Diabetes I: Diagnosis and Initial Management

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Learning Objectives
1. Evaluate asymptomatic adults and children with risk factors for diabetes.
2. Implement the ADA's diagnostic criteria for diabetes.
3. Follow the ADA screening recommendations for gestational diabetes.
4. Develop a disease management plan based on the type of diabetes and any diabetes-related complications that are present in patients.
5. Provide patients with blood glucose goals and the information they need to meet these goals.

Starting Notes
- 26 million in U.S. 11.6% of adults
- 35% of adults have "pre-diabetes"
- Fastest growing populations: adolescents and Hispanic males
- 7th leading cause of death; major cause of blindness, renal failure, amputations
- 1 in 7 health care dollars; 63% for inpatient costs
- CHD causes 2/3 of deaths in diabetics > 65 years

Metabolic Syndrome
- Increased risk of cardiovascular disease (CVD)
- Combination of 3 of the following:
  - Insulin resistance/Glucose intolerance (fasting glucose ≥ 100 mg/dl)
  - Obesity (waist > 40" men, > 35" women, or BMI ≥ 25-30 kg/m²)
  - HDL < 50 mg/dl women, < 40 mg/dl men
  - Triglycerides ≥ 150 mg/dl
  - Elevated blood pressure (≥ 130/85 mmHg)
  - Microalbuminuria (> 20 µg/min)
- 25-35% of Americans 20-79 years of age

Prediabetes
- Increased risk of developing diabetes
  - A1c 5.7-6.4%
  - Impaired fasting glucose (100-125 mg/dL)
  - Impaired glucose tolerance (140-199 mg/dL after 75 gm load)
- Treatment
  - Lifestyle changes
  - Metformin if obese and < 60 years

1. Which of the following does the USPSTF recognize as the most important risk factor in screening for diabetes?
   A. Obesity
   B. Hypertension
   C. Hyperlipidemia
   D. Age
   E. Ethnicity
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- A. Obesity
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- D. Age
- E. Ethnicity

2. Of the following, who should be screened for diabetes?

- A. 37 y/o BM with hyperlipidemia and no family history, BP 130/75
- B. 42 y/o obese WF with no health issues
- C. 23 y/o thin BM with a strong family history of diabetes with a BP of 127/65
- D. 12 y/o very obese HF with acanthosis nigricans

American Diabetes Association Screening Recommendations

- Screen if BMI ≥ 25 and an additional risk factor
  - Physical inactivity
  - Family history of diabetes (esp. in 1st degree relative)
  - High risk ethnic population
  - Previous Gestational Diabetes or baby > 9 lbs
  - Hypertension
  - History of vascular disease
  - Dyslipidemia (HDL < 35 / triglycerides > 250)
  - History of impaired glucose tolerance
  - Clinical conditions associated with diabetes (acanthosis nigricans)
  - PCOS (polycystic ovarian syndrome)
- Screen at age 45 then every 3 years

Screening in Children*

- Every 2 years at age 10 or puberty if:
  - BMI or weight > 85% (> 120% of ideal)*
  - 2 of the following risk factors
    - Family history 1st or 2nd degree relative
    - High risk ethnic/racial group
    - Signs or symptoms of insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, polycystic ovarian disease)

Adult Screening Recommendations

The USPSTF: screen asymptomatic adults with sustained blood pressure (either treated or untreated) greater than 135/80 mm Hg (level B)

http://www.ahrq.gov/clinic/uspsdiab.htm
Screening and Treatment in Children

- Treatment in children: metformin and insulin*
- Screening for complications in Type 1
  - Microalbumin yearly beginning age 10
  - Retinopathy beginning at age 10 and 3-5 years after onset then yearly
  - Screen for celiac disease
  - Screen for hypothyroidism
- Hypertension: ACE inhibitor for HTN or elevated albumin/creatinine
- Lipids
  - Check if positive family history
  - Use statins if > age 10

Gestational Diabetes

- Screening women at low risk is controversial (< 25 years of age and < 25 BMI)
- 1 hour GTT (glucose tolerance test) 24-28 weeks
  - 50 g load of glucose (18 jelly beans); non-fasting
  - Values > 130-140 mg/dL = positive screen
- Diagnosis 3-hour GTT with 100 g load (2 abnormal)
  - Fasting > 95 mg/dL
  - 1-hour > 180 mg/dL
  - 2-hour > 155 mg/dL
  - 3-hour > 140 mg/dL
- USPSTF: evidence is insufficient to recommend for or against screening
- ADA recommends screening on first visit and all women have a 2-hour GTT (75 gm load) at 24-28 weeks:
  - Fasting > 90 mg/dL, 1-hour ≥ 180 mg/dL, 2-hour ≥ 153
  - One abnormal is diagnostic (new—not on boards)

