Basal Bolus in the Hospital Setting- Getting to Goal

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President, Diabetes Education Services
Basal-Bolus in the Hospital Setting – Getting to Goal

Objectives:

- Discuss the importance of inpatient glucose control.
- Describe the goals of care
- Describe basal bolus insulin therapy
- Discuss appropriate insulin therapy considerations for a variety of situations.
Hospitals and Hyperglycemia—What’s the Big Deal?

- Hyperglycemia is associated with increased morbidity and mortality in hospital settings.
  - Acute Myocardial Infarction
  - Stroke
  - Cardiac Surgery
  - Infection
  - Longer lengths of stay
Stress response and hyperglycemia

Metabolic and Hormonal Changes Leading to Stress Hyperglycemia

- Adipose Tissue → Free Fatty Acids → Liver → Amino acids
- Lipolysis → Glycerol → Lactate → Muscle

Glucocorticoids
Catecholamines
Growth hormone
Inflammatory cytokines
IV dextrose
Enteral nutrition
Parenteral nutrition

Hyperglycemia

<table>
<thead>
<tr>
<th>Immune dysfunction</th>
<th>Hemodynamic effects</th>
<th>Tissue effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Impaired leukocyte function and phagocytosis</td>
<td></td>
<td></td>
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<tr>
<td>• Wound and systemic infections</td>
<td>• Osmotic diuresis</td>
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<td></td>
<td>• Dehydration</td>
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<td>• Volume depletion</td>
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<td></td>
<td>• Electrolytes loss</td>
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<tr>
<td></td>
<td>• Tissue hypoperfusion</td>
<td></td>
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</tbody>
</table>

↓ Glucose output
↓ Protein breakdown
↓ Glucose utilization

Sepsis, multiple organ failure and death
Blood Glucose Above Normal = Trouble

- **Pre Diabetes**
  - Fasting Glucose = 100-125mg/dl
  - A1c 5.7 – 6.4%

- **Diabetes**
  - Fasting Glucose = 126 mg/dl +
  - Random Glucose = 200 mg/dl +
  - A1c 6.5% +
Management of Inpatient Hyperglycemia and Diabetes in Older Adults

- Hospitalization 3.1 times higher for all people with diabetes (compared to those without)
- Diabetes increases with age:
  - 65-75 yrs, 20% with diabetes
  - 80 yrs plus, 40% with diabetes
- Inpatients over the age of 65
  - 70% in critical care and cardiac surgery are hyperglycemic (BG > 140)
  - 30% of general medicine and surgery are hyperglycemic

Guillermo E. Umpierrez, and Francisco J. Pasquel Dia Care 2017;40:509-517
Causes of Inpatient Hyperglycemia

- Pre-existing Type 1 or Type 2
- Discovered diabetes / prediabetes
- Holding of usual diabetes med(s)
- Infection, Cardiac events
- Admin of agents that cause hyperglycemia
  - Steroids
  - Enteral or parenteral nutrition
  - Vasopressors (epi)
Poll question 1

PZ is admitted for CHF. Creat 1.4. On Metformin 1000 mg BID at home. How would his diabetes best be managed in hospital setting according to ADA Standards?

A. Keep him on metformin
B. Hold metformin and start sliding scale insulin
C. Keep metformin, add basal insulin
D. Hold metformin, start basal-bolus therapy
Recommendations for Managing Patients With Diabetes in the Hospital Setting

Antihyperglycemic Therapy

- **Insulin**
  - Recommended

- **Oral DM Meds**
  - Not Generally Recommended

- **IV Insulin**
  - Critically ill patients in the ICU

- **SC Insulin**
  - Non-critically ill patients

*Umpierrez et al*
Getting to BG Target in Hospital

• In certain situations, it may be appropriate to continue home regimens, including oral therapy (with caution).

