Objectives

- Discuss challenges of the transitions process that occurs at time of admission for a resident with diabetes.
- Identify potential clinical complications associated with assessment and management of the long-term care resident with diabetes.
- Define primary goals of diabetes management.
- Discuss effective management of glucose levels.
- Define role of Care Area Assessment (CAA) in developing.

A 79 year old male is admitted to your facility after a brief hospitalization. At home, prior to being hospitalized, he woke up late every morning, read his newspaper while having a cup of coffee, then he would get dressed and ready for the rest of his day.

At the LTC the staff would wake him up early in the morning to make sure he didn’t miss breakfast at 7 AM. There was no leisure time or newspaper before breakfast.

No coffee, no newspaper, no choice, but plenty of frustration.
Care Area Assessment

- Part of the MDS 3.0 included as a patient centered approach (CAA)
- Nutrition Professionals must complete a thorough assessment
- Residents have a voice: The focus is on the individual needs of the resident
- The assessment also includes care area triggers (CATs) to help identify areas that need special attention

Transitions of Care Issues

- Medication Reconciliation
  - If not on ASA or an ACE/ARB – Why?
- Laboratory reports from the hospital
  - Level of glucose control
  - Renal Function
- Changes from community regimen at time of hospital admission
  - Sliding Scale Insulin
  - Removal of Oral Agents
- Medications given during the hospital stay that could change glycemic control

The Physiology of Glucose
Managing Diabetes in LTC: Strategies for Long-Term Success
Albert Riddle, MD, CMD

Glucose Metabolism

- Food containing carbohydrate is consumed.
  - Starch
  - Sugar
  - Milk and some dairy products
  - Fruit
- Once in the stomach and digestive system carbohydrates are converted to glucose.
- Glucose then moves into the blood stream to provide a source of energy.

www.diabetes.org.uk

Glucose Metabolism

As glucose moves into the blood stream the body detects the rising levels.

Glucose Metabolism

The pancreas responds by releasing the hormone insulin into the blood stream. Glucagon, a hormone found in the pancreas, stimulates breakdown of Glycogen to glucose in the liver.

Incretins (GI Hormones): GLP1 and GIP
Hormones secreted by the Gastrointestinal Tract
- Stimulate beta cells in the pancreas to make insulin, in a glucose dependent fashion (more brisk response if glucose levels are already high), as soon as food enters the digestive tract, even prior to glucose entering the circulation.
- Slows rate of absorption of nutrients into the blood stream by reducing gastric emptying.
- Inhibit glucagon release (results in less glucose production and release by the liver).
- Sends signals to the brain that reduce appetite.

Both of these hormones are rapidly shut down by Dipeptidyl Peptidase-4 (DPP-4).

The blood stream then carries the insulin and glucose together to every part of the body that requires this form of energy.

Target cells, such as those in skeletal muscle, have glucose channels that will not allow passage unless opened by activation of insulin receptors by insulin.
Glucose leaves the bloodstream and enters the cell where it is needed for energy and as it does, the blood glucose level drops down to optimum levels.

Diabetes Mellitus

- **Type I**
  - The body does not make any insulin, usually due to an autoimmune response where the immune system destroys insulin producing cells in the pancreas.
  - Accounts for about 15% of all cases.
  - Most often found in individuals prior to age 40.
  - Most common type of diabetes found in childhood.

- **Type II**
  - Glucose and insulin travel to cells in the blood stream.
  - The insulin receptors are stimulated by insulin, but the glucose channels are not as responsive because of interference from local fat deposits, making it more difficult for insulin to enter the cells.
  - The blood glucose levels continue to rise.
Diabetes Mellitus Type II

- The pancreas responds by producing even more insulin resulting in high levels of both glucose and insulin.
- The cells, now desperate for energy, send out distress signals to the liver to release stored glucose.
- Ever increasing amounts of insulin are produced until the pancreas wears out.

Consequences of Poor Glycemic Control

The body tries to get rid of the excess sugar in the body through the kidneys. As the kidneys filter the glucose from the blood, it takes water with it. The result is an increase in both urination and thirst. Because the urine contains a lot of glucose bacteria is able to thrive. This results in genital rash with localized itching. Higher levels of bacteria will also be found in flesh wounds causing slow healing.

Glucose will accumulate in the lens of the front of the eye, causing the liquid in the lens to become cloudy. This will result in blurred vision. The diabetic will also become tired, and perhaps even lethargic, because they are not able to utilize glucose as an energy source. Further visual complications occur with progression of vascular disease and retinopathy.

