of hyperglycaemia in general wards might have an influence on morbidity/mortality rates in such a patient population.

**Disclosure of interest**

The authors declare that they have no conflicts of interest concerning this article.

**Acknowledgments**

For this study, the HOPTIDIAB study group received a grant from the Société francophone du diabète (SFD; French-Speaking Diabetes Society).

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