• If oral meds are stopped in hospital, they should be resumed 1-2 days before discharge

• ADA 2019
ADA/AACE Goals and Treatments For Hospitalized Patients

ADA Goals: If BG 180 +
- Start subq insulin
- Blood glucose goals 140-180
  - Individualize based on pt status
- Basal /bolus Insulin or
- Insulin drip preferred (Critical Care)
- ADA Standards of Care

AACE Goals:
- Before meal < 140
- After meal <180

Consensus: Inpt Hyperglycemia, Endocr Pract. 2009;15 (No.4)
Diabetes Care in the Hospital - ADA

- A1c on all patients with Diabetes or new hyperglycemia (if not done in past 3 mo’s)
- Insulin dosing should be based on standard protocols that allow for predefined adjustments based on BG fluctuations
- Consider consulting with glucose mgmt. team
- Have hypoglycemia protocol. Ongoing quality improvement to keep BG > 70.
- Create structured discharge plan based on individual.
### A1c and Estimated Avg Glucose (eAG) 2008

<table>
<thead>
<tr>
<th>A1c (%)</th>
<th>eAG</th>
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<tr>
<td>5</td>
<td>97</td>
</tr>
<tr>
<td>6</td>
<td>126</td>
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<tr>
<td>7</td>
<td>154</td>
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<td>8</td>
<td>183</td>
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<td>10</td>
<td>240</td>
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<tr>
<td>11</td>
<td>269</td>
</tr>
<tr>
<td>12</td>
<td>298</td>
</tr>
</tbody>
</table>

\[
eAG = 28.7 \times A1c - 46.7 \sim 29 \text{ pts per 1%}
\]

*Translating the A1c Assay Into Estimated Average Glucose Values – ADAG Study*

Diabetes Care: 31, #8, August 2008
Glucose Goals – Clinical judgement required

- More relaxed BG goals
  - Terminally ill
  - At risk of hypo due to other health issues
  - In setting where intensive checks not feasible

- When setting goals consider:
  - Clinical status
  - Severity of illness
  - Nutritional status
  - Glucose variability and trends
  - Pt’s usual management plan and expertise
Physiologic Insulin Secretion: 24-Hour Profile

- **Insulin (µU/mL)**
  - Basal Insulin
  - Bolus Insulin

- **Glucose (mg/dL)**
  - Basal Glucose
  - Mealtime Glucose

**Time of Day**

- 7 A.M.
- 8
- 9
- 10
- 11
- 12
- 1 P.M.
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9 P.M.
Insulin Action Teams

- **Bolus**: lowers after meal glucose levels
  - Rapid Acting
    - Aspart, Lispro, Glulisine, Afrezza
  - Short Acting
    - Regular
- **Basal**: controls glucose between meals, hs
  - Intermediate
    - NPH
  - Long Acting
    - Detemir (Levemir)
    - Glargine (Lantus, Basaglar)
    - Degludec (Tresiba)
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<td>Analog Analogs</td>
<td>Aspart (Novolog)</td>
<td></td>
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<td></td>
<td>Lispro (Humalog)*, Admelog</td>
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<td>20 - 24 hrs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Degludec (Tresiba)*</td>
<td>~1 hr</td>
<td>No peak</td>
<td>&lt;42 hrs</td>
<td></td>
</tr>
<tr>
<td><strong>Basal + short</strong></td>
<td>Combo of NPH + Reg 70/30 = 70% NPH + 30% Reg</td>
<td>30 - 60 min</td>
<td>Dual peaks</td>
<td>10 - 16 hrs</td>
<td>Discard open vials after 28 days. For pen storage guidelines, see package insert.</td>
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<td><strong>Basal + Bolus</strong></td>
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<td>Intermediate +</td>
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<td>5 - 15 min</td>
<td>No peak</td>
<td>24 hrs</td>
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</tr>
<tr>
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<td>Humalog® Mix - 75/25 or 50/50</td>
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</table>

*Concentrated insulins available - see next page for details.

Insulin action times vary. Time periods listed here are general guidelines only; please consult prescribing information for details.
43 yr old admitted to evaluate angina.
Morning blood sugar is 142.
You walk in with his insulin dose.
The patient says, “I will bottom out if I take that much insulin.”
“That dose won’t touch my blood sugar”
“Can my wife bring in my insulin pump?”

What do you say?
Mrs. Jones admitted to hospital

Mrs. Jones is 62 years old, complains of feeling tired and is experiencing painful urination several times a day. Admitted with a urinary tract infection. WBC is 12.3. GFR 56. Wt 90kg

- Fasting glucose 237 with an A1c of 9.3%.
- Home meds:
  - 60 units glargine (Lantus) at hs
  - 10 units lispro (Humalog) at breakfast and dinner
  - Metformin 850mg three times daily with meals

What type of diabetes does she have?