The diabetic (more prominent in type I) will eventually break down fat stores as an energy source to replace the glucose that they can’t utilize, leading to weight loss.
Managing Diabetes in LTC: Strategies for Long-Term Success
Albert Riddle, MD, CMD

Natural History of Insulin Resistance

- Increase in insulin resistance.
- Increase in endogenous insulin in response to rising FPG and PPG.
- Increased hepatic glucose production in response to distress call from energy-deprived cells.
- Diagnosis somewhere in a 3 year window (grey box) after macrovascular damage has started.

Measures of Glycemic Control
Interpretation and Use in Clinical Practice

Diagnostic Criteria for Diabetes and Pre Diabetes

<table>
<thead>
<tr>
<th></th>
<th>WHO</th>
<th>ADA</th>
<th>AACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes Mellitus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FPG (mg/dL)</td>
<td>&gt;= 126</td>
<td>&gt;= 126</td>
<td>&gt;= 126</td>
</tr>
<tr>
<td>PCPG (mg/dL)</td>
<td>&gt;= 200</td>
<td>&gt;= 200</td>
<td>&gt;= 200</td>
</tr>
</tbody>
</table>

Impaired Fasting Glucose (IFG) – Pre-Diabetes

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FPG (mg/dL)</td>
<td>&lt; 126</td>
<td>100 – 125</td>
<td>100 – 125</td>
</tr>
<tr>
<td>PCPG (mg/dL)</td>
<td>&gt;= 140 &amp;</td>
<td>NVI</td>
<td>NVI</td>
</tr>
<tr>
<td></td>
<td>&lt; 200</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Impaired Glucose Tolerance (IGT) – Pre-Diabetes

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FPG (mg/dL)</td>
<td>110 – 125</td>
<td>NVI</td>
<td>NVI</td>
</tr>
<tr>
<td>PCPG (mg/dL)</td>
<td>&lt; 140</td>
<td>140 – 199</td>
<td>140 – 199</td>
</tr>
</tbody>
</table>

NVI = No value indicated, PCPG = Post-challenge Plasma Glucose
What is HgA1c

Hemoglobin is a protein in red blood cells. It contains iron and is used to carry oxygen from the lungs to the rest of the body.

For most patients, A1c measurements provide a record of average plasma glucose levels over the previous 2–3 months.

Conditions that affect red cell lysis or production, such as hemolytic anemia or erythropoietic stimulation, can falsely reduce HgA1c levels.

Hemoglobin molecules inside red blood cells are bound to glucose (glycosylated) in proportion to circulating glucose levels.

Correlation Between A1c and Estimated Average Plasma Glucose Levels

<table>
<thead>
<tr>
<th>A1c (%)</th>
<th>Estimated Average Glucose Level (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>97 (76 – 120)</td>
</tr>
<tr>
<td>6</td>
<td>126 (100 – 152)</td>
</tr>
<tr>
<td>7</td>
<td>154 (123 – 185)</td>
</tr>
<tr>
<td>8</td>
<td>183 (147 – 217)</td>
</tr>
<tr>
<td>9</td>
<td>212 (170 – 249)</td>
</tr>
<tr>
<td>10</td>
<td>240 (193 – 282)</td>
</tr>
<tr>
<td>11</td>
<td>269 (217 – 314)</td>
</tr>
<tr>
<td>12</td>
<td>298 (240 – 347)</td>
</tr>
</tbody>
</table>

(Data in parentheses are 95% confidence intervals)

The Importance of Glycemic Control

- **Kumamoto Study**
  - Intensive glycemic control prevented and delayed progression of
    - Neuropathy
    - Nephropathy
    - 69% risk reduction for worsening of condition
    - Retinopathy
    - 70% risk reduction for worsening of condition

- **UKPDS**
  - Lower glycemic levels yield a 26% reduction in risk for microvascular complications
  - 37% risk reduction for every 1% reduction in HgA1c
Subsequent Studies of Tight Control

- Advance Study and the VA Diabetes Trial
  - Both studies were completed in 2008
  - Intensive diabetic control was not associated with a significant decrease in cardiovascular events in either study.
  - Lower rates than expected of cardiovascular events was seen in both the standard and intensive treatment groups in both studies but this may have been due to better control of hyperlipidemia and hypertension in both groups.
  - Differed from ACCORD in that tighter glycemic control was not associated with cardiovascular-related death or death due to any cause.

Recent results from UKPDS

- A legacy effect may have been found in those who were in the tight glycemic control group
  - 10 years after completion of the study, the intensive glycemic control group is showing lower risk for MI than the standard treatment group even though differences in glycemic control between the two groups was lost as early as 1 year after the end of the study.
  - This most likely represents the complex nature of macovascular disease in diabetes.