3. 27-yr-old obese AAF is pregnant at 8 weeks when she present to your office with a blood sugar of 210 mg/dL. What would be the most likely cause of a miscarriage in this woman?
   A. Hypoglycemia in the child
   B. Insufficient placental blood supply
   C. Congenital anomaly
   D. Preeclampsia

4. Which of the following would be considered diagnostic of type 2 diabetes?
   A. A hemoglobin A1c ≥ 6.0% on two separate occasions
   B. An oral glucose tolerance test with 75-g load and a 2-hour glucose level ≥ 150 mg/dL
   C. A fasting glucose level ≥ 126 mg/dL on 2 separate occasions
   D. A random glucose level of 212 mg/dL in an asymptomatic person

Pregnancy

- Most common cause of neonatal death in children of mother’s with diabetes prior to the pregnancy: congenital anomalies*
- Most common complication in pregnancy is macrosomia
- Insulin (intermediate and short acting), glyburide and metformin used
- Screen for retinopathy in the 1st trimester
- Maintaining fasting glucose < 100 mg/dL improves neonatal outcomes
- Following gestational diabetes
  - 5-10% develop DM in 6 mo
  - 50% develop DM in 10 years
  - Screen at 6-12 weeks postpartum and every 3 years thereafter
4. Which of the following would be considered diagnostic of type 2 diabetes?

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<table>
<thead>
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<tbody>
<tr>
<td>1%</td>
<td>A. A hemoglobin A1c ≥ 6.0% on two separate occasions</td>
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<tr>
<td>2%</td>
<td>B. An oral glucose tolerance test with 75-g load and a 2-hour glucose level ≥ 150 mg/dL</td>
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<tr>
<td>7%</td>
<td>C. A fasting glucose level ≥ 126 mg/dL on 2 separate occasions</td>
</tr>
<tr>
<td>23%</td>
<td>D. A random glucose level of 212 mg/dL in an asymptomatic person</td>
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**Diagnosis of Diabetes**

- Any of the following + a confirmation test:
  - Fasting glucose ≥ 126 mg/dl
  - Random glucose ≥ 200 mg/dl with classic symptoms
  - 2-hour glucose tolerance test ≥ 200 mg/dl after 75-g load
  - Hgb A1c ≥ 6.5% (reference lab)
    - A1c of 6% = ~ 120 mg/dL glucose
    - A1c of 7% = ~ 150 mg/dL glucose
    (add 30 for each additional %)

5. A 65-year-old Asian male presents to your clinic with a 10-year history of type 2 diabetes. Which of the following is true concerning this patient?

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<table>
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<tbody>
<tr>
<td>21%</td>
<td>A. He is likely to be very obese</td>
</tr>
<tr>
<td>24%</td>
<td>B. He has a higher risk of retinopathy than your Hispanic patients</td>
</tr>
<tr>
<td>40%</td>
<td>C. He has a higher risk of renal failure than your white patients</td>
</tr>
<tr>
<td>7%</td>
<td>D. He has a higher risk of neuropathy than your African American patients</td>
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**Cultural Competence**

- Asian-Americans:
  - Develop diabetes at a lower body mass
    - (BMI <24, compared to African American = 26, Caucasian = 30)
  - Develop diabetes at a younger age
  - Develop more end-stage renal failure
- African-Americans
  - Insulin resistance is higher
  - Socioeconomic factors: diabetes is expensive
- Latino-Americans
  - Peripheral vascular disease 80% more common
  - Mortality rate 2X whites
  - 50% of Latino children will develop diabetes and the rate in Latinos will double in the next 10 years

**Type 1 vs Type 2**

- < 10% of diabetics
- Onset usually in childhood or adolescence
- Loss of beta cells in the pancreas: insulin requiring
- Weight loss is prevalent
- Sudden onset
- Screening for complications begins 5 years after diagnosis

- > 90% of diabetics
- Onset now common in adolescence
- Insulin resistance so high insulin levels
- Obesity is prevalent
- Insidious onset
- Screening for complications begins at diagnosis
Managing Diabetes

