



Advanced Level Diabetes Workshop Getting to the Nitty Gritty

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OBJECTIVES

- ◉ Discuss main types of diabetes
- ◉ Describe the new MNT Guidelines
- ◉ Discuss a patient centered approach to Meds and Type 2
- ◉ State 2 insulin dosing strategies
- ◉ Identify 2 commonly undiscovered complications of diabetes
- ◉ Discuss a lower extremity assessment
- ◉ Describe strategies to encourage behavior change

CDC ANNOUNCES



35% of Americans
will have
Diabetes by
2050

Boyle, Thompson, Barker, Williamson

2010, Oct 22:8(1)29

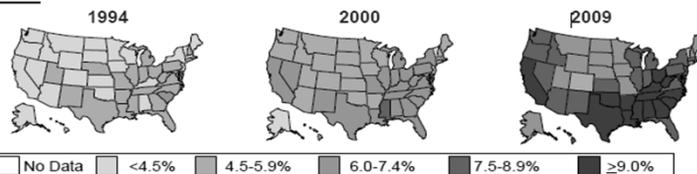
www.pophealthmetrics.com

DIABETES IN AMERICA 2014

- ◎ 25.8 million or > 8.3%
- ◎ 79 million have pre diabetes

CDC 2011

Diabetes



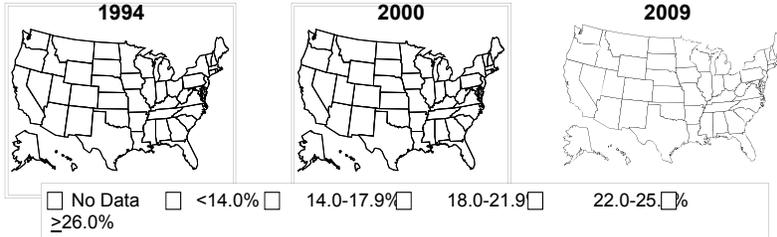
CDC's Division of Diabetes Translation, National Diabetes Surveillance System available at <http://www.cdc.gov/diabetes/statistics>



Age-adjusted Percentage of U.S. Adults with Obesity or Diagnosed Diabetes

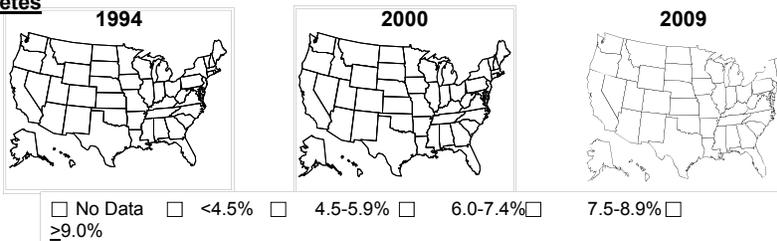
Obesity (BMI ≥ 30 kg/m²)

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Diabetes

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

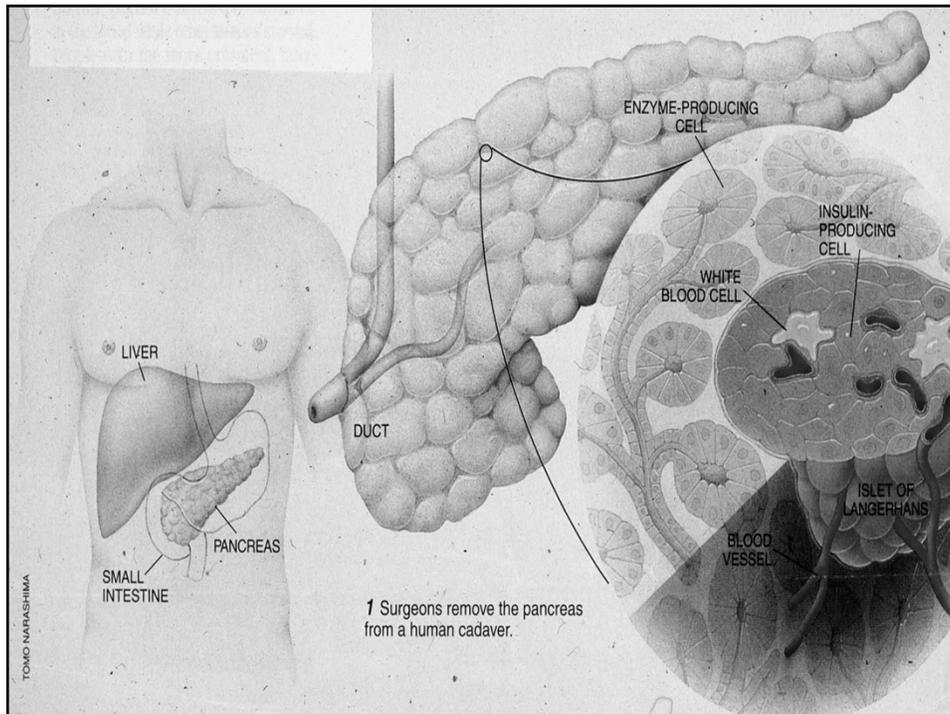
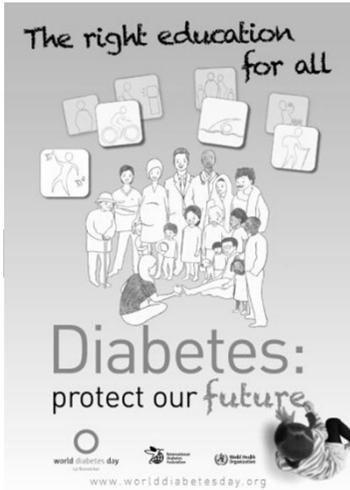


GLOBAL EPIDEMIC

- Every 10 seconds
 - 1 person dies with diabetes
 - 2 people develop diabetes
- Every year
 - 3 million deaths
 - 6 million new cases
- World Diabetes Day is November 14
- March is ADA Sound the Alert Day “find people w/ undetected diabetes”



WORLD DIABETES DAY- NOVEMBER 14



DIABETES CLASSIFICATIONS

- Type 1
- Type 2
- LADA
- Secondary





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?



Type 1 Diabetes Facts

- As many as **3 million Americans** may have type 1 diabetes.
- Each year, approximately **80 people per day** are diagnosed with type 1 diabetes in the U.S.
- Approximately **85 percent** of people living with type 1 diabetes are adults, and **15 percent** are children.
- The rate of type 1 diabetes incidence among children under age 14 is estimated to **increase by 3 percent annually** worldwide.
- Type 1 diabetes accounts for **\$14.9 billion** in healthcare costs in the U.S. each year.

