“IT’S MORE OF AN ART”: MANAGING INSULIN THERAPY IN THE OLDER PATIENT

Auburn University Harrison School of Pharmacy
Consultant Certification and Geriatric Pharmacotherapy CE Session
Saturday, July 22nd, 2017

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Department of Pharmacy Practice
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I, Katelin Lisenby, have no actual or potential conflict of interest in relation to this program.
OBJEKTIVES

- Identify patient characteristics or health statuses that guide individualized treatment goals and therapies
- Compare and contrast various insulin regimens and distinguish their role in therapy in the older patient
- Utilize evidence-based resources to design safe and effective insulin regimens in the older patient
- Implement appropriate and individualized treatment goals and therapies to reduce the risk of complications and preserve quality of life
MH is a 69 YO AAM who presents to your pharmacy for medication therapy management (MTM)

CC: “I’ve tried to help control my diabetes with my diet, exercise, and medications but my doctor told me my sugar is still too high. Am I on the best medications?”

PMH:
- T2DM x 10 years
- Peripheral neuropathy x 2 years
- Hypertension x 15 years
- Depression x 5 years
- HFrEF x 8 years (EF 35%, NYHA II) ago

SH:
- Insurance: Medicare/AL Medicaid
- Exercise: Walks 1 mile daily
- (-) Tobacco x 20 pack year, quit smoking 10 years
Which of the following statements is true about diabetes in the older population?

A. All patients will have similar treatment goals due to their advanced age
B. Patients have an increased risk of hypoglycemia
C. Patients have a decreased risk of microvascular complications
D. This population (≥ 65 years of age) has the lowest prevalence of diabetes of any age group
At least 25% of older adults (≥ 65 years of age) have diabetes

- Higher rates of mortality, functional disability, and coexisting illnesses (e.g., hypertension, coronary heart disease, stroke, and depression)
- Increased risk of acute and chronic microvascular and macrovascular complications and institutionalization
- Increased hypoglycemia risk, increased fall risk, polypharmacy, and cognitive impairment
- Heterogeneity of duration of disease, health statuses, and life expectancies limits standardized interventions

Increased risk of developing diabetes
- Age-related insulin resistance
- Postprandial hyperglycemia common
  - 2-hr oral glucose tolerance test

Impact of diabetes onset
- Incident disease (diagnosed after 65 yoa) vs. onset in middle age or earlier
  - Glycemic control
  - Rates of microvascular disease

Which of the following patient characteristics should be considered to individualize treatment goals for diabetes?

A. Smoking history
B. Coexisting chronic illnesses
C. Pertinent family history
D. BMI
TREATMENT OVERVIEW

Goals

- Minimize symptoms and complications of hyperglycemia
- Minimize pharmacological therapy adverse effects
- Maintain quality of life

Individualize treatment

ADA RECOMMENDATIONS IN OLDER ADULTS

- Functional and cognitively intact and have significant life expectancy
  - Care and goals similar to those developed for younger adults. (C)

- Glycemic goals might reasonably be relaxed using individual criteria, but hyperglycemia leading to symptoms or risk of acute hyperglycemic complications should be avoided in all patients. (C)

- Screening for diabetes complications should be individualized, but particular attention should be paid to complications that would lead to functional impairment. (C)

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### MH's Vitals and BG Values

<table>
<thead>
<tr>
<th>7/10/17</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>136/82 mm Hg</td>
</tr>
<tr>
<td>HR</td>
<td>62 bpm</td>
</tr>
<tr>
<td>Height (self-reported)</td>
<td>5’10’’</td>
</tr>
<tr>
<td>Weight (self-reported)</td>
<td>180 lbs (82 kg)</td>
</tr>
<tr>
<td>BMI</td>
<td>26 kg/m²</td>
</tr>
<tr>
<td>Preprandial range (self-reported from BG log)</td>
<td>190-230s mg/dL</td>
</tr>
<tr>
<td>Point of Care A1c</td>
<td>9.7% (previously 9.9% - 4/17)</td>
</tr>
</tbody>
</table>
# MH’s Medications

<table>
<thead>
<tr>
<th>Medication</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin 81 mg daily</td>
<td>Primary Prevention</td>
</tr>
<tr>
<td>Atorvastatin 20 mg daily</td>
<td>Primary Prevention</td>
</tr>
<tr>
<td>Furosemide 20 mg daily PRN</td>
<td>HFrEF/Edema</td>
</tr>
<tr>
<td>Gabapentin 300 mg TID</td>
<td>Peripheral neuropathy</td>
</tr>
<tr>
<td><strong>Glyburide 10 mg BID (8 years)</strong></td>
<td><strong>T2DM</strong></td>
</tr>
<tr>
<td>Losartan 150 mg daily</td>
<td>HFrEF/HTN</td>
</tr>
<tr>
<td><strong>Metformin 1000 mg BID (10 years)</strong></td>
<td><strong>T2DM</strong></td>
</tr>
<tr>
<td>Metoprolol Succinate 100 mg daily</td>
<td>HFrEF/HTN</td>
</tr>
<tr>
<td>Sertraline 100 mg daily</td>
<td>Depression</td>
</tr>
<tr>
<td>Spironolactone 25 mg daily</td>
<td>HFrEF/HTN</td>
</tr>
</tbody>
</table>
Which A1c goal would you recommend for MH?

