DIABETES UPDATE 2019

OBJECTIVES

• REVIEW DIABETES DIAGNOSTIC CRITERIA
• REVIEW GOALS FOR GLUCOSE CONTROL
• HIGHLIGHT WHEN NEW DIABETES MEDS ARE APPROPRIATE AND WHEN OLDER ONES MAY BE NEEDED
• REVIEW DIABETES TECHNOLOGIES INCLUDING INSULIN PUMPS AND CONTINUOUS GLUCOSE MONITORS—WHO IS A CANDIDATE
Decision Cycle for Patient-Centered Glycemic Management in Type 2 Diabetes

Number and Percentage of U.S. Population with Diagnosed Diabetes, 1958-2015

DIABETES NUMBERS

- **Prevalence**: In 2015, 30.3 million Americans, or 9.4% of the population, had diabetes.
  - Approximately 1.25 million American children and adults have type 1 diabetes.
- **Undiagnosed**: Of the 30.3 million adults with diabetes, 23.1 million were diagnosed, and 7.2 million were undiagnosed.
- **Prevalence in Seniors**: The percentage of Americans age 65 and older remains high, at 25.2%, or 12.0 million seniors (diagnosed and undiagnosed).
- **New Cases**: 1.5 million Americans are diagnosed with diabetes every year.
- **Deaths**: Diabetes remains the 7th leading cause of death in the United States in 2015, with 79,535 death certificates listing it as the underlying cause of death, and a total of 252,806 death certificates listing diabetes as an underlying or contributing cause of death.

PREDIABETES NUMBERS

- Eighty-six million people aged 20 years and older
- 1 in 3 American adults
- The percentage of U.S. adults with prediabetes is similar for non-Hispanic whites (35%), non-Hispanic blacks (39%), and Hispanics (38%)
- Without weight loss and moderate physical activity, 15-30% of people with prediabetes will develop type 2 diabetes within 5 years

COST OF DIABETES

- **Updated March 22, 2018**
- $327 billion: Total costs of diagnosed diabetes in the United States in 2017
- $237 billion for direct medical costs
- $90 billion in reduced productivity
- After adjusting for population age and sex differences, average medical expenditures among people with diagnosed diabetes were 2.3 times higher than what expenditures would be in the absence of diabetes.
- Difficult to measure cost in relation to quality of life
CLASSIFICATION.

Diabetes can be classified into the following general categories:

1. Type 1 diabetes (due to autoimmune β-cell destruction, usually leading to absolute insulin deficiency)
2. Type 2 diabetes (due to a progressive loss of β-cell insulin secretion frequently on the background of insulin resistance)
3. Gestational diabetes mellitus (GDM) (diabetes diagnosed in the second or third trimester of pregnancy that was not clearly overt diabetes prior to gestation)
4. Specific types of diabetes due to other causes, e.g., monogenic diabetes syndromes (such as neonatal diabetes and maturity-onset diabetes of the young [MODY]), diseases of the exocrine pancreas (such as cystic fibrosis and pancreatitis), and drug- or chemical-induced diabetes (such as with glucocorticoid use, in the treatment of HIV/AIDS, or after organ transplantation)

Staging of Type 1 Diabetes

<table>
<thead>
<tr>
<th>Stage</th>
<th>Diagnostic criteria</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Autonomic neuropathy</td>
</tr>
<tr>
<td>2</td>
<td>Pancreatic neuropathy</td>
</tr>
<tr>
<td>3</td>
<td>Monogenic diabetes</td>
</tr>
</tbody>
</table>

DIAGNOSTIC CRITERIA FOR DM AND PREDIABETES

<table>
<thead>
<tr>
<th>Status</th>
<th>Fasting Glucose</th>
<th>Random BG</th>
<th>A1c</th>
<th>GTT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 99 mg/dl</td>
<td>3.5-5.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prediabetes</td>
<td>100-125 mg/dl</td>
<td>5.7-6.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>&gt; 126 mg/dl</td>
<td>&gt; 200 mg/dl</td>
<td>&gt;6.5%</td>
<td></td>
</tr>
<tr>
<td>Gestational</td>
<td>50 gm non-fasting 1 hour ≥140 mg/dl</td>
<td>100 gm OGTT Fasting &gt; 95 mg/dl 1 hr ≥180 mg/dl 2 hr ≥155 mg/dl 3 hr ≥140 mg/dl</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SCREENING RECOMMENDED

