

# Example Protocol: Stepwise Approach to Managing Inpatient Hyperglycemia

## 1. Define an actionable target glucose range:

For non-critical care areas: ADA Guideline, 90-130 mg / dL fasting, 180 maximum random  
 Institutional Glycemic Target: fasting 90-130 mg / dL (most patients) or 100-150 mg/dL (hypoglycemia risk factors)

## 2. Decide if the patient needs scheduled basal insulin:

Use a basal insulin in patients with known diabetes if...	Use a basal insulin in patients with or without a history of diabetes if...
<ul style="list-style-type: none"> <li>Type 1 DM or otherwise markedly insulin deficient</li> <li>Patient already requires insulin</li> <li>Poor control despite oral agents</li> </ul>	<ul style="list-style-type: none"> <li>The patient consistently has fasting blood glucoses out of the target range.</li> </ul>

## 3. Decide if oral hypoglycemic agents should be discontinued (they usually should be):

Rapid titration to achieve glycemic control is not possible. Contraindications to oral agents are very common in the hospitalized patient. Oral agents may be restarted in the hospital as part of the discharge planning process if indicated.

## 4. Estimate the appropriate dose of insulin for the patient: (Order HbA1c if not available.)

The **total daily dose (TDD)** of insulin is the amount of insulin that a patient requires over the course of a day, assuming they are taking in 100% of their nutritional needs. It can be estimated in any of 3 different ways:

- Add up total insulin dose as outpatient, adjusting for the quality outpatient control, current degree of hyperglycemia, current patient status, and other factors.
- Weight-based estimation: TDD (in units) = the patient's weight (in kg) x N

If patient has these features...	N =
Malnourished, elderly, CKD, (on dialysis), severe liver disease	0.3
Normal-weight patients, including Type 1 diabetes.	0.4
Overweight	0.5
Obese, high dose steroids, or other markers of significant insulin resistance.	0.6 +

OR

- Calculate TDD from recent insulin infusion requirements: Calculate the average hourly drip rate. Then, multiply X 20 to get a conservative estimate of the insulin need. Then, determine whether that dose represents basal insulin (infusion insulin only covered basal needs) or TDD (infusion covered basal *and* nutritional needs).

## 5. Divide the TDD into the appropriate components of insulin treatment (basal, nutritional, and correction), depending on the nutritional status of the patient:

Nutritional status	Necessary insulin components	Preferred regimen*
NPO (or clear liquids)	Basal insulin: 50% of TDD Nutritional insulin: none	Basal insulin: glargine given once daily Nutritional insulin: none Correction: regular q 6 h Provide dextrose infusion @ 75-125 mL/hr if prolonged NPO
Eating meals (or bolus TF)	Basal insulin: 50% of TDD (40% if bolus TF) Nutritional insulin: 50% of TDD (60% of bolus TF) divided equally before each meal	Basal insulin: glargine given once daily Nutritional insulin: rapid-acting analogue (RAA) insulin (e.g., lispro) given with the first bite of meal or w/ bolus. Correction: same RAA insulin as nutritional.
Continuous tube feeds	Basal insulin: 40% of TDD Nutritional insulin : 60% of the TDD	Basal Insulin: glargine given once daily Nutritional: regular insulin q 6 hours Correction: regular insulin
Parenteral nutrition	Regular insulin is usually given parenterally, with the nutrition. Correction subcutaneous insulin is usually continued, in addition	Initially, a separate insulin drip allows for accurate dose finding. Subsequently, the separate insulin infusion can be stopped, and 80% of the 24 hour infusion insulin dose can be placed in the TPN bag.

**Nutritional insulin** amounts should be reduced accordingly if less than 100% intake expected. Rapid acting insulin analogues may be given just after the meal if the amount to be consumed is uncertain.

Correction **insulin** scales vary in intensity based on TDD, and q HS correction dose scale is halved in eating patients.

## 6. Assess and adjust insulin regimen at least every 1-2 days in hospitalized patients, based on glucose trends.

Decrease by  $\geq 20\%$  of any hypoglycemia, *evaluate cause of glycemic excursion*. Call Glycemic Team consult (pager \_\_\_\_\_) if questions or difficulty keeping patient in glycemic target range.

Institutional Protocol Example: Preferred regimens reflect SHM Glycemic Control Task Force Recommendations, but individual insulin choices are shown for illustrative purposes only. Insulin preferences will vary among different institutions.

