Prediabetes: An Overview

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Objectives
- Definitions
- Prevalence of prediabetes and diabetes
- Physiology of prediabetes
- Link between prediabetes and oral health

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Fasting Plasma Glucose (mg/dL)</th>
<th>OGTT (2 hr post glucose load) (mg/dL)</th>
<th>HbA1c (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;100</td>
<td>&lt;140</td>
<td>&lt;5.7</td>
</tr>
<tr>
<td>IFG*</td>
<td>100-125</td>
<td>140-199</td>
<td>5.7-6.4</td>
</tr>
<tr>
<td>IGT**</td>
<td></td>
<td>140-199</td>
<td>5.7-6.4</td>
</tr>
<tr>
<td>Diabetes</td>
<td>≥126</td>
<td>≥200</td>
<td>≥6.4</td>
</tr>
</tbody>
</table>

OR: ≥ 200 mg/dl casual plasma glucose (regardless of time since last meal) plus symptoms of diabetes (polyuria, polydipsia, unexplained weight loss)

*IFG – impaired fasting glucose; **IGT – impaired glucose tolerance
Undiagnosed type 2 diabetes ~8.1 million
Prediabetes ~79 million
Diagnosed type 2 diabetes ~21 million
Diagnosed type 1 diabetes ~1.0 million

Type 2 Diabetes Risk Factors
- Obesity
- Family History
- Age
- Race/ethnicity
- Impaired fasting glucose/impaired glucose tolerance
- Gestational diabetes or baby >9 lb
- Polycystic ovarian syndrome

Overweight and Obesity Trends in U.S. Adults

http://ndep.nih.gov/diabetes-facts/
**Relationship Between BMI and Risk of Type 2 Diabetes Mellitus**

![Graph showing the relationship between BMI and the relative risk of type 2 diabetes mellitus.](image)

**Obesity and Diabetes in Maryland**

- Obesity: 1.68 million (28.8%)
- Diabetes: 400,679 (8.9%)

![Maps showing obesity and diabetes prevalence in Maryland.](image)

**Age at Diagnosis of Diabetes**

![Bar chart showing the age at diagnosis of diabetes.](image)
**Prevalence of Diabetes by Age**

![Bar chart showing prevalence of diabetes by age and gender](chart1.png)

**Prevalence of Type 2 Diabetes by Race/Ethnicity**

![Bar chart showing prevalence of diabetes by race/ethnicity](chart2.png)

**Metabolic Syndrome**

<table>
<thead>
<tr>
<th>Trait</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting glucose</td>
<td>$\geq 100 \text{ mg/dL}$</td>
</tr>
<tr>
<td>Abdominal obesity-waist circumference</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>$&gt;40 \text{ inches}$</td>
</tr>
<tr>
<td>Women</td>
<td>$&gt;35 \text{ inches}$</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>$\geq 150 \text{ mg/dL}$</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>$&lt;40 \text{ mg/dL}$</td>
</tr>
<tr>
<td>Women</td>
<td>$&lt;50 \text{ mg/dL}$</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>$\geq 130/85 \text{ mm Hg}$</td>
</tr>
</tbody>
</table>
Risk of Type 2 Diabetes with Family History of Diabetes

<table>
<thead>
<tr>
<th>Population</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>General population</td>
<td>9.3</td>
</tr>
<tr>
<td>Identical twin</td>
<td>60-90</td>
</tr>
<tr>
<td>Brother/Sister</td>
<td>40</td>
</tr>
<tr>
<td>Child of diabetic father</td>
<td>40</td>
</tr>
<tr>
<td>Child of diabetic mother</td>
<td>40</td>
</tr>
</tbody>
</table>

Type 2 Diabetes Genetic Studies

- Over 70 genes associated with prediabetes and type 2 diabetes
  - Beta cell function/insulin secretion
  - Beta cell formation
  - Insulin signaling pathway
  - Adipocyte differentiation
  - Weight
  - Unknown

