

Avoiding Complications in the Hospitalized Patient: The Case for Tight Glycemic Control

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Hyperglycemia is common in the hospital among patients with diabetes and those without. The exact overall prevalence of diabetes in the hospital is unknown; however, in 2000, 12.4% of U.S. hospital discharges listed diabetes as a diagnosis. Among cardiac surgery patients, the prevalence of diabetes is as high as 29%.² Another study reported a 26% prevalence of diabetes in a community teaching hospital, with an additional 12% of patients having unrecognized diabetes or hospital-related hyperglycemia.³ Levetan et al. found laboratory-documented hyperglycemia in 13% of 1034 consecutively hospitalized patients.⁴ A subsequent chart review found that more than one-third of patients with hyperglycemia identified by laboratory testing remained unrecognized as having diabetes documented in the discharge summary, although diabetes or hyperglycemia was noted in the progress notes. In a retrospective chart review study, Umpierrez et al. similarly found 38% of 1886 consecutively hospitalized patients who had glucose measurements on admission were hyperglycemic.³ One-third of these patients were not previously known to have diabetes, and compared to patients with diagnosed diabetes, they were more likely to require admission to the intensive care unit, had longer hospital stays, and were less likely to be discharged straight home.

Until recently, most clinicians viewed tight glucose control in the hospitalized patient as an intervention with little immediate benefit and significant potential for harm. The goal was simply to prevent excessive hyperglycemia and avoid ketoacidosis or significant fluid derangements while minimizing the risk for hypoglycemia. Today, a growing body of evidence suggests a close correlation between tight glucose control and improved clinical outcomes. Among those who have had a myocardial infarction and those in the surgical intensive care unit, it is known that intensive glycemic control reduces mortality.^{5,6} Maintaining normoglycemia in patients in the surgical intensive care unit through intravenous insulin infusion also reduces the incidence of comorbidities such as transfusion requirements, renal failure, sepsis, and neuropathy and reduces the duration of ventilator dependence.⁶ Although trials using glucose-insulin-potassium infusions (GIK), when conducted such that lowering of blood glucose occurred, have shown benefit in the settings of myocardial infarction^{5,7} and cardiac surgery,⁸ not all studies of GIK therapy have yielded positive results. The negative results of the CREATE-ECLA study suggest that GIK therapy per se is not beneficial unless it reduces blood glucose.⁹ An abundance of additional observational data and comparisons with historical control data suggest that favor-

able outcomes might be causally dependent on euglycemia. The outcomes studied include hospital or critical care unit mortality and nosocomial infection,^{10–14} specifically outcomes of strokes,^{15–22} trauma,^{23–25} renal transplantation,^{26–28} myocardial infarction,^{29–36} endocarditis,³⁷ acute lymphocytic leukemia,³⁸ community-acquired pneumonia,³⁹ infectious complications in the hospital,^{40–46} and cardiac surgery,^{9,44,45,47–51} as well as length of stay and costs.^{11,25,51–56}

It is important for each hospital to consider the methodology used for blood glucose measurement, realizing that measurements in the Leuven Belgium studies were performed on arterial whole blood using a blood gas analyzer. With recognition that the normal range for blood glucose is method dependent, the data presented above form the basis for the recommended glycemic targets for hospitalized patients:

Target range blood glucose (AACE et al., 2004)

- Preprandial: < 110 mg/dL
- Peak postprandial: < 180 mg/dL
- Critically ill surgical patients: 80-110 mg/dL
Target range blood glucose (ADA, 2006)
- Critically ill:
Blood glucose as close to 110 mg/dL as possible and generally < 180 mg/dL.
These patients generally will require IV insulin.
- Noncritically ill:
Premeal blood glucose as close to 90-130 mg/dL as possible (midpoint 110 mg/dL).
Postprandial blood glucose < 180 mg/dL.

This supplement, “Avoiding Complications in the Hospitalized Patient: The Case for Tight Glycemic Control,” reviews several aspects of hyperglycemia in the hospital setting. Evidence that supports more intensive glucose control is reviewed, along with a “real-world” success story that demonstrates how to apply the new glycemic targets in a multidisciplinary performance improvement project. In addition, the standard insulin “sliding scale” is examined in terms of efficacy, safety, and potential for meeting the new recommended glycemic targets.

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Received 28 July 2006; accepted 12 December 2006.

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