• All adults at 45, earlier if
  – BMI > 25
  – First degree relative
  – Physical inactivity
  – High risk race/ethnicity
  – Women delivered > 9# baby or PCOS
  – HDL < 35
  – A1C > 5.7%
  – Hypertension
  – CVD

• Gestational Diabetes
  – Screen for undiagnosed DM at first prenatal visit based on DM risk criteria
  – Screen all women at 24-28 weeks for those not previously known to have diabetes
  – 6 to 12 weeks postpartum, rescreen for diabetes

CHILDREN AT RISK

• Screening to begin age 10 or puberty onset if
  – Weight is >120% ideal body weight
  – Plus any two risk factors
    • Family history of type 2 dm
    • Race/ethnicity (Native American, African American, Latino, Asian American, Pacific Islander
    • Signs of insulin resistance: acanthosis nigricans, hypertension, dyslipidemia, PCOS, small for gestational age
    • Maternal history of DM or GDM during gestation

Acanthosis Nigricans
ADA/AACE GLUCOSE GOALS

INDIVIDUALIZATION OF GOALS

- More stringent targets if able to achieve without significant hypoglycemia
- Less stringent targets for those with history of severe hypoglycemia, limited life expectancy, advanced micro or macrovascular disease, limited life expectancy
Insulin Therapy in T2DM

- The progressive nature of T2DM should be regularly & objectively explained to T2DM patients.
- Avoid using insulin as a threat, describing it as a failure or punishment.
- Give patients a self-titration algorithm.

American Diabetes Association Standards of Medical Care in Diabetes. Approaches to glycemic treatment. Diabetes Care 2017; 40 (Suppl. 1): S64-S74

Combination Injectable Therapy in T2DM

American Diabetes Association Standards of Medical Care in Diabetes. Approaches to glycemic treatment. Diabetes Care 2017; 40 (Suppl. 1): S64-S74
New Recommendation: Pharmacologic Therapy For T2DM

- In patients with long-standing suboptimally controlled type 2 diabetes and established atherosclerotic cardiovascular disease, empagliflozin or liraglutide should be considered as they have been shown to reduce cardiovascular and all-cause mortality when added to standard care. Ongoing studies are investigating the cardiovascular benefits of other agents in these drug classes. B

American Diabetes Association: Standards of Medical Care in Diabetes. Approaches to glycemic treatment. Diabetes Care 2017; 40 (Suppl. 1): S64-S74

MIMICKING NATURE WITH INSULIN THERAPY

BASAL/BOLUS CONCEPT

- Suppresses glucose production between meals and overnight
- Nearly constant levels
- 50% of daily needs

Basal glucose


HELPING PATIENTS UNDERSTAND INSULIN REPLACEMENT
CURRENTLY AVAILABLE BASAL INSULINS

<table>
<thead>
<tr>
<th>Insulin Type</th>
<th>NPH Insulin</th>
<th>Insulin Glargine U-100 &amp; U-300</th>
<th>Insulin Degludec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset, hr</td>
<td>2-4</td>
<td>0.5-1</td>
<td>0.25</td>
</tr>
<tr>
<td>Peak, hr</td>
<td>4-10</td>
<td>No pronounced peak</td>
<td>Relatively flat</td>
</tr>
<tr>
<td>Effective duration, hr</td>
<td>10-16</td>
<td>U-100: Up to 24 hrs U-300: Beyond 24 hrs (pen only)</td>
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CURRENTLY AVAILABLE SHORT-ACTING PRANDIAL INSULINS

<table>
<thead>
<tr>
<th>Insulin Type</th>
<th>Regular Insulin</th>
<th>Insulin Lispro U100 U200 (pen only)</th>
<th>Insulin Aspart</th>
<th>Insulin Glulisine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset, hr</td>
<td>0.5-1</td>
<td>0.5-2.5</td>
<td>0.5-1.0</td>
<td>0.25-0.5</td>
</tr>
<tr>
<td>Peak, hr</td>
<td>2-3</td>
<td>0.5-3.5</td>
<td>1-1.5</td>
<td>0.5-1</td>
</tr>
<tr>
<td>Effective duration, hr</td>
<td>3-6</td>
<td>3-6.5</td>
<td>3-5</td>
<td>3-5</td>
</tr>
<tr>
<td>Injection meal timing, min</td>
<td>-30 to -45</td>
<td>-15 to immediately after</td>
<td>5 to 10</td>
<td>15 to 30</td>
</tr>
</tbody>
</table>