Genetics of Type 2 Diabetes

<table>
<thead>
<tr>
<th>Gene</th>
<th>Per allele odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCF7L2</td>
<td>1</td>
</tr>
<tr>
<td>KCNQ1</td>
<td>1.1</td>
</tr>
<tr>
<td>CDKN2B</td>
<td>1.2</td>
</tr>
<tr>
<td>FTO</td>
<td>1.3</td>
</tr>
<tr>
<td>HHEX/IDE</td>
<td>1.4</td>
</tr>
<tr>
<td>SLC30A8</td>
<td></td>
</tr>
<tr>
<td>THADA</td>
<td></td>
</tr>
<tr>
<td>PPARG</td>
<td></td>
</tr>
<tr>
<td>KCNJ11</td>
<td></td>
</tr>
<tr>
<td>CDKAL1</td>
<td></td>
</tr>
<tr>
<td>IGF2BP2</td>
<td></td>
</tr>
<tr>
<td>NOTCH2</td>
<td></td>
</tr>
<tr>
<td>WFS1</td>
<td></td>
</tr>
<tr>
<td>CDC123/CAMK1D</td>
<td></td>
</tr>
<tr>
<td>HNF1B</td>
<td></td>
</tr>
<tr>
<td>JAZF1</td>
<td></td>
</tr>
<tr>
<td>TSPAN5/LGR5</td>
<td></td>
</tr>
<tr>
<td>ADAMTS9</td>
<td></td>
</tr>
</tbody>
</table>

Medicographia 31:307 2009
Natural History of Type 2 Diabetes

Pathophysiology of Type 2 Diabetes

Diabetes/Obesity Genes
- Aging, Lifestyle
- Adipokines, Inflammation

TNFα and Insulin Resistance

- TNFα Receptor
- Insulin Receptor
- IRS1
- JNK

Insulin Signaling Pathway
**Pathophysiology of Type 2 Diabetes**

Diabetes/Obesity Genes
Lifestyle, Adipokines
Inflammation

- **Beta Cell Dysfunction**
- **Glucotoxicity**
- **Lipotoxicity**

- **Insulin Resistance**
- **Insulin**
- **Lipolysis**
- **Free Fatty Acids**
- **Glucose Production**
- **Glucose Uptake**

**Diabetes & the Incretin Effect**

- Healthy Patients
- Type 2 Diabetics

- GLP1 & GIP1
- GLP1 & GIP1

- Oral Glucose (50 g/400 ml)
- Isoglycemic IV Glucose Infusion


**Prediabetes and Associated Disorders**

- Periodontal disease
- Cardiovascular disease
- Cognitive dysfunction
- Hypertension
- Obstructive sleep apnea
- Low testosterone
- Fatty liver disease
- Cancer
Diabetes and Periodontal Disease: a two-way relationship

Diabetes —————————————————— Periodontitis

Periodontal Disease in Newly Diagnosed Pre-DM and Type 2 DM

Diabetes and Periodontitis

J Clin Periodont 41:1055 2014

J Periodontol 84(4 Suppl.):S113 2013
Diabetes and Periodontitis

- Chronic Periodontitis
- Immune dysfunction and cytokine imbalance (TNFα, IL-6, IL-1β)
- Adipocyte release of FFAs
- Impaired insulin signaling
- Insulin resistance
- Hyperglycemia
- Diabetes

UNIVERSITY OF MARYLAND SCHOOL OF MEDICINE AND DENTISTRY COLLABORATION

- Over the past 3 years, >400 students University of Maryland second year dental students trained on how to use a glucometer and how to interpret results

UNIVERSITY OF MARYLAND SCHOOL OF MEDICINE AND DENTISTRY COLLABORATION

- Identify patients at high risk for diabetes using a screening questionnaire
- Fingerstick glucose if meet high risk criteria
- Referred to PCP or endocrinologist if fasting glucose ≥100 mg/dL or nonfasting ≥140 mg/dL
49 of 67 patients → high risk for diabetes
Given pamphlets about lifestyle changes and diabetes risk factors
26 of 28 patients agreed to fingerstick blood sugar check
3 patients referred back to PCP for follow-up of elevated glucose