Diabetes Pathophysiology

Beverly Dyck Thomassian, RN, MPH, BC-ADM, CDE
President, Diabetes Education Services

www.DiabetesEd.net

Lecture Objectives

1. Discuss the current epidemiologic impact of diabetes.
2. Describe the pathway of pathophysiological defects associated with the development of diabetes
3. Describe and differentiate between the different types: prediabetes, Type 1, Type 2, LADA and GDM
4. Describe the laboratory tests used for the diagnosis of Diabetes Mellitus including FBG, OGTT, A1C, antibodies
5. List the characteristics of Insulin Resistance.
6. Differentiate between hypoglycemia, hyperglycemic crisis and the macrovascular complications of DM.

Quick Question

▸ What best describes the prevalence of diabetes in the U.S.?
   a. 30% of people above the age of 20 have type 2 diabetes.
   b. The prevalence of type 1 and type 2 diabetes are almost equal.
   c. 1 out 3 persons has type 2 diabetes.
   d. About 10% of Americans have diabetes.

CDC Announces

35% of Americans will have Diabetes by 2050

Boyle, Thompson, Barker, Williamson
2010, Oct 22:8(1)29
www.pophealthmetrics.com

Diabetes in America 2016

▸ 29 million or > 9.3%
▸ 27% don't know they have it
▸ 37% of US adults have pre diabetes (86 mil)

Diabetes

| | 1994 | 2000 | 2009 |

No Data   <4.5%   4.5-5.9%   6.0-7.4%   7.5-8.9%   ≥9.0%

CDC's Division of Diabetes Translation. National Diabetes Surveillance System available at http://www.cdc.gov/diabetes/statistics

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Age-adjusted Diabetes Prevalence

20 yrs or older, by race/ethnicity— U.S. 20014

Age-adjusted* percentage of people aged 20 years or older with diagnosed diabetes, by race/ethnicity, United States, 2010–2012
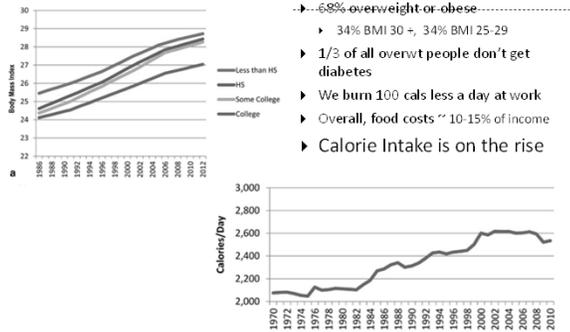
Non-Hispanic whites	7.6
Asian Americans	9.0
Hispanics	12.8
Non-Hispanic blacks	13.2
American Indians/Alaska Natives	15.9

*Based on the 2000 U.S. standard population.
Source: 2010–2012 National Health Interview Survey and 2012 Indian Health Service's National Patient Information Reporting System.

- Among Hispanic adults, the age-adjusted rate of diagnosed diabetes was 8.5% for Central and South Americans, 9.3% for Cubans, 13.9% for Mexican Americans, and 14.8% for Puerto Ricans.
- Among Asian American adults, the age-adjusted rate of diagnosed diabetes was 4.4% for Chinese, 11.3% for Filipinos, 13.0% for Asian Indians, and 8.8% for other Asians.
- Among American Indian and Alaska Native adults, the age-adjusted rate of diagnosed diabetes varied by region from 6.0% among Alaska Natives to 24.1% among American Indians in southern Arizona.

Obesity and Economics in America

- 68% overweight or obese
  - 34% BMI 30 +, 34% BMI 25-29
- 1/3 of all overwt people don't get diabetes
- We burn 100 cals less a day at work
- Overall, food costs ~ 10-15% of income
- Calorie Intake is on the rise

Average Daily Per Capita Calories Adjusted for Waste. Source: Economic Research Service of the United States Department of Agriculture (Per Capita) Data System.

