Type 2 Diabetes Mellitus (T2DM) and Other Non-Diabetes-Associated Hyperglycemia (i.e., Stress Induced)

- This guideline does **NOT** apply to:
  - Patients with Type 1 Diabetes or Diabetic Ketoacidosis (DKA).
  - [Diabetes: Type 1 Diabetes Mellitus (T1DM) and Diabetic Ketoacidosis (DKA)] guideline.
- If the type of diabetes is unknown, treat as type 1 diabetes.
- This guideline should be used for patients with gestational diabetes requiring insulin infusion.

### Table 1. IV Insulin Infusion

<table>
<thead>
<tr>
<th>Current Glucose</th>
<th>Change in Glucose from Prior Measure</th>
<th>Decreased &gt; 100 mg/dL$^1$</th>
<th>Decreased 50-100 mg/dL</th>
<th>Decreased 25-50 mg/dL</th>
<th>Increased or decreased &lt; 25 mg/dL</th>
<th>Increased 25-50 mg/dL</th>
<th>Increased &gt; 50 mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 400 mg/dL</td>
<td>• Contact the prescriber.</td>
<td>Increase infusion rate by 1 unit/hr</td>
<td>Increase infusion rate by 2 units/hr</td>
<td>Increase infusion rate by 2.5 units/hr</td>
<td>Increase infusion rate by 3 units/hr</td>
<td>Increase infusion rate by 4 units/hr</td>
<td></td>
</tr>
<tr>
<td>301-400 mg/dL</td>
<td>No Change</td>
<td>Run infusion at 75% of current rate$^3$</td>
<td>No Change</td>
<td>Increase infusion rate by 1 unit/hr</td>
<td>Increase infusion rate by 1 unit/hr</td>
<td>Increase infusion rate by 2 unit/hr</td>
<td>Increase infusion rate by 3 unit/hr</td>
</tr>
<tr>
<td>201-300 mg/dL</td>
<td>Run infusion at 50% of current rate</td>
<td>Decrease infusion by 1 unit/hr</td>
<td>No Change</td>
<td>Increase infusion rate by 0.5 unit/hr</td>
<td>Increase infusion rate by 1 unit/hr</td>
<td>Increase infusion rate by 2 unit/hr</td>
<td>Increase infusion rate by 3 unit/hr</td>
</tr>
<tr>
<td>120-150 mg/dL</td>
<td>Run infusion at 25% of current rate</td>
<td>Run infusion at 50% of current rate</td>
<td>Run infusion at 75% of current rate</td>
<td>No Change</td>
<td>No Change</td>
<td>Increase infusion by 1 unit/hr</td>
<td></td>
</tr>
<tr>
<td>80-120 mg/dL</td>
<td>Stop the infusion, contact the prescriber and recheck glucose in 15 minutes</td>
<td>Run infusion at 10% of current rate; consider contacting prescriber</td>
<td>Run infusion at 25% of current rate$^2$</td>
<td>Run infusion at 50% of current rate</td>
<td>Run infusion at 75% of current rate$^3$</td>
<td>No Change</td>
<td></td>
</tr>
<tr>
<td>&lt; 80 mg/dL</td>
<td>• Stop infusion of insulin and contact the prescriber.</td>
<td>Double current infusion rate of dextrose solution.</td>
<td>If not receiving dextrose IV infusion, start D5W at 50 ml/hr.</td>
<td><strong>Consider</strong> giving D50% according to the Hypoglycemia Treatment in Non-Pregnant Adults guideline.</td>
<td>• Recheck glucose and treat according to the Hypoglycemia Treatment in Non-Pregnant Adults guideline every 15 minutes until glucose &gt; 80 mg/dL.</td>
<td>• <strong>Resume insulin at 25% of previous dose and reduce dextrose back to previous rate</strong> when glucose &gt; 150 mg/dL in the absence of subcutaneous basal insulin (detemir, glargine, NPH).</td>
<td>• This applies to patients with type 2 diabetes or other causes of hyperglycemia. Click here to access the OSUWMC [Type 1 Diabetes Mellitus (T1DM) and Diabetic Ketoacidosis (DKA)] guideline.</td>
</tr>
</tbody>
</table>

$^1$ Contact prescriber if rate of decline in glucose >100 mg/dL/hr. Patient may need a more rapid taper of the drip than indicated in the table above.

$^2$ Example for 25% of current rate: 1 unit/hr (old rate) x 0.25 = 0.25 unit/hr (new rate)

$^3$ Example for 75% of current rate: 4 units/hr (old rate) x 0.75 = 3 units/hr (new rate)
Steps for IV Insulin Infusion

1. Measure patient's glucose q1hr.
   - Intensive care unit: Fingerstick (capillary) blood glucose monitoring may be inaccurate in some situations (see BRAVE criteria).
   - Venous or arterial source may be used for point of care testing. Any glucose result that does not correlate to patient’s status should.
2. Initiate insulin infusion at:
   - 1 unit/hour for patients with ESRD
   - 2 units/hour for patients with normal renal function.
3. Adjust the insulin infusion rate as directed in the table.

General Considerations for Dose Ranges

When unsure of dose within the range, use the lower infusion rate.
- More severely ill patients will generally require more insulin.
- Insulin naïve patients will generally require less insulin.
- Patients with chronically poor control generally require more insulin.
- Use the patient’s response to previous changes in insulin infusion rate to guide subsequent changes.
- If the patient is on vasopressors that are being titrated down, consider decreasing infusion by half.

