

# Hyperglycemia in the Hospitalized Patient

Reviewed by Yasser Ousman, MD, CDE

## STUDY

Umpierrez GE, Isaacs SD, Bazargan N, You X, Thaler LM, Kitabchi AE: Hyperglycemia: an independent marker of in-hospital mortality in patients with undiagnosed diabetes. *J Clin Endocrinol Metab* 87:978–982, 2002

## SUMMARY

**Introduction.** Hyperglycemia at time of admission has been associated with increased hospital mortality in critically ill patients; however, it is not known whether hyperglycemia in patients admitted to general hospital wards is also associated with poor outcomes.

**Design.** A retrospective review of medical records of 2,030 consecutive adult patients admitted to a community teaching hospital from July 1, 1998, to October 20, 1998.

**Aims.** The goals of this study were to determine the prevalence of in-hospital hyperglycemia and to determine the survival (primary endpoint) and functional outcome (secondary endpoint) of patients with hyperglycemia with and without diabetes.

New hyperglycemia was defined as an admission or in-hospital fasting glucose  $\geq 126$  mg/dl or more or a random blood glucose  $\geq 200$  mg/dl on two or more determinations in patients who did not have a known history of diabetes.

**Results.** Of the 2,030 admitted patients, 144 patients (7%) were excluded because no blood glucose measurement was recorded during the hospital stay. Data from the remaining 1,886 patients were analyzed.

Hyperglycemia was present in 38% of admitted patients; 26% had a known history of diabetes, and 12% had no history of diabetes before the admission.

Newly discovered hyperglycemia was associated with higher in-hospital mortality rate (16%) compared to those patients with a history of diabetes (3%) and patients with normoglycemia (1.7%).

Patients with new hyperglycemia had a longer average hospital stay and a higher admission rate to the intensive care unit (ICU). They were less also likely to be discharged to home, frequently requiring transfer to a transitional care unit or nursing home facility.

**Conclusion.** In-hospital hyperglycemia is a common finding and is a marker of poor outcomes and higher mortality, more so in patients with no known history of diabetes than in those with a known history of diabetes or in those with normoglycemia.

## COMMENTARY

The findings of this important study by Umpierrez et al. complement and confirm data from previous studies that addressed the relationship between admission or in-hospital hyperglycemia and patients' clinical outcomes. Hyperglycemia has been associated with poor outcomes in patients with and without known diabetes who are admitted to the hospital for myocardial infarction, congestive heart failure, and stroke. A direct relationship has also been found between in-hospital glucose levels and the risk of post-operative infection in patients with diabetes undergoing cardiopulmonary bypass surgery.

In this study, investigators divided patients into three groups: those with a known history of diabetes, those with new hyperglycemia, and those with normoglycemia. Review of patients' characteristics revealed that there were no significant differences among the three patient groups in terms of mean age, sex, race, blood pressure, or admission ward (medicine or surgery).

As expected, diabetic patients and patients with new hyperglycemia had significantly higher admission blood glucose levels than did those with normoglycemia. Compared with known diabetic patients and patients with normoglycemia, those with new hyperglycemia were more likely to be admitted to the ICU.

Total mortality was significantly higher in patients with new hyperglycemia (16%) than in diabetic patients (3%) and patients with normoglycemia (1.7%). The difference in mortality between the first and third groups is striking: nearly 10 times as many deaths among new hyperglycemic patients than among normoglycemic ones. The increased risk of in-hospital mortality in patients with new hyperglycemia remained highly significant after adjustment for age, body mass index, sex, hypertension, coronary artery disease, presence of infection, renal failure, and ICU admission.

The investigators also examined the clinical characteristics of the deceased patients in the three groups. Deceased patients in the new hyperglycemic group tended to be younger than those in the known diabetes group and those in the normoglycemic group. The causes of death were similar in all three groups.

Mean random blood glucose was highest in deceased patients with known diabetes.

Patients with new hyperglycemia had a longer mean hospital stay (9 days) compared to patients with known diabetes (5.5 days) and those with normoglycemia (4.5 days). They also were less likely to be discharged from the hospital without spending time in a transitional care unit or nursing home facility. Only 56% of patients with new hyperglycemia went straight home compared with 74% of patients with known diabetes and 84% of normoglycemic patients.

Another interesting finding was that new hyperglycemia was frequently left untreated. Only 13% of patients had orders for a diabetic diet; 2% were prescribed oral hypoglycemic agents; 6% received scheduled insulin regimens; and 35% received sliding-scale insulin.

As with previous studies addressing the relationship between admission or in-hospital hyperglycemia and patients' clinical outcomes, this study raises two questions.

First, what is the clinical significance of hyperglycemia in inpatients with no known history of diabetes? It is clear that some of these patients do have undiag-

nosed diabetes. We know that on average there is a 7- to 10 year delay between the onset of diabetes and its diagnosis.<sup>1</sup> It is also clear that new hyperglycemia in patients who are admitted to a hospital is a marker of an acute illness and does predict poor outcomes. This has been called "stress hyperglycemia."

The second question is whether treatment of stress hyperglycemia affects patient survival. The answer to this question is partially known. Malmberg et al.<sup>2</sup> have shown that such an intervention in *diabetic* patients admitted with myocardial infarction results in significant reduction in mortality. More recently, van den Berghe et al.<sup>3</sup> demonstrated that tight glucose control achieved through use of intravenous insulin infusion in mechanically ventilated patients in a surgical intensive care unit resulted in a significant reduction in patients' in-hospital mortality and morbidity. The reduction in mortality was seen in patients *with or without* known diabetes.

Based on the data provided by Umpierrez et al., the logical next step would be to conduct a prospective, randomized trial that examines the impact of tight or improved glucose control on morbidity and mortality in patients who

are admitted to general hospital wards. Meanwhile, admitting physicians and physicians taking care of inpatients need to address and treat hyperglycemia more aggressively. Upon discharge and recovery from acute illness, patients without known diabetes but who had hyperglycemia upon admission or during their hospital stay should be reevaluated and screened for diabetes, and therapeutic measures should be initiated.

## REFERENCES

<sup>1</sup>Harris MI, Klein R, Welborn TA, Knudman MW: Onset of NIDDM occurs at least 4 to 7 years before clinical diagnosis. *Diabetes Care* 15:815-819, 1992

<sup>2</sup>Malmberg K, Ryden L, Efendic S, Herlitz J, Nicol P, Waldenstrom A, Wedel H, Welin L: Randomized trial of insulin-glucose infusion followed by subcutaneous insulin treatment in diabetic patients with acute myocardial infarction (DIGAMI study): effect on mortality at 1 year. *J Am Coll Cardiol* 26:57-65, 1995

<sup>3</sup>van den Berghe G, Wouters P, Weekers F, Verwaest C, Bruyninckx F, Schetz M, Vlasselaers D, Ferdinande P, Lauwers P, Bouillon R: Intensive insulin therapy in the surgical intensive care unit. *N Engl J Med* 345:1359-1367, 2001

*Yasser Ousman, MD, CDE, is the associate director of the diabetes team at Washington Hospital Center in Washington, D.C.*