A. <7% (Preprandial 80-130, bedtime 80-140)
B. <7.5% (Preprandial 90-130, bedtime 90-150)
C. <8% (Preprandial 90-150, bedtime 100-180)
D. <8.5% (Preprandial 100-180, bedtime 110-200)
# ADA Treatment Goal Recommendations in Older Adults

<table>
<thead>
<tr>
<th>Patient characteristic/health status</th>
<th>Rationale</th>
<th>Reasonable A1C goal</th>
<th>Fasting or preprandial glucose</th>
<th>Bedtime glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy (few coexisting chronic illnesses)</td>
<td>Longer remaining life expectancy</td>
<td>&lt;7.5%</td>
<td>90–130 mg/dL</td>
<td>90–150 mg/dL</td>
</tr>
<tr>
<td>Complex/intermediate (multiple coexisting chronic illnesses)</td>
<td>Intermediate remaining life expectancy, high treatment burden, hypoglycemia vulnerability, fall risk</td>
<td>&lt;8.0%</td>
<td>90–150 mg/dL</td>
<td>100–180 mg/dL</td>
</tr>
<tr>
<td>Very complex/poor health (LTC or end-stage chronic illnesses)</td>
<td>Limited remaining life expectancy makes benefit uncertain</td>
<td>&lt;8.5%</td>
<td>100–180 mg/dL</td>
<td>110–200 mg/dL</td>
</tr>
</tbody>
</table>

Adapted from Table 11.1 in ADA. Diabetes Care. 2017;40(Suppl. 1):S101
Coexisting chronic illnesses are conditions serious enough to require medications or lifestyle management:

- Arthritis, cancer, congestive heart failure, depression, emphysema, falls, hypertension, incontinence, stage 3 or worse chronic kidney disease, myocardial infarction, and stroke

- “Multiple” = at least three

The presence of a single end-stage chronic illness may cause significant symptoms or impairment of functional status and significantly reduce life expectancy:

- Stage 3–4 congestive heart failure or oxygen-dependent lung disease, chronic kidney disease requiring dialysis, or uncontrolled metastatic cancer

<table>
<thead>
<tr>
<th>VA/DoD</th>
<th>European Diabetes Working Party for Older People (≥ 70 yoa)</th>
</tr>
</thead>
</table>
| A1c target of 6-7% (if it can be achieved without risk):  
- Either no or very mild microvascular complications of diabetes and  
- Life expectancy of at least 10-15 years | A1c target of 7-7.5%:  
- Single system involvement (free of other major comorbidities) |
| A1c target of 7-8.5%:  
- Established microvascular or macrovascular disease and/or  
- Comorbid conditions and/or  
- 5-10 years life expectancy | A1c target of 7.6-8.5%:  
- Frail (dependent; multisystem disease; care home residency including those with dementia) patients where the hypoglycemia risk is high and symptom control and avoidance of metabolic decompensation is paramount |
| A1c target of 8-9%:  
- Advanced complications and/or  
- Significant comorbid conditions and/or  
- Life expectancy of ≤5 years and/or  
- Difficulties in self-management | *Precise target will depend on existing CV risk, presence of microvascular complications, and ability of individual to self-manage |

**Insulin Therapy**

- **Physiological action:**
  - Increase glucose disposal
  - Decrease hepatic glucose production
  - Suppresses ketogenesis

- **Advantages**
  - Universal response
  - Theoretically unlimited efficacy
  - Decreased microvascular risk (UKPDS)
  - Dosing flexibility

- **Disadvantages**
  - Hypoglycemia
  - Weight gain
  - Training requirements/injectable
  - Patient and provider reluctance

ADA. Diabetes Care. 2017;40(Suppl. 1):S64–S74
Which of the following types of insulin has the longest duration of action?

