Improving Patient Acceptance and Adherence to Insulin Therapy in the Management of Type 2 Diabetes

Wednesday, April 27, 2011

Anaheim Convention Center
Anaheim, California
Session 1: Improving Patient Acceptance and Adherence to Insulin Therapy in the Management of Type 2 Diabetes

Learning Objectives

2. Individualize insulin strategies for patients with type 2 diabetes with regard to type of insulin agent, regimen, starting dose, and delivery device.
3. Identify and resolve patient barriers to adherence to insulin therapy.
4. Modify insulin therapy based on A1C levels and plasma glucose profiles with appropriate modification or intensification of therapy to achieve desired goals.

Faculty

Jeff Unger, MD
Associate Director of Metabolic Studies
Catalina Research Institute
Chino, California

Jeff Unger, MD, is the associate director for metabolic studies at the Catalina Research Institute in Chino, California. The Center uniquely incorporates primary care with clinical research in areas related to diabetes, metabolism, pain, obesity, and mental illness. Dr Unger is the recipient of the National Headache Foundation Speaker of the Year Award and has published more than 150 peer-reviewed articles, Medscape publications, and book chapters on diabetes, mental illness, and pain management. He has discussed the use of incretin therapies on Reach MD satellite radio several times in 2009. Over the past 6 years, Dr Unger has spoken internationally on topics linking mental illness with metabolic dysfunction, chronic pain disorders, and diabetic neuropathy, and on ways that primary care physicians might assist their diabetic patients to successfully achieve their metabolic targets. His medical textbook, entitled Diabetes Management in Primary Care (Lippincott, Williams & Wilkins) was published in April 2007. A second book on diabetes edited by Dr Unger was published by Elsevier in 2007.

Robert E. Rakel, MD
Professor, Department of Family and Community Medicine
Baylor College of Medicine
Houston, Texas

Robert E. Rakel, MD, is professor in the Department of Family and Community Medicine at Baylor College of Medicine, Houston, Texas. After receiving his medical degree from the University of Cincinnati College of Medicine and subsequent residencies in internal medicine and general practice, Dr Rakel was in private practice as a family physician in Newport Beach, California. In 1969, he was appointed the first chairman of family medicine at the University of California–Irvine College of Medicine. In 1971, he was selected to develop the Department of Family Practice at the University of Iowa and served as head of that department for 15 years. From 1985 to 1997, he served as associate dean for academic and clinical affairs at Baylor College of Medicine and as the Richard M. Kleberg, Sr. Professor and chairman of the Department of Family Medicine.

Over the past 30 years, Dr Rakel has written or edited more than 50 books. He is editor of the Textbook of Family Practice and Essentials of Family Practice, an undergraduate text for medical students; and he has been editor of Conn’s Current Therapy since 1984. He is or has served on the editorial boards of the Journal of the American Medical Association, the Archives of Internal Medicine, Consultant, the Journal of Clinical Psychopharmacology, and others.

Faculty Financial Disclosure Statements

The presenting faculty reported the following:

Dr Unger is a consultant to Amylin, Novo Nordisk Inc, and Roche; he is a speakers bureau member for Amylin, Lilly, and Novo Nordisk Inc; and he receives grants for contracted research from Novo Nordisk Inc, GlaxoSmithKline, sanofi-aventis, Roche, Forrest, AstraZeneca, Takeda, Daiichi-Sankyo, Ortho-McNeil, Arena, Wyeth, Cephalon, Procter & Gamble, Allergan, and Abbott. Dr Unger also receives royalty fees from Lippincott Publishing for Diabetes Management in Primary Care textbook.

Dr Rakel has no financial relationships to disclose.
**Education Partner Financial Disclosure Statement**

The content collaborators at Global Directions in Medicine have no financial relationships to disclose.

### Drug List

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### Suggested Reading List


Practical Pearls for Initiating Insulin for Patients With Type 2 Diabetes

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Case Scenario: Bob

- 58-year-old male, type 2 diabetes
- Diagnosed 10 years ago
  - BMI 29.6 kg/m²
  - Has lost 20 lb over last 4 to 5 years with diet and exercise; recently regained 5 lb
- Current therapy
  - Baby ASA, ACEI, statin
  - Metformin 1 g bid
  - Glimepiride 4 mg qd
- Current A1C level: 9.4%; FPG: 157 mg/dL
- Home glucose ranges
  - FPG: 110–170 mg/dL
  - PPG (2 hours): 160–250 mg/dL
- ROS negative except poor glucose control

What would you add to Bob’s therapy?