How much insulin should she be started on
Life Study – Mrs. Jones

How would we manage her BG in hospital?
Already on insulin at home? Dosing

- Patient with type 2 treated with insulin prior to admission
- Take total daily insulin dose at home:
  - Give half as long-acting basal insulin
  - Give half as prandial insulin.
  - Reduce dose by 20% to 25% to prevent hypoglycemia, particularly in those with poor or uncertain caloric intake.\(^\text{31}\)

Umpierrez and Lansang, Cleveland Clinic 2016
Bolus Insulin

- Regular, Novolog, Humalog, Apidra,
- Starts working fast (15-30 mins)
- Gets out fast (3-6 hours)
- Post meal BG reflects effectiveness
- Should comprise about ½ total daily dose
- Covers food or hyperglycemia.
- 1 unit
  - Covers ≈ 10 -15 gms of carb
  - Lowers BG ≈ 30 – 50 points
Bolus Insulin Timing

- How is the effectiveness of bolus insulin determined?
  - Before next meal blood glucose

- Inpt Glucose goals (ADA) – may be modified by provider/pt
  - 1-2 hours post meal <180
  - Before next meal 80 - 140
Bolus Basics

- **Carbohydrate/ Prandial Coverage**
  - Match the insulin to the carbohydrates
  - 1 unit for 15 gms - Common starting point
  - Usual meal 45 – 60gms = 3 - 4 units insulin

- **Correction Bolus - targets hyperglycemia**
  - 1 unit for every 30-50 points over target

- Adjust ratios depending on sensitivity and response
Hospital Meal – 1 unit /15 gms carb

- ½ cup of juice
- 2 pieces of toast
- 2 scrambled eggs
- Coffee black

How many units lispro (Humalog)?

- Turkey with gravy
- Green salad
- ½ c. mashed potatoes
- ½ cup of corn
- Roll with butter
- ½ cup of jello

How many units Reg?
Now What?

- Nurse had an emergency and pt already ate lunch?
- Nurse administered insulin and pt only ate a few bites of turkey and drank non sugar tea?
- You just gave 3 units of Novolog and patient needs to go to OR NOW!
Now that we covered food, what about BG > 150?

- That’s where the Correction Bolus comes into play.
## Sample Correction Bolus

**Rapid/Fast Acting Insulin (1 unit: 50 mg/dl > 150)**

<table>
<thead>
<tr>
<th>Blood Sugar Range</th>
<th>Recommended Bolus</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 or less</td>
<td>Treat for Hypo, hold dose, subtract 1 unit from carb cov</td>
</tr>
<tr>
<td>71-150 mg/dl</td>
<td>0 units</td>
</tr>
<tr>
<td>151-200 mg/dl</td>
<td>1 unit</td>
</tr>
<tr>
<td>201-250 mg/dl</td>
<td>2 units</td>
</tr>
<tr>
<td>251-300 mg/dl</td>
<td>3 units</td>
</tr>
<tr>
<td>301-350 mg/dl</td>
<td>4 units</td>
</tr>
<tr>
<td>351-400 mg/dl</td>
<td>5 units</td>
</tr>
</tbody>
</table>
How much Insulin?

- 1 unit for every 10 gms carb
- 1 unit for every 50 points over 150.

- 60 gms carb. BG 240
- 70 gms carb, BG 69
- 45 gms carb, BG 148
What About Basal Insulin?
Insulin Therapy Components

- **Prandial or meal insulin** – a bolus insulin that covers food, IV dextrose, enteral nutrition, TPN or other nutritional supplements
- **Correction insulin** – bolus insulin dosed to correct for hyperglycemia that occurs despite use of basal and nutritional insulin
- **Basal insulin** – long acting insulin covers between meals and through night
## Basal Insulins
(½ of total daily dose)

<table>
<thead>
<tr>
<th>Intermediate Acting</th>
<th>Peak Action</th>
<th>Duration</th>
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<tbody>
<tr>
<td>NPH</td>
<td>4-12 hrs</td>
<td>12-24</td>
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<tr>
<td>Detemir (Levemir)</td>
<td>No Peak</td>
<td>20 hrs</td>
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*Fasting BG reflects efficacy of basal*
# Insulin PocketCard™

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Insulin action times vary. Time periods listed here are general guidelines only; please consult prescribing information for details.