A. Insulin degludec (Tresiba®)
B. Insulin detemir (Levemir®)
C. Insulin glargine (Lantus®)
D. NPH (Humulin® N)
<table>
<thead>
<tr>
<th>Insulin Type</th>
<th>Onset (min)</th>
<th>Peak (hr)</th>
<th>Duration (hr)</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rapid acting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspart (Novolog®)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lispro (Humalog®)</td>
<td>15-30</td>
<td>1-3</td>
<td>3-5</td>
<td>• Decreased hypoglycemia compared to regular</td>
<td>• Cost</td>
</tr>
<tr>
<td>Glulisine (Apidra®)</td>
<td></td>
<td></td>
<td></td>
<td>• Flexible dosing around meal times</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Lispro 200 units/mL product</td>
<td></td>
</tr>
<tr>
<td><strong>Short acting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular (Humulin® R and Novolin® R)</td>
<td>30-60</td>
<td>2-5</td>
<td>4-12 (6-8)</td>
<td>• Cost</td>
<td>• Longer duration of action increases risk for hypoglycemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• IV route available</td>
<td>• Needs to be given at least 30 min before meals, decreased flexibility around meals</td>
</tr>
</tbody>
</table>

ADA. Diabetes Care. 2017;40(Suppl. 1):S64–S74
Lexi-Comp, Inc (Lexi-Drugs®). Lexi-Comp, Inc.; June 16, 2017
<table>
<thead>
<tr>
<th>Insulin Type</th>
<th>Onset (hr)</th>
<th>Peak (hr)</th>
<th>Duration (hr)</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermediate acting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPH (Humulin® N and Novolin® N)</td>
<td>1-2</td>
<td>4-12</td>
<td>12-24 (12-18)</td>
<td>• Cost</td>
<td>• Variable onset • BID dosing • Hypoglycemia risk</td>
</tr>
<tr>
<td>Long acting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glargine (Lantus®, Basaglar®, Toujeo®)</td>
<td>3-4</td>
<td>N/A</td>
<td>24</td>
<td>• Peakless, decreased hypoglycemia • 300 units/mL product</td>
<td>• Cost</td>
</tr>
<tr>
<td>Detemir (Levemir®)</td>
<td>3-4</td>
<td>3-9</td>
<td>6-23</td>
<td>• Kept at room temperature for 42 days</td>
<td>• Dose dependent duration • Peak • Cost</td>
</tr>
<tr>
<td>Degludec (Tresiba®)</td>
<td>1</td>
<td>9</td>
<td>42</td>
<td>• Decreased hypoglycemia (e.g. nocturnal) vs. glargine • Flexible dosing schedule • Kept at room temperature for 8 weeks • 200 units/mL product</td>
<td>• Cost</td>
</tr>
</tbody>
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<tbody>
<tr>
<td>NPH/Regular 70/30 (Humulin® 70/30 and Novolin® 70/30)</td>
<td>30</td>
<td>18-24</td>
<td>• Adherence • Cost • Decreased complexity</td>
<td>• Decreased flexibility • Pharmacodynamic profiles</td>
</tr>
<tr>
<td>Aspart 70/30 (Novolog® Mix 70/30)</td>
<td>10-20</td>
<td>18-24</td>
<td>• Adherence • Decreased complexity</td>
<td>• Decreased flexibility</td>
</tr>
<tr>
<td>Lispro 75/25 (Humalog® Mix 75/25)</td>
<td>15-30</td>
<td>14-24</td>
<td>• Adherence • Decreased complexity</td>
<td></td>
</tr>
<tr>
<td>Lispro 50/50 (Humalog® Mix 50/50)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degludec/Aspart 70/30 (Ryzodeg® 70/30)</td>
<td>15</td>
<td>&gt;24</td>
<td>• Above plus once daily dosing option</td>
<td>• Currently unavailable in US</td>
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ADA. Diabetes Care. 2017;40(Suppl. 1):S64–S74
Lexi-Comp, Inc (Lexi-Drugs®). Lexi-Comp, Inc.; June 16, 2017
FORMULATION CONSIDERATIONS

- Most types of insulin available in vial (except Toujeo® and Tresiba®) and pen (except Novolin® products)
  - Pens generally more expensive than vials
  - Available in 3 mL and 10 mL vials and 3 mL pens (Toujeo® 1.5 mL)
- Reduced dexterity vs. vision impairment
  - Pressure required to press injection button on pens
  - Vision required to accurately read syringes
- Insulin administration devices (i.e. Autopen® 1-42 units)
- Consider caregiver availability and/or administration assistance when making recommendations

Lexi-Comp, Inc (Lexi-Drugs®). Lexi-Comp, Inc.; June 16, 2017
INHALED INSULIN

- Regular insulin (Afrezza®) (4, 8, and 12 unit dry powder cartridges)
- Prandial use
  - Limited dosing range (4 units-24 units based on conversion scale)
  - Pharmacokinetics comparable to rapid acting insulin
- Contraindicated in lung disease (i.e. asthma, COPD)
- Not recommended in patients that smoke or recently quit smoking and caution in patients with current or history of lung cancer
- Spirometry required prior to and after starting therapy to identify potential lung disease
  - Monitor FEV$_1$ at baseline, 6 months, yearly thereafter
  - Consider discontinuation if $\geq$ 20% decline in FEV$_1$

ADA. Diabetes Care. 2017;40(Suppl. 1):S64-S74
Lexi-Comp, Inc (Lexi-Drugs®). Lexi-Comp, Inc.; June 16, 2017
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</table>
Which of the following changes would you make to MH’s therapy for management of his diabetes?

