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Glycemic Chaos (not Glycemic Control) Still the Rule for Inpatient Care

How Do We Stop the Insanity?

“Insanity: doing the same thing over and over again and expecting different results.”—Albert Einstein

Diabetes is one of the most common diagnoses in hospitalized patients.¹ A third of all persons admitted to urban general hospitals have glucose levels qualifying them for the diagnosis of diabetes, and a third of these hyperglycemic patients have not previously been diagnosed with diabetes.² The impact of hyperglycemia on the mortality rate of hospitalized patients has been increasingly appreciated. Extensive evidence from observational studies indicates that hyperglycemia in patients with or without a history of diabetes is a marker of a poor clinical outcome.^{3–8} In addition, the results of prospective randomized trials in patients with critical illness or those undergoing coronary bypass surgery suggest that aggressive glycemic control improves clinical outcomes including reductions in: a) short- and long-term mortality, b) multiorgan failure and systemic infection, and c) length of hospitalization.^{7,9–11}

The importance of glycemic control is not limited to patients in critical care areas but may also apply to patients admitted to general surgical and medical wards. The development of hyperglycemia in such patients with or without a history of diabetes has been associated with prolonged hospital stay, infection, disability after hospital discharge, and death.^{12,13} In general-surgical patients, serum glucose > 220 mg/dL on postoperative day 1 has been shown to be a sensitive, albeit nonspecific, predictor of the development of serious postoperative hospital-acquired infection.¹⁴ A retrospective review of 1886 admissions to a community hospital in Atlanta, Georgia, found an 18-fold increase in mortality in hyperglycemic patients without a history of diabetes and a 2.5-fold increase in mortality in patients with known diabetes compared with controls.² A meta-analysis of 26 studies identified an association of admission glucose > 110 mg/dL with the increased mortality of patients hospitalized for acute stroke.¹⁵ More recently, hyperglycemia on admission was also shown to be independently associated with adverse outcomes in patients with community acquired pneumonia.^{16,17}

In view of the increasing evidence supporting better glycemic control in the hospital, the American Association of Clinical Endocrinologists (AACE) in late 2003 convened a consensus conference on the inpatient with diabetes, cosponsored or supported by other prominent professional organizations, including the Society of Hospital Medicine (SHM). An expert panel agreed on and pub-

lished glycemic targets and recommendations for inpatient management of hyperglycemia.¹⁸ The American Diabetes Association (ADA) subsequently published an excellent technical review evaluating the evidence and outlining treatment, monitoring, and educational strategies¹³ for the hospitalized patient, and these recommendations were largely incorporated into the 2005 ADA Clinical Practice Guidelines for Hospitalized Patients.¹⁹ The recommended glycemic targets for hospitalized patients in the intensive care unit are between 80 and 110 mg/dL. In non-critical care settings a preprandial glucose of 90-130 mg/dL (midpoint 110 mg/dL) and a postprandial or random glucose of less than 180 mg/dL are the recommended glycemic targets. Physiologic and safe insulin regimen strategies for virtually all patient situations were succinctly presented. Although there have been modest (and occasionally dramatic) improvements in glycemic control in several institutions, the reviews and guidelines have not yet resulted in widespread change in clinical practice on the inpatient wards.

Two retrospective studies from prestigious medical institutions reported in this issue of the *Journal of Hospital Medicine* dramatically illustrate that glycemic control and insulin-ordering practices in general medicine services continue to be deficient and underscore the contribution of physician inertia in the management of hyperglycemia in noncritically ill patients.^{20,21} From their findings and experiences in our institutions, you should expect the following at your institution unless you have embarked on an organized program to improve non-critical care inpatient glycemic control.

- Around one third of your patients with hyperglycemia have a mean glucose of more than 200 mg/dL during their hospital stay.
- Despite these out-of-control values, 60% of your inpatients will remain on a static regimen of sliding-scale insulin over the duration of their stay. Unfortunately, this degree of hyperglycemia is not protective for hypoglycemic episodes.
- Around 10% of your monitored ward inpatients will have at least one hypoglycemic episode during their stay. Many of these episodes will be precipitated by poor coordination of nutrition and insulin administration and nonsensical insulin regimens that lead to “insulin stacking.”
- Discharge summaries and plans will include mention and follow-up of hyperglycemia only a minority of the time.