Therapeutic Glycemic Targets

<table>
<thead>
<tr>
<th></th>
<th>IDF</th>
<th>ADA</th>
<th>AACE</th>
<th>AGS</th>
<th>AMDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c (%)</td>
<td>&lt; 6.5%</td>
<td>&lt; 7.0%</td>
<td>&lt;= 6.5%</td>
<td>*&lt;7%</td>
<td>*&lt;7%</td>
</tr>
<tr>
<td>PrePG (mg/dL)</td>
<td>&lt; 110</td>
<td>70 – 130</td>
<td>70 – 130</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PPG (mg/dL)</td>
<td>&lt; 145</td>
<td>&lt; 180</td>
<td>&lt; 180</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

IDF = International Diabetes Federation
ADA = American Diabetes Association
AACE = American Association of Clinical Endocrinologist
AGS = American Geriatrics Society
AMDA = American Medical Director’s Association
### Criteria for HgA1c Based Diagnosis

- The ADA published guidelines in January 2010 and again in January 2011 that recommend HgA1c level as an option for making the diagnosis of diabetes.
- The ADA did not recommend HgA1c for diagnosis prior to 2010 because of lack of standardization of the assay used to do the test.
  - Only standardized, validated assays should be used for HgA1c measurement (The lab should be certified by the NGSP).
- **Threshold 6.5%**

### Criteria for HgA1c Based Diagnosis

- Traditional glucose criteria should be used for diagnosis when feasible (AACE).
- If blood glucose levels are normal and the HgA1c exceeds 6.5%, the HgA1c should be repeated.
- HgA1c is not recommended for the diagnosis of type 1 diabetes or the diagnosis of gestational diabetes.
- HgA1c may be misleading in conditions associated with hemolysis, anemia, and severe hepatic or renal disease.

### FPG & PPG Contributions to A1c

<table>
<thead>
<tr>
<th>Poor Glycemic Control</th>
<th>HgA1c &lt; 7.3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contribution</strong></td>
<td><strong>Contribution</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Post Prandial Glucose levels make a greater relative contribution to HgA1c levels in patients with good glycemic control.
Managing Diabetes in LTC: Strategies for Long-Term Success
Albert Riddle, MD, CMD

FPG & PPG Contributions to A1c

- Data suggests that strategies for monitoring the diabetic must be personalized with changes made over time that are based on level of glycemic control.
- Currently there is support to use all 3 glycemic measures (A1c, FPG, and PPG) to direct therapy and achieve glycemic targets.

PPG: Current Treatment Guidelines

- ADA Guidelines
  - Include A1c measurements if a patient achieves FPG levels but does not meet A1c goals.
- AACE Guidelines
  - Management of the diabetic must include strategies that address both FPG and PPG.
- IDF
  - To achieve A1c goals, controlling PPG excursions is at least as important, and perhaps more important, than lowering FPG levels.
  - Optimal glycemic control cannot be achieved without adequate management of post-meal glucose.

Therapeutic Agents

<table>
<thead>
<tr>
<th>Focus of FPG</th>
<th>Focus on PPG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin</td>
<td>Rapid acting insulin analogs</td>
</tr>
<tr>
<td>Long Acting Insulin</td>
<td>Glinides</td>
</tr>
<tr>
<td></td>
<td>Alpha-glucosidase inhibitors</td>
</tr>
<tr>
<td></td>
<td>Amylin analogues</td>
</tr>
<tr>
<td></td>
<td>Incretin based therapies</td>
</tr>
</tbody>
</table>
Oral Antidiabetic Agents

- Oral agents may be initiated concurrently with lifestyle and diet modifications.
- Metformin is generally the preferred initial oral agent
  - Increases insulin sensitivity, decreases intestinal glucose absorption, decreases hepatic glucose production. Not associated with hypoglycemia.
  - Weight loss can occur
  - Caution with renal dysfunction (GFR < 60), CHF, dehydration, elderly (> 80 yrs).

Combining Oral Therapy

- If the HgA1c is initially > 9%, two agents of different classes will be required to achieve target HgA1c levels.
- The maximum reduction in A1c is approximately 2%.
- If FFP > 140 mg/dL or A1c > 7.0% a second drug of another class should be added.
- It is recommended that insulin be added if two oral agents are ineffective.

