Unrecognized Diabetes Among Hospitalized Patients

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OBJECTIVE — To evaluate the hospital care rendered to hyperglycemic individuals who did not have a diagnosis of diabetes before admission.

RESEARCH DESIGN AND METHODS — A total of 1,034 consecutively hospitalized adult patients at a 750-bed inner-city teaching hospital were evaluated. Patients with one or more plasma glucose values >200 mg/dl were identified by the laboratory data system on a daily basis. Patients without a diagnosis of diabetes at the time of admission were evaluated to determine if and how physicians addressed the hyperglycemia, whether a new diagnosis of diabetes was made during admission, and whether follow-up was planned to address the hyperglycemia.

RESULTS — After excluding patients who were admitted for a primary diagnosis of diabetes, 37.5% of all hyperglycemic medical patients and 33% of hyperglycemic surgical patients were without a diagnosis of diabetes at the time of admission. These patients had a mean peak glucose of 299 mg/dl, and 66% had two or more elevated values during their hospitalization. Fifty-four percent received insulin therapy, and 59% received bedside glucose monitoring, yet 66% of daily patient progress notes failed to comment on the presence of hyperglycemia or diabetes. Diabetes was documented in only three patients (7.3%) as a possible diagnosis in the daily progress notes.

CONCLUSIONS — Despite marked hyperglycemia, most medical records made no reference to the possibility of unrecognized diabetes. Given the average delay of a decade between the onset and diagnosis of type 2 diabetes, further evaluation of hyperglycemic hospitalized patients may present an important opportunity for earlier detection and the initiation of therapy.

Half of the 16 million Americans with diabetes are undiagnosed (1–3). The diagnosis of diabetes is frequently not considered until another medical problem occurs and hyperglycemia is found incidentally. As a result, the diagnosis of type 2 diabetes is estimated to be delayed by an average of 10 years after the actual onset of the disease (4,5).

Despite the fact that more than 4 million Americans with a known diagnosis of diabetes are hospitalized annually in this country, little is known about the prevalence of hyperglycemia within the hospitalized population who do not have a diagnosis of diabetes before admission (6). We set forth to evaluate the hospital care rendered to these hyperglycemic individuals without a prior diagnosis of diabetes and to determine whether such patients are appropriately evaluated and treated.

RESEARCH DESIGN AND METHODS

— We prospectively evaluated all 1,034 consecutively hospitalized adult patients during a single week at an inner-city tertiary-care teaching hospital with a capacity of 750 beds. Patients with one or more plasma glucose values >200 mg/dl were identified by the laboratory data system on a daily basis. In addition to the glucose value, the following data were obtained: name, medical record number, medical service, patient age, and sex.

The medical records of these patients were evaluated after their discharge to determine if diabetes was a diagnosis that was present at the time of admission to the hospital. Those patients in whom diabetes was the primary reason for their hospital admission were excluded from further analysis. Medical records of hyperglycemic patients without a diagnosis of diabetes at the time of admission were further reviewed.

A checklist was developed for the purposes of data collection. Frequency tables were run on demographic and outcomes data, and percentages were calculated based on the following information:

1. Presence of diabetes in the medical problem list or included in the initial history by the admitting physician.
2. Presence of more than one glucose value >200 mg/dl.
3. Value of the peak glucose.
4. Documentation in the daily progress notes of diabetes as a possible diagnosis.
5. Documentation of hyperglycemia in the daily progress notes.
6. Orders for medical therapy for the treatment of hyperglycemia.
7. Orders for bedside glucose monitoring.
8. Documentation of hyperglycemia in the discharge summary.
9. Documentation of follow-up plans for further diabetes work-up or therapy in the final progress note or the discharge summary.

RESULTS

— Of the 1,034 hospitalized adult patients, 130 (12.6%) had one or more documented plasma glucose values >200 mg/dl. Fifteen patients (11.5%) had diabetes documented as the principal reason for hospital admission and were excluded from further study; the other 115 with hyperglycemia served as the study population for further analysis. Those with preexisting diabetes plus those recognized as having new-onset diabetes at the time of admission constituted 64% (74/115) of the hyperglycemic population (Fig. 1).