Bacterial Cells Outnumber Human Cells 10 to 1

- 10 trillion human cells
- Host 100 trillion bacterial and fungal cells

The Human Microbiome Project

Quick Question

- How much does your gut bacteria weigh?
  - A. 24 ounces
  - B. 3 pounds
  - C. Less than 1 pound
  - D. 1.5 pounds
  - E. Not sure

3 lbs of Microbes in our Gut

- Community of bacteria extra 'organ' "microbiome".
- Evolved together with our microbiome over millions of years.
- Ratios of these communities has changed over the past 30 years
- Mirrors global spikes in obesity, diabetes, allergic and inflammatory diseases
- What are we doing to change these bacteria?
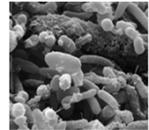
Gut Microbiome

- Part of endocrine axis
- Stabilized by 3 years of age
- Influenced by:
  - Birth method
  - Breast fed
  - Early Antibiotic use
  - Environment
  - Travel
- Help us
  - utilize energy
  - fight off invaders

Microbes maketh man

Human Intestine Friends

- The majority belong 2 major phyla:
- Firmicutes
  - includes *Clostridium*, *Enterococcus*, *Lactobacillus* and *Ruminococcus*
- Bacteroidetes
  - includes *Bacteroides* and *Prevotella*

in proportions determined in part by birth, breastfeeding, diet

Weight and Gut Bacteria
New and Early Research

- Leaner people appear to have more bacterial diversity and a higher proportion of bacteroidetes
- Obese people appear to have higher levels of firmicutes
- Bacteria tend to run in families

By Age 3, Gut Guests are Settled In

- NPR Story Oct 1, 15
- Kids who:
  - Born vaginally
  - Are breastfed
  - Limited antibiotic exposure
- Have less allergy and asthma
- And a different microbiome
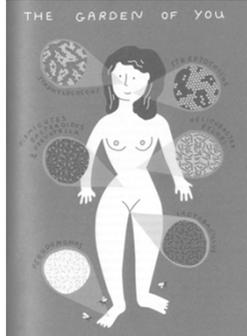
Some of My Best Friends Are Germs
By MICHAEL POLLAN   MAY 15, 2013

Follow Your Gut – Dr. Rob Knight

THE GARDEN OF YOU

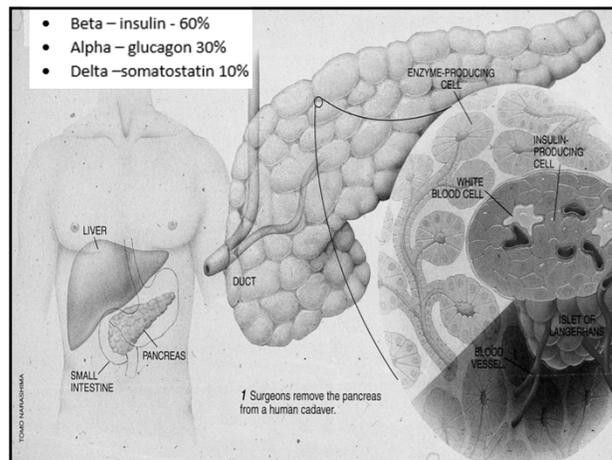**Check out Dr. Knight's:**

- TED Talk
- Website – AmericanFoodProject.org
- Articles in Nature and all over

- Beta – insulin - 60%
- Alpha – glucagon 30%
- Delta –somatostatin 10%

ENZYME-PRODUCING CELL

INSULIN-PRODUCING CELL

WHITE BLOOD CELL

LIVER

DUCT

PANCREAS

SMALL INTESTINE

ISLET OF LANGERHANS

BLOOD VESSEL

1 Surgeons remove the pancreas from a human cadaver.

TOMO NAKASHIMA

Hormones Effect on Glucose

Hormone	Effect
Glucagon (pancreas)	⬆
Stress hormones (kidney)	⬆
Epinephrine (kidney)	⬆
Insulin (pancreas)	⬇
Amylin (pancreas)	⬇
Gut hormones - incretins (GLP-1) released by L cells of intestinal mucosa, beta cell has receptors)	⬇