Source: JDRF

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.

THE HYGIENE HYPOTHESIS

- In studies, mouse raised in clean environment is higher risk for DM than one raised in dirty one
- ◉ “Clean living” may increase risk for autoimmune diseases
- ◉ Risk is higher in urban than rural settings
- ◉ •Daycare, other early exposures, lower risk for DM



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)

WHAT DOES TYPE 1 LOOK LIKE?



Mary Tyler Moore

Adam Morrison



Sharon Stone
Halle Berry



Nick Jonas

Bret Michaels

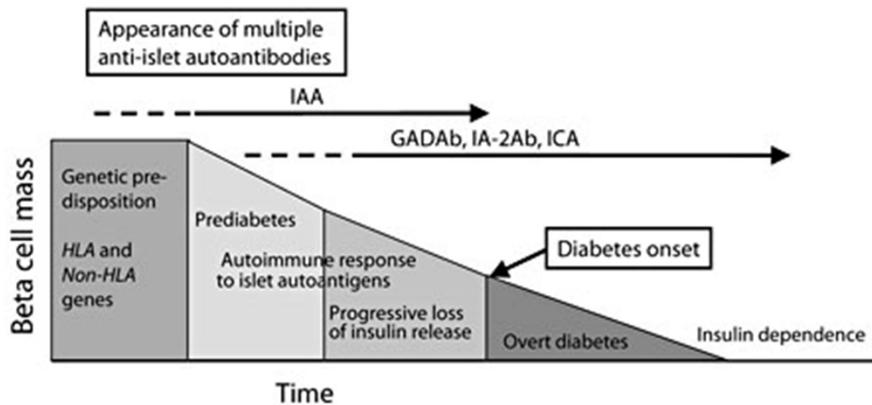


From Debbie Nagata's slide collection



Justice Sonia Sotomayor

NATURAL HISTORY OF TYPE 1



AUTOANTIBODIES ASSOC W/ TYPE 1

Panel of autoantibodies –

- GAD65 - Glutamic acid decarboxylase –
- ZnT8 - Zinc Co-Transporter 8
- ICA - Islet Cell Cytoplasmic Autoantibodies
- IA-2A - Insulinoma-Associated-2 Autoantibodies
- IAA - Insulin Autoantibodies



TAKE HOME MESSAGE

- ◉ Get Dirty
- ◉ Breastfeed if possible.
- ◉ Avoid early exposure to cows milk and cows milk based formula and gluten? – year of life for those at high risk
- ◉ Keep an eye on new research results



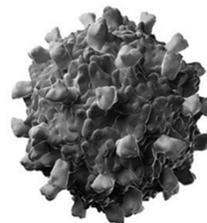
TYPE 1 –INTERVENTION STUDIES

- ◉ Trial Net – Oral insulin, delay onset 4 yrs
- ◉ Vaccine (glutamic acid decarboxylase)- Start earlier
- ◉ START Trial – Thymoglobulin – still enrolling
- ◉ CD3 Monoclonal Antibodies
- ◉ Stem Cell



COXSACKIE VIRUS VACCINE?

- ◉ Opens up novel possibilities for future research aimed at developing vaccines against these viruses to prevent type 1 diabetes.
- ◉ Since the group B coxsackieviruses includes only six enterovirus types it may be possible to include all of them in the same vaccine.



SCIENCEPHOTOLIBRARY

CD3 – TEPLIZUMAB STOPS AUTOIMMUNE DESTRUCTION

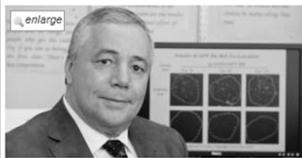
- 52 participants
- Most less than 14 years old, with “new-onset type 1 diabetes” within 8 wks of trial’s start.
- All 52 were treated with the experimental drug for two weeks at diagnosis and again one year later,
- About ½ of the participants on Teplizumab maintained insulin production

○ The clinical trial was led by Keivan Herold, MD, PhD, a professor of immunobiology and deputy director for translational science at Yale University.

MEDALIST STUDY – HARVARD JOSLIN DIABETES CENTER

- After 50 years with diabetes
 - Many still produced some insulin
 - Many had no eye disease





University of Missouri scientist Habib Zaghouani, PhD, is developing a potential cure for type 1 diabetes by combining adult stem cells with a promising new drug he developed at MU. (Credit: Image courtesy of University of Missouri School of Medicine)

STEM CELLS RESEARCH IN MICE

"The combination of Ig-GAD2 and bone marrow cells did result in production of new beta cells, but not in the way we expected,"

"We thought the bone marrow cells would evolve directly into beta cells. Instead, the bone marrow cells led to growth of new blood vessels, the blood vessels facilitated reproduction of new beta cells.

In other words, we discovered that to cure type 1 diabetes, we need to repair the blood vessels that allow the subject's beta cells to grow and distribute insulin throughout the body."

Get Involved – Get Screened DiabetesTrialNet.org

www.DiabetesTrialNet.org

1-800-HALT-DM1
(1-800-425-8361)

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+44-117-959 5337

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Italy
39-02-2643 2818

Finland
358-2-313 0000

[contact label]

If Someone In Your Family Has

Type 1 Diabetes

You May Be At Risk



Can Type 1 Diabetes Be Prevented?

You Can Help Answer This Question



NIDDK NATIONAL INSTITUTE OF DIABETES AND DIGESTIVE AND KIDNEY DISEASES



National Center for Human Genome Research



August 2011

Type 1
Diabetes
TrialNet

TYPE 1 DIABETES ASSOCIATED WITH OTHER IMMUNE CONDITIONS

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



TYPE 1 OR 2?

- ◉ 43 year old, lost 13 lbs over past 3 weeks. Urine is sticky. Husband tells you her breath smells funny.



- ◉ 43 year old, gained some weight after her mom died. Getting frequent vag yeast infections. BMI 28.



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?

UNCONDITIONAL POSITIVE REGARD

◎ *unconditional positive regard involves showing complete support and acceptance of a person no matter what that person says or does.*



◎ Term coined by humanist, Carl Rogers

◎ Can you think of a time when someone gifted you with unconditional positive regard?

MOTIVATIONAL INTERVIEWING

◎ “A collaborative, person-centered form of guiding to elicit and strengthen motivation for change.”