Table 1 describes the distribution of hyperglycemic patients by medical service. Thirty-six percent (41/115) of patients were previously unrecognized as having a disorder of glucose metabolism. Of the 41 patients with hyperglycemia in whom there was no documentation of diabetes existing before hospital admission, 23 (56.1%) were men and 18 (43.9%) were women (Table 2). Of

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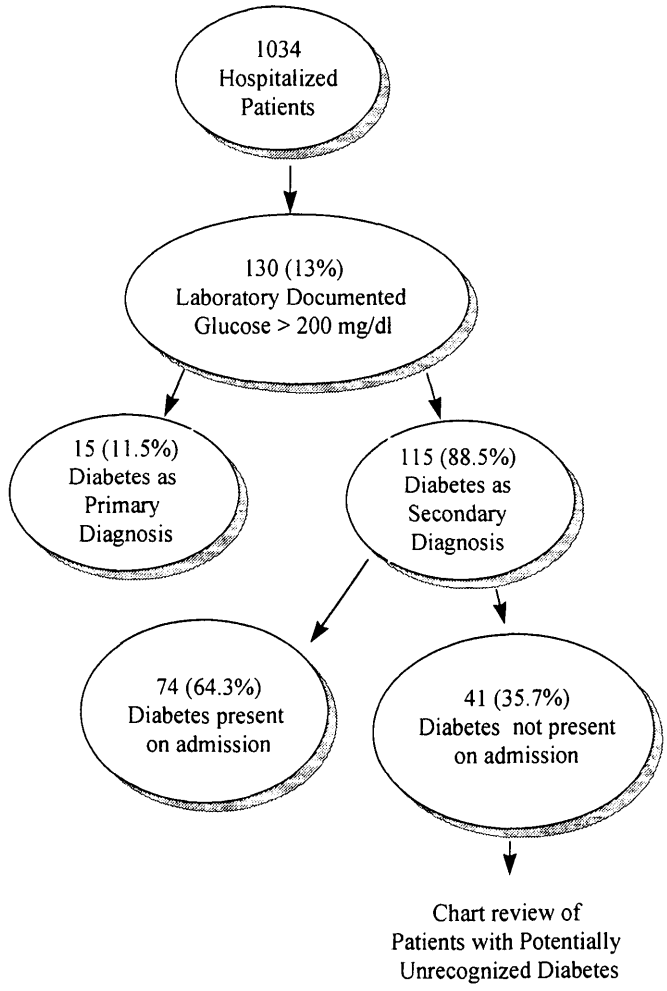

Figure 1—*Schematic of hospitalized patients evaluated for hyperglycemia.*

the 41 patients, 27 (65.9%) had two or more documented glucose values >200 mg/dl with a mean peak glucose of 299 mg/dl with a range of 202–503 mg/dl. The mean age among these patients was 61 years.

There was no physician documentation that hyperglycemia or diabetes was present in 27 (65.9%) of the 41 records (Fig. 2). Eleven records (26.8%) did not use the word diabetes, but described "hyperglycemia" or an "increased finger stick glucose" value. Only three records (7.3%) mentioned diabetes as a diagnostic possibility. Other than the three records in which diabetes was considered, none of the daily progress notes or discharge summaries discussed plans for the further evaluation or specific management of hyperglycemia after hospital discharge.

Although 66% of the medical records did not mention diabetes or hyperglycemia, 22 (54%) of the 41 patients received both bedside glucose monitoring and regular insulin coverage for their elevated glucose values, of which two patients (5%) were subsequently placed on definitive diabetes therapy during admission (Table 3). Two patients (4.9%) received bedside glucose monitoring but no insulin coverage, and seventeen patients (41.5%) had no medical orders reflecting the recognition or treatment of hyperglycemia.

CONCLUSIONS — We found that one-third of all hyperglycemic patients on both the medical and surgical services had no prior history of diabetes. Sixty-six percent of these hyperglycemic individuals had two or more elevated glucose values. Despite therapeutic intervention with insulin in more than half of our patients, there was almost never documentation regarding the hyperglycemia and rarely was diabetes a diagnostic consideration.

We believe that physicians assumed that the hyperglycemia was a transient finding that resulted from the stress of acute illness rather than considering the diagnosis of unrecognized diabetes. Given the profound delay in the diagnosis of type 2 diabetes nationwide, we believe that it is a common occurrence for physicians to overlook hyperglycemia, and our findings are, therefore, not unique to this institution or geographic region (4,5).

There are no unique diagnostic criteria or recommendations for making a definitive diagnosis of diabetes in the stressed state. All of the patients identified had glucose values >200 mg/dl and met the laboratory criteria for diabetes established by the National Diabetes Data Group, the World Health Organization, and the American Diabetes Association (7–11).

Despite the well-defined pathophysiology of intercurrent illness and surgery on serum glucose, stress hyperglycemia has eluded consistent documentation (12–27). Although impaired carbohydrate metabolism resulting in hyperglycemia is seen in patients both with and without diabetes, studies have also demonstrated that stress can also result in diminished glucose values, and patients not given sufficient exogenous glucose can develop hypoglycemia and ketosis in times of stress (9–27). Stress hyperglycemia should theoretically result in higher glycemic excursions in diabetic individuals than in nondiabetic individuals

Table 1—*The distribution of hyperglycemic patients by medical service*

Service	Glucose >200 mg/dl	Diabetes recognized before or at admission	Diabetes unrecognized at admission	Unrecognized at admission (%)
n	115	74	41	—
Medicine	66	40	25	37.5
Surgery	48	32	16	33
Gynecology	2	1	1	50
Podiatry	1	1	0	0

Data are *n* or %.