1. DPP-4 inhibitor
2. Insulin detemir
3. Insulin glargine
4. TZD
5. GLP-1 agonist
6. Nothing; encourage more intensive lifestyle changes

Case Scenario: Bob

- You started Bob on a long-acting insulin analog 10 units at bedtime and asked him to up-titrate his dose to reach FBS <110 mg/dL
- At 3-month visit
  - FBS: ~110–120 mg/dL
  - A1C level = 7.8%
- His current basal dose is 50 units at bedtime

What would your next step be with Bob’s treatment?

1. Increase his basal insulin dose further
2. Add a second dose of basal insulin in the morning
3. Add a rapid acting insulin analog to his largest meal

Current Status of Care

Adults with previously diagnosed diabetes achieving ADA-recommended A1C goal

NHANES III 1988–1989 (n = 1234)
NHANES 1999–2000 (n = 370)
NHANES 2003–2004 (n = 465)

Clinical Inertia

Phenomenon of failing to initiate or intensify therapy when indicated

Mean Number of Months with A1C > 7%
Pre-Test Question #1: On a scale of 1-7, rate your degree of actively trying to overcome clinical inertia relating to diabetes in your practice

1. Low
2. X
3. X
4. Medium
5. X
6. X
7. High

What A1C level prompts you to adjust therapy?

1. > 7% for more than 3 months
2. > 7.5% for more than 3 months
3. > 8% for more than 3 months
4. > 8.5% for more than 3 months
5. ≥ 9% for 1 time

Challenges in Achieving Targeted A1C Levels

- Late diagnosis and initiation of therapy
- Hesitancy to intensify therapy in patients who are not at or below target
- Lack of effective lifestyle interventions
- Adverse events associated with antihyperglycemic therapies
- Secondary drug failure vs continued programmed beta-cell death
- Complexity of care from both patient and physician perspectives
- Nonphysiologic attempts to control postprandial hyperglycemia

Pre-test Question #2: If following the ADA/EASD recommendations, which “well-validated” medication should be added when the combination of lifestyle management and metformin therapy no longer achieves the desired glycemic control?

1. Basal insulin
2. DPP-4 inhibitor
3. GLP-1 agonist
4. TZD

EASD = European Association for the Study of Diabetes.

ADA/EASD Consensus Statement Recommendations

Lifestyle Changes Are Difficult to Implement in Modern Times

AACE/ACE Diabetes Algorithm for Insulin Use

Insulin*
• ± other agents
• Not NPH/regular (analogs preferred)
• If ≥9.0% and symptomatic
• If triple combo fails
• Not reserved for last line use!

*A rapid-acting insulin analogue is superior to “regular human insulin” and provide a better, safer alternative. NPH insulin is not recommended. Use of NPH as a basal insulin has been superseded by the synthetic analogues insulin glargine and insulin detemir, which provide a relatively peakless profile for approximately 24 hours and yield better reproducibility and consistency, both between patients and within patients, and a corresponding reduction in the rate of hypoglycemia."

AACE = American Association of Clinical Endocrinologists; ACE = American College of Endocrinology; NPH = neutral protamine Hagedorn.


Progressive Nature of Type 2 Diabetes

IGT = impaired glucose tolerance.

A1C Level Increases With Time, Irrespective of Treatment Choice

OADs Often Fail to Maintain Control

• After 3 years, 50% of patients need more than 1 agent
• After 9 years, 75% of patients need more than 1 agent
• Eventually, most will require insulin

OADs = oral antidiabetic drugs.


Type 2 Treatment Algorithm

When a patient with type 2 diabetes is not controlled on monotherapy, what does the average physician do next?

1. Add a second OAD
2. Change OAD
3. Add insulin
Type 2 Treatment Algorithm

When a patient with type 2 diabetes fails on 2 OADs, what does the average physician do next?

