Misdiagnosis of Diabetes

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Objectives

- Define the Incidence and Prevalence of Diabetes in the United States
- Review the ADA standards of care regarding the testing for diabetes in asymptomatic adults and children
- Define the ADA diagnosis criteria for Pre-diabetes and Diabetes
- Define the ADA classifications of Diabetes
- Discuss the characteristics of each classification:
  - Type 1
  - Latent Autoimmune Diabetes of the Adult
  - Type 2
- Case Study: LADA

Incidence and Prevalence of Diabetes in the United States

National Diabetes Fact Sheet, 2011

Diagnosed and undiagnosed diabetes in the United States, all ages, 2010

Total: 25.8 million; 8.3% of the U.S. population
Diagnosed: 18.8 million
Undiagnosed: 7.0 million people

Source: National Center for Chronic Disease Prevention and Health Promotion: Division of Diabetes Translation, Center for Disease Control

Estimated number of new cases of diagnosed diabetes among people aged 20 years or older, by age group, United States, 2010

Rate of new cases of type 1 and type 2 diabetes among youth aged <20 years, by race/ethnicity, 2002–2005

Criteria for Testing for Diabetes in Asymptomatic Adult Individuals (1)

1. Testing should be considered in all adults who are overweight (BMI ≥25 kg/m²) and have additional risk factors:
   - Physical inactivity
   - First-degree relative with diabetes
   - High-risk race/ethnicity (e.g., African American, Latino, Native American, Asian American, Pacific Islander)
   - Women who delivered a baby weighing >9 lb or were diagnosed with GDM
   - Hypertension (≥140/90 mmHg or on therapy for hypertension)
   - HDL cholesterol level <35 mg/dl (0.90 mmol/l) and/or a triglyceride level >250 mg/dl (2.82 mmol/l)
   - Women with polycystic ovarian syndrome (PCOS)
   - A1C ≥5.7%, IGT, or IFG on previous testing
   - Other clinical conditions associated with insulin resistance (e.g., severe obesity, acanthosis nigricans)
   - History of CVD

   *At-risk BMI may be lower in some ethnic groups.

2. In the absence of criteria (risk factors on previous slide), testing for diabetes should begin at age 45 years

3. If results are normal, testing should be repeated at least at 3-year intervals, with consideration of more frequent testing depending on initial results and risk status

ADA. Testing in Asymptomatic Patients. Diabetes Care 2011;34(suppl 1):S14. Table 4

Criteria for Testing for Diabetes in Asymptomatic Adult Individuals (2)

ADA. Testing in Asymptomatic Patients. Diabetes Care 2011;34(suppl 1):S14. Table 4

Classification of Diabetes

- Type 1 diabetes
  - β-cell destruction leading to absolute insulin deficiency
- Type 2 diabetes
  - Progressive insulin secretory defect (insulin resistance)
- Other specific types of diabetes
  - Genetic defects in β-cell function, insulin action (MODY)
  - Diseases of the exocrine pancreas (cystic fibrosis, hemochromatosis)
  - Drug- or chemical-induced (HIV, psychiatric medication, use of steroids)
- Gestational diabetes mellitus

ADA. 3. Classification and Diagnosis. Diabetes Care 2011;34(suppl 1):S12. Table 3

Pre-diabetes: IFG, IGT, Increased A1C

Categories of increased risk for diabetes (Pre-diabetes)*
- FPG 100-125 mg/dl (5.6-6.9 mmol/l): IFG
- 2-h plasma glucose in the 75-g OGTT 140-199 mg/dl (7.8-11.0 mmol/l): IGT
- A1C 5.7-6.4%

*For all three tests, risk is continuous, extending below the lower limit of a range and becoming disproportionately greater at higher ends of the range.

ADA. 1. Classification and Diagnosis. Diabetes Care 2011;34(suppl 1):S13. Table 1

Diagnosis of Pre-diabetes

ADA. Testing in Asymptomatic Patients. Diabetes Care 2011;34(suppl 1):S14. Table 4
Criteria for the Diagnosis of Diabetes

A1C ≥6.5%

The test should be performed in a laboratory using an NGSP-certified method standardized to the DCCT assay*

*In the absence of unequivocal hyperglycemia, result should be confirmed by repeat testing.

Fasting plasma glucose (FPG) ≥126 mg/dl (7.0 mmol/l)

Fasting: no caloric intake for at least 8 h*

*In the absence of unequivocal hyperglycemia, result should be confirmed by repeat testing.

Two-hour plasma glucose ≥200 mg/dl (11.1 mmol/l) during an OGTT

The test should be performed as described by the World Health Organization, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water*

*In the absence of unequivocal hyperglycemia, result should be confirmed by repeat testing.

In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥200 mg/dl (11.1 mmol/l)

Testing for Type 2 Diabetes in Asymptomatic Children

• Overweight BMI
  – >85th percentile for age sex, weight for height
  – >120% for ideal height
• Plus any 2 of the following risk factors
  – Family history of Type 2 diabetes in 1st/2nd degree relative
  – Race/Ethnicity high risk group
  – Signs of IR (acanthosis nigrans, HTN, dyslipidemia, PCOS, small for gestational age birth weight
  – Maternal history of GDM during the child’s gestation
  – Age of initiation: age 10 or at onset of puberty, if puberty occurs at a younger age

Type 1

Age >25

Type 2

Age 40<

LADA

Age 25-40

Age 10<
Characteristics: Type 1, LADA, Type 2 Diabetes

### Onset/Age at diagnosis
- **Type 1**: Rapid onset; days to weeks. Occurs in children and young adults. The highest % of cases diagnosed in early teens to age 20.
- **LADA**: Slower onset; months to years; more insidious than type 1. Typically 1st seen in ages 30-45 and older but can be seen as young as 25 years old.
- **Type 2**: Onset over a long period of time (years). Diagnosed in older adults with trends now seen in overweight children/adolescents.