GLP-1 Effects in Humans
Understanding the Natural Role of Incretins

GLP-1 secreted upon the ingestion of food

Promotes satiety and reduces appetite

↑ Beta-cell response

Alpha cells: ↓ Postprandial glucagon secretion

Liver: ↓ Glucagon reduces hepatic glucose output

Beta cells: Enhances glucose-dependent insulin secretion

Stomach: Helps regulate gastric emptying
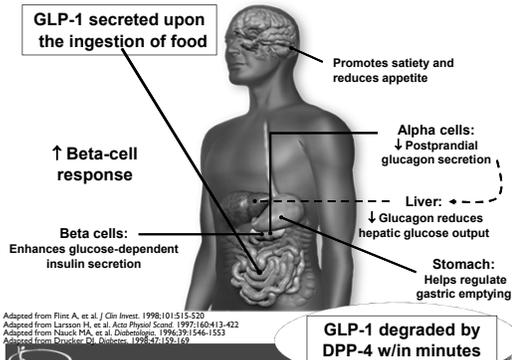
Adapted from Flint A, et al. *J Clin Invest*. 1998;101:515-520
Adapted from Larsson H, et al. *Acta Physiol Scand*. 1997;160:413-422
Adapted from Nauck MA, et al. *Diabetologia*. 1996;39:1546-1553
Adapted from Drucker DJ. *Diabetes*. 1998;47:159-169

GLP-1 degraded by DPP-4 w/in minutes

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Signs of Diabetes

▸ Polyuria	➡ Glycosuria, H_2O l
▸ Polydipsia	➡ Dehydration
▸ Polyphasia	➡ Fuel Depletion
▸ Weight loss	➡ Loss of body tissue, H_2O
▸ Fatigue	➡ Poor energy utilization
▸ Skin and other infections	➡ Hyperglycemia increases incidence of infection
▸ Blurry vision	➡ Osmotic changes

Quick Question

▸ Which of the following level is considered pre-diabetes range:

a. A1c of 6.2 %

b. Fasting BG of 62

c. A1c of 7.1 %

d. After meal BG of 127

Natural History of Diabetes

Normal	Prediabetes	Diabetes
FBG <100	**FBG 100-125**	**FBG 126 +**
Random <140	**Random 140 - 199**	**Random 200 +**
A1c <5.7%	**A1c ~ 5.7- 6.4%**	**A1c 6.5% or +**
	50% working pancreas	**20% working pancreas**

Development of type 2 diabetes happens over years or decades

6. A1c Test

▸ Measures glycation of RBC's over 2-3 months

▸ Weighted mean (50% preceding month)

▸ Each 1% ~ 29mg/dl

Red Blood Cell

▸ Accuracy: affected by some anemias, hemoglobinopathies

▸ A measurement of glucose in fasting and postprandial states

▸ African Americans may have false lows

6. A1c and Estimated Avg Glucose (eAG)

A1c (%)	eAG
5	97
6	126
7	154
8	183
9	212
10	240
11	269
12	298

Order teaching tool kit free at diabetes.org

eAG = 28.7 x A1c-46.7 ~ 29 pts per 1%

Translating the A1c Assay Into Estimated Average Glucose Values – ADAG Study

Diabetes Care: 31, #8, August 2008

Diagnostic Criteria

- All test should be repeated in the absence of unequivocal hyperglycemia
- If test abnormal, repeat same test to confirm diagnosis on a different day
- If one test normal, the other abnormal, repeat the abnormal test to determine status
- Medicare still using fasting as criteria for reimbursement for education

Quick Question

What factors would make you suspect type 1 diabetes?

a. Pt has a history of celiac disease

b. Pt presents with low HDL cholesterol

c. Friend tells you she has been eating "tons of sweets"

d. Pt is slightly overweight

What Kind of Diabetes?

- AJ, a 12 year old female admitted to the ICU with a blood glucose of 476 mg/dl and a pH of 7.1.
- What further questions and or testing is needed to determine if patient has type 1 or type 2 diabetes?

Type 1 Diabetes

Miracle of Insulin

Patient J.L., December 15, 1922   **February 15, 1923**

Type 1 Rates Increasing Globally

- 23% rise in type 1 diabetes incidence from 2001-2009
- Why?
  - Autoimmune disease rates increasing over all
  - Changes in environmental exposure and gut bacteria?
  - Hygiene hypothesis
  - Obesity?

