

# Software-Guided Insulin Dosing Decreases Glycemic Variability in Critically Ill Patients

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## Background

Severe hyperglycemia increases mortality in critically ill patients, and this is now universally managed with intensive insulin.

Hypoglycemia, even when mild, is strongly associated with increased death in patients treated with intensive insulin.

Glycemic variability is commonly observed in critically ill patients, and is also now consistently associated with increased death in patients treated with intensive insulin.

This triad of hyperglycemia, hypoglycemia and glycemic fluctuations represents a conundrum in sick patients, and is perpetuated by present-day methods that rely upon intermittent and sometimes inaccurate glucose measurements, while using sliding insulin scales based on paper protocols.

## Objective

We hypothesized that software-guided insulin dosing would be superior to paper-based protocols in controlling glycemic variability, and would achieve safe, tight glycemic control. To test this hypothesis, we compared two periods of intensive insulin management in our surgical critically ill patients:

- 1st, a conventional period during which insulin dosing was paper-based and
- 2nd, a later period after transitioning to a computerized, software-based system.

## Methods

- The Surgical ICU is a 10 bed unit that manages all manner of noncardiac surgical postoperative and trauma patients
- 2 identical 6-month time periods were studied to compare paper-guided with software-guided insulin dosing
  - The conventional when intensive insulin was managed using a traditional paper protocol that had been in place since 2002;
  - Following an initial start up period, data were collected after implementation of the GlucoStabilizer®, a software-guided insulin dosing program
- The routine targeted blood glucose range of 95 - 135 mg/dL has been in place since 2002, and was sustained during both study periods.
- Blood glucose measurements were primarily obtained using a Roche bedside glucometer, hardwired into the hospital laboratory and computerized medical record
- 197 patients for which complete data were available were included in this study
- The GlucoStabilizer software program has previously been shown to successfully improve tight glycemic control while also mitigating against hypoglycemia.
- The GlucoStabilizer, located in a bedside computer, works by prompting the on-site measurement of glucose and advising an intravenous insulin infusion rate. All blood glucose values and insulin doses are tracked in a database for analysis and reporting.

## GlucoStabilizer Program

**GlucoStabilizer** Snooze History Change Setup Drip Weaning

PATIENT

Enter Glucose Cover Carbs Stop/Hold Erase

Name: John Piper Room: jk 04/19/2006 Run # 75

CURRENT ORDERS AS APR 19 2006 4:55PM

Start Insulin Infusion at 3.8 Units/hour

**BG IS DUE NOW!!!**

Insulin Infusion Status

Insulin infusion running at 3.8 Units/hour, Multiplier = 0.02  
Next Blood Glucose due at 04/19/2006 17:55:30 Last BG = 250

Blood Glucose Data Entry - Web Page Dialog

Enter BG: 180

Comments:

Next Cancel



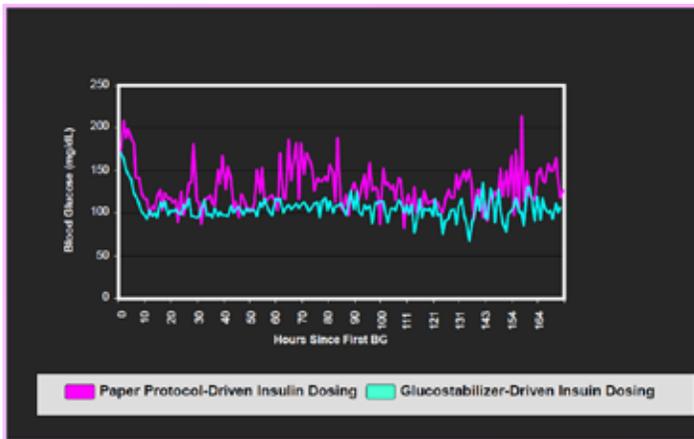
Results and Conclusions continued on back...

**Results**

	Paper (110)	Software (87)	P
Age	59	60	ns
Apache II	16	15	ns
% Sepsis	35	39	ns
% Mortality	12	9	ns
Admission BG	156±60 mg/dL	181±45 mg/dL	< .01
Mean BG	135 mg/dL	117 mg/dL	< .001
% Time in Target	52	68	< .001
% Time < 70mg/dL	1.44	0.51	< .01
BG Variability, SD	±42	±29	< .01
Final BG	145 mg/dL	99 mg/dL	< .001

This study was not powered to examine differences in patient outcome. No differences in outcome, ie survival, LOS, duration Mechanical Ventilation were observed.

**Glycemic Variability**



Glucostabilizer: Mean Blood Glucose Hourly over 1 Week

**Conclusions**

Patients whose intensive insulin infusions were managed using the GlucoStabilizer software program, as compared to a traditional paper protocol:

1. Sustained tighter glycemic control
2. Spent more time within the blood glucose target range
3. Achieved a 2/3 decrease in time spent in the range of hypoglycemia
4. Achieved a significant decrease in glycemic variability
5. Were discharged from the ICU with a significantly reduced final blood glucose

Software-guided insulin dosing achieved tighter glycemic control, decreased hypoglycemia and decreased glycemic variability.

These findings need to be extended to determine if outcomes would improve in response to this change in insulin dosing methodology.

**References**

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