Hit Me With Your Best Shot: Updates in Insulin Therapy

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Pharmacist Learning Objectives
- List the onset, peak and duration of action for the various insulin preparations
- Determine which insulin to use and how to adjust doses based on blood glucose values from a given patient
- Assess where the newest insulin products fit into diabetes management

Pharmacy Technician Learning Objectives
- List the onset, peak and duration of action for the various insulin preparations
- Describe the newest insulin products
- Describe how blood glucose values are used to make adjustments to insulin regimens

Insulin Basics
- When is insulin indicated?
  - Type 1 = ALWAYS
  - Type 2 =
    - High baseline A1c
    - Poorly controlled on 3 oral/non-insulin medications
    - Contraindications to non-insulin medications
    - Pregnant women
    - Hospitalized patients

Review Question
- Which of the following appropriately orders the insulins from shortest acting to longest acting?
  A. NPH, Lantus, Humalog
  B. Humulin R, Novolog, Levemir
  C. Tresiba, NPH, Levemir
  D. Novolog, NPH, Lantus

<table>
<thead>
<tr>
<th>Types</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid-acting</td>
<td>Aspart (Novolog)</td>
</tr>
<tr>
<td></td>
<td>Lispro (Humalog)</td>
</tr>
<tr>
<td></td>
<td>Glulisine (Apidra)</td>
</tr>
<tr>
<td>Short-acting</td>
<td>Regular (Humulin R, Novolin R)</td>
</tr>
<tr>
<td>Intermediate-acting</td>
<td>NPH (Humulin N, Novolin N)</td>
</tr>
<tr>
<td>Long-acting</td>
<td>Glargine (Lantus, Basaglar, Toujeo)</td>
</tr>
<tr>
<td></td>
<td>Detemir (Levemir)</td>
</tr>
<tr>
<td>Ultra long-acting</td>
<td>Degludec (Tresiba)</td>
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</tbody>
</table>
**Insulin Basics**

<table>
<thead>
<tr>
<th>Rapid-acting</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15-30 min</td>
<td>30 min to 2.5 hours</td>
<td>3 to 6.5 hours</td>
</tr>
<tr>
<td>Short-acting</td>
<td>30 min to 1 hour</td>
<td>2 to 3 hours</td>
<td>8 hours</td>
</tr>
<tr>
<td>Intermediate-acting</td>
<td>1 to 2 hours</td>
<td>4 to 10 hours</td>
<td>16 to 24 hours</td>
</tr>
<tr>
<td>Long-acting</td>
<td>3 to 6.5 hours</td>
<td>Relatively flat</td>
<td>20 to 24 hours</td>
</tr>
<tr>
<td></td>
<td>1 to 2 hours</td>
<td>Relatively flat</td>
<td>22 to 24 hours (dose dependent)</td>
</tr>
<tr>
<td>Ultra long-acting</td>
<td>1 hour</td>
<td>9 to 12 hours</td>
<td>Up to 42 hours (still dosed once daily)</td>
</tr>
</tbody>
</table>

**Combinations**

| NPH + short-acting | 30 min to 1 hour | Dual | 10 to 16 hours |
| NPH + rapid-acting | Less than 15 min | Dual | 10 to 16 hours |
| Degludec + rapid-acting (Ryzodeg) | 5 to 15 min | 2 hours | > 24 hours |
| U-500              | 30 min | 4 to 8 hours | 13 to 24 hours |

**Newer Insulin Formulations**

- **Toujeo®**
  - Lantus, Basaglar = 100 units/mL
  - Toujeo = 300 units/mL (pen only, max dose 80 units/dose same as Lantus Solostar, but less volume)
- **Tresiba®**
  - Comes as 100 units/mL or 200 units/mL pen (delivers up to 160 units/dose)
- **Humulin® R U-500 Kwikpen®**
  - 500 units/mL pen-dials in increments of 5
  - Can administer up to 300 units with one injection

**Insulin Stability**

<table>
<thead>
<tr>
<th>Insulin</th>
<th>Vial</th>
<th>Pen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lispro, aspart, glulisine</td>
<td>28 days</td>
<td>28 days</td>
</tr>
<tr>
<td>Humulin R u-100</td>
<td>31 days</td>
<td>28 days</td>
</tr>
<tr>
<td>Humulin R u-500</td>
<td>40 days</td>
<td>28 days</td>
</tr>
<tr>
<td>Novolin R u-100</td>
<td>42 days</td>
<td></td>
</tr>
<tr>
<td>Humulin N</td>
<td>31 days</td>
<td>14 days</td>
</tr>
<tr>
<td>Novolin N</td>
<td>42 days</td>
<td></td>
</tr>
<tr>
<td>Glargine (Lantus)</td>
<td>28 days</td>
<td>28 days</td>
</tr>
<tr>
<td>Glargine (Toujeo)</td>
<td>42 days</td>
<td>42 days</td>
</tr>
<tr>
<td>Detemir (Levemir)</td>
<td>42 days</td>
<td>42 days</td>
</tr>
<tr>
<td>Degludec (Tresiba)</td>
<td>56 days</td>
<td></td>
</tr>
</tbody>
</table>
Patient Case #1

- Ted is a 67 year old man with type 2 diabetes x 7 years. His current weight is 100 kg. He is on metformin 1000 mg BID and glipizide 20 mg/day. His last A1c from 1 week ago was 10.5%.