A. Continue glyburide (Diabeta®), increase metformin (Glucophage®) to 850 mg PO TID

B. Discontinue glyburide (Diabeta®), initiate insulin NPH and insulin regular (Humulin® 70/30) 10 units SQ BID

C. Discontinue glyburide (Diabeta®), initiate pioglitazone (Actos®) 15 mg PO daily

D. Discontinue glyburide (Diabeta®), initiate insulin glargine (Lantus®) 15 units SQ QHS
Basal Insulin Dosing and Adjustments

- Basal insulin (usually with metformin)
  - 10 units per day or 0.1-0.2 units/kg/day
  - Adjust 10-15% or 2-4 units once or twice weekly to reach FBG target
- For hypoglycemia, determine and address cause
  - Decrease dose by 4 units or 20%
- Consider combination injectable therapy if A1C remains above target AND
  - Basal insulin titrated to FBG target OR
  - Basal insulin dose is >0.5 units/kg/day

BEFORE making adjustments, assess:
1. Timing of administration in relation to meals
2. Injection technique (including site selection and rotation)
3. Insulin stability

ADA. Diabetes Care. 2017;40(Suppl. 1):S64-S74
COMBINATION INSULIN THERAPY DOSING AND ADJUSTMENTS

Option 1

Add 1 rapid-acting insulin injection before largest meal

**Start:** 4 units, 0.1 U/kg, or 10% basal dose. If A1C <8%, consider ↓ basal by same amount

**Adjust:** ↑ dose by 1–2 units or 10–15% once or twice weekly until SMBG target reached

**For hypo:** Determine and address cause; if no clear reason for hypo, ↓ corresponding dose by 2–4 units or 10–20%

Option 2

Change to premixed insulin twice daily (before breakfast and supper)

**Start:** Divide current basal dose into ¾ AM, ¼ PM or ½ AM, ½ PM

**Adjust:** ↑ dose by 1–2 units or 10–15% once or twice weekly until SMBG target reached

**For hypo:** Determine and address cause; if no clear reason for hypo, ↓ corresponding dose by 2–4 units or 10–20%

Note: When switching NPH BID patients to glargine, give 80% of total daily NPH dose to reduce risk of hypoglycemia

Adapted from Figure 8.2 in ADA. Diabetes Care. 2017;40(Suppl. 1):S67
Lexi-Comp, Inc (Lexi-Drugs®). Lexi-Comp, Inc.; June 16, 2017
COMBINATION INSULIN THERAPY
DOsing AND ADJUSTMENTS

Option 1

If A1C not controlled, advance to basal-bolus

Add ≥2 rapid-acting insulin injections before meals (‘basal-bolus’)

Start: 4 units, 0.1 U/kg, or 10% basal dose/meal. If A1C <8%, consider ↓ basal by same amount
Adjust: ↑ dose(s) by 1-2 units or 10-15% once or twice weekly to achieve SMBG target
For hypo: Determine and address cause; if no clear reason for hypo, ↓ corresponding dose by 2-4 units or 10-20%

If goals not met, consider changing to alternative insulin regimen

Option 2

If A1C not controlled, advance to 3rd injection

Change to premixed analog insulin 3 times daily (breakfast, lunch, supper)

Start: Add additional injection before lunch
Adjust: ↑ doses by 1-2 units or 10-15% once or twice weekly to achieve SMBG target
For hypo: Determine and address cause; if no clear reason for hypo, ↓ corresponding dose by 2-4 units or 10-20%

Adapted from Figure 8.2 in ADA. Diabetes Care. 2017;40(Suppl. 1):S67
Self-Monitoring Blood Glucose (SMBG)

- Individualize blood glucose monitoring and involve family and/or caregivers
- Education/training should account for impairments in sensation, cognition, and functional/physical status
- Higher rates of unidentified cognitive deficits in older adults
  - Difficulty in complex self-care activities (e.g., SMBG, adjusting doses, etc.)
- Recommendations when providing education
  - Speak in simple terms
  - Use signals that aid memory (e.g. hands-on experience, demonstrations)
  - Sequenced visits to build on information