Categories of Oral Agents

- Sulfonylureas
  - Enhances insulin secretion; weight gain common
  - 1st generation agents should be avoided in the elderly
- Meglitinides
  - Shorter acting insulin secretagogues
- Alpha glucosidase inhibitors
  - Slows carbohydrate digestion
- Dipeptidyl Peptidase (DPP-IV) inhibitors
  - Enhanced insulin secretion
- Thiazolidinediones
  - Reduces insulin resistance
  - Multiple FDA alerts
AGS BEERS Criteria

2012 Update

<table>
<thead>
<tr>
<th>Drug System or Therapeutic Category or Drug</th>
<th>ADR</th>
<th>Evidence of Efficacy</th>
<th>Recommendation</th>
<th>Strength of Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repaglinide, long-acting磺酰脲类</td>
<td>Discontinue</td>
<td>High</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>Glipizide, metformin</td>
<td>Discontinue</td>
<td>High</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>Glibenclamide, repaglinide</td>
<td>Discontinue</td>
<td>High</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>Metformin</td>
<td>Discontinue</td>
<td>High</td>
<td>Strong</td>
<td></td>
</tr>
</tbody>
</table>

QA Activity

- Sample residents who are taking one or more oral diabetic agents.
  - Is renal function declining?
    - Evidence of worsening glycemic control while on an oral agent that was originally working
  - If on metformin is there increasing risk for lactic acidosis?
    - CHF
    - GFR falling & worsening level of renal insufficiency
  - Are long acting agents that increase insulin levels in use?

A 78 year old female who weighs 172 pounds (she weighed 192 pounds 6 months ago) and is a type II diabetic who has been well controlled on the following regimen for 10 months;

Metformin 500 mg BID
Lantus Insulin 30 units once daily at 9 PM
Regular Insulin 8 units three times daily
Sliding Scale Insulin 4 times daily

She has been more active since losing weight and now gets out of her wheelchair and ambulates long distances throughout the day.

An accucheck, done prior to administering 9 PM insulin, shows that her blood glucose level is 62. She is awake and alert with no symptoms of hyperglycemia and had 100% intake throughout the day.
Poll Question

1. Give insulin as ordered
2. Hold insulin

Key Resident Oriented Points

- Asymptomatic hypoglycemia
- 100% intake that day
- 10% weight loss over 6 months
- Increase in physical activity over 6 months
- Insulin has not been adjusted in 10 months

Insulin Therapy

- Insulin may be used in combination with one or more oral agents
- Insulin is available in many formulations
  - Short acting
  - Ultra-short acting
  - Intermediate acting
  - Long acting
  - Pre-mixed in various combinations
**Insulin Profiles**

<table>
<thead>
<tr>
<th>Insulin</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-Acting Basal Insulin</td>
<td>1–2 H</td>
<td>None</td>
<td>24 H</td>
</tr>
<tr>
<td>(Lantus)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-Acting Basal Insulin</td>
<td>3–4 H</td>
<td>6–8 H</td>
<td>6–24 H</td>
</tr>
<tr>
<td>(Levemir)</td>
<td></td>
<td></td>
<td>Dose Dependent</td>
</tr>
<tr>
<td>NPH Insulin</td>
<td>1–1.5 H</td>
<td>4–12 H</td>
<td>24 H</td>
</tr>
<tr>
<td>Premix Insulin</td>
<td>30 min</td>
<td>2–12 H</td>
<td>24 H</td>
</tr>
<tr>
<td>Regular human insulin</td>
<td>0.5–1 H</td>
<td>2–3 H</td>
<td>5–8 H</td>
</tr>
<tr>
<td>(Humulin. Novolin)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapid acting insulin</td>
<td>20 min</td>
<td>0.5–1.5 H</td>
<td>3–4 H</td>
</tr>
<tr>
<td>(Apidra, Humalog, Novolog)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 min</td>
<td>0.5–1.5 H</td>
<td>3–4 H</td>
</tr>
<tr>
<td></td>
<td>30 min</td>
<td>1–3 H</td>
<td>3–5 H</td>
</tr>
</tbody>
</table>

**Insulin Step Therapy**

- Continue oral therapy and add an intermediate or long-acting insulin if glycemic control is poor on maximum oral therapy or if you are starting to lose control on oral therapy.
- If long acting is used, a typical dose is 10 units per injection.
- Follow with a slow upward dose titration by 2 units per week until desired fasting blood glucose levels are obtained.

- If fasting glucose levels are obtained, but the HgA1c is still above target range, evaluate post prandial glucose levels
- Add short or rapid acting insulin one meal at a time
Use of Sliding Scale Insulin

- Routine and prolonged use is not recommended.
- Data does not support efficacy in obtaining and maintaining glycemic control.
- Risk is created by having sustained periods of hyperglycemia.
- Diabetic complications occur when blood glucose level over 200 mg/dL for extended periods of time.