Insulin Initiation

- How would you initiate insulin therapy in this patient?
  - Basal insulin
    - Start: 10 units/day or 0.1-0.2 units/kg/day
    - Adjust: 10-15% or 2-4 units once to twice weekly to reach fasting blood glucose target
    - Hypoglycemia: Address cause; decrease dose by 4 units or 10-20%.

Patient Case #1 (continued)

- Ted has now been on glargine for 9 months (along with metformin & glipizide) and his FBG levels are within goal with 80 units daily, but he still has 2 hr PPG levels above 180mg/dL.

Insulin Initiation

- When should mealtime insulin be considered?
  - If not controlled after FBG goal reached or if dose > 0.5 units/kg/day
    - Add 1 rapid insulin injection before largest meal of the day
    - Add > 2 rapid insulin injections before meals
    - Change to premixed insulin twice daily

Insulin Initiation

- “Sliding scale” insulin
  - On Beers list for those 65 years of age and older
  - Little clinical benefit with increased risk of adverse outcomes

Patient Case #1 (continued)

- Ted comes back to the clinic a year later and he is on metformin 1000mg BID, glargine 150 units daily, and Lispro 50 units prior to each meal. His A1C is 8.2 and he wants a more simple regimen with less co-pays and less injections.
Humulin R U-500

- Can be dosed BID or TID
  - BID: 60/40
  - TID: 40/30/30

Patient Case #1 (continued)

- TDD of insulin is:
  - 150 units Basal + 150 units Bolus

- A1C is 8.2
  - So in his case: 1:1 conversion to U-500
    - Can dose twice daily (60% breakfast/40% dinner)
      - 180 units AM and 120 units PM
    - Can dose as three times daily (40/30/30)
      - 120 units AM, 90 units lunch, 90 units dinner

Patient Case #1 (continued)

- Ted’s BG is much better controlled with AM readings at goal 80-130 before breakfast but his pre-dinner readings are typically 150-200.
  - What are the options?
    - Keep as BID & increase pre-breakfast by 5-10%
    - Change to TID dosing and change to 40/40/30 dosing (with same TDD)

Humulin R U-500

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  - What are the options?
    - Keep as BID & increase pre-breakfast by 5-10%
    - Change to TID dosing and change to 40/40/30 dosing (with same TDD)

Patient Case #2

Jane is a 50 year old female who comes to the hospital on metformin 1000mg BID & Januvia 100mg QAM. Initial BG at presentation is 210mg/dL and A1C is 7.8. Current weight is: 120kg. She is diagnosed with an acute exacerbation of COPD and steroids are initiated.

Physician asks for your assistance in managing this patient’s BG in the hospital.
Hospital Management of Diabetes

- ADA recommendations
  - Discontinue oral diabetes home medications
  - Initiate Basal-Bolus regimen
    - Initial dose: 0.3-0.6 units/kg/day
    - Target patients for lower range?
      - Lean, older, or at high risk of hypoglycemia
    - What about patients for higher range?
      - Obese, BG > 300mg/dL at admission, high steroid doses
    - 50% basal, 50% bolus with Sliding scale

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Patient Case #2 (continued)

- Jane’s TDD 60 units insulin per day
  - Basal:Bolus – 30 units basal: 10 units TID pre-meals
- Her BG levels are 180-300 mg/dL with highest level pre-dinner and lowest level fasting BG
  - Since FBG levels also still not at goal, can increase Basal by 10-20%
    - Pre-dinner is elevated: adjust pre-lunch dose by 10-15%

Glucocorticoid-Induced Hyperglycemia

- NPH versus Basal-bolus
  - NPH may be more effective
    - Prednisone/prednisolone
      - Peak effects occur 4-8 hrs post dose
      - Duration: 12-16 hrs
    - NPH Insulin
      - Peak: 4-10 hrs
      - Duration: 12-24 hrs
    - Studies not definitive

Patient Case #3

Ray is a 68 year-old male with a history of type 2 diabetes. He has been using the Lantus Solostar pen for the last year and is currently injecting 76 units nightly. Most recent HbA1c = 10%. He notes he experiences “leaking” of his dose when he gives his injection and is wondering about the new “Toujeo” pen he saw on TV.

- Would Toujeo be a reasonable option for Ray? Why or why not?

Patient Case #3

- Concentrated insulin glargine (AKA Touejo®)
  - Pen still only dials up to 80 units, but volume injected is less
  - Cost is equal to Lantus on unit per unit basis
  - 450 total units in each pen; pack of 3-1.5 mL pens
  - Conversion from Lantus is 1:1
    - Studies show patients treated with Toujeo required up to 11% more insulin than patients using Lantus
Patient Case #4

- Kendra is a 35 year old female who was admitted to the hospital for chest pain. BG 545 mg/dL & A1C 11.2%. No previous diagnosis of diabetes & started on basal/bolus insulin regimen inpatient and metformin 500mg BID.
- What things should occur with this patient prior to discharge from the hospital and at her community pharmacy?

Transitions of Care

- New diagnosis of Diabetes?
  - Glucometer, lancet & supplies
  - Counseling: new medications
  - Education re: diabetes
    - SMBG – best times to assess & BG goals
    - Hypoglycemia S/S & treatment
  - Nutrition Consult while inpatient
  - Referral to Outpatient diabetes class
  - Follow-up with PCP

References