Incidence of Type 1 in Youth

- **General Pop 0.3%**
- **Sibling 4%**
- **Mother 2-3%**
- **Father 6-8%**
- Rate doubling every 20 yrs
- Many trials underway to detect and prevent (Trial Net)

Type 1 – 10% of all Diabetes Genetics and Risk Factors

- Auto-immune pancreatic beta cells destruction
- Most commonly expressed at age 10-14
- Insulin sensitive (require 0.5 - 1.0 units/kg/day)

- Combo of genes and environment:
  - Autoimmunity tends to run in families
  - Higher rates in non breastfed infants
  - Viral triggers: congenital rubella, coxsackie virus B, cytomegalovirus, adenovirus and mumps.

How do we know someone has Type 1 vs Type 2?

- Type 1
  - Positive antibodies
    - GAD
    - ICA
    - IAA and others
- Younger people develop quickly
- Older people take longer to develop
- Body wt and presentation

Autoantibodies Assoc w/ Type 1

Panel of autoantibodies –

- GAD65 - Glutamic acid decarboxylase –
- ICA - Islet Cell Cytoplasmic Autoantibodies
- IAA - Insulin Autoantibodies

Type 1 Diabetes Associated with other immune conditions

- Celiac disease (gluten intolerance)
- Thyroid disease
- Addison's Disease
- Rheumatoid arthritis
- Other

Type 1 back in hospital

- 14 yr old admitted for 3rd time this month for DKA
- Admission BG 648.
- She is 5'6 inches and weighs 100-110 lbs
- They ask you to provide diabetes education.
- What top 3 things are you going to assess for?
- If no action taken, what could this lead to?

Disordered Eating

- "DiaBulimia"
- People with type 1 diabetes give themselves less insulin than needed to lose weight
- Tends to start in adolescence, more likely to occur in women than men.
- Signs: unexplainable spikes, A1c, weight loss, lack of marks from fingerpricks, lack of prescription refills for diabetes meds, records that don't match A1c.
- Treatment – Mental health specialist and team

Diabetes KetoAcidosis

- 135,000 Hospitalizations a year
- $2.4 billion U.S. dollars spent on treatment
- Often a cry for help

ADA article on Hyperglycemic Crises

DKA Precipitating Factors

- 25 -30% of time, illness and infection
  - increases stress hormone release
- 50% inadequate insulin dosage
- initial manifestation of type 1
- emotional stress - especially teens, neglect or mismanagement

Extreme Hyperglycemia – Diabetes KetoAcidosis (DKA)

- DKA - profound insulin deficiency
- Excess stress hormones such as glucagon, epinephrine, and cortisol render insulin less effective
- Excess glucose production by liver
- Lipolysis leads to FFA's and ketones
- Osmotic diuresis, dehydration, lyte imbalances, acidosis

DKA Signs and Symptoms

- hyperglycemia- leads to weakness, lethargy, malaise, headache
- GI symptoms - N/V, abd pain
- Kussmaul's deep, rapid breathing
- hypothermia, acetone breath
- hyperpnea - to rid acidosis
- changes in mentation, hyporeflexia/tonia
- dehydration, ortho hypo

Extreme Hyperglycemia – Hyperosmolar Hyperglycemic State (HHS)

- occurs in elderly pt's w/ type 2 - esp if not closely monitored
- often precipitated by illness or stress
- symptoms may go unrecognized for wks
- massive fluid loss from osmotic diuresis
  - burns, hyperglycemia, diarrhea, hemodialysis, diuretics, steroids
- MI, infections, hypertonic feedings

DKA vs HHS

- Usually < 40 yrs old
- < 2 days symptoms
- Glucose >250
- Serum Ketones: +++
- pH low (<7.3)
- Anion Gap > 12
- Usually Type 1
- 3 – 10% mortality

- Usually >60 yrs old
- > 5 days symptoms
- Glucose >600
- Ketones: none to +
- pH normal (>7.3)
- Usually Type 2
- 10 - 20% mortality