7 STEPS FOR DOING BEHAVIORAL COUNSELING

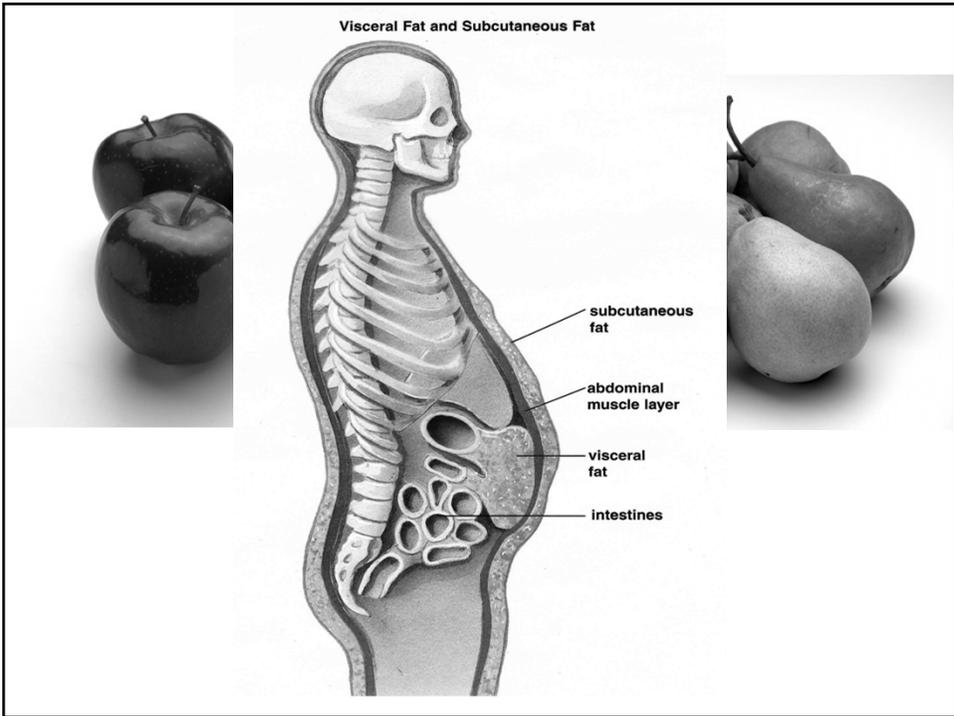
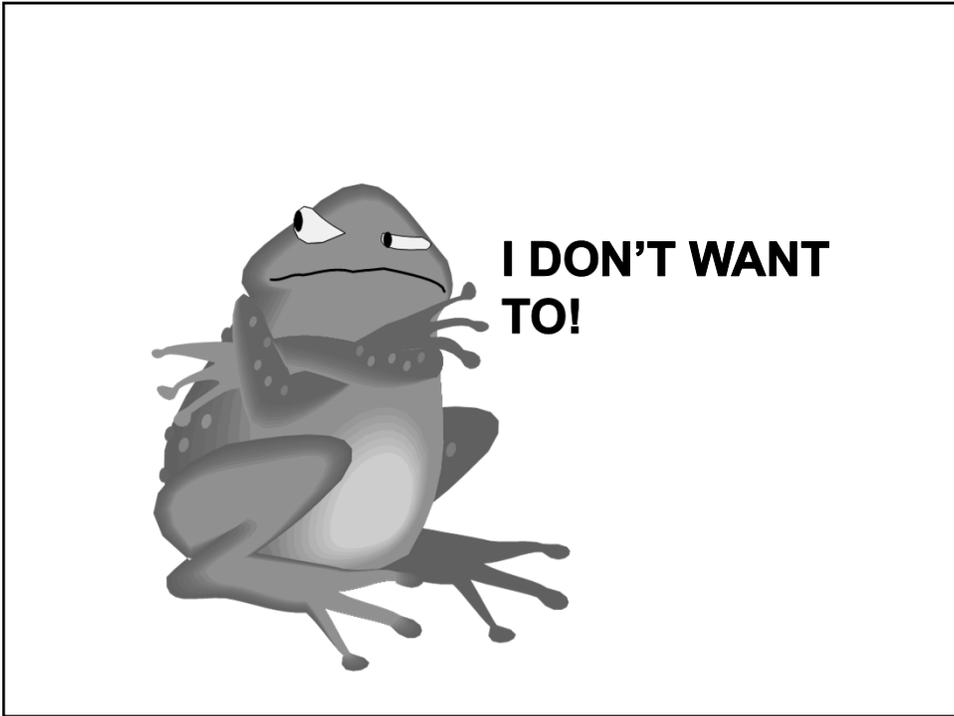


- ◉ Choose one area together
- ◉ How important is it for you to change (1-5)
Explore and listen for “Change Talk”
- ◉ Summarize patient’s perspective
- ◉ Share information or give advice with permission
- ◉ Ask Question, “Where does this leave you?”
- ◉ Clarify Plan and move on to SMART goal
- ◉ Plan for barriers and end on a positive note

KEEP IT SMART

- ◉ Specific
- ◉ Measurable
- ◉ Achievable
- ◉ Realistic
- ◉ Time Related

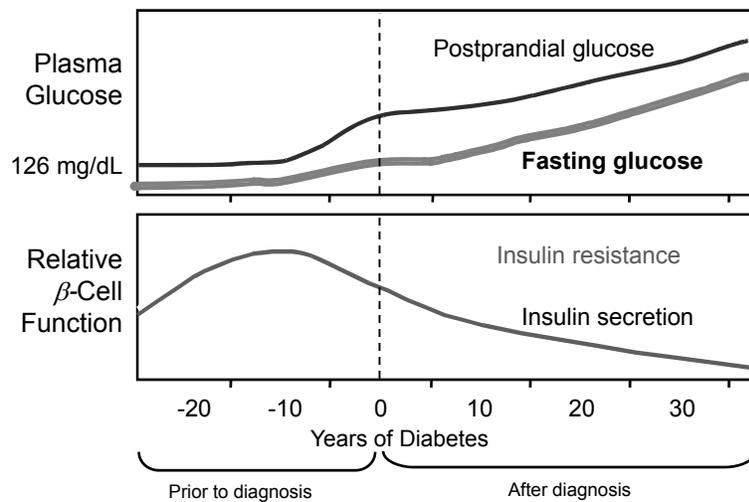




VISCERAL FAT – “ENDOCRINE ORGAN”