INHALED INSULIN - AFREZZA

Spirometry prior to starting and at 4 months; then annually.
INSULIN REPLACEMENT WITH INTERMEDIATE- AND SHORT-ACTING INSULINS

Risk of hypoglycemia

Time of day

Relative concentrations plasma insulin

Absorptive period

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Relative concentration plasma insulin

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CLASSIFICATION OF HYPOGLYCEMIA

<table>
<thead>
<tr>
<th>Level of Hypoglycemia</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe hypoglycemia</td>
<td>No specific glucose threshold</td>
</tr>
<tr>
<td>Moderate hypoglycemia</td>
<td>Glucose &lt; 54 mg/dL (3.0 mmol/L)</td>
</tr>
<tr>
<td>Clinically significant hypoglycemia</td>
<td>Glucose &lt; 71 mg/dL (3.9 mmol/L)</td>
</tr>
<tr>
<td>Mild hypoglycemia</td>
<td>Glucose &lt; 95 mg/dL (5.3 mmol/L)</td>
</tr>
</tbody>
</table>

RISK FACTORS FOR HYPOGLYCAEMIA IN THE OLDER ADULT

- Use of insulin or insulin secretagogues
- Poly-pharmacy (≥ 5 concurrent medications)
- Cognitive decline, depression
- Duration of diabetes
- Antecedent hypoglycaemia
- Hospital discharge within the preceding 30 days
- Comorbidities such as renal insufficiency
- Use of non-steroidal anti-inflammatory drugs

NOCTURNAL HYPOGLYCAEMIA

- During sleep, the neuroendocrine response against hypoglycaemia is markedly blunted (the response threshold is shifted to lower glucose levels)
- While symptoms of hypoglycaemia trigger awakening in healthy subjects, individuals with type 1 diabetes frequently fail to respond to symptoms during sleep
RISK FACTORS FOR NOCTURNAL HYPOGLYCEMIA

- Intensive Insulin Management
- Exercise
- Bedtime blood glucose level
- Daytime hypoglycemia
- Premix insulin twice daily/NPH insulin
- Alcohol
- Impaired sympathoadrenal response during sleep
- Children who go to bed early
- Use of sulfonylureas (type 2 diabetes)

HYPOGLYCEMIA

- Individuals at risk for hypoglycemia should be asked about symptomatic and asymptomatic hypoglycemia at each visit
  - At what number do you feel your low blood glucose
  - Have you had any hypoglycemia that required the assistance of another person or glucagon
  - Not limited to only those on insulin
TECHNOLOGY

INSULIN INFUSION PUMP OPTIONS

Tandem basal IQ
Omnipod Dash
Medtronic 670G

INSULIN PUMP-HOW IT WORKS

Dosage instructions are entered into the pump, which calculates and the appropriate amount of insulin is then injected into the body in a calculated, controlled manner.
Insulin pump
Recommendations: Glucose Monitoring (2)

- Most patients on multiple-dose insulin (MDI) or insulin pump therapy should do SMBG
  - Prior to meals and snacks
  - At bedtime
  - Prior to exercise
  - When they suspect low blood glucose
  - After treating low blood glucose until they are normoglycemic
  - Prior to critical tasks such as driving
  - Occasionally postprandially


Recommendations: Glucose Monitoring (3)

- When used properly, CGM in conjunction with intensive insulin regimens is a useful tool to lower A1C in selected adults (aged ≥ 25 years) with type 1 diabetes. A
- Although the evidence for A1C lowering is less strong in children, teens, and younger adults, CGM may be helpful in these groups. Success correlates with adherence to ongoing use of the device. B
- CGM may be a supplemental tool to SMBG in those with hypoglycemia unawareness and/or frequent hypoglycemic episodes. C

Recommendations: Glucose Monitoring (4)

• Given variable adherence to CGM, assess individual readiness for continuing use of CGM prior to prescribing. E
• When prescribing CGM, robust diabetes education, training, and support are required for optimal CGM implementation and ongoing use. E
• People who have been successfully using CGM should have continued access after they turn 65 years of age. E

American Diabetes Association, Standards of Medical Care in Diabetes. Glycemic targets. Diabetes Care 2017; 40 (Suppl. 1): S48-S56

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