DKA - HHS Presentation and Action

- Labs
  - NA - low to high
  - K+ - moves into vascular space
  - Hct and Hgb ↑ dehydration
  - BUN / Creatinine ↑
  - WBC ↑ (no infect)
  - pH low to normal
- Action
  - maintain insulin drip until ketone neg, glucose <200
  - maintain hydration
  - check BG q1 hour
  - assess lytes (esp K+)
  - give sub-Q insulin before d/c IV insulin
  - teach, teach, teach

DKA and HHS

5 most important interventions

- Fluids (NS, →0.45 NS, →D51/2 NS once glucose 300mg/dl)
- Insulin (.05 - 0.1unit/kg per hour)
- Potassium / lyte replacement
  - (K+, Mg, Ca, Phos)
- Determine, treat precipitating cause
- Education to prevent future episodes

Type 1 Summary

- Autoimmune pancreatic destruction
- Need insulin replacement therapy
- Often first present in DKA
- At risk for other autoimmune diseases
- Eval coping strategies

What kind of Diabetes?

- Pt is 58, states she has had type 1 diabetes for 18 years. Quit smoking a year ago and gained about 20 lbs. BMI 25.
- Meds
  - Humalog 18-23 units before each meal
  - Lantus 28 units at bedtime
  - Metformin 500mg TID
- What tests would you recommend?

What type of Diabetes?

- 72 Years old
- A1c 3 months prior 6.2%
- A1c now 13.9%
- BMI 24.5
- Lost about 10 pounds over last month

Latent AutoImmunity Diabetes in Adults (LADA)

- Antibody positive to 1-2 of below
  - GAD-65 autoantibodies
  - Insulin Autoantibodies
  - Islet Cell antigen-2
- Adult Age at onset
- Usually need insulin w/in first 6 months of diagnosis
- Early insulin therapy may preserve beta cell function

Diabetes Care 26:536-538, 2003
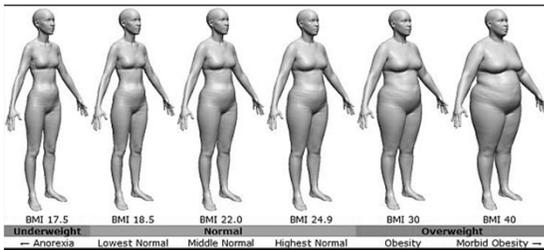Jerry P. Palmer, MD and Irl B. Hirsch, MD

LADA Clinical Features Compared to Type 2

Feature	LADA	Type 2
Age <50	63%	19%
Acute hyperglycemia	66	24
BMI < 25	33	13
Hx of autoimmune dx	27	12
Family hx autoimmune	46	35

Practical Diabetology March 08, Unger MD

BMI – Visual Image
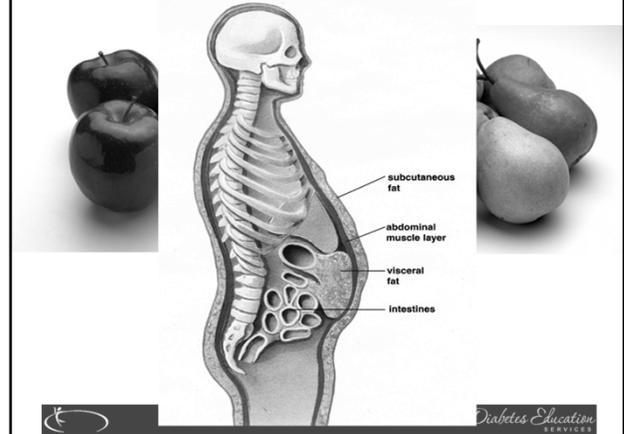
Factors Associated with Insulin Resistance

- Abdominal obesity
- Sedentary lifestyle
- Genetics / Ethnicity
- Gestational Diabetes
- Polycystic ovary syndrome
- Acanthosis Nigricans
- Obstructive Sleep Apnea
- Cancer