1. Add a third OAD
2. Add insulin
3. Replace 1 OAD with insulin
4. Change 1 or both OADs

Antihyperglycemic Monotherapy: Maximum Therapeutic Effect on A1C

- Acarbose
- Nateglinide
- Sitagliptin
- Lianglizide
- Esmalade
- Rosiglitazone
- Pioglitazone
- Rogapilazine
- Glimperind
- Glimepride
- Glipizide GITS
- Metformin

Reduction in A1C Level (%)

-0.50 –1.0 –1.5 –2.0

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<th>Nateglinide</th>
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</tr>
<tr>
<td>Glipizide GITS</td>
<td>Metformin</td>
<td>Insulin</td>
</tr>
</tbody>
</table>

Selecting Insulin Therapies

- Basal-Bolus insulin ± Sensitizer(s)
- Basal insulin ± Oral Agent(s)
- Premixed insulin ± Sensitizer(s)
- Self-mix:
  - Rapid-acting analog or regular + NPH

Insulins Used in Clinical Practice

- Rapid-acting analogs:
  - Aspart
  - Lispro
- Short-acting insulin:
  - Regular (sulubins)
- Intermediate-acting insulin:
  - NPH
- Long-acting insulin:
  - Glargine
  - Detemir

Initiation and Adjustment of Insulin Regimens

- Start once-a-day long-acting insulin analog or NPH bedtime or morning
- Starting dose 10 units or 0.2 units/kg
- Titrate against FPG until in target range (70–130 mg/dL)
- Increase dose typically by 2 units q 3 days
- Can increase dose by 4 units q 3 days if BG >180 mg/dL
- If hypoglycemia occurs or if BG <70 mg/dL
  - Reduce dose by ≥4 U, or by 10% if dose >60 U
- A1C level <7% after 2–3 months?
  - Yes
    - Intensify Basal-bolus
    - Insulin
  - No
    - Continue regimen, recheck A1C level q 3 months

Why Insulin Analogs?

- Recombinant DNA technologies overcome limitations in the time–action profiles of conventional insulins
- Insulin analogs are associated with more physiologic time–action profiles
- Both rapid-acting and long-acting insulin analogs offer several advantages over human insulin (regular, NPH)

Advantages of Insulin Analogs Over Human Insulin

Rapid-acting
- More rapid onset
- Higher peaks
- More rapid return to basal levels
- Convenient mealtime administration
- Better PPG control
- Greater predictability
- Less hypoglycemia

Basal
- Less variability from day to day
- Longer-acting (up to 24 hours), once-a-day administration
- Lower risk of nocturnal and overall hypoglycemia
- Less weight gain


Less Hypoglycemia With Insulin Glargine vs NPH

Hypoglycemia Events per 100 Patient-years

NPH Insulin glargine

P = 0.004 between treatments

P = 0.021 between treatments

T1DM = type 1 diabetes mellitus

Predictive: Change in A1C Levels Following Switch to Insulin Detemir Therapy in Patients With Type 2 Diabetes

Baseline Follow-up

Previous Therapy

*Statistically significant differences.
Weight changes on the order of 1.2–2 kg were seen when therapy was switched to detemir.
Mean A1C Level (%)

Target A1C (%)


≈ 60% reach target A1C <7%

Treat-to-Target Study: Insulin Glargine vs NPH Insulin Added to Oral Therapy

Hypoglycemia defined as PG ≤ 72 mg/dL, by hour

*P <0.05 vs glargine.

Hypoglycemia by Time of Day (hour)

70% of patients achieved A1C <7%

Events per Patient-year

Insulin glargine

NPH Insulin

Risk of Hypoglycemia

P <0.001

P = 0.012

No difference in hypoglycemia.


Which of the following is the insulin starting regimen that you initiate most commonly in practice?