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Basal Insulin Summary

- NPH, Levemir, Lantus, Degludec
- Covers in between meals, through night
- Starts working slow (4 hours)
- Stays in long (12-24 hours)
  - NPH 12 hrs
  - Levemir, Lantus 20-24 hrs
  - Degludec – 42 hours
- Fasting blood glucose reflects effectiveness
- Based on body weight or start at ~10 units
# Combo Sub-Q Insulin

<table>
<thead>
<tr>
<th>Insulin Type</th>
<th>Onset</th>
<th>Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humalog Mix</td>
<td>0.25 - 0.5 hr</td>
<td>0.5-6.5 hrs</td>
</tr>
<tr>
<td>75/25: 75% NPL, 25% lispro</td>
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</tr>
<tr>
<td>50/50: 50% NPL, 50% lispro</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NovoLog Mix</td>
<td>0.25 - 0.5 hr</td>
<td>1 – 4 hrs</td>
</tr>
<tr>
<td>70/30: 70% NPA, 30% aspart</td>
<td></td>
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<td>NPH + Reg Combo</td>
<td>0.5 – 1.0 hr</td>
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**Considerations:**
- Pre-mixed, difficult to fine tune therapy
How Much Insulin Does a Patient Need?

- It depends, based on:
  - Body weight
    - Overwt, normal wt, or thin
  - Frail, elderly
  - Eating status
    - Normal, poor intake or NPO
  - Renal or hepatic insufficiency
  - Type of Diabetes
  - Current meds; steroids, insulin, diabetes meds
  - Infected or Septic
Initiating Insulin in Hospital

Stop oral agents - Obtain patient wt in kg

Calculate total daily dose (TDD) as 0.2-0.5 units per kg/day

Choose the dosing schedule

50% of TDD as basal insulin
50% of TDD as prandial or nutritional insulin

Use Correction Insulin for BG above goal

Adjust according to results of BSGM
Adjust dose for NPO status or changes in clinical status

Management of Hyperglycemia in Hospitalized Patients in Non-Critical Care Setting: An Endocrine Society Clinical Practice Guideline
Diabetes with glucose > 140 mg/dL (7.7 mmol/L)

- Nothing by mouth
- Uncertain oral intake
- Poor oral intake

Nothing by mouth

- Basal insulin
  - Start at 0.2–0.25 U/kg/day\(^a\)
  - Correction doses with rapid-acting insulin before meals
  - Adjust basal as needed

Adequate oral intake

- Basal-bolus\(^b\)
  - Total daily dose: 0.4–0.5 U/kg/day
    - 1/2 basal, 1/2 bolus
    - Adjust as needed

\(^a\)Reduce total daily dose to 0.15 U/kg in patients \(\geq\) age 70 or with serum creatinine \(\geq\) 2.0 mg/dL.

\(^b\)In patients already on basal-bolus at home, decrease insulin dose by 25%.
Mrs. K is 71 years old, with a BMI of 28. She weighs 60kg and has a good appetite. She is admitted with an infected foot ulceration. GFR is 62.

Her A1c 8.9%

What insulin dose would we start Ms. K on?
Insulin Dose – Mrs. Jones

- Usual – 0.4 units/insulin/kg day
- Why?
  - Average weight, good oral intake
Basal/Bolus Insulin Dosing Strategy

50/50 Rule
- 0.3-0.5 units/kg day
- Basal = 50% of total
  - Glargine at HS or AM
  - NPH or Detemir BID
- Bolus = 50% of total
  - usually divided into 3 meals

Example
- Wt 50kg x 0.4 = 20 units of insulin/day
- Basal dose: 10 units
  - Glargine 10 units QD
  - NPH/Detemir 5u BID
- Bolus dose: 10 units
  - 3 units NovoLog, Apidra Reg, Humalog each meal
Basal/Bolus Insulin Dosing Strategy 0.4u/kg

50/50 Rule
- 0.3-0.5 units/kg day
- Basal = 50% of total
  - Glargine at HS or AM
  - NPH or Detemir BID
- Bolus = 50% of total
  - divided into 3 meals