If Patient Is Eating While on Insulin Infusion

- Order meal coverage with I:CHO ratio before meals SQ, but DO NOT give the correction (sliding scale) component.
- The dose should be commensurate with the estimated total daily insulin requirements from all sources (see Table 2 below); increase for patients that have a substantial increase in insulin infusion rate following meals.

Indications for Discontinuing IV Insulin

Recommend continuing insulin infusion at least 24 hours once started.

- BG is controlled on insulin infusion with minimal rate changes for at least 6 hours
- Ideally, patient should be extubated, off vasopressors, and ready to begin oral intake

Transitioning off Intravenous Insulin Infusion

If patient requires < 1 unit/hr, patient may not need basal insulin.

- Patients may still require an oral agent if basal insulin is not needed.
- Provide correction factor + I:CHO with meals.
- Monitor glucose q1hr x 4 when infusion is stopped followed by 4 times/day.

If patient requires between 1-3 unit/hr (whether patient has known diabetes):

- Patient should receive basal insulin in the hospital.
- Formulas for calculating the basal insulin dose are only valid in those who are NPO or receiving adequate SQ prandial insulin.
  - In patients with stable IV insulin requirements, multiply average insulin rate (i.e., 1 unit/hr) by 15, (1 x 15 = 15 units).
- Basal dose must be compared to home dose
- Cut infusion rate in half after the initial dose of basal insulin and wean infusion to off over at least 2 hours.
  - If glucose > 200 mg/dL within 6 hours, consider re-starting infusion guideline at lower infusion rate.
- Discontinue dextrose, if ordered, when insulin infusion is stopped.
- Glucose monitoring q1hr X 4 when insulin infusion is stopped and then qachs.

Note: If requiring > 3 units/hr or control is labile, consider DM consult for transition guidance.

If Patient Requires Tube Feeds

- Continue the IV infusion until patient reaches goal tube feed rate for at least 12-24 hours.
- If tube feeds are interrupted, the infusion should be stopped and restarted at no more than half the previous rate if the glucose subsequently exceeds 150 mg/dL. Contact the prescriber for additional dextrose order. Recommend increasing dextrose containing fluids to same rate as tube feeds were running if not contraindications.

Table 2. Insulin: Carb Coverage for Patients on IV Insulin Infusion

<table>
<thead>
<tr>
<th>Total Daily Dose (units)</th>
<th>Insulin: Carb (units: grams)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20</td>
<td>1:20 (low dose)</td>
</tr>
<tr>
<td>20-40</td>
<td>1:15</td>
</tr>
<tr>
<td>41-50</td>
<td>1:10 (standard dose)</td>
</tr>
<tr>
<td>51-80</td>
<td>1:8</td>
</tr>
<tr>
<td>81-120</td>
<td>1:5 (high dose)</td>
</tr>
</tbody>
</table>

Copyright © 2008, The Ohio State University. All rights reserved. No part of this document may be reproduced, displayed, modified, or distributed in any form without a written agreement with the Ohio State University Technology Commercialization Office
When transitioning to SQ insulin, the total daily scheduled dose should be calculated from 80% of the IV insulin requirements, and then administered as one-fourth long-acting basal insulin once daily and three-quarters regular insulin divided q6hr.

IV insulin should be used with caution in patients requiring bolus tube feeds or overnight tube feeds. Subcutaneous rapid-acting insulin (aspart or lispro) may be more appropriate for bolus tube feeds, and NPH may be more appropriate for overnight tube feeds. Consider Diabetes Consultation.

Consultation

- For a Diabetes Consult, enter consult in IHIS.
- To speak to a Diabetes Specialist:

  8 a.m. – 5 p.m.:
  - OSUMC: Page 7592, 5234 or 3165
  - OSU East: Page 1821 or 2516

  5 p.m. – 8 a.m.:
  - IM Consult Serv Endocrine/Diabetes, page via WebXchange

OSUWMC Resources

Guidelines

- Diabetes Mellitus in Non-Pregnant Adults: Inpatient Management
- Diabetes Mellitus in Pregnancy: Inpatient Management
- Perioperative / Periprocedure Glucose Management
- Diabetic Foot Burn Management
- MICU Hyperglycemia Treatment Guideline

Other Resources

- Clinical Nutrition- Carbohydrate Content

References Resources

- American Diabetes Association Position Statement: Standards of Medical Care in Diabetes Care January 2012. 35:(Suppl 1) S11-S63.
- AACE Diabetes Care Plan Guidelines, Endocrine Practice 2011:17 (Suppl 2).

Quality Measures

- Number of episodes of > 150 mg/dl while on infusion
- Number of episodes of < 80 mg/dl while on infusion
- Average time to 150 mg/dl (hrs)
- Effective insulin therapy after infusion cessation
- Potentially ineffective insulin therapy
- Initiation of insulin if infusion rate >1 unit per hour at the time of infusion discontinuation

Guideline Authors

- Kathleen Dungan, MD
- Claire Murphy, PharmD


Disclaimer: Clinical practice guidelines and algorithms at The Ohio State University Wexner Medical Center (OSUWMC) are standards that are intended to provide general guidance to clinicians. Patient choice and clinician judgment must remain central to the selection of diagnostic tests and therapy. OSUWMC’s guidelines and algorithms are reviewed periodically for consistency with new evidence; however, new developments may not be represented.