Understanding your Insulin Activity Curve—AKA Your Crystal Ball (or Timing is Everything!)

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CHICAGO DIABETES EXPERTS
Type 1 Diabetes—Controlled or Not?
Type 1 Diabetes—Controlled, Really?!

Continuous Glucose Monitoring

Avg glucose
140 = A1c ~7
What We Expect
A Better Reflection of Reality
Problems In Type 1

- Glucose variability
- Glucagon excess, esp. post-meal
- Insulin deficiency, less than ideal injected insulin
- Western Diet, large meals, carbohydrate heavy
- Liver overproduction of glucose
Islet Architecture

**Type 1 Diabetes**

*Glucagon excess*

**Normal**

*Insulin predominates*
Subcutaneous insulin leads to whole body insulin excess
Normal is the Problem
Principles of Intensive Therapy of Type 1 Diabetes
Insulin Options
Action Profiles of Insulins

Humalog, Novolog, Apidra ~4 hours

Regular 6–8 hours

NPH 12–18 hours

Levemir 12-24 hours

Lantus >24 hours

Physiologic Multiple Injection Regimens

The Basal-Bolus Insulin Concept

- **Basal insulin**
  - Controls glucose production between meals and overnight
  - Near-constant levels
  - Usually ~50% of daily needs

- **Bolus insulin (mealtime or prandial)**
  - Limits hyperglycemia after meals
  - Immediate rise and sharp peak at 2 hours postmeal
  - 10% to 20% of total daily insulin requirement at each meal
Insulin Absorption Pattern with Intensive Insulin Therapy

Basal and Bolus

Adapted from Skyler J, Kelley’s Textbook of Internal Medicine. 2000.
Variable Basal Rate Continuous Subcutaneous Insulin Infusion (CSII) Program-uses Rapid Acting Insulin
No Repeating Pattern

30 yo female - Continuous glucose tracings for 21 days – A1c 7.5
Action Profile of “Rapid” Insulin
Here is your Crystal Ball

Humalog, Novolog, Apidra ~4 hours
Humalog, Novolog, Apidra 4–5 hours

2 hours to peak is not “fast”

Carbs
Delicious
Nutritious
Carbohydrates – Some are Only Delicious
A Glucose Spike with Every Meal
Pure Carbs Meals are Most Tricky
Use of Advance Insulin
When Do You Think This Patient Started Using Insulin In Advance of Meals?
Delay the Meal After Insulin if Glucose is High

A lower glucose at the start of a meal reduces glucose exposure.

Rules:
- Test early
- Bolus early
- Don’t forget to eat on time
- Don’t forget you’ve already bolused
Proteins and Fats are not Free!
Proteins
Intermediate Effect on Blood Glucose
FATS ARE SLOOOOOOW.....
Action Profiles of Insulins

Humalog, Novolog, Apidra 4–5 hours

4 hours often not long enough for food effect

High Carb + High fat
Carbs Spike Fast
Fats Keep You Up
The Ultimate Test!

Insulin Action

<table>
<thead>
<tr>
<th>Hours</th>
<th>Units</th>
</tr>
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<tbody>
<tr>
<td>2pm</td>
<td>100</td>
</tr>
<tr>
<td>530pm</td>
<td>160</td>
</tr>
<tr>
<td>9pm</td>
<td>120</td>
</tr>
<tr>
<td>6am</td>
<td>90</td>
</tr>
</tbody>
</table>

+ 10% basal
The Ultimate Test
Minimize Variables to Minimize Variance

- Variables: food and insulin

- If the doses of food and insulin are kept small, the variance in blood glucose is minimized
My strategy for success

A protein and 2 veggies
Veggies are very important!
This is More Flat than People Without Diabetes
Low Carbohydrate Diets are Often an Important Consideration

Trend Patterns

Statistics

- Average Glucose: 97 mg/dL
- Sensor Usage: 21 of 30 days
- Calibrations / Day: 5.48
- Standard Deviation: ± 20 mg/dL

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IMPROVING LIVES. CURING TYPE 1 DIABETES.
New Devices Make It Easier to Remember Where You Are on the Insulin Activity Curve
Action Profiles of Insulins
Even Basal Insulins Require Consideration

Glargine >24 hours
Detemir 12-24 hours

Thank you!