Example – You Try
- Wt 60 kg x 0.4 = ___ units of insulin/day
- Basal dose: _____ units
  - Glargine _____ units QD
  - NPH/Detemir _____ BID
- Bolus dose: _____ units
  _____ units NovoLog, Apidra
  Humalog, Reg each meal
## Sample Correction Bolus /HS Scale

Rapid/Fast Acting Insulin (1 unit:50 mg/dl>150)

<table>
<thead>
<tr>
<th>Blood Glucose Range</th>
<th>Insulin Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 or less</td>
<td>Treat for Hypo, hold dose, subtract 1 unit from carb cov</td>
</tr>
<tr>
<td>71-150 mg/dl</td>
<td>0 units</td>
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<td>251-300 mg/dl</td>
<td>3 units</td>
</tr>
<tr>
<td>301-350 mg/dl</td>
<td>4 units</td>
</tr>
<tr>
<td>351-400 mg/dl</td>
<td>5 units</td>
</tr>
<tr>
<td>Day</td>
<td>Break</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
</tr>
<tr>
<td>Day 1</td>
<td>admit</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 2</td>
<td>129</td>
</tr>
<tr>
<td></td>
<td>4 u</td>
</tr>
<tr>
<td>Day 3</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Held ins</td>
</tr>
<tr>
<td>Day 4</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>4 units</td>
</tr>
</tbody>
</table>
Hypoglycemia Symptoms

- **Autonomic**
  - Anxiety
  - Palpitations
  - Sweating
  - Tingling
  - Trembling
  - Hypoglycemic Unawareness

- **Neuroglycopenia**
  - Irritability
  - Drowsiness
  - Dizziness
  - Blurred Vision
  - Difficulty with speech
  - Confusion
  - Feeling faint
BG Running Low?

- Possible Causes
  - Too much insulin
    - Premeal bolus
    - Basal
  - Glucose toxicity improving
  - Infection improving
  - Stopped/lowered steroids
  - Poor kidney function
  - Skipped meal, poor PO intake
  - Not eating enough carbs
Treatment of Hypoglycemia

- If BG **70 mg/dl** or less and pt is eating:
  - 15 gms of carb (gel, glucose tabs, juice)
- If BG **70 mg/dl** or less, pt is **NOT** eating
  - D50 if IV access
  - Glucagon if no IV access
- Recheck BG every 15 minutes
- Hold next correction insulin dose
- Give next meal insulin and Lantus Dose
Steps to Prevent Hypo

- If fasting BG < 100, consider adjusting basal insulin
- If patient has renal failure, conservative insulin dosing required
- Patient has N/V or not consistent eater?
  - Give bolus insulin after meals
- Anticipate events that put pt at risk of hypo:
  - NPO for surgery, decreasing steroid dose, improving infection, recovering after cardiac event
  - Strive to admin the least amount of insulin necessary to reach glycemic targets
Next Steps?

- Ms. K is improved and ready to go home.
- What glucose management strategies for home?
- Her A1c = 8.9%
Topics to Cover in Hospital

- **Survival Skills**
  - Diabetes, self-monitoring, BG Goals
  - Hypo & Hyper – recognition, treatment and prevention
  - Healthy eating
  - Meds- how to take, potential side effects and action
  - Proper use and disposal of needles and syringes

- **ID of health care provider for post d/c care**
  - Schedule for f/u visit within 1 month
  - Parameters of when to call for help
    - Sick days, N/V, if BG < 70 or > 300
Medication Reconciliation

- Pts meds must be crossed-checked to make sure no chronic meds were stopped
- Ensure the safety of new prescriptions
- New or changed prescriptions reviewed with pt/ family before discharge
- Avoid complex insulin regimens for those with limited cognition
  - As pt heals, remind them that they may need less insulin / diabetes meds to control BG
  - Supplies for insulin administration
Discharge Teaching

- What supplies will she need?
- What top 3 things do we need to teach her?
- What resources can we provide?
- What referrals?
Mr. R has Pneumonia
How Much Insulin Needed?