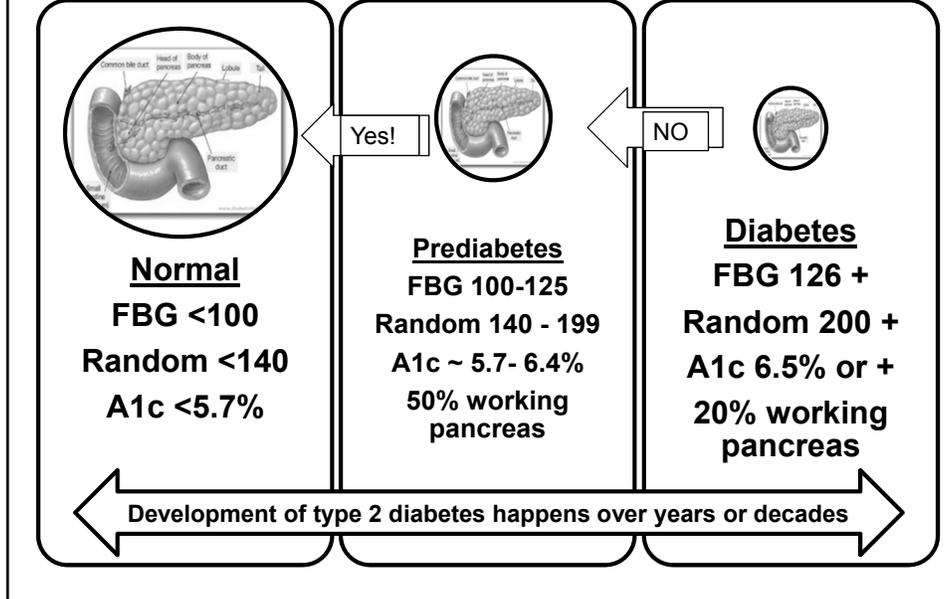


NATURAL PROGRESSION OF TYPE 2 DIABETES



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

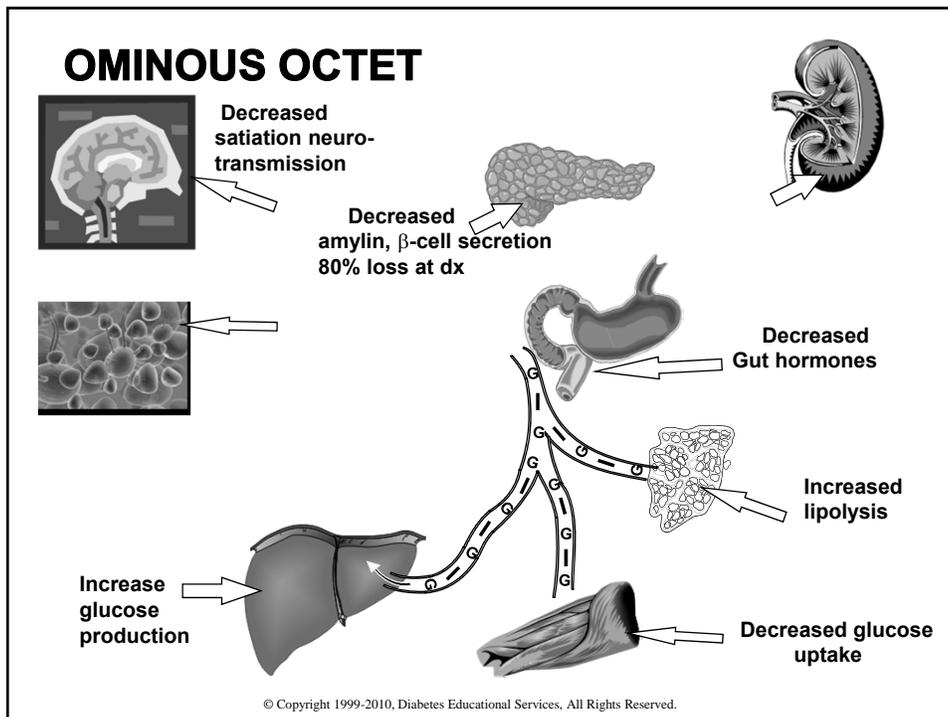
NATURAL HISTORY OF DIABETES



FLASH MOB – WORLD DIABETES DAY TO BEAT IT

- March R/C/R
 - Fred Astaire
 - Point R/L
 - Arms up, down
 - Shoulder Walk
 - Punch down/up
 - Scoot Rt/Left
 - Reach up R/L
 - Shoulder Walk
- Open door
 - Ride Horse
 - Scoot Rt/Left
 - Turn R & Clap, then L
 - Shoulder Walk
 - Punch down/up





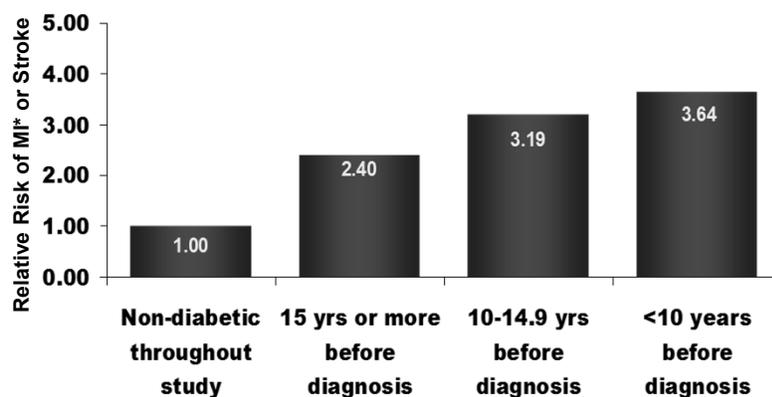
CARDIO METABOLIC RISK - 5 HYPERS -

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



Manifestations of Insulin Resistance

RISK OF CVD IS ELEVATED PRIOR TO DIAGNOSIS OF TYPE 2 DIABETES



*MI = myocardial infarction. Nurses Health Study

Adapted from: Hu F, et al. *Diabetes Care*. 2002;25:1129-1134.