- Your nursing and medical staffs are unevenly educated about the proper use of insulin, even though insulin errors are very common, and insulin is one of the top 3 drugs involved in adverse drug events in your institution.
- Transitions in care will lead to an inconsistent approach to glycemic control, leaving some of your patients confused and others just plain angry.

The ubiquitous use of the insulin sliding scale as the single routine response for controlling hyperglycemia in inpatients has been discredited for a long time.²²⁻²⁴ Strong terms have been used the condemnation of this method: “mindless medicine,” “paralysis of thought,” and “action without benefit,” for example.^{25,26} Yet this remains the most popular default regimen in most institutions across the country. Clinical inertia is defined as not initiating or intensifying therapy when doing so is indicated,^{27,28} and that term certainly applies to glycemic control practices and the continued heavy use of sliding-scale insulin across the nation.

Why is clinical inertia so strong in this area? Why have well-done practice guidelines and reviews not eradicated the use of sliding-scale insulin? First, hyperglycemia is rarely the focus of care during the hospital stay, as the overwhelming majority of hospitalizations of patients with hyperglycemia occur for comorbid conditions.^{2,29} Second, fear of hypoglycemia constitutes a major barrier to efforts to improve glycemic control in hospitalized patients, especially in those with poor caloric intake.^{13,30} Third, practitioners initiate sliding-scale insulin regimens, even though this has been a thoroughly discredited approach, *simply because it is the easiest thing to do* in their current practice environment.³¹

How do we break this inertia and redesign our practice environment in such a way that using a more physiologic and sensible insulin regimen is the easiest thing to do? It starts with local physician leadership. On non-critical care wards, hospitalists and endocrinologists are the natural candidates to “own” the issue of inpatient diabetes care. These physician leaders need to garner appropriate institutional support, form a multidisciplinary steering committee or team, and formulate interventions.

Implementing a standardized subcutaneous insulin order set promoting the use of scheduled insulin therapy is a key intervention in the inpatient management of diabetes. These order sets should encourage basal replacement insulin therapy (ie,

NPH, glargine, detemir) and scheduled nutritional/prandial short-/rapid-acting insulin (ie, regular, aspart, lispro, glulisine). The order set should also state the glycemic target, eliminate improper abbreviations and notations, incorporate a hypoglycemia protocol, and provide a range of default correction insulin dosage scales appropriate for varied levels of insulin sensitivity. Examples of such order sets are widely available.^{13,32} This simple intervention can result in a tripling of insulin regimens including scheduled basal insulin, substantial subsequent improvement in glycemic control on the hospital floor, and significant reduction in hypoglycemic event rates.

The standardized order set can be much more effective when it is complemented by institution-specific algorithms, protocols, and policies that support their effective use. These tools must not merely exist; they must be widely disseminated and used and, if possible, embedded in the order set. They should outline the calculation of insulin dosages, define recommended insulin regimens for patients with different forms of nutritional intake, guide transitions from insulin infusion to subcutaneous regimens, and enhance discharge planning and education.

The SHM, AACE, ADA, and other organizations are partnering to create a compendium of tested tools and strategies to assist hospitalists and their hospitals in these and other interventions and to assist them in devising reliable and practical metrics to gauge the impact of their efforts. These tools and a guidebook to walk teams through the improvement process step by step should be available on the SHM (www.hospitalmedicine.org) and other Web sites in the fall of 2006.

Look around and take stock. Does your hospital have standardized subcutaneous insulin order sets, algorithms and protocols supporting the order set, a multidisciplinary team tasked with improving insulin safety and glycemic control, and metrics to gauge whether your efforts are making a difference? Expecting better results without these essential elements is not only foolhardy but fits Einstein's definition of insanity: doing the same thing over and over again and expecting different results. Let's stop this sliding-scale insulin insanity now.

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