- Creatinine 1.6
- 76 years old
- Not very hungry
- BMI 22
- Weighs 70kg
- Glucotrol 5mg at home
- A1c 7.2%
Basal/Bolus Insulin Dosing Strategy 0.3u/kg

50/50 Rule
- 0.3-1.0 units/kg day
- Basal = 50% of total
  - Glargine at HS or AM
  - NPH or Detemir BID
- Bolus = 50% of total
  - divided into 3 meals

Example – You Try
- Wt 70kg x 0.3 = ____ units of insulin/day
- Basal dose: ____ units
  - Glargine __ units QD
  - NPH/Detemir ___u BID
- Bolus dose: ____ units
  - ____ NovoLog, Apidra Humalog, Reg w/meal
# Sample Correction Bolus /HS Scale

Rapid/Fast Acting Insulin (1 unit: 50 mg/dl > 150)

<table>
<thead>
<tr>
<th>Glucose Level (mg/dl)</th>
<th>Insulin Dose</th>
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<tbody>
<tr>
<td>70 or less</td>
<td>Treat for Hypo, hold dose, subtract 1 unit from carb cov</td>
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<tr>
<td>151-200</td>
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<tr>
<td>251-300</td>
<td>3 units</td>
</tr>
<tr>
<td>301-350</td>
<td>4 units</td>
</tr>
<tr>
<td>351-400</td>
<td>5 units</td>
</tr>
</tbody>
</table>
Mr. R- Pattern / 3 unit meal bolus + Correction + 11u Lantus hs

<table>
<thead>
<tr>
<th></th>
<th>Break</th>
<th>Lunch</th>
<th>Dinner</th>
<th>HS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td></td>
<td>admit</td>
<td>381</td>
<td>198</td>
</tr>
<tr>
<td></td>
<td>3 + 5 units</td>
<td></td>
<td>3 + 5 units</td>
<td>1 unit</td>
</tr>
<tr>
<td>Day 2</td>
<td>98</td>
<td>127</td>
<td>69</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>3 units</td>
<td>3 units</td>
<td>ins held</td>
<td>RN Held Lantus</td>
</tr>
<tr>
<td>Day 3</td>
<td>137</td>
<td>67</td>
<td>72</td>
<td>207</td>
</tr>
<tr>
<td></td>
<td>3 units</td>
<td>Ins held</td>
<td>tube feeding 4 times a day</td>
<td>3 + 2 units</td>
</tr>
<tr>
<td>Day 6</td>
<td>142</td>
<td>129 Tube pulled 3 units</td>
<td>Pt feels funny 63 held</td>
<td>184</td>
</tr>
<tr>
<td></td>
<td>3 units</td>
<td></td>
<td></td>
<td>3 units</td>
</tr>
</tbody>
</table>
3 days poor intake, pt started on Tube Feeding

- If on continuous tube feeding, how would this change his insulin regimen?
- If on intermittent tube feeding, how would this change his insulin regimen?
- If patient's tube feeding is interrupted, what precautions would you take?
Glycemic Management of the Patient Receiving Enteral Nutrition

**Continuous enteral nutrition (EN)**
- Basal insulin: 50% of daily dose twice daily
- Prandial bolus insulin: 50% given q6h

**Cycled enteral nutrition**
- Combination basal/bolus insulin (ie 70/30) given at the start of each tube feeding
- Bolus insulin administered q4 to 6 hours for duration of EN administration
- Correctional insulin given for BG above goal

**Bolus enteral nutrition**
- Rapid acting analog or short acting insulin given prior to each bolus
Mr. R after 9 days feeling better. Eating again, regaining strength. DC today.

- What glucose mgmt strategy?
- What supplies will he need?
- What top 3 things do we need to teach him?
- What resources and referrals?
Mr. R has Pneumonia Discharge plan?

- Creatinine 1.6
- 76 years old
- Not very hungry
- BMI 22
- Weighs 70kg
- Glucotrol 5mg at home
- A1c 7.2%
How Much Insulin Needed? 
Mr. K

- Waistline 46”
- Creat 0.9
- Infected Foot Ulcer
- Asthma
- Meds
  - Metformin
  - Trulicity (ran out)
  - Actos (worried about ankles swelling)
- A1c 10.8%
Basal/Bolus Insulin Dosing Strategy 0.5u/kg

50/50 Rule

- 0.3- 0.5 units/kg day
- Basal = 50% of total
  - Glargine at HS or AM
  - NPH or Detemir BID
- Bolus = 50% of total
  - divided into 3 meals