- **Lifestyle change**
  - Nutrition
  - Activity
  - Weight loss
- **Medication**
- **Prevention of and screening for complications**
- **Surgery**

Management Goals

- Preprandial glucose < 100 mg/dl*
- Bedtime glucose < 120 mg/dl
- A1C < 7%** (many now using 6.5%)
  - Higher for longstanding (> 12 yrs), advanced complications, limited life expectancy
  - Lower for new diagnosis, long life expectancy
- ACCORD trial found excessively rapid or aggressive control associated with increased risk
- ADVANCE trial - intensive therapy appeared safe
  - Monitor every 3 months
- Blood pressure < 130/80**
- LDL cholesterol < 100 mg/dl*
  - < 70 mg/dl with cardiovascular disease

Weight Loss/Lifestyle

- The USPSTF recommends:
  - Intensive behavioral dietary counseling for adult patients with hyperlipidemia and other known risk factors for cardiovascular and diet-related chronic disease delivered by primary care clinicians or by referral
- Individualized lifestyle interventions better than group
- Weight loss (cut calories 500-1000 kcal/d)
  - 3500 kcal = 1 pound** (20 oz soda = 250 kcal)
  - Low-carb, low-fat, or Mediterranean diet
  - Low-carb diet: monitor lipids, renal function, and protein intake
- Weight loss medications
  - Orlistat (OTC as Alli)
  - Phentermine (15-30 mg daily)—appetite suppressant
  - GLP-1 agonists (exenatide, liraglutide) and pramlintide

Nutrition

- Protein: < 20% of total daily energy
  - 0.8-1.0 g/kg in microalbuminuria and 0.8 g/kg in macroalbuminuria
- Whole grains, fruits, veggies, low fat dairy, high fiber (2 servings whole grains = 21% ↓ diabetes)
- Increase potassium, calcium, and vitamin D
- Low glycemic load diets better for high insulin secretors—may have "modest benefit"
- Increase amount and variety of sea food
- Fats: < 30% total and < 7% saturated fat, minimize trans fats
  - Replace fats with oils
- < 200 mg cholesterol
- Limit alcohol
- Sodium < 1500 mg
- Increase B12 as patients age
- Some evidence for chromium and magnesium

Exercise

- 5-7 times/wk, 30 or more minutes
  - 150 min/wk of moderate aerobic activity
  - 55-69% predicted max. heart rate
  - Resistance training 2-3 times/wk
- Combination of aerobic and resistance training will reduce A1c (less effect with either alone)
- Exercise before and during pregnancy reduces risk of developing gestational diabetes
- In type 1: Athletes should not participate in strenuous activity if glucose > 300 mg/dl or > 250 mg/dl with urine ketones*

Self Monitoring

- No conclusive evidence for association between self monitoring of blood glucose and improved glycemic control in patients with type 2 diabetes
- Self-monitoring of blood glucose is an integral component of diabetes therapy and should always be included in the management plan (SOR:C from Journal of Family Practice)
- Indicated for the following
  - Type 1 (3 x/d for multiple insulin injections or the pump)
  - During illness
  - When oral medications are adjusted
  - During corticosteroid use
  - When postprandial hyperglycemia is a concern
  - When using oral sulfonylureas
  - Continuous monitoring may be useful in type 1

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## Immunizations

- Influenza yearly
- Pneumococcal once and repeat at age 65 (but 5 years after the 1st)
- Hepatitis B now recommended for all ≤ age 60 (after age 60 at high risk for hep B) not on test
- Tdap (replaces dT one time only)
  - OK after age 65
  - No minimum time after lastTd

## Screening for Comorbid Conditions

- Blood pressure at every visit
- Lipids yearly
- Screen for hypothyroidism as it can contribute to dyslipidemia*
- Screen for tobacco use
- Screen for depression (more prevalent in patients with chronic disease)

### Complications

<table>
<thead>
<tr>
<th>Macrovascular</th>
<th>Microvascular</th>
<th>Diabetic foot problems</th>
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<tbody>
<tr>
<td>Heart disease</td>
<td>Retinopathy</td>
<td>Ulcers</td>
</tr>
<tr>
<td>Stroke</td>
<td>Neuropathy</td>
<td>Osteomyelitis</td>
</tr>
<tr>
<td></td>
<td>Nephropathy</td>
<td>Charcot foot</td>
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<tr>
<td></td>
<td></td>
<td>Ketoacidosis and Hyperosmolar hyperglycemia</td>
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</table>