## Example Protocol: Stepwise Approach to Managing Inpatient Hyperglycemia

### **INSULIN TERMINOLOGY**

**Basal insulin:** long acting insulin required in all Type 1 patients, and patients over glycemic target, required even when NPO.

**Nutritional (or prandial) insulin:** scheduled short acting insulin given in anticipation of carbohydrate induced hyperglycemic excursion. Adjust amount given if nutrition is diminished or interrupted.

**Correction insulin:** short acting insulin given in addition to scheduled insulin as a response to unexpected glycemic excursions. If correction insulin is used extensively, then scheduled insulin should be initiated or increased.

#### **1. Target blood glucose range**

Optimal/tightest range is 90-130 mg/dl; set the goal to 100-150 mg/dl in elderly patients and those with w/ end-stage disease, renal or hepatic failure, malnutrition, hypoglycemia unawareness or in any patients in whom hypoglycemia is a concern.

#### **2. Diet / Nutrition/Patient Education**

A constant carbohydrate diet is recommended for eating patients. Consider a nutritionist consult (ext \_\_\_\_\_) and Diabetes Educator consult (pager \_\_\_\_\_). Begin diabetes education early using our standardized teaching materials. Need more educational materials or forms? Call ext \_\_\_\_\_.

#### **3. Stopping oral diabetes medications**

Oral antidiabetes medicines act too slowly to be used to treat hyperglycemia in the hospital, and they may lead to hypoglycemia or other complications in inpatients. Metformin should be discontinued in patients with a serum creatinine >1.5 (1.4 in women) or in whom there is a risk of nephrotoxicity; sulfonylureas should not be used in the NPO patient; and TZDs should be discontinued in patients with volume overload.

#### **4. For patients eating meals or receiving bolus tube feeds**

Peakless long acting basal insulin (our formulary drug is glargine, brand name Lantus®) is recommended in these patients. Rapid acting analogue (RAA) insulin (our formulary RAA is lispro, brand name Humalog®) is more appropriate than regular insulin for nutritional doses due to its shorter, more predictable half-life and correspondence with inpatient meal times. Adjust dose down if nutritional intake is <100%.

#### **5- For patients receiving continuous enteral nutrition (tube feeds).**

**A.** Glargine is the preferred basal insulin. Regular insulin is recommended as our nutritional insulin rather than a RAA insulin in this setting-- because of its longer half-life, it can be dosed q6h instead of q4h. Adjust the dose down if nutritional intake is < 100%.

**B.** If the tube feeds are held or interrupted, the nutritional regular insulin doses should be stopped, and dextrose infusion should be started.

#### **6. For the patient on TPN.**

**A.** Use an insulin infusion for optimal control in this setting. Keep insulin separate from PN until a stable dose is reached.

#### **7. For the NPO patient**

**A.** Patients with prolonged NPO status should have a low-dose dextrose infusion ( D5 @75-125 cc/hr) along with their basal insulin.

**B.** Glargine is recommended over NPH as the basal insulin in this setting due to its longer half-life and lack of serum spike, which mimic physiologic basal insulin secretion. Nutritional or scheduled short-acting insulin should not be given to patients without a nutritional source.

#### **8. Special Situations**

**A.** If patient is eating or receiving tube feeds, but intake is inconsistent or unreliable (“grazing”), continue basal insulin but *decrease or hold the nutritional dose.*

**B.** If patient is receiving nocturnal tube feeds, consider adding additional NPH or regular insulin when feeds are started to cover this time period.

**C.** Steroids – suggest Glycemic team consult pager \_\_\_\_\_. See full protocol for other suggestions.

**D.** If transitioning off of IV insulin infusion, calculate TDD as outlined under Step 4 on reverse, and be sure to give SC insulin BEFORE you stop infusion.

#### **9. Discharge Planning**

**A.** Communicate specific glycemic diagnosis (see full protocol) and f/u needs to PCP.

**B.** Take patient’s knowledge base, insurance status, HbA1c, expected change in medication, and severity of illness into account when determining discharge medications/home regimen. See full protocol for further guidance.

Institutional Protocol Example: Preferred regimens reflect SHM Glycemic Control Task Force Recommendations, but individual insulin choices are shown for illustrative purposes only. Insulin preferences will vary among different institutions.