Example – You Try

- Wt 100 kg x 0.5 = ___ units of insulin/day
- Basal dose: _____ units
  - Glargine _____ units QD
  - NPH/Detemir _____ BID
- Bolus dose: _____ units
  - _____ units NovoLog, Apidra Humalog, Reg each meal
# Sample Correction Bolus / HS Scale

**Rapid/Fast Acting Insulin** (2 unit: 50 mg/dl > 150)

<table>
<thead>
<tr>
<th>Glucose Level (mg/dl)</th>
<th>Insulin Dose (Units)</th>
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<td>4 units</td>
</tr>
<tr>
<td>251-300 mg/dl</td>
<td>6 units</td>
</tr>
<tr>
<td>301-350 mg/dl</td>
<td>8 units</td>
</tr>
<tr>
<td>351-400 mg/dl</td>
<td>10 units</td>
</tr>
</tbody>
</table>
Started on Prednisone 60mg qd for Asthma

- Blood glucose levels running 300-500.
BG Running High?

- Possible Causes
  - Glucose Toxic
  - Infection
  - Started on steroids
  - Physical stress
  - Insulin dose too low
BG Too High?
Insulin Adjustment Strategies

- Meal Blood glucose too high?
  - Increase prandial dose by 2 units and/or
  - Increase correction scale by 1-2 units

- Morning blood glucose > 140?
  - Increase evening basal by 10%

- Identify cause
- Consider insulin drip
## Mr. K- Pattern

8 unit meal bolus + High Correction  25 Lantus am

<table>
<thead>
<tr>
<th>Day</th>
<th>Break</th>
<th>Lunch</th>
<th>Dinner</th>
<th>HS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td></td>
<td>admit</td>
<td>432</td>
<td>182</td>
</tr>
<tr>
<td></td>
<td>8 + 6</td>
<td>8 + 10</td>
<td>8 + 10</td>
<td>2</td>
</tr>
<tr>
<td>Day 2</td>
<td>292</td>
<td>417</td>
<td>391</td>
<td>234</td>
</tr>
<tr>
<td></td>
<td>8 + 6</td>
<td>8 + 10</td>
<td>8 + 8</td>
<td>4</td>
</tr>
<tr>
<td>Day 3</td>
<td>318</td>
<td>497</td>
<td>408</td>
<td>367</td>
</tr>
<tr>
<td></td>
<td>8 + 6</td>
<td>8 + 10</td>
<td>8 + 10</td>
<td>8 units</td>
</tr>
<tr>
<td>Day 6</td>
<td>423</td>
<td></td>
<td>429 insulin drip started</td>
<td></td>
</tr>
</tbody>
</table>
Mr. K BG Levels Too High
Insulin Drip Started

- 100 units insulin in 100 cc NS Bag
  - 1 cc = 1 unit of insulin

Society of Hospital Medicine listing of sample Insulin Drip Protocols
What Glucose Mgmt Strategy for Discharge?

- Waistline 46”
- Infected Foot Ulcer
- Asthma (on pred)
- Meds
  - Metformin
  - Trulicity (ran out)
  - Actos (worried about ankles swelling)
- A1c 10.8%
Revised Discharge Insulin Algorithm

Discharge Treatment

A1C < 7%
   - A1C < 8%
     - Re-start outpatient treatment regimen (OAD and/or insulin)
   - A1C 8%-10%
     - Re-start outpatient oral agents and D/C on glargine once daily at 50% of hospital dose

A1C 7%-9%
   - A1C 8%-10%
     - Re-start outpatient oral agents and D/C on glargine once daily at 50% of hospital dose
   - A1C > 10%
     - D/C on basal bolus at same hospital dose
     - Alternative: re-start oral agents and D/C on glargine once daily at 80% of hospital dose

MR K. Stable, ready for discharge.

- What is your biggest concern?
- What supplies will he need?
- What top 3 things do we need to teach him?
- What resources and referrals?
Strategies to Improve Inpatient Glucose Control in Hospital Setting

- Standardized bolus / basal scales
- Enhanced PharmD roles to determine insulin needs
- Dedicated inpatient Diabetes Specialists
- Evidence based IV insulin drip protocols
- Computerized MD order sheets
- A trained interdisciplinary team
- Staff education and adequate staffing
Thank You

Online University

- Diabeteseduniversity.net