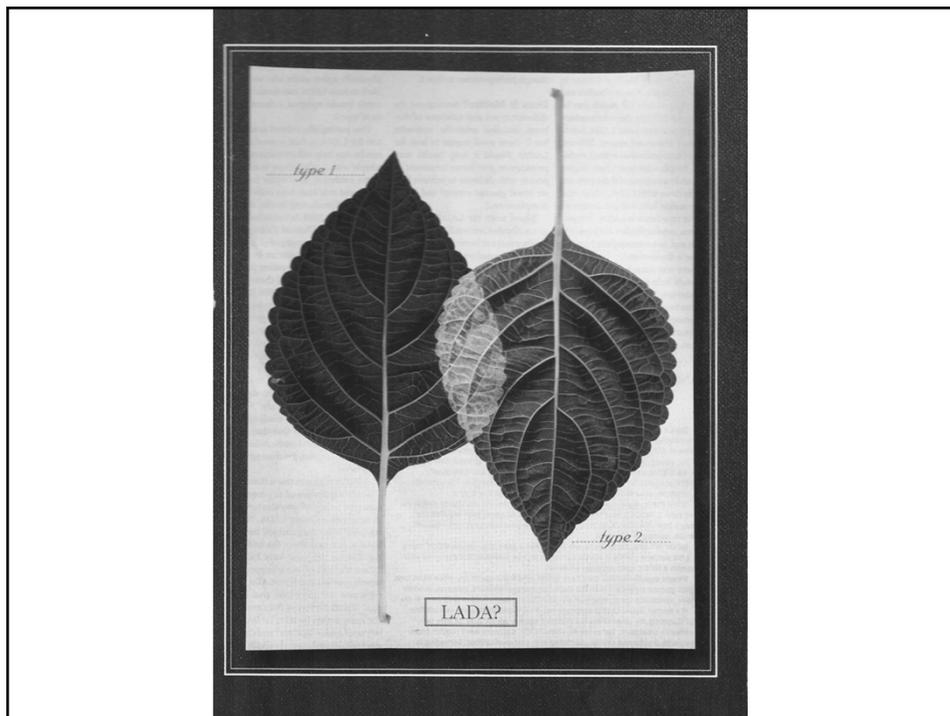
BOTTOM LINE

- 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



COMPARISON OF TYPE 1,TYPE 2, LADA

	<u>Type 1</u>	<u>Type 2</u>	<u>LADA</u>
Obesity	x	xxx	X
Insulin dependence	xxx	30%	need
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



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

OTHER CAUSES OF HYPERGLYCEMIA

- Steroids
- Agent Orange
- Tube feedings / TPN
- Transplant medications
- Cystic Fibrosis

Regardless of cause, requires treatment

- Insulin always works
- Sign of pancreatic malfunction

DIABETES IS ALSO ASSOCIATED WITH

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



PERIODONTAL DISEASE - 6TH COMPLICATION OF DIABETES?

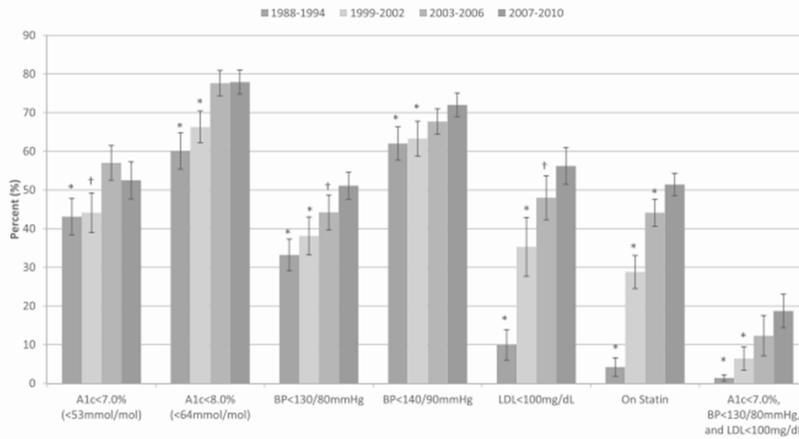
- ⊙ Chronic inflammatory disorder by the anaerobic bacteria invasion into periodontal tissues including gingival connective tissue, periodontal ligament, and alveolar bone.
- ⊙ Periodontal disease major stages-
 - gingivitis – inflammation of the gums
 - Periodontitis inflammation and infection of the ligaments and bones that support the teeth

ABCS OF DIABETES –

- ⊙ **A**1c less than 7% (avg 3 month BG)
 - Pre-meal BG 70-130
 - Post meal BG <180
- ⊙ **B**lood Pressure < 140/80
- ⊙ **C**holesterol
 - HDL >40
 - LDL <100 (if CHD, <70)
 - Triglyceride < 150

HOW ARE WE DOING? REACHING GOAL

Casagrande and Associates



Diabetes Care, 2/13

“LEGACY EFFECT”



- For participants of DCCT and UKPDS
 - long lasting benefit of early intensive BG control prevents
 - microvascular complications
 - Macrovascular complications (15-55% decrease)
 - Even though their BG levels increased over time
 - Message – Catch early and Treat aggressively

MR. JONES - WHAT ARE YOUR RECOMMENDATIONS?

Patient Profile

64 yr old with type 2 for 11 yrs. Hx of CVD.

Labs:

- A1c 7.3%
- HDL 37 mg/dl
- LDL 164 mg/dl
- Triglyceride 160mg/dl
- Proteinuria - neg
- B/P 138/96

Self-Care Skills

- ⊙ Walks dog around block 3 x's a week
- ⊙ Bowls every Friday
- ⊙ 3 beers daily
- ⊙ Widowed, so usually eats out
- ⊙ 15 lbs overweight
- ⊙ *Last eye exam 2009*

DIABETES CARE GUIDELINES- ADA

Test / Exam	Frequency
⊙ A1c	At least twice a year
⊙ B/P	Each diabetes visit
⊙ Cholesterol (LDL, HDL, Tri)	Yearly (less if normal)
⊙ Weight	each diabetes visit
⊙ Microalbumin/GFR/Creat	Yearly
● Eye exam	Yearly
● Dental Care	At least twice a year
● Comprehensive Foot Exam	Yearly (more if high risk)
● Physical Activity Plan	As needed to meet goals
● Preconception counseling	As needed

VACCINATIONS- IMMUNIZATIONS



- Flu vaccine
 - every year starting 6 months
- Pneumococcal starting at 2 years.
 - One time Revaccination for those over 64 and had first vaccine >5 years prior
- Hepatitis B Vaccine (ADA Stds 2013, pg s28)
 - For diabetes pts age 19 – 59 (not previously vaccinated)
 - Double risk of Hep B due to lancing devices/ glucose meter exposure

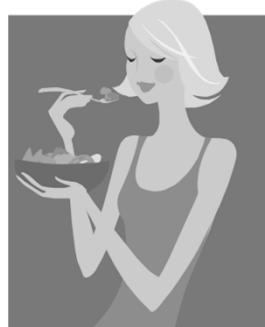
MEDICAL NUTRITION THERAPY – ADA 2014 UPDATES



- No ideal percentage of calories from protein, carbohydrate and fat for people with diabetes.
- Macronutrient distribution should be based on an *individualized assessment* of eating patterns, preferences and metabolic goals.