1 Kirkman MS, et al. Diabetes Care 2012;35:2650–2664
2 ADA. Diabetes Care. 2017;40(Suppl. 1):S64–S74
SELF-MONITORING BLOOD GLUCOSE (SMBG)

- Monitoring parameters
  - Basal insulin ➔ Fasting BG and preprandial BG
  - Bolus insulin ➔ 2-hr postprandial (PP) BG, bedtime, and preprandial BG at subsequent meal
- Adjust doses once or twice weekly
  - Do NOT increase insulin glargine (Toujeo®) more often than every 3 to 4 days
- An algorithm for self-titration of basal insulin based on SMBG improves glycemic control (ex. 3 units every 3 days based on target FBG)
  - Healthy patients with good functional capacity

1ADA. Diabetes Care. 2017;40(Suppl. 1):S64–S74
AFTER INITIATING INSULIN GLARGINE (LANTUS®) 15 UNITS SQ QHS, MH REPORTS A FBG RANGE OF 150-180 MG/DL WITH NO EPISODES OF HYPOGLYCEMIA, WHAT WOULD YOU RECOMMEND?

A. Decrease current dose by 3 units due to risk of hypoglycemia
B. Continue current insulin dose due to acceptable FBG values
C. Increase current insulin dose by 3 units due to FBG values above target
D. Increase current insulin dose by 6 units due to FBG values above target
RL is a 83 YO WF admitted to your nursing home 3 months ago. The physician consults you to review her DM therapy.

Date: 7/13/17

PMH: T2DM x 6 years (albuminuria x 2 years and retinopathy x 1 year)
HTN x 14 years
COPD x 9 years (oxygen during sleep)
Osteoporosis x 8 years
Anxiety x 16 years
Renal insufficiency x 2 years
TIA x 2 (2014)

SH: Widowed, 2 children
Retired teacher with Medicare insurance
Exercise: walks the hallway 6x/day (uses walker occasionally)
Diet: 1800 kcal diabetic diet (tends to eat less for breakfast or dinner, lunch largest meal)
(-) Tobacco-quit smoking 8 years ago, 25 pack years
(-) Alcohol and illicit drugs
### RL’s Vitals and Labs

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>144/86 mm Hg</td>
</tr>
<tr>
<td>HR</td>
<td>66 bpm</td>
</tr>
<tr>
<td>Height</td>
<td>5’6’’</td>
</tr>
<tr>
<td>Weight</td>
<td>141 lbs (64 kg)</td>
</tr>
<tr>
<td>BMI</td>
<td>23 kg/m²</td>
</tr>
</tbody>
</table>

#### Blood Work 7/13/17 at 0600

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na</td>
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</tr>
<tr>
<td>K</td>
<td>3.9</td>
</tr>
<tr>
<td>Cl</td>
<td>101</td>
</tr>
<tr>
<td>CO₂</td>
<td>32</td>
</tr>
<tr>
<td>BUN</td>
<td>26</td>
</tr>
<tr>
<td>SCr</td>
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</tr>
<tr>
<td>Glucose</td>
<td>202</td>
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<tr>
<td>AST</td>
<td>26</td>
</tr>
<tr>
<td>ALT</td>
<td>30</td>
</tr>
<tr>
<td>Total Chol</td>
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</tr>
<tr>
<td>LDL</td>
<td>124</td>
</tr>
<tr>
<td>HDL</td>
<td>36</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>228</td>
</tr>
<tr>
<td>A1c (July 2017)</td>
<td>10.2% (eAG 246 mg/dL)</td>
</tr>
</tbody>
</table>
## RL’s Medications

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</thead>
<tbody>
<tr>
<td>Amlodipine 10 mg daily</td>
<td>HTN</td>
</tr>
<tr>
<td>Aspirin 81 mg daily</td>
<td>Secondary Prevention</td>
</tr>
<tr>
<td>Calcium carbonate 600 mg/vitamin D3 200 units BID</td>
<td>Osteoporosis</td>
</tr>
<tr>
<td>Citalopram 20 mg daily</td>
<td>Anxiety</td>
</tr>
<tr>
<td>Combivent® (albuterol/Ipratropium) inhaler 2 puffs QID</td>
<td>COPD</td>
</tr>
<tr>
<td><strong>Glimepiride 4 mg daily</strong></td>
<td><strong>T2DM</strong></td>
</tr>
<tr>
<td><strong>Humulin® R sliding scale insulin (SSI) AC and HS (started 7/11/17)</strong></td>
<td><strong>T2DM</strong></td>
</tr>
<tr>
<td>Lisinopril 40 mg daily</td>
<td>HTN</td>
</tr>
<tr>
<td><strong>Metformin 500 mg BID</strong></td>
<td><strong>T2DM</strong></td>
</tr>
<tr>
<td>Spiriva® (tiotropium) 1 capsule inhaled daily</td>
<td>COPD</td>
</tr>
<tr>
<td>Symbicort® (budesonide/formoterol) 160/4.5 two inhalations BID</td>
<td>COPD</td>
</tr>
</tbody>
</table>
Which set of goals would you recommend for RL?