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Table 2—*Characteristics of hyperglycemic patients without a prior diagnosis of diabetes*

Sex (%) (M/F)	56.1/43.9
Age (years)	61 ± 18 (27–92)
Mean peak glucose (mg/dl)	299 (202–503)
Patients with two or more glucose values >200 mg/dl (%)	65.9

because of a relative or absolute deficiency of endogenous insulin.

Husband et al. (28) followed a group of hospitalized patients with acute myocardial infarction with newly recognized hyperglycemia. Two months after hospital discharge, patients were evaluated with glucose tolerance testing with findings that an admission glucose value of ≥180 mg/dl predicted undiagnosed diabetes rather than stress hyperglycemia (28). Although stress can account for hyperglycemia, our patient population had glucose values in a range that warrants the consideration for a diagnosis of diabetes rather than the assumption of stress hyperglycemia.

The Diabetes Insulin-Glucose in Acute Myocardial Infarction (DIGAMI) series underscores the importance of aggressive early intervention in the management of hyperglycemic patients who have been admitted with suspected myocardial infarction, including those without a previous history of diabetes. Significantly lower mortality rates were seen during the 3-year follow-up period for patients in whom intravenous insulin, followed by multiple daily injections, was initiated in the hospital and continued as an outpatient (29–31).

Although dozens of medications have been described as inducing diabetes, there has been little documented about the glycemic status of patients before the initiation of the offending drugs. Corticosteroids have been evaluated as a means of unmasking impaired glucose tolerance, but among normal controls, only 3% had a positive glucose tolerance test when pretreated with corticosteroids (32). Studies of corticosteroid-treated individuals have found that <20% of steroid-treated individuals develop diabetes (33,34).

It is critical that diabetes be diagnosed as early as possible, since diabetic complications frequently occur before the diagnosis of type 2 diabetes. More than 20% of the individuals with diabetes have retinopathy at the time of diagnosis, and it is often their retinopathy eye findings that lead to the subsequent diagnosis of diabetes (4,5). The prevalence of unrecognized diabetes remains extremely high. By 65 years of age, 18.7% of the population has diabetes, yet half remain undiagnosed (35). Regardless of the etiology, persistent hyperglycemia leads to the acceleration of both microvascular and macrovascular disease (36).

In the U.S., expenditures resulting from the morbidity of patients with diabetes exceed $100 billion per year and account for 15% of the entire health care budget (37). Delays in the diagnosis of diabetes carry with it substantial financial and health ramifications. Further study is needed to define differences between the hospitalized patient population with transient stress-induced hyperglycemia and those with unrecognized diabetes.

We believe that the failure to consider the possibility of diabetes represents a missed window of opportunity for making an earlier diagnosis and for initiating interventions that may delay the devastating complications of this disease. We recommend that physicians assume that hyperglycemia is diabetes until they prove otherwise.

Table 3—*Therapeutic intervention for patients with hyperglycemia and without a prior history of diabetes*

Intervention	Percentage
Received insulin treatment and bedside glucose monitoring	53.6
Received bedside monitoring without insulin treatment	4.9
No medical orders for hyperglycemia	41.5

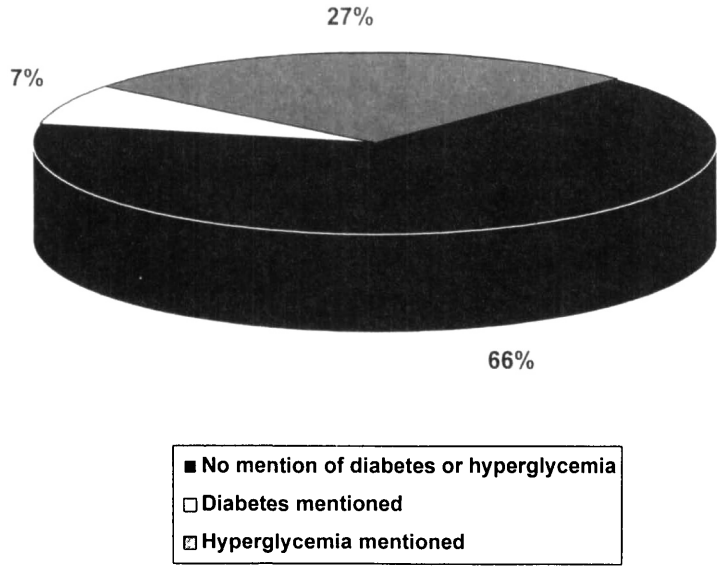

Figure 2—*Documentation of diabetes or hyperglycemia in the physicians' daily progress notes.*

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