### Other Complications

- Dupuytren's disease prevalence up to 33%*
- Diabetes is a risk factor for developing necrotizing soft-tissue infections*
- Perinephric abscess*:
  - Fever and persistent flank pain
  - Fever > 4 days after initiation of antibiotics
  - *CT for peri-renal fluid or enlargement of psoas muscle
  - Peri-renal gas on CT is diagnostic
  - Treatment: drainage and antibiotics
- Fatty liver
- Acrochordons* (skin tags) common finding

### Screening for Complications

- Yearly eye exam (retinal photos are adjunct to eye exams)
- Yearly urine microalbumin and creatinine
- Foot screening to prevent amputation:
  - Yearly monofilament (+) screening of feet
  - Yearly evaluation of pulses
  - Visual inspection of feet at every visit
- Ask about autonomic neuropathies: erectile dysfunction, postural hypotension, gastroparesis (best test is gastric emptying time*)
- Screening for cardiac disease with stress echo/thallium if patient is symptomatic, develops microalbuminuria, or for high index of suspicion

### Prevention of Complications

- Glycemic control:
  - 1% reduction in HbA1c = 21% decrease in risk of developing a complication
  - Better outcomes with tight control early in the disease process (no evidence for tight control as the disease progresses)
- Correction of dyslipidemia (statins)
- Smoking cessation
- Healthy diet and active lifestyle
- Aspirin to prevent cardiovascular complications
Prevention of Complications

- Blood pressure control (< 130/80) to prevent nephropathy
  - Type 1 with hypertension and/or microalbuminuria: ACE I (angiotensin-converting enzyme inhibitor) slows progression of renal disease
  - Type 2 with hypertension and/or microalbuminuria: ACE inhibitor or angiotensin receptor blocker (ARB) slows progression
  - Type 2 with hypertension, macroalbuminuria, and renal insufficiency (Cr > 1.5)—use ARB
  - ACE inhibitors and ARBs are beneficial in reducing the progression of microalbuminuria in normotensive patients with diabetes**
  - Use ARBs when ACE inhibitors are not tolerated*

New Aspirin Recommendations

- Diabetics: 2-4 times the risk for cardiovascular complications
- Stroke risk doubles within 5 years of diagnosis
- Low-dose aspirin reasonable in adults with diabetes and no history of vascular disease whose 10-year risk of CHD events is > 10% and no increased risk of bleeding
- Males > 50 and Females > 60 with 1 additional risk factor
- Smoking, hypertension, dyslipidemia, albuminuria, family history of premature death
  - Secondary prevention for diabetes and known cardiovascular disease
    - Clopidogrel (Plavix) 75 mg/d if allergic to aspirin
    - Does not increase retinal hemorrhage in retinopathy

6. What is the most common cause of death following bariatric surgery?

A. Sepsis
B. Pulmonary embolus
C. Malnutrition
D. Myocardial infarction

Bariatric Surgery

- Indicated for patients with BMI > 35
- Up to 75% of obese patients have complete resolution of diabetes following bariatric surgery
- Mortality rates 3-4 X higher in those treated with oral medications vs. surgery
- 0.3% mortality after bariatric surgery
- #1 Cause of death following bariatric surgery is pulmonary embolus**
- Rates of serious complications are inversely associated with hospital and surgeon procedure volume.

Multidisciplinary Approach

- Nurse practitioners
- Diabetes educators
- Social worker
- Medical specialists (ophthalmology, neurology, renal, endocrine)
- Consider group visits and other novel approaches to care
- Dietitian
- Exercise physiologist
- Podiatrist
- Home health nurse
- Family physician is the team leader!
References


Evidence

- Intensive treatment early in diabetes with tight control of blood sugar and blood pressure can decrease complications (neuropathy, retinopathy, nephropathy, and foot infections) and improve long-term outcomes*. (Ebell in AFP)
- Tight control in type 1 improves cardiovascular outcomes. In type 2 and elderly, tight control may be detrimental.* (Nathan, Diab Care, 2009;32:193)
- Lowering blood pressure below conventional standards reduces the incidence of cardiovascular events and mortality. (JAMA)
- Lifestyle interventions for overweight individuals with impaired glucose tolerance reduces the incidence of progression to diabetes. (Bandolier)

Answers

1. B  
2. D  
3. C  
4. C  
5. C  
6. B