A. <7% (Preprandial 80-130, bedtime 80-140)
B. <7.5% (Preprandial 90-130, bedtime 90-150)
C. <8.0% (Preprandial 90-150, bedtime 100-180)
D. <8.5% (Preprandial 100-180, bedtime 110-200)
E. <9% (Preprandial 120-200, bedtime 160-240)
RL’s BG Patterns and SSI Doses

<table>
<thead>
<tr>
<th>Date and Time</th>
<th>BG Reading</th>
<th>SSI Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/11/17 0630</td>
<td>224</td>
<td>4 units</td>
</tr>
<tr>
<td>7/11/17 1130</td>
<td>178</td>
<td>2 units</td>
</tr>
<tr>
<td>7/11/17 1630</td>
<td>282</td>
<td>6 units</td>
</tr>
<tr>
<td>7/11/17 2130</td>
<td>146</td>
<td>2 units</td>
</tr>
<tr>
<td>7/12/17 0130</td>
<td>94</td>
<td>Woke up, felt “bad”, juice given</td>
</tr>
<tr>
<td>7/12/17 0630</td>
<td>238</td>
<td>4 units</td>
</tr>
<tr>
<td>7/12/17 1130</td>
<td>169</td>
<td>2 units</td>
</tr>
<tr>
<td>7/12/17 1630</td>
<td>302</td>
<td>8 units</td>
</tr>
<tr>
<td>7/12/17 2130</td>
<td>135</td>
<td>2 units</td>
</tr>
<tr>
<td>7/13/17 0200</td>
<td>86</td>
<td>sweating, juice given</td>
</tr>
<tr>
<td>7/13/17 0630</td>
<td>294</td>
<td>6 units</td>
</tr>
</tbody>
</table>
Which medication is most likely contributing to LR’s BG fluctuations and hypoglycemia?

A. Metformin (Glucophage®)
B. Insulin regular (Humulin® R)
C. Glimepiride (Amaryl®)
D. Albuterol/Ipratropium (Combivent®)
Which of the following changes would you make to LR’s regimen?

A. Increase glimepiride (Amaryl®) to 8 mg daily and increase metformin (Glucophage®) to 850 mg TID

B. Discontinue glimepiride (Amaryl®), continue SSI but change to insulin aspart (Novolog®)

C. Discontinue SSI and glimepiride (Amaryl®), initiate insulin regular (Humulin® R) 5 units 30 min before meals

D. Discontinue SSI and glimepiride, and consider discontinuation of metformin, initiate insulin glargine (Lantus®) 12 units SQ daily
Roller Coaster Effect of Insulin Sliding Scale

THE SSI ROLLER COASTER

- Inadequate glycemic control with more hypoglycemia, extreme glucose elevations (>300 mg/dL), and longer hospital stays compared to more intensive and physiologic insulin regimens¹-²

- Reactive vs. proactive³
  - Significant fluctuations in high and low BG levels
  - Hyperglycemia results if no insulin is administered due to “normal range”
  - High risk of hypoglycemia if not correlating with meal patterns

- Lack of individualization³
  - Basal metabolic needs, carbohydrate intake, weight, insulin sensitivity, or resistance

Higher risk of hypoglycemia without improvement in hyperglycemia management regardless of care setting

Guidelines recommend against its use

- ADA
  - Regimens with basal, nutritional, and correctional components preferred for noncritically ill patients depending on oral intake

- American Medical Directors Association

- American Geriatrics Society (Beers Criteria)

1. ADA. Diabetes Care. 2017;40(Suppl. 1):S120
SSI VS. BASAL-BOLUS (BB)

Figure 1 from Schmeltz LR. Lab Med. 2011;42(7):427-434
# SSI vs. Basal-Bolus (BB)

> Poorer glycemic control associated with SSI in the inpatient setting\textsuperscript{1-4}