Quick Question

- Which of the following BEST describes insulin resistance?
  a. Lack of sufficient insulin receptors on fat and muscle cells.
  b. Visceral adipose tissue.
  c. A physiological condition where insulin becomes less effective at lowering blood glucose levels.
  d. Excessive triglyceride levels

2. Classification and DM Diagnosis

‣ Pre Diabetes & Type 2- Screening Guidelines
‣ Start screening at age 45 or for anyone who is overweight (BMI ≥ 25, Asians BMI ≥ 23) with one or > additional **risk factor**:

▸ First-degree relative w/ diabetes
▸ Member of a high-risk ethnic population
▸ Habitual physical inactivity
▸ PreDiabetes
▸ History of heart disease

Diabetes 2 - Who is at Risk?
(ADA Clinical Practice Guidelines)

Risk factors cont'd
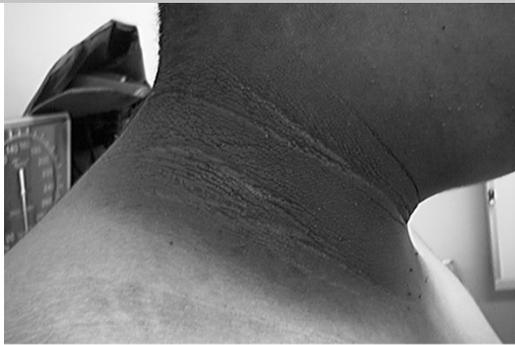‣ HTN - BP > 140/90
‣ HDL < 35 or triglycerides > 250
‣ baby >9 lb or history of Gestational Diabetes Mellitus (GDM
‣ Polycystic ovary syndrome (PCOS)
‣ Other conditions assoc w/ insulin resistance:
  ▸ Severe obesity, acanthosis nigricans (AN)

Acanthosis Nigricans

Acanthosis Nigricans (AN)

‣ Signals high insulin levels in bloodstream
‣ Patches of darkened skin over parts of body that bend or rub against each other
  ▸ Neck, underarm, waistline, groin, knuckles, elbows, toes
  ▸ Skin tags on neck and darkened areas around eyes, nose and cheeks.
‣ No cure, lesions regress with treatment of insulin resistance
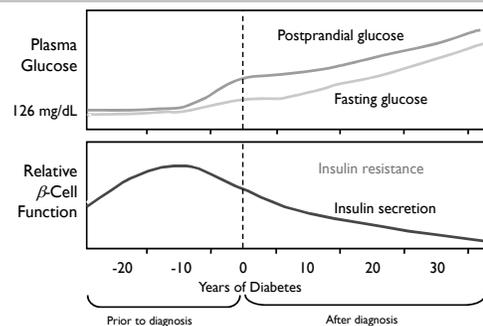

What is Type 2 Diabetes?

‣ Complex metabolic disorder ….
  (Insulin resistance and deficiency)
with social, behavioral and environmental risk factors unmasking the effects of genetic susceptibility.

New Diagnosis?
Call 800 – DIABETES to request "Getting Started Kit"
www.Diabetes.org

Natural Progression of Type 2 Diabetes

Plasma Glucose

126 mg/dL

Postprandial glucose

Fasting glucose

Relative β-Cell Function

Insulin resistance

Insulin secretion

-20   -10   0   10   20   30
Years of Diabetes

Prior to diagnosis   After diagnosis

Adapted from Bergenstal et al. 2000; International Diabetes Center.

Ominous Octet

Decreased satiation neuro-transmission

Decreased amylin, β-cell secretion 80% loss at dx

Decreased Gut hormones

Increased lipolysis

Increase glucose production

Decreased glucose uptake

Diabetes Education SERVICES
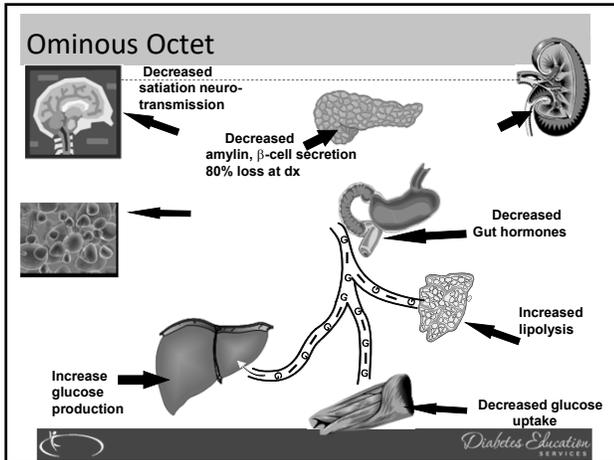
Life Study – Mrs. Jones

