Less Is More: Backing off Sliding Scale Insulin for Hospitalized Patients

Lakshmi Karra, MD, Roxanne Radi, MD, MPH, and Corey Lyon, DO

In hospitalized patients with type 2 diabetes (T2DM), a less aggressive supplemental insulin regimen is noninferior to a standard, more aggressive, supplemental regimen. (J Am Board Fam Med 2024;37:150–152.)

Keywords: **Diabetes Mellitus Type 2, Hospitalization, Sliding Scale Insulin**

Strength of Recommendation

B: Based on a single randomized controlled trial.[1]

Illustrative Case

A 58-year-old female patient with a known history of well-controlled diabetes mellitus type 2 (T2DM) on metformin and long-acting insulin is admitted to your inpatient service for community-acquired pneumonia. Glucose level at admission is 160 mg/dL. Since admission to the hospital, her home antidiabetic medications are held and she is started on a standard basal-bolus insulin regimen with supplemental sliding scale insulin. On hospital day 2, the patient reports that she does not like mealtime injections and feels that she is being stuck all day. The patient wants to know if she really needs the supplemental sliding scale insulin while hospitalized.

Clinical Context

Treating hyperglycemia in the inpatient setting is known to be an important factor in decreasing in-hospital mortality, length of hospital stay, and other clinical outcomes such as surgical site infections and delayed wound healing.[2,3] With the global burden of T2DM rising, this is an increasingly common component of inpatient medical management.[4] For noncritically hospitalized patients with known T2DM, current American Diabetes Association (ADA) guidelines recommend an insulin regimen with basal, bolus (also known as prandial), and correction components (Grade A recommendation).[5] This correction component is also commonly known as supplemental sliding-scale insulin (SSI). The ADA's insulin regimen recommendations are adapted from principles of outpatient treatment of type 1 diabetes; however, it is unclear whether this is the optimal regimen when extrapolated to T2DM physiology. Use of SSI significantly increases treatment burden for hospitalized patients and nursing staff, involving multiple point-of-care blood glucose checks and rapid-acting insulin administrations. Formative studies on basal-bolus insulin regimens used a threshold blood glucose (BG) level of 140 mg/dL, above which SSI was initiated, though studies to determine if this is the most appropriate lower BG limit do not currently exist.

The authors of this study previously showed that less aggressive SSI for noncritically ill patients with T2DM did not change fasting glucose or mean daily glucose levels.[6] These less aggressive regimens, generally defined as higher BG thresholds for treatment, reduce treatment burden and iatrogenic hypoglycemia. However, to this point, there has been no randomized level evidence evaluating less aggressive SSI regimens. This study sought to compare more aggressive SSI regimens with less aggressive SSIs in hospitalized patients on basal-bolus insulin regimens. The implications of this

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Corresponding author: Corey Lyon, DO, University of Colorado FMR, 3055 Roslyn St, Suite 100, Denver, CO 80018 (E-mail: corey.lyon@cuanschutz.edu).
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study may provide a significant reduction in treatment burden without a detrimental effect on clinical outcomes.

Methods

This article was identified as a potential PURL through the standard systematic methodology[7]. An additional literature search was conducted by searching DynaMed, UpToDate, and PubMed with the terms "sliding scale insulin AND hospitalized patients" to find additional literature to place this research into the context of current clinical practice.

Study Summary

This noninferiority open-label randomized control trial evaluated the difference in mean daily BG levels in 215 nonintensive care unit hospitalized adult patients in a US teritiary medical center with T2DM with and without aggressive SSI management. Included patients had a diagnosis of T2DM for greater than 3 months and were treated with lifestyle changes, oral medications, noninsulin injectable medications, or insulin. Patients with type 1 diabetes mellitus, admission BG >400 mg/dL, patients on glucocorticoids and those with significant renal or hepatic disease were excluded. Patients with admission glucoses of 140 to 400 mg/dL were randomized to either an intensive sliding scale (correction for BG >140 mg/dL) or nonintensive sliding scale (correction for BG >260 mg/dL) group. Basal insulin was provided for all patients; those on insulin therapy at home were given 80% of their home basal dose and those not on insulin were dosed 0.4-0.5 units/kg/day with 1 half of that dose given as the basal dose. All home medication for diabetes were held during the hospital stay. Point of care glucose was checked before meals and before bed. The primary outcome measured was the difference in mean daily BG levels. Secondary outcomes were percentage of time spent in hypoglycemia, percentage of time spent in hyperglycemia, daily total, basal, prandial, and supplemental insulin doses, and a composite of hospital complications (acute kidney injury, infection, pneumonia, and death).

Patients had a mean duration of T2DM for over 10 years, majority of patients were on home insulin (mean: 63 units/day in the intensive group, 77 units/day in the nonintensive group), and mean A1c was greater than 9%. Mean daily BG levels in the nonintensive sliding scale group were noninferior to BG in the intensive sliding scale group (intensive 172 mg/dL vs nonintensive 173 mg/dL, $P = .001$ for noninferiority). There was no statistically significant difference between the groups in proportion of days spent at target BG or severe hypo- or hyperglycemic episodes. Fewer patients in the nonintensive group received SSI (intensive 91% vs nonintensive 34%, $P < .0001$). However, ultimately there was no difference in total number of SSI units administered between the 2 groups (intensive 7 units/day vs nonintensive 8 units/day, $P = .34$), suggesting many patients likely received low doses of insulin on the prescribed sliding scale that ultimately did not affect their overall daily glucose level. There was no difference in instances of acute kidney injury, infection, pneumonia or death between the 2 groups (composite complications: intensive = 12 vs nonintensive = 11, $P = .84$).

What Is New

With daily, active titration of basal-bolus insulin therapy, less aggressive SSI is not associated with worse overall glycemic control for hospitalized patients with T2DM and BG 140 to 260 mg/dL. Furthermore, there was no difference in morbidity or mortality for patients with a less aggressive SSI regimen when compared with a standard, more aggressive SSI regimen.

Caveats

This study only included noncritically ill T2DM hospitalized patients. The findings may not apply to patients with type 1 diabetes mellitus, admission BG >400 mg/dL, patients on glucocorticoids, geriatric patients, and those with significant renal or hepatic disease. These high-risk populations may require different cutoff thresholds and require further study. Furthermore, though continuous glucose monitoring (CGM) has been validated in the inpatient setting, the authors used the current standard of care, point of care (POC) checks due to availability.[8] The higher sensitivity available with CGM may allow future research to determine more exact thresholds to prevent hypoglycemia and minimize treatment burden.

Challenges to Implementation

Due to the ubiquitous nature of T2DM in the population, most hospital systems have protocolized nursing orders and created institutional guidelines

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using BG thresholds of >140 mg/dL to trigger SSI administrations for the inpatient management of T2DM. To implement more permissive treatment thresholds may require close management by the physician and retraining and familiarizing nursing staff who may initially be uncomfortable waiting for BGs >240 mg/dL to start SSI. In larger hospital systems where endocrinologists or glucose management teams manage patients with T2DM, the primary team may not be actively managing these medications.

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