MEDICAL NUTRITION THERAPY 2014 - ADA

- ◉ Focus on the Individual
- ◉ Maintain pleasure of eating
- ◉ Provide positive messages about food
- ◉ Limit food choices only when backed by science
- ◉ Provide practical tools
- ◉ Refer to a RD and Diabetes Education – Lowers A1c by 1-2%



APPROACH DEPENDS ON PATIENT

- New Type 2
 - Portion Control
 - Plate Method
 - Record Keeping
 - Education
- On Insulin?
 - Carb counting



LOSING 2-8 KG EARLY IN DIAGNOSIS TYPE 2 HELPFUL

ADA 2014

- Weight Loss –
 - *The optimal macronutrient intake to lose weight not known*
 - *The literature does not support one particular nutrition therapy to reduce weight, but rather a spectrum of eating patterns that result in reduced energy intake.*

- Wt loss goal ½ pound to 1 lb a week
 - Decrease intake 250-500 cal daily + exercise

- 2013 – Try and keep less than 2,300 mg a day
- Vitamin and mineral supplements not recommended - lack of evidence.
- Fiber 25 -38 gms a day



WEIGHT LOSS AND PREVENTION

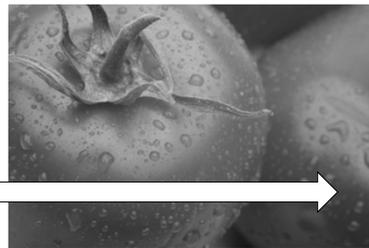
A screenshot of a website slide. At the top left is the logo for 'dttac' (Diabetes Training and Technical Assistance Center) with navigation links 'HOME ABOUT HELP'. Below the logo is the text 'Diabetes Training and Technical Assistance Center'. The main content area features the 'NATIONAL Diabetes PREVENTION PROGRAM' logo, which includes icons of a heart, a person, and a checkmark. To the right of this logo is the 'EMORY ROLLINS SCHOOL OF PUBLIC HEALTH' logo. Below the logos is a navigation bar with 'PREV' and 'NEXT' buttons. The main text on the slide reads: 'For every 2.2 pounds of weight loss achieved, risk for type 2 diabetes was reduced by 13%.' There is also a small 'Rectangular Snip' watermark.

SUCCESSFUL WEIGHT LOSS STRATEGIES INCLUDE

- ◉ Weekly self-weighing
- ◉ Eat breakfast
- ◉ Reduce fast food intake.
- ◉ Decrease portion size
- ◉ Increase physical activity
- ◉ Use meal replacements
- ◉ Eat healthy foods



MOVE TOWARD THE TOMATO



HEALTH CAMPAIGNS

1250 CALORIES

CHOOSE LESS. WEIGH LESS.

680 CALORIES

PORTION SIZE MATTERS.
2000 calories a day is all most adults need.

For more information and tips on healthy eating visit:
CHOOSEHEALTHLA.COM

Double Cheeseburger, Large Fries, 32 oz. Cola

Cheeseburger, Small Fries, 16 oz. Cola

ADA RECOMMENDATION EAT LESS JUNK FOOD & SUGARY DRINKS –

- ◉ Less Processed Foods
- ◉ Less Sugary Beverages
 - increase visceral adiposity
 - With sugar or
 - High fructose corn syrup
- ◉ Soda Tax?
- ◉ Junk Food Tax?



10 SUPERFOODS

- ◉ Beans
- ◉ Dark Green Leafy Veggies
- ◉ Citrus Fruit
- ◉ Sweet Potatoes
- ◉ Berries
- ◉ Tomatoes
- ◉ Fish High in Omega-3 Fatty Acids
- ◉ Whole Grains
- ◉ Nuts
- ◉ Fat-Free Milk and Yogurt



USDA FOOD PYRAMID WWW.MYPLATE.GOV

Balancing Calories

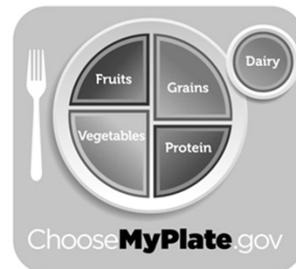
- ◉ Enjoy your food, but eat less.
- ◉ Avoid oversized portions.

Foods to Increase

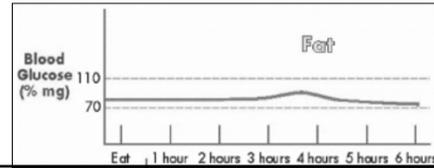
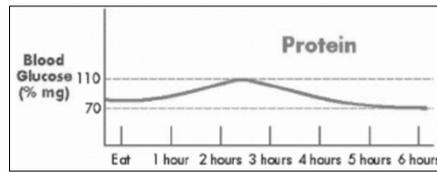
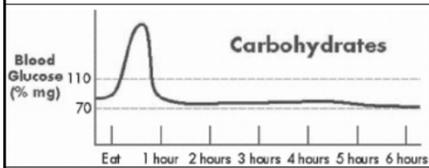
- ◉ Make half your plate fruits and vegetables.
- ◉ Make at least half your grains whole grains.
- ◉ Switch to fat-free or low-fat (1%) milk.

Foods to Reduce

- ◉ Compare sodium in foods like soup, bread, and frozen meals — and choose the foods with lower numbers.
- Drink water instead of sugary drinks.



HOW NUTRIENTS AFFECT BLOOD SUGAR



CARBS AFFECT POST MEAL BLOOD GLUCOSE

- Starch
- Fruit
- Milk
- Desserts

Starchy foods



ADAM.

CARBOHYDRATE NEEDS FOR MOST ADULTS

	<u>Grams</u>	<u>Servings</u>
Each Meal	45-60 gm	3 - 4
Snacks	15-30 gm	1- 2

Carbs affect Post Meal Blood Glucose



CHOOSE HEALTHY CARBS

- o Carbs have fiber, vitamins, minerals and phytonutrients
- o 25 gms of fiber a day
- o Power Carbs include:
 - o Beans
 - o Veggies
 - o Fruits
 - o Whole grain foods



PATIENT CENTERED APPROACH TO MANAGING TYPE 2 DM



1. Discuss a patient centered approach to manage hyperglycemia.
2. Describe the epidemiology impact on health
3. State strategies to treat hyperglycemia from lifestyle to medications.
4. Discuss how the unique characteristics of patients determine the best approach to hyperglycemic management.