### Presentation
- **Type 1**: DKA, recent weight loss, thin. Often misdiagnosed as T2DM. Weight not an indicator of LADA; can be thin or normal weight (1).
- **LADA**: Often diagnosed incidentally, overweight/obese, insulin resistance.
- **Type 2**: Not insulin resistant.

### Genetic/Associated risks
- **Type 1**: Genetic: HLA-DR, HLA-DQ (HLA region of chromosome 6). Environmental triggers: exposure to a virus.
- **LADA**: Genetic predisposition and environmental triggers suspected.
- **Type 2**: Usually absence of type 2 DM in family history (4).

### Serological Marker
- **Type 1**: ICA-512 (Islet cell antibody) 80% of cases confirms diagnosis of LADA.
- **Type 2**: IAA (Insulin Auto Antibody) Often detected prior to starting insulin. No.
- **LADA**: IAA rare – if present may be an indicator of LADA (1),(7),(15).
- **GAD65** (Glutamic Acid Decarboxylase) Very often. 80% of those diagnosed with type 2 with a +GAD will progress to insulin dependency within 6 years. (1)
- **IA2** (Islet Antigen 2) 50-70% newly diagnosed cases. Those with +GAD and +IA2 progress more rapidly to insulin dependence (2). No (15).
- **C-peptide Endogenous insulin production** Low – Normal to high
- **HLA**: Yes – most often.

### Treatment Options
- **Type 1**: Insulin replacement
  - Diabetes Education
  - Group class ADA Certified Program
  - Weights: 10% (1.5-1.0) per year
- **LADA**: Initially a combo of Oral Agents + Insulin supplementing insulin replacement
  - Diabetes Education
  - Injecting insulin
  - Carb counting
  - BG monitoring
  - Hypoglycemia/DKA
  - Sick days
- **Type 2**: Combo oral meds +/- insulin
  - Diabetes Education Group class ADA Certified Program

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### Case Study

www.isletofhope.com : Comparison of clinical features between type 1, LADA, type 2 diabetes
Initial Visit
47 year old male with DM 2 diagnosed 3 years ago.
Co-morbidities: HTN, Hyperlipidemia, Obesity
PSH: None
Family History: +CAD, HTN, Hyperlipidemia, Obesity, - diabetes
Social: Married with 3 children. Employed in sales – full time
Psychological: Has high anxiety and frustration regarding his health. He verbalizes frustration with the lack of diabetes control in spite of oral medication, insulin, and lifestyle changes. PCP stated on his last visit that his “lack of diabetes control” is less about the medications and more due to eating and lack of exercise.
ROS: + Poly symptoms, blurry vision, weakness, leg cramps, weight loss (10 pounds in the past 8 weeks), no abdominal pain or N & V, numbness and tingling in extremities
PE: Normal Findings
Annual Exams:
Eyes – Dilated within the year – Normal findings without retinopathy
Feet – Does not perform daily foot checks or see a podiatrist
Kidneys: Microalbumin due

Plan
DSME – Type 1 diabetes skills:
ABC Targets to avoid diabetes related complications, carbohydrate counting, pump exploration, (life style change) healthy heart eating, portion control, increased physical activity strategies, insulin adjustments for increased activity and illness, glucose targets / testing schedule, hypoglycemia, hyperglycemia, sick days and DKA management, avoiding long term complications, expectations for diabetes and referral to specialist medical follow-up (eyes, kidneys, feet) diabetes organizations, research studies and diabetes center contact info
Basal/Bolus insulin regimen -optimizing dose to achieve the targeted glycemic goals
Resume anti hypertension and hyperlipidemia therapy
OTC Vitamin D supplementation (2,000 IU/daily)
Medical follow-up: weekly contact with the DC, clinical visits every 4 weeks until diabetes stable then quarterly

Follow-up Findings
Insulin Pump started March 28th – tolerating and adjusting well
Weight gain 30 pounds since insulin treatment optimized
Blood pressure and lipids normalized
HbA1c: not yet at goal – moving in the right direction

Self Management Practices
Meds:
Metformin 500mg in AM
Lantus 20units AM
Simvastatin 10mg (stopped taking 2 months ago)
Benazapril 10mg (stopped taking 2 months ago)
Humalog at dinner meal: sliding scale if numbers are high post dinner

SBGM Tests 3x daily
Hypes occur in the middle of the night - below 70mg/dl with symptoms
Highs occur after meals (afternoon and evening).

Activity:
No scheduled workout due to extreme fatigue

Diet: 3-3 meals daily – 2 snacks
History: Drinks diet soda or water, portions reasonable

Date: 2011    Feb 2  March 24th  May 30th  June 5th
B/P          154/90     130/80    144/80    125/79
BMI: kg/m2    29.7      31.9     33.9     34.5
Weight: lbs.  219       230      250      255
Height :     72 (6)     6 feet
BSA m :2      2.21      2.26     2.34/m2  2.36
POC A1c >13.0 9.5 7.5 7.5

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<th>May 30th</th>
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POC A1C 9.5 % = epsilon A1C 226mg/dl
A1c 7.5% (169mg/dl)

THANK YOU FROM THE BOTTOM OF MY PANCREAS

... that's like the bottom of my heart only cleaner.