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>RABBIT 2 Medical\textsuperscript{4} N=130</th>
<th>RABBIT 2 Surgical\textsuperscript{5} N=211</th>
<th>Basal Plus (BP) Trial\textsuperscript{6} n=353</th>
</tr>
</thead>
<tbody>
<tr>
<td>1° Mean BG (mg/dL)</td>
<td>193 (SSI) vs. 166 (BB) ((P&lt;.001))</td>
<td>176 (SSI) vs. 157 (BB) ((P&lt;.001))</td>
<td>After first day of therapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>172 (SSI) vs. 163 (BP) vs. 156 (BB) (BP vs. BB (P=.16), B vs. SSI (P=.04))</td>
</tr>
<tr>
<td>1° Composite of Postoperative Complications (%)</td>
<td>N/A</td>
<td>24.3 (SSI) vs. 8.6 (BB) ((P=.003))</td>
<td>N/A</td>
</tr>
<tr>
<td>BG Readings &lt;140 mg/dL (%)</td>
<td>66 (BB) VS. 38 (SSI)</td>
<td>53 (BB) vs. 31 (SSI) ((P&lt;.001))</td>
<td>42 (BP) vs. 37 (BB) vs. 32 (SSI) (B vs. SSI (P=.04))</td>
</tr>
<tr>
<td>Mild Hypoglycemia (%)</td>
<td>BG &lt;60 mg/dL</td>
<td>BG &lt;70 mg/dL</td>
<td>BG &lt;60 mg/dL</td>
</tr>
<tr>
<td></td>
<td>3 (SSI) vs. 3 (BB)</td>
<td>23.1 (BB) vs. 4.7 (SSI)</td>
<td>8 (BB) vs. 5 (BP) vs. 1 (SSI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>((P&lt;.001))</td>
<td>(B vs. SSI (P=11))</td>
</tr>
<tr>
<td>Severe Hypoglycemia &lt;40 mg/dL (%)</td>
<td>0 (SSI) vs. 0 (BB)</td>
<td>3.8 (BB) VS. 0 (SSI)</td>
<td>1 (BB) vs. 1 (BP) vs. 0 (SSI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>((P=.057))</td>
<td>(B vs. SSI (P=.76))</td>
</tr>
</tbody>
</table>

CONSIDERATIONS FOR LONG-TERM CARE FACILITY (LTCF) RESIDENTS

- 25-34% of residents have diabetes\(^1-2\)
  - Increased falls, rates of CVD and depression, functional impairment, and cognitive decline and dependency than residents without diabetes\(^1\)
- Irregular meal consumption, undernutrition, and impaired swallowing\(^1\)
  - Frequent staff turnover results in unfamiliarity with vulnerable patients and inadequate oversight of glycemic control and trends
- High prevalence of SSI regimens despite current recommendations\(^1-4\)
  - Lack of diabetes treatment algorithms\(^1\)
  - High fingerstick burden and poorer glycemic control\(^4\)
- Underutilization of basal insulin\(^5\)

CONSIDERATIONS FOR LTCF RESIDENTS

Cost considerations

- Pen vs. vial
  - Cost advantages with pen formulations short-term (<30 days) due to unused insulin remaining in 10 mL vials\(^1\)
  - Staff training and education on new insulin agents and treatment algorithms may require initial investment\(^2\)

- Resource utilization
  - Depends on number of injections (e.g., SSI vs. basal only vs. basal plus additional injections)

- Long-term costs analyses warranted

Hypoglycemia risk is the most important factor in determining glycemic goals due to the catastrophic consequences in this population. B

Simplified treatment regimens are preferred and better tolerated. E

- Basal insulin combined with oral agents may lower PPBG while reducing hypoglycemia risk and regimen complexity

Sole use of SSI should be avoided. C

Liberal diet plans have been associated with improvement in food and beverage intake in this population. To avoid dehydration and unintentional weight loss, restrictive therapeutic diets should be minimized. B

Physical activity and exercise are important in all patients and should depend on the current level of the patient’s functional abilities. C

<table>
<thead>
<tr>
<th>Current regimen</th>
<th>Suggested steps</th>
</tr>
</thead>
</table>
| SSI is the sole mode of insulin treatment                                                                                                         | • Review average daily insulin requirement over prior 5–7 days  
• Give 50–75% of the average daily insulin requirement as basal insulin  
• Stop SSI  
• Use noninsulin agents or fixed-dose mealtime insulin for postprandial hyperglycemia  
• Consider giving basal insulin in the morning to impact postprandial hyperglycemia and reduce risk of early-morning hypoglycemia |
| SSI is being used in addition to scheduled basal insulin                                                                                          | • Add 50–75% of the average insulin requirement used as SSI to the existing dose of basal insulin  
• Use noninsulin agents or fixed-dose mealtime insulin for postprandial hyperglycemia                                                                                 |
| SSI is being used in addition to basal and scheduled meal time insulin (i.e., correction dose insulin)                                             | • If correction dose is required frequently, add the average correction dose before a meal to the scheduled mealtime insulin dose at the preceding meal. For example, if glucose values are consistently elevated before lunch or dinner requiring 2–3 unit corrections, the scheduled breakfast or lunchtime dose of insulin could be increased by the average correction dose (2 units), respectively. Similarly, if glucose values are consistently elevated before breakfast requiring correction doses, the scheduled basal insulin dose could be increased by the average correction dose used |
| SSI is used in short term due to irregular dietary intake or due to acute illness                                                                  | • Short-term use may be needed for acute illness and irregular dietary intake  
• As health and glucose levels stabilize, stop SSI and return to previous regimen as tolerated                                                                 |
| Wide fluctuations in glucose levels in patients with cognitive decline and/or irregular dietary intake on a chronic basis                          | • Use scheduled basal and mealtime insulin based on individual needs with the goal of avoiding hypoglycemia  
• May use a simple scale, such as “give 4 units of mealtime insulin if glucose >300 mg/dL”  
• Keep patients hydrated, especially when glucose levels are high (e.g., >300 mg/dL)                                                                 |
You recommended to D/C glimepiride and metformin due to declining renal function. You also recommended to D/C SSI and to initiate Lantus 12 units daily on 7/13/17.