MANAGEMENT OF HYPERGLYCEMIA IN TYPE 2 DIABETES: A PATIENT-CENTERED APPROACH

**POSITION STATEMENT OF THE AMERICAN DIABETES
ASSOCIATION (ADA) AND
THE EUROPEAN ASSOCIATION FOR THE STUDY OF
DIABETES (EASD)**



Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

The logo for the European Association for the Study of Diabetes (EASD), consisting of the letters 'EASD' in white on a black rectangular background.

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ADA-EASD Position Statement: Management of Hyperglycemia in T2DM: A Patient-Centered Approach

1. PATIENT-CENTERED APPROACH

2. BACKGROUND

- Epidemiology and health care impact
- Relationship of glycemic control to outcomes
- Overview of the pathogenesis of Type 2 diabetes

3. ANTI-HYPERGLYCEMIC THERAPY

- Glycemic targets
- Therapeutic options
 - Lifestyle
 - Oral agents & non-insulin injectables
 - Insulin

*Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596*

ADA-EASD Position Statement: Management of Hyperglycemia in T2DM

Patient-Centered Approach

"...providing care that is respectful of and responsive to individual patient preferences, needs, and values - ensuring that patient values guide all clinical decisions."

- Gauge patient's preferred level of involvement.
- Explore, where possible, therapeutic choices.
- Utilize decision aids.
- Shared decision making – final decisions re: lifestyle choices ultimately lie with the patient.



Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

ADA-EASD Position Statement: Management of Hyperglycemia in T2DM: A Patient-Centered Approach

3. ANTIHYPERGLYCEMIC THERAPY

- Implementation Strategies
 - Initial drug therapy
 - Advancing to dual combination therapy
 - Advancing to triple combination therapy
 - Transitions to and titrations of insulin

4. OTHER CONSIDERATIONS

- Age
- Weight
- Comorbidities (*Coronary artery disease, Heart failure, Chronic kidney disease, Liver dysfunction, Hypoglycemia*)

5. FUTURE DIRECTIONS / RESEARCH NEEDS

Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

2. BACKGROUND

- Relationship of glycemic control to outcomes

Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

IMPACT OF INTENSIVE THERAPY FOR DIABETES: SUMMARY OF MAJOR CLINICAL TRIALS

Study	Microvasc		CVD		Mortality	
UKPDS	↓	↓	↔	↓	↔	↓
DCCT / EDIC*	↓	↓	↔	↓	↔	↔
ACCORD	↓		↔		↑	
ADVANCE	↓		↔		↔	
VADT	↓		↔		↔	

Kendall DM, Borgenstal RM. © International Diabetes Center 2009

UK Prospective Diabetes Study (UKPDS) Group. *Lancet* 1998;352:854.
Holman RR et al. *N Engl J Med*. 2008;359:1577. DCCT Research Group. *N Engl J Med* 1993;329:977.
Nathan DM et al. *N Engl J Med*. 2005;353:2643. Gerstein HC et al. *N Engl J Med*. 2008;358:2545.
Patel A et al. *N Engl J Med* 2008;358:2560. Duckworth W et al. *N Engl J Med* 2009;360:129. (erratum:
Moritz T. *N Engl J Med* 2009;361:1024)

Initial Trial

Long Term Follow-up

* in T1DM

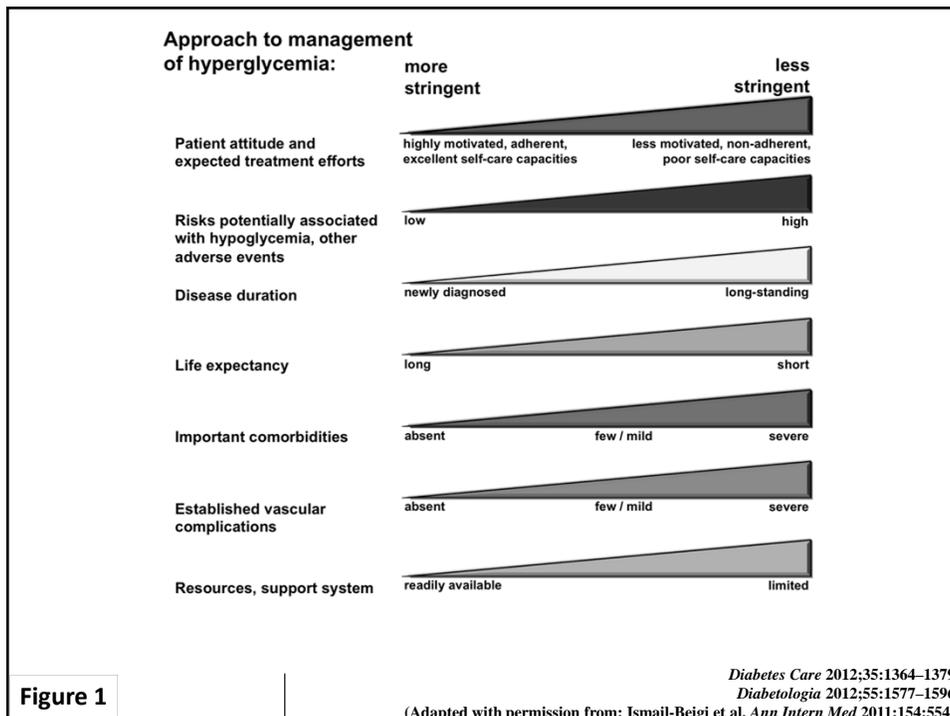
3. ANTI-HYPERGLYCEMIC THERAPY

- **Glycemic targets**

- **HbA1c < 7.0%** (mean PG ~150-160 mg/dl)
- Pre-prandial PG <130 mg/dl (7.2 mmol/l)
- Post-prandial PG <180 mg/dl (10.0 mmol/l)
- **Individualization** is key:
 - Tighter targets (6.0 - 6.5%) - younger, healthier
 - Looser targets (7.5 - 8.0%+) - older, comorbidities, hypoglycemia prone, etc.
- Avoidance of hypoglycemia