Mrs. Jones is 62 years old, overweight and complaining of feeling tired and urinating several times a night. She is admitted with a urinary tract Infection. Her WBC is 12.3, glucose 237. She is hypertensive with a history of gestational diabetes. No ketones in urine.

‣ What are her risk factors, signs of diabetes
‣ What type of diabetes does she have?
‣ Does she have insulin resistance?

What Do You Say?
Mrs. Jones asks you

‣ What is type 2 diabetes?
‣ Will this go away?
‣ Will I get complications?
‣ Will I need to take diabetes medication for the rest of my life?
‣ How come I got diabetes?
‣ Do I have to check my blood sugars?

Quick Question

‣ What is the preferred approach when providing diabetes education with patients?

a. Provide patient centered self-management support
b. Instruct all patients to meet national standards
c. Highlight risk of complications when goals aren't met
d. Remind them that insulin treatment can be beneficial.

Comparison of
Type 1, Type 2, LADA

	Type 1	Type 2	LADA
Obesity	x	xxx	x
Insulin dependence	xxx	30%	6mos
Respond to oral agents	0	xxx	x
Ketosis	xxx	x	x
Antibodies present	xxx	0	xx
Typical Age of onset	teens	adult	adult
Insulin Resistance	0	xxx	x

Diabetes is also associated with

‣ Fatty liver disease
‣ Obstructive sleep apnea
‣ Cancer; pancreas, liver, breast
‣ Alzheimer's
‣ Depression

Other Types of Diabetes

▸ Gestational
▸ Other specific types of diabetes

Gestational DM ~ 7% of all Pregnancies

▸ GDM prevalence increased by
  ▸ ~10–100% during the past 20 yrs
▸ Native Americans, Asians, Hispanics, African-American women at highest risk
▸ Immediately after pregnancy, 5% to 10% of GDM diagnosed with type 2 diabetes
▸ Within 5 years, 50% chance of developing DM in next 5 years.

Increasing Prevalence –
A public health perspective

▸ Body weight before and during pregnancy influences risk of GDM and future diabetes
▸ Children born to women with GDM at greater risk of diabetes
▸ Focus on prevention

Quick Question

▸ What best describes gestational diabetes?
a. Diabetes discovered within the first 12 weeks of pregnancy.
b. Diabetes discovered in the 24-28 week of pregnancy.
c. Risk of getting diabetes before pregnancy.
d. Diabetes discovered at any point during pregnancy.

Screen Pregnant Women
Before 13 weeks

▸ Screen for undiagnosed Type 2 at the first prenatal visit using standard risk factors.
▸ Women found to have diabetes at their initial prenatal visit treated as "Diabetes in Pregnancy"
▸ If normal, recheck at 24-28 weeks

Postpartum after GDM

▸ 50% risk of getting diabetes in 5 years
▸ Screen at 6-12 wks post partum
▸ Repeat at 3 yr intervals or signs of DM
  ▸ Encourage Breast Feeding
  ▸ Encourage weight control
  ▸ Encourage exercise
  ▸ Make sure connected with health care
  ▸ Lipid profile/ follow BP
  ▸ Preconception counseling

The Link Between Hyperglycemia, Insulin Resistance and Cardiovascular Disease

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Heart Disease & DM = 3-5xs Risk

- CHF
  - 7.9 % w/ diabetes vs.
  - 1.1 % no diabetes
- Heart attack
  - 9.8 % w/ diabetes vs.
  - 1.8 % no diabetes
- Coronary heart disease
  - 9.1 % w/ diabetes vs.
  - 2.1 % no diabetes
- Stroke
  - 6.6 % w/ diabetes vs.
  - 1.8 % no diabetes
    - 2007 AACE