Sliding Scale Monotherapy

- May be useful for a newly diagnosed diabetic to establish insulin requirement.
- Patients should be re-evaluated within 1 week and converted to a fixed daily insulin dose that minimizes the need for correction doses.

QA Activity

Sample residents with diabetes.

What percentage are getting accuchecks?
  - How Often?
  - Evidence to taper use over time?
  - Accuchecks without coverage?
  - Evidence that information is used to adjust treatment.
Estimating Insulin Doses

- Lean (BMI < 25) or new diabetic or new steroid induced hyperglycemia
  - 0.4 units/kg/day
- Overweight (BMI 25 – 30)
  - 0.5 units/kg/day
- Obese (BMI > 30) or high dose steroids
  - 0.6 units/kg/day
- Dialysis (regardless of BMI)
  - 0.3 units/kg/day

Physiologic = approximately 40-50% basal and 50-60% bolus insulin

Calculating Insulin Dose for Our Case Study

Step 1: Convert weight from pounds to kilograms

\[ 172 \times 0.543 = 78 \text{ kg} \]

BMI 31

Step 2: She needs 0.6 units/kg/day

\[ 78 \times 0.6 = 46 \text{ units/day} \]

At prior weight she required 52 units per day (was receiving 54)

Plan: Reduce insulin by 6 units to reduce risk of hypoglycemia

Correction Protocols for Hypoglycemia

- Basal Insulin Adjustment
  - Blood Glucose low in AM
    - Decrease basal insulin

- Bolus/ Rapid Acting Insulin
  - Blood glucose low before lunch
    - Decrease rapid acting insulin at breakfast
  - Blood glucose low before dinner
    - Decrease rapid acting insulin at lunch
  - Blood glucose low before bedtime
    - Decrease rapid acting insulin at dinner

Source: aida.org
Correction Protocols for Hyperglycemia

- All blood glucose levels > 200 mg/dL or high
  - Increase basal insulin by 0.1 units/kg
- All Pre-supper blood glucose high
  - Increase basal insulin by 0.1 units/kg
- Fasting AM blood glucose high
  - Perform 3 AM blood glucose checks

Source: 2aida.org

Management of Hypoglycemia

Hypoglycemia

- Defined as blood glucose level less than 70 mg/dL
- Incidence rises substantially with age.
- Frequently goes unrecognized due to asymptomatic or atypical presentation.
- Can result in long term disability, especially in cognitively impaired individuals.
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Albert Riddle, MD, CMD

Rule of 15

- Give 15 g of glucose or carbohydrate, which is equivalent to:
  - 1/2 cup juice
  - 1/2 cup apple sauce
  - 1 cup milk
  - 1 tube glucose gel
    - Insta-glucose (24 g carbohydrate in 31 g tube)
- Wait 15 minutes
- Recheck blood glucose levels. If level is still below the target, give another 15 g of glucose or carbohydrate and call MD
- Assess for possible cause of hypoglycemia and document

Use of Glucagon

- If the resident is unable to take oral glucose secondary of altered mental status or swallowing issues, Glucagon should be administered as follows
  - 1 mg Glucagon subcutaneously X 1 dose and call MD
  - Wait 15 minutes
  - Recheck blood glucose levels. If level is still below the target, give another 1 mg of Glucagon subcutaneously
  - Assess for possible cause of hypoglycemia and document

Tips on When to Call the MD for Diabetic Problems

- The patient has two or more blood glucose values greater than 250 mg/dL on current treatment regimen.
- The patient has blood glucose levels greater than 300 mg/dL during all or part of 2 consecutive days (may be mixed with normal or lower glucose levels).
Tips on When to Call the MD for Diabetic Problems

- The patient has a glucose level of < 70 mg/dL AND is unresponsive OR
- Has consecutive blood glucose readings less than 70 mg/dL.

It is important to initiate treatment for hypoglycemia immediate. Have protocols in place to start treatment while waiting for the prescriber to return your call.

Tips on When to Call the MD for Diabetic Problems

- The patient has not eaten well or not consumed sufficient fluids for 2 or more days and has one of the following additional symptoms
  - Abdominal pain
  - Fever
  - Hypotension
  - Lethargy
  - Confusion
  - Respiratory distress

Summary

- Diabetes, particularly type II, is a prominent chronic disease in the LTC setting.
- A1c levels are effective in both making diagnosis and monitoring response to treatment.
- PPG is an important parameter to monitor.
- “Intensive therapy” may not be in the best interest of all residents with diabetes.
- Many therapeutic options are available, however, use sliding scale insulin with caution.
Thank You
Questions?