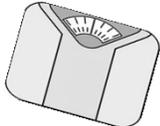
PG = plasma glucose

Diabetes Care 2012;35:1364-1379
Diabetologia 2012;55:1577-1596

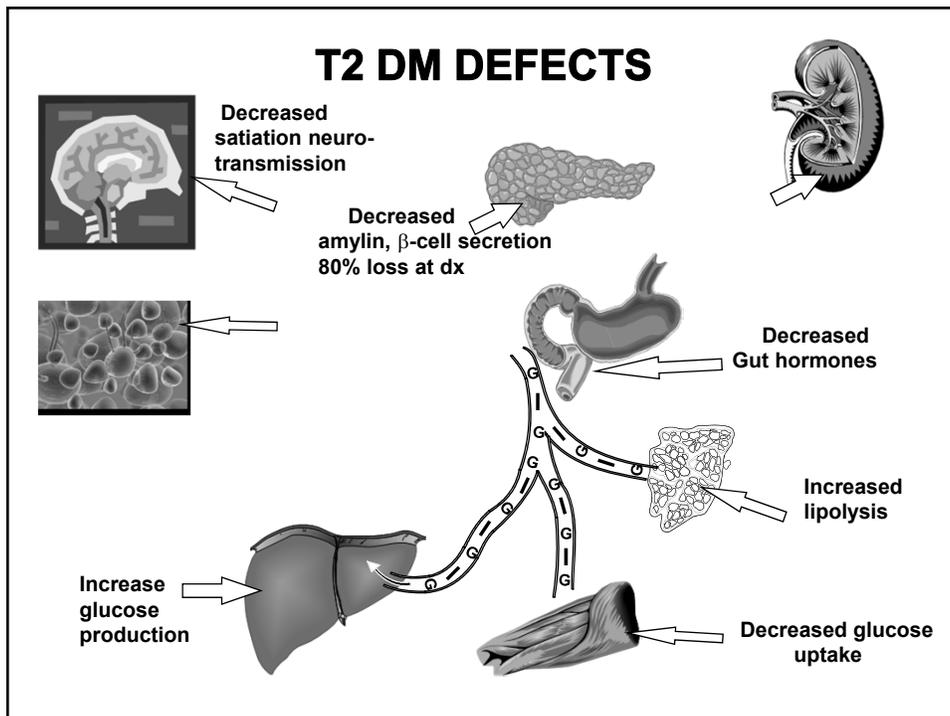


3. ANTI-HYPERGLYCEMIC THERAPY

- Therapeutic options: Lifestyle

- Early Weight Loss 2 -12 kg 
- Healthy diet 
- Increased activity level 

Diabetes Care 2012;35:1364-1379
Diabetologia 2012;55:1577-1596



IDEAL DIABETES MED -



- ⦿ No hypoglycemia
- ⦿ No weight gain
- ⦿ Affordable
- ⦿ Lowers CV risk
- ⦿ Most people can tolerate /use?

ADA-EASD Position Statement: Management of
Hyperglycemia in T2DM

3. ANTI-HYPERGLYCEMIC THERAPY



- Therapeutic options:

- Oral agents & non-insulin injectables**

- Metformin
- Sulfonylureas
- Thiazolidinediones
- DPP-4 inhibitors
- GLP-1 receptor agonists
- Meglitinides
- α -glucosidase inhibitors
- Dopamine-2 agonists
- Amylin mimetics
- SGLT-2 Inhibitors

Diabetes Care 2012;35:1364-1379
Diabetologia 2012;55:1577-1596

Class	Mechanism	Advantages	Disadvantages	Cost
Biguanides (Metformin)	<ul style="list-style-type: none"> • Activates AMP-kinase • ↓ Hepatic glucose production 	<ul style="list-style-type: none"> • Extensive experience • No hypoglycemia • Weight neutral • ? ↓ CVD events 	<ul style="list-style-type: none"> • Gastrointestinal • Lactic acidosis • B-12 deficiency • Contraindications 	Low
SUs / Meglitinides	<ul style="list-style-type: none"> • Closes KATP channels • ↑ Insulin secretion 	<ul style="list-style-type: none"> • Extensive experience • ↓ Microvascular risk 	<ul style="list-style-type: none"> • Hypoglycemia • Weight gain • Low durability • ? ↓ Ischemic preconditioning 	Low
TZDs	<ul style="list-style-type: none"> • Activates PPAR-γ • ↑ Insulin sensitivity 	<ul style="list-style-type: none"> • No hypoglycemia • Durability • ↓ TGs, ↑ HDL-C • ? ↓ CVD events (pio) 	<ul style="list-style-type: none"> • Weight gain • Edema / heart failure • Bone fractures • ? Bladder ca (pio) 	High
α-GIs	<ul style="list-style-type: none"> • Inhibits α-glucosidase • Slows carbohydrate absorption 	<ul style="list-style-type: none"> • No hypoglycemia • Nonsystemic • ↓ Post-prandial BG • ? ↓ CVD events 	<ul style="list-style-type: none"> • Gastrointestinal • Dosing frequency • Modest ↓ A1c 	Mod.

Table 1. Properties of anti-hyperglycemic agents

Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

Class	Mechanism	Advantages	Disadvantages	Cost
DPP-4 inhibitors	<ul style="list-style-type: none"> • Inhibits DPP-4 • Increases GLP-1, GIP 	<ul style="list-style-type: none"> • No hypoglycemia • Well tolerated 	<ul style="list-style-type: none"> • Modest ↓ A1c • ? Pancreatitis • Urticaria 	High
GLP-1 receptor agonists	<ul style="list-style-type: none"> • Activates GLP-1 receptor • ↑ Insulin, ↓ glucagon • ↓ gastric emptying • ↑ satiety 	<ul style="list-style-type: none"> • Weight loss • No hypoglycemia • ? ↑ Beta cell mass • ? CV protection 	<ul style="list-style-type: none"> • GI • ? Pancreatitis • Medullary ca  • Injectable 	High
Amylin mimetics	<ul style="list-style-type: none"> • Activates amylin receptor • ↓ glucagon • ↓ gastric emptying • ↑ satiety 	<ul style="list-style-type: none"> • Weight loss • ↓ Post-prandial glucose 	<ul style="list-style-type: none"> • GI • Modest ↓ A1c • Injectable • Hypo w/ insulin • Dosing frequency 	High
SGLT-2 Inhibitors	<ul style="list-style-type: none"> • Osmotic • Inhibits reuptake of glucose through renal tubules 	<ul style="list-style-type: none"> • No hypoglycemia • Weight loss • 	<ul style="list-style-type: none"> • Vulva infections • UTI's • Orthostatic Hypo 	High
Dopamine-2 agonists	<ul style="list-style-type: none"> • Activates DA receptor • Modulates hypothalamic control of metabolism • ↑ Insulin sensitivity 	<ul style="list-style-type: none"> • No hypoglycemia • ? ↓ CVD events 	<ul style="list-style-type: none"> • Modest ↓ A1c • Dizziness/syncope • Nausea • Fatigue 	High