Cardio Metabolic Risk -
5 Hypers -

- Hyperinsulinemia (resistance)
- Hyperglycemia
- Hyperlipidemia
- Hypertension
- Hyper"waistline"emia (35" women, 40" men)

Manifestations of Insulin Resistance

Vascular Disease & Diabetes "atheroscleropathy"

- Normal endothelial cells are protective
- Abnormal glucose = Endothelial cell dysfunction
  - Lower Nitric Oxide levels = Poor vasodilation
  - Release of inflammatory mediators
  - Higher aldosterone levels
  - Adipokines = > angiotensin = HTN
  - = Increased risk of acute thrombotic event
- Increased arterial stiffness
  - Due to chronic hyperglycemia, endothelial inflammation

Quick Question

- MJ has been admitted with a heart attack and wants to know what he can do to get healthier. Which of the following are considered modifiable cardiovascular risk factors?
  a. Family history, obesity
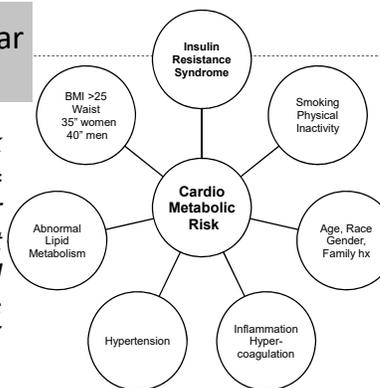 b. Smoking, obesity
  c. Hypertension, ethnicity
  d. BMI and age

CardioVascular Risk Factors

The more risk factors = greater risk of heart disease and diabetes
ADA 2007

Insulin Resistance Syndrome

BMI >25 Waist 35" women 40" men

Smoking Physical Inactivity

Cardio Metabolic Risk

Abnormal Lipid Metabolism

Age, Race Gender, Family hx

Hypertension

Inflammation Hyper-coagulation

Bottom Line

- Cardiovascular disease is the leading cause of death for people with diabetes
- 65% of people with diabetes die from heart disease (36% in general population)
- Prevention and aggressive treatment of diabetes is critical

Hypoglycemia prevention

- 72 yr old, thin, lives alone, A1c 7.3%. History of MI, stroke. DM for 12 yrs, takes glyburide 10mg BID. Limited income. Creat 1.4.
- What strategies to Prevent hypo?

Glycemic Threshold Values

John White, PharmD, Diabetes Spectrum, 2007

Classification	BG	Physical Response
Lower euglycemia	80-90's	Endogenous insulin
Hypoglycemia	70's	Glucagon, adrenaline
Symptoms	60s	Growth hormone, cortisol
	50's	Cognitive deterioration
Neuroglycopenia	40's	
	30's	
Severe	20's	Coma, seizures
neuroglycopenia	10	

(shortage of glucose in the brain affects function of the neurons)

Hypoglycemia Awareness

- autonomic symptoms adrenergically based
- after 2-5 yrs of type 1 dm,
  - glucagon secretion impaired
  - epinephrine secretion becomes primary mechanism to restore BG levels
- over time, epi response diminished or delayed
- decreases awareness of hypo and hormonal response

Hypoglycemia Symptoms

- Autonomic
  - Anxiety
  - Palpitations
  - Sweating
  - Tingling
  - Trembling
  - Hypoglycemic Unawareness
- Neuroglycopenia
  - Irritability
  - Drowsiness
  - Dizziness
  - Blurred Vision
  - Difficulty with speech
  - Confusion
  - Feeling faint

Treatment of Hypoglycemia

- If blood glucose **70**mg/dl or below:
  - 10-15 gms of carb to raise BG 30 - 45mg/dl
- Retest in 15 minutes, if still low, treat again, even without symptoms
- Follow with usual meal or snack
- If BG less than 40, allow recovery time
- Severe hypo may require glucagon

Key points

‣ At the center of diabetes is someone living with it everyday.
‣ Focus on their successes
‣ Coach and support

Thank You

Diabetes Education
SERVICES

‣ www.DiabetesEd.net