<table>
<thead>
<tr>
<th>Date and Time</th>
<th>Preprandial Reading</th>
<th>2-Hr PPBG</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/14/17 0630</td>
<td>168</td>
<td></td>
</tr>
<tr>
<td>7/14/17 0900</td>
<td></td>
<td>192</td>
</tr>
<tr>
<td>7/14/17 1700</td>
<td>226</td>
<td></td>
</tr>
<tr>
<td>7/15/17 0630</td>
<td>149</td>
<td></td>
</tr>
<tr>
<td>7/15/17 0900</td>
<td></td>
<td>188</td>
</tr>
<tr>
<td>7/15/17 1700</td>
<td>232</td>
<td></td>
</tr>
<tr>
<td>7/15/17 1900</td>
<td></td>
<td>208</td>
</tr>
<tr>
<td>7/16/17 0630</td>
<td>152</td>
<td></td>
</tr>
</tbody>
</table>
WHAT ADJUSTMENT WOULD YOU MAKE TO LR’S REGIMEN?

A. Add insulin regular (Novolin® R) 4 units 30 minutes before meals
B. Add insulin lispro (Humalog®) 6 units 15 minutes before meals
C. Add insulin lispro (Humalog®) 5 units 15 minutes before lunch
D. Increase insulin glargine (Lantus®) to 15 units SQ QHS
E. Increase insulin glargine (Lantus®) to 20 units SQ QHS
CORRECTONAL INSULIN DOSING

- Used to correct preprandial hyperglycemia
  - Administered in addition to bolus or nutritional insulin if prescribed
- Insulin Sensitivity Factor (ISF)
  - Number of mg/dL \textbf{1 unit} of insulin will lower BG
  - Calculate total daily dose (TDD) of insulin
    - 1500 rule (1500/TDD) - regular insulin
    - 1800 rule (1800/TDD) - rapid-acting insulin

Toyoshima MT, et al. Diabetol Metab Syndr. 2015;21(7):114
**PATIENT CASE EXAMPLE: APPLYING CORRECTIONAL INSULIN**

- **Current Regimen**
  - Insulin detemir (Levemir®) 10 units BID and insulin glulisine (Apidra®) 5 units with lunch and dinner

- **Target preprandial BG 140 mg/dL and current BG prior to dinner is 200 mg/dL**

- **Calculate TDD of insulin and determine ISF**
  - TDD = 30 units, 1800/30 = 60 mg/dL
  - 1 unit of insulin should lower BG by 60 mg/dL
  - Give 1 extra unit of insulin glulisine (Apidra®), so 6 total units should be given before dinner
IMPLEMENTING CHANGE

“Barriers to changing the sliding-scale insulin culture”
- Practitioners’ resistance
- Fear of hyperglycemia overcorrection and possible hypoglycemia
- Time to calculate bolus and correctional doses
- Lack of understanding of the risks associated with SSI

Overcoming barriers
- Ongoing education (administration, practitioners, nurses, etc.)
- Multidisciplinary effort
  - Design and implement new policies and procedures

Coggins MD. Aging Well. 2012;5(6):8
KEY TAKEAWAYS

- Heterogeneity of duration of disease, health statuses, and life expectancies limit standardized interventions for the elderly patient population

- **Individualize** goals and therapy

- Once-daily long acting insulin is preferred for basal therapy and rapid acting insulin is preferred for bolus or correction insulin therapy

- SSI creates a roller coaster effect with no evidence that it improves hyperglycemia and basal-bolus regimens create a more stable and physiologic BG profile
“IT’S MORE OF AN ART”: MANAGING INSULIN THERAPY IN THE OLDER PATIENT

Auburn University Harrison School of Pharmacy
Consultant Certification and Geriatric Pharmacotherapy CE Session
Saturday, July 22nd, 2017

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Assistant Clinical Professor
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