1. Single injection of basal insulin analog
2. Single injection of premixed insulin analog
3. Single injection of NPH
4. Single injection of human premixed insulin

Stepwise Treatment of Type 2 Diabetes

Further intensification

Insulin initiation

Basal

Basal Plus

Add prandial insulin at main meal

Additional OADs

Lifestyle Changes + Metformin

Progressive deterioration of beta-cell function

Long-acting Insulin Analogs vs NPH in Type 2 Diabetes: A Meta-analysis

• Provide comparable glycemic control to NPH
• Reduced risks of nocturnal and symptomatic hypoglycemia
• May be associated with less weight gain than NPH

A1C Level Reflects PPG and FPG


Fasting vs Postprandial Glucose Relationship to A1C Level


PREVENTIVE:
Basal Analog vs Premixed Analog
Change in A1C Level From Baseline to Study End

Documented Hypoglycemic Episodes (<56 mg/dL)

Premixed vs Basal-bolus

A1C Level Control in a Primary Care Setting:
Self-titrating an Insulin Analog Premix (INITIATEplus trial)

Initiated twice-daily biphasic insulin aspart 70/30 with 6 units pre-breakfast and 6 units pre-supper, self-titrating according to self-measured blood glucose values.

Subjects were randomized (1:1:1) to telephone counseling provided by a registered dietitian.

Hypoglycemia was experienced by 10.2% to 11.4% of the subjects in each group.

Rates of minor and major hypoglycemia were low but decreased as dietary counseling increased.


Basal Plus Mealtime Insulin

- Use rapid-acting analogs, not regular insulin
  - Easier timing, less postprandial hypoglycemia
  - Can be taken up to 20 minutes after start of meal
- Start with 1 shot, at largest meal:
  - 4 units and titrate, OR
  - By weight – 0.1 U/kg
- Titrate to:
  - <160 mg/dL 2 hours postprandial OR
  - <130 mg/dL next meal or bedtime
- Continue oral secretagogues until full basal-bolus regimen
The 1–2–3 Study: Achievement of A1C Targets With Premixed Insulin Analog Therapy

ITT population* (n = 100)
Mean baseline A1C level: 8.6%

<table>
<thead>
<tr>
<th>Subjects (Cumulative %)</th>
<th>≤6.5% (AACE)</th>
<th>&lt;7.0% (ADA)</th>
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<tbody>
<tr>
<td>QD</td>
<td>21</td>
<td>41</td>
</tr>
<tr>
<td>BID</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>TID</td>
<td>77</td>
<td>77</td>
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</table>

*All patients enrolled in the trial.

Options When Not at Goal With One Injection of Basal Insulin

- Add rapid-acting analog before meals
  - 10% of the basal dose
- OR
- Switch to a premixed insulin analog
  - Divide dose in half and give twice daily (breakfast and dinner) after meals if feeding uncertain
- OR
- Switch to basal-bolus

Summary

- Insulin therapy usually needed when A1C level >7.0% and blood glucose levels not controlled on multiple OADs
- In most situations, first address the fasting blood sugars with basal insulin therapy
  - Monitor blood glucose
  - Continue OADs or adjust dosages if necessary
  - Use adequate insulin
- Start prandial insulin at the meal with the highest postprandial blood glucose levels
- Promote continued adherence to a healthy diet and regular physical activity
- Be enthusiastic and confident as well as encourage and empower your patients!

Post-Test Question #1:
Moving forward, on a scale of 1-7, rate your degree of actively trying to overcome clinical inertia relating to diabetes in your practice

1. Low
2. X
3. X
4. X
5. X
6. X
7. High

Improving Patient Acceptance and Adherence to Insulin Therapy in Clinical Practice

Jeff Unger, MD
Associate Director of Metabolic Studies
Catalina Research Institute
Chino, CA

Post-test Question #2:
If following the ADA/EASD recommendations, which “well-validated” medication should be added when the combination of lifestyle management and metformin therapy no longer achieves the desired glycemic control?

1. Basal insulin
2. DPP-4 inhibitor
3. GLP-1 agonist
4. TZD
Case Scenario #1: Meet Phylles

- 67-year-old patient; T2DM x12 years
- A1C level in 2008 was 6.9%
- A1C level in 2009 was 7.4%
- A1C level in 2010 was 8.4%
- A1C level in 1/2011 was 9.1%; patient is symptomatic
- Current medications include metformin 850 mg bid and saxagliptin 5 mg qd
- All other metabolic parameters are within target range

Pre-test Question #3: What is the most appropriate treatment strategy at this time?

1. Add pioglitazone 15 or 30 mg in AM
2. Substitute a GLP-1 analog for the DPP-4 inhibitor
3. Initiate basal insulin, 10 units at bedtime and allow patient to self-titrate her dose based on specific fasting targeted blood glucose levels
4. Initiate basal insulin, 10 units at bedtime and re-check A1C level in 3 months
5. Refer to a CDE for lifestyle intervention
6. Refer to an endocrinologist

Pathophysiologic Approach to Treating Diabetic Hyperglycemia

### Principles of the AACE Guidelines/A1C Goal 6.5%
1. Minimize risk/severity of hypoglycemia
2. Minimize risk/severity of weight gain
3. Fast therapeutic changes (2–3 months; earlier even better)
4. Address fasting and postprandial glucose

#### Diet and Exercise

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<th>Diet and Exercise</th>
<th>Asymptomatic</th>
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<td>Pioglitazone</td>
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<tr>
<td>GLP-1 agonist</td>
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<tr>
<td>DPP-4 inhibitor (or AGI)</td>
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Therapeutic choice should match the drug with patient characteristics.


Endocrinologists; AGI = alpha-glucosidase inhibitor

Common Reasons Why Patients May Resist Insulin Replacement Initiation

- Fear of Needles
- Complexity of self-injection and pain
- Fear of hypoglycemia
- Observation of others’ experiences with insulin
- Ability to deal with insulin
- Whether the person will handle the equipment
- Feeling of loss of control
- Whether the person will handle the equipment
- Belief that insulin is unnecessary
- Lack of understanding of disease process
- Observation of others (death or complications will follow introduction of insulin)
- Belief that insulin is unnecessary
- Lack of understanding of disease process
- Not necessary with stricter dieting and increased exercise

Relative Risk of Progression of Diabetic Complications

<table>
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<th>Relative Risk</th>
<th>Mean A1C Level</th>
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<td>15</td>
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</tr>
<tr>
<td>13</td>
<td>7</td>
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<td>5</td>
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Progression of Treatment Options for Type 2 Diabetes

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<th>Years From Diagnosis</th>
<th>Established T2DM: OAD ± basal insulin</th>
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<tr>
<td>0</td>
<td>Early T2DM: non-insulin antihyperglycemic agents</td>
</tr>
<tr>
<td>6</td>
<td>Late T2DM: basal-bolus treatment</td>
</tr>
</tbody>
</table>


GLP-1 = glucagon-like peptide-1; DPP-4 = dipeptidyl peptidase-4; CDE = Certified Diabetes Educator.
Patients who are provided guidance can safely and effectively self-titrate insulin therapy.

1. True
2. False

Self-titration of Insulin Detemir: PREDICTIVE 303 Study
- Design: randomized 24-week study comparing physician- versus patient-directed basal insulin dose adjustment
- Subjects: type 2 diabetes
- Outcomes: Safety and efficacy
  Dose adjustments every third day

<table>
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<tr>
<th>FPG (mg/dL)</th>
<th>Response</th>
<th>FPG (mg/dL)</th>
<th>Response</th>
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<td>Reduce dose by 3 units</td>
<td>&gt;110</td>
<td>Increase dose by 3 units</td>
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<tr>
<td>80–110</td>
<td>No change</td>
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- FPG = fasting plasma glucose,

Patient Self-titration vs Physician-adjusted: A1C and Fasting Glucose in Type 2 Diabetes Treated With Long-acting Insulin Detemir

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<tr>
<td>A1C</td>
<td>N = 2441</td>
<td>N = 2457</td>
</tr>
<tr>
<td>FBG</td>
<td>N = 2392</td>
<td>N = 2409</td>
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Achieving Patient Acceptance of Treatment in Diabetes Management Can Be a Challenge

- The patient is given an overwhelming or vague goal:
  "Follow a meal and exercise plan, take medications, and check blood sugars"

- The health care provider is frustrated and may blame the patient

- The patient may feel like a failure if his/her disease is not controlled

How Do We Break the Cycle?
- Support patient with education and coaching
- Need time, knowledge, good communication, and caring


Which of the following insulin delivery devices do you prescribe most often?

1. Vial and syringe
2. Insulin pen delivery device
3. Pump
**Insulin Pens**

- More convenient than traditional vial and syringe
- Repeatedly more accurate dosages
- Easier to use for those with visual or fine motor skill impairments
- Less injection pain
  - Polished and coated needles are not dulled by insertion into a vial of insulin before a second insertion into the skin
- Increased patient acceptance and adherence
  - A greater likelihood (>100 times) of pen use was found when physicians merely presented the pen as an option


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**Phylles agrees to initiate basal insulin therapy:** 10 units at 9 PM increasing 1 unit every night until the fasting glucose level is <100 mg/dL. However, when she reaches 21 units (in 11 days), she feels "weak, cold, and clammy." At 2 PM her blood glucose = 173 mg/dL. She calls your office and is very worried. What should you tell her?

1. Drink 8 oz of orange juice and reduce your insulin dose by 2 units
2. Drink 4 oz of orange juice. Continue titrating your insulin as directed
3. Reassure patient that she is "getting better."
   Do not drink orange juice
4. Have your nurse call the endocrinologist to have the patient seen first thing tomorrow morning

**Hypoglycemia Incidence**

- **T1DM:** 2 episodes of symptomatic hypoglycemia weekly and 1 episode of severe hypoglycemia annually
- **T2DM:** Episodes of symptomatic hypoglycemia are dependent on the type of treatment and duration of the disease. Frequency of severe hypoglycemia is equal to that of T1DM!


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**Considerations in Insulin Delivery Device Selection**

- Consider pens for patients with visual impairment, manual dexterity problems
- Check patient insurance
  - Prior authorization may be needed
- Select between prefilled disposable or reusable pens
- Choose needle size/prescribe needles


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**Insulin Pens and Cartridges: Adopted Worldwide**

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**Insulin Delivery Devices (2011)**

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Symptoms

- **Adrenergic symptoms**
  - Usually seen in patients with a history of poorly controlled diabetes who are undergoing intensification. Blood glucose levels remain well above target, but lower than patient normally experiences. Symptoms: tachycardia, tachypnea, anxiety, and diaphoresis
- **Neuroglycopenic symptoms**
  - Blood glucose <50 mg/dL
  - Symptoms: lethargy, confusion, palpitations, sweating, perioral tingling, falling out of bed, visual loss, coma, seizures

Pathophysiology of Hypoglycemia

- **Counter-regulation**
  - Glucagon stimulates both glycogenolysis and gluconeogenesis (secreted when blood glucose = 65–70 mg/dL)
  - Epinephrine acts via beta-adrenergic receptors and stimulates glycogenolysis and gluconeogenesis (secreted when blood glucose = 65–70 mg/dL)
  - Cortisol and growth hormone contribute only after prolonged hypoglycemia by limiting peripheral utilization of glucose (secreted when blood glucose <60 mg/dL)

Hypoglycemia-associated Autonomic Failure (HAAF)

- Episodes of hypoglycemia, even if asymptomatic, impairs counter-regulatory defenses, resulting in one’s inability to respond to and recover from subsequent events

The Ravages of Iatrogenic Hypoglycemia

- **Hypoglycemic unawareness**
  - Loss of symptom recognition
- **Defective glucose counter-regulation**
- **Reduced adrenomedullary response (epinephrine)**
- **Reduced sympathoadrenal response to hypoglycemia x24 hours**

Risk Factors for iatrogenic Hypoglycemia

- **Factors that result in absolute or relative insulin excess**
  - Drug dose, timing, and type
  - Patterns of food ingestion and exercise
  - Interactions with alcohol and other drugs
  - Altered sensitivity to or clearance of insulin
- **Factors that are clinical surrogates of compromised glucose counterregulation**
  - Endogenous insulin deficiency
  - History of severe hypoglycemia, hypoglycemia unawareness, or both
  - Aggressive glycemic therapy per se, as evidenced by lower A1C levels, lower glycemic goals, or both

Preventing Hypoglycemia

- Educate regarding symptoms and effective treatment upon initiation of ANY diabetes therapy
- Utilize appropriate "lag times" for rapid-acting mealtime insulin analogs
- Consider using insulin pumps for patients with "malglycemia," as this could be due to delayed gastric emptying
- Exercise with target blood glucose levels of 120 to 180 mg/dL
- Understand insulin pharmacokinetics and principles of "active insulin on board" so that insulin stacking can be avoided
- Use of continuous glucose sensors when indicated for patients with HAAF
- “Paired glucose testing” can PREDICT hypoglycemia

Paired Glucose Testing. A 2-hour Post-meal Delta of –50 mg/dL Is Predictive of Impending Hypoglycemia

Paired Glucose Testing Can Provide Valuable Therapeutic Info to Patient

<table>
<thead>
<tr>
<th>Post-meal Delta Value</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;50 mg/dL</td>
<td>Not enough insulin used to cover carbs</td>
</tr>
<tr>
<td></td>
<td>&quot;Insulin lag time&quot; not utilized</td>
</tr>
<tr>
<td></td>
<td>Illness (flu)</td>
</tr>
<tr>
<td></td>
<td>Snacking between the meal and 2-hour check time</td>
</tr>
<tr>
<td>&gt;100 mg/dL</td>
<td>Forgot to give insulin (especially if delta &gt;200 mg/dL)</td>
</tr>
<tr>
<td></td>
<td>Insulin has expired or is denatured</td>
</tr>
<tr>
<td></td>
<td>Insulin antibodies forming</td>
</tr>
<tr>
<td></td>
<td>Insulin-to-carb mismatch</td>
</tr>
<tr>
<td>&lt;50 mg/dL</td>
<td>Too much insulin (watch for hypoglycemia)</td>
</tr>
<tr>
<td></td>
<td>Alcohol use (decreases gluconeogenesis)</td>
</tr>
<tr>
<td></td>
<td>Insulin stacking, consider this option when the delta is NEGATIVE at 2 hours!</td>
</tr>
</tbody>
</table>

Case Scenario #2: Meet Duffy

- 42-year-old martial arts instructor on an insulin pump for 8 years. Average A1C level = 6.2%
- Presents with complaint that for the past 6 weeks he has been unable to get his glucose levels below 200 mg/dL
- A1C level = 9.3%

What is the differential diagnosis of acute and prolonged hyperglycemia in a previously WELL-CONTROLLED patient using insulin therapy?

1. Insulin pump malfunction
2. Insulin allergies
3. Mental illness
4. Systemic illness/medication use
5. Celiac sprue
6. Disturbed eating behaviors
7. Lypodystrophy/lypaterrophy
8. All of the above

Pre-test Question #4: As part of your workup for acute, prolonged hyperglycemia, how often do you perform a comprehensive physical examination including vital signs and download the patient’s blood glucose meter?

1. Always
2. Sometimes
3. Never
Lypoatrophy in a Patient With “Brittle Diabetes”

Improving Adherence in Patients With Diabetes

- Praise every patient at every visit
- Understand that achieving “perfect” glycemic control is extremely challenging
- Challenge patients to take control of their diabetes rather than having diabetes control them
- Employ technology when possible
- Use phrases such as, “How would you like to be the first one in your neighborhood to use an insulin pen?”
- Refer to CDEs for patients who present with difficult issues (e.g., eating disorders, shift workers, mental illness, pregnancy, adolescents)
- Consider joining the ADA or AACE to become more involved in diabetes care
- Intensification of therapy of your patients will likely bring more patients to your practice!
- Consider “Group Visits” for your practice

Thanks!

Post-test Question #3:
Moving forward, what is the most appropriate treatment strategy at this time?

1. Add pioglitazone 15 or 30 mg in AM
2. Substitute a GLP-1 analog for the DPP-4 inhibitor
3. Initiate basal insulin, 10 units at bedtime and allow patient to self-titrate her dose based on specific fasting targeted blood glucose levels
4. Initiate basal insulin, 10 units at bedtime. Recheck A1C level in 3 months
5. Refer to a CDE for lifestyle intervention
6. Refer to an endocrinologist

Post-test Question #4:
As part of your workup for acute, prolonged hyperglycemia, how often will you perform a comprehensive physical examination including vital signs and download the patients blood glucose meter?

1. Always
2. Sometimes
3. Never