Insulin Therapy in Diabetes
So Many Choices...

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Disclosures

• Mytonomy-consultant
• Quantia –webinars
• Acknowledgements:
  — Dr. Sue Kirkman-UNC- Chapel Hill
  — Dr. Steve Edelman-UC-San Diego
  — Jan NicolleratDiabetes Educator Emeritus Duke
• 45 year old male with Type 2 diabetes times 5 years
• Metformin and Glipizide
• HgbA1C 9.5 (decreased from 11% at diagnosis)
• Feels poorly-
• His boss asked him-”why are you so lethargic?”

Should he start insulin?
Basal

- Background insulin

Bolus

- Meal insulin
- Correction (Not sliding scale)
### Insulin Preparations

<table>
<thead>
<tr>
<th>Modified human insulins</th>
<th>Regular, NPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin analogs</td>
<td>Rapid Acting: Aspart, Glulisine, Lispro</td>
</tr>
<tr>
<td></td>
<td>Long Acting: Glargine, Detemir, Degludec</td>
</tr>
<tr>
<td>Premixed insulins</td>
<td>Human N/R: 70/30, 50/50</td>
</tr>
<tr>
<td>(Proportions)</td>
<td>“N”/Analog: 70/30, 75/25</td>
</tr>
<tr>
<td></td>
<td>Degludec/Aspart: 70/30</td>
</tr>
<tr>
<td>Concentrations other than U-100</td>
<td>U-500 Regular</td>
</tr>
<tr>
<td></td>
<td>Degludec U-200</td>
</tr>
<tr>
<td></td>
<td>Lispro U-200</td>
</tr>
<tr>
<td></td>
<td>Glargine U-300</td>
</tr>
<tr>
<td>Basal insulin+GLP1 agonists</td>
<td>IDegLira, LixiLan</td>
</tr>
<tr>
<td>Biosimilar Insulin</td>
<td>BasaGlar (glargine)</td>
</tr>
<tr>
<td>Insulin other than by shots</td>
<td>Inhaled insulin</td>
</tr>
<tr>
<td></td>
<td>Disposable insulin delivery device</td>
</tr>
</tbody>
</table>

Kirkman, ACP Precourse, 2017

### What does it all mean?

- **U-100**
- **U-200**
- **U-300**
- **U-500**
Which Basal to Use?

- NPH much cheaper (uninsured/doughnut hole patient); caution regarding hypoglycemia

- If hypoglycemia a concern: Basal analog
  - Biosimilar glargine modestly less costly (discuss later)

- If hypoglycemia on glargine or detemir
  - Consider degludec or glargine U-300

Kirkman, ACP 2017
Patients can adjust their insulin

- Math literacy
- Check blood glucose
- Clear glycemic goals
- Avoid hypoglycemia

Cost is a factor

<table>
<thead>
<tr>
<th>Insulin</th>
<th>Cost</th>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPH(Novolin)</td>
<td>$24.00</td>
<td>10ml of 100 units/ml</td>
</tr>
<tr>
<td>Lantus</td>
<td>$266.78</td>
<td>5 pens/3ml</td>
</tr>
<tr>
<td>Basalgar</td>
<td>$333.32</td>
<td>5 pens/3ml</td>
</tr>
<tr>
<td>Toujeo</td>
<td>$275.28</td>
<td>3 pens/1.5ml</td>
</tr>
<tr>
<td>Tresiba</td>
<td>$464.38</td>
<td>5 pens/3ml</td>
</tr>
</tbody>
</table>

Prices from GoodRx at Walmart 5/2017
Factors that affect insulin absorption

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Strenuous use of injected limb within one hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massage of area</td>
<td>Do not rub site vigorously</td>
</tr>
<tr>
<td>Temperature</td>
<td>Heat increases, cold decreases</td>
</tr>
<tr>
<td>Site of Injection</td>
<td>Abdomen&gt;arms&gt;thigh (R &amp; N only)</td>
</tr>
<tr>
<td>Lipohypertrophy</td>
<td>Delays absorption</td>
</tr>
<tr>
<td>Large doses (&gt;80 units)</td>
<td>Delay onset and duration</td>
</tr>
</tbody>
</table>

Pattern Adjustments in Insulin Therapy

- Know Target Blood Glucoses
- Gather data
- Look for patterns
- Assess influencing factors
- Take action

Adapted from www.endotext.org, 2004
Diabetes Management

Dosing Info for SQ Insulin: KEY is WEIGHT-BASED Total Daily Dose

Type 1 – start 0.3-0.5 units/kg/day
Often quite sensitive; start on low end

Type 2 – start 0.3-0.7 units/kg/day
New to insulin: start on low end
Some patients may require > 1 unit/kg/day

EXAMPLE: 100 kilogram patient × 0.3 units/kg/day
= 30 units/day = Total Daily Dose

Truth or Myth?

Adding a single injection of insulin at bedtime to your oral medications can make a large improvement in your blood sugar levels?

Absolutely True

Jan Nicollerat ANP, CDE
Combination Therapy

• 1 injection per day
• Convenience (usually given at night)
• Slow, safe, and simple titration
• None or limited weight gain
• Effective improvement in glucose control

Diabetes Management

Distribution of the Total Daily Dose

Basic Starting Regimens: (*Type 2*)
(Oral plus) Basal Insulin Therapy (1-injection)
Premixed Insulin Therapy (2-injections)

Intensification: (*Type 1 and Type 2*)
Most Intensive: Basal-Bolus Insulin Therapy (4-shots)
In between: Stepwise Addition of Bolus Insulin to Basal Insulin

A 59 year-old educated businessman is currently on maximum doses of 3 oral agents: Metformin 1000 mg BID, Glipizide 20 mg BID and Pioglitazone 45 mg QD.

Refused to start insulin for years, but did try 10 units of glargine at bedtime. It “did not work” and he stopped it weeks ago. A1c > 8.8% for the past 3 years. Current HGM results below.

Case Presentation

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>L</th>
<th>D</th>
<th>HS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon</td>
<td>227</td>
<td>---</td>
<td>---</td>
<td>195</td>
</tr>
<tr>
<td>Tues</td>
<td>241</td>
<td>---</td>
<td>179</td>
<td>---</td>
</tr>
<tr>
<td>Wed</td>
<td>199</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Thurs</td>
<td>265</td>
<td>---</td>
<td>168</td>
<td>---</td>
</tr>
</tbody>
</table>
Why did this person with diabetes have such a hard time?

A. Patient inertia: He was afraid to start insulin
B. PCP inertia: The physician waited too long to discuss insulin
C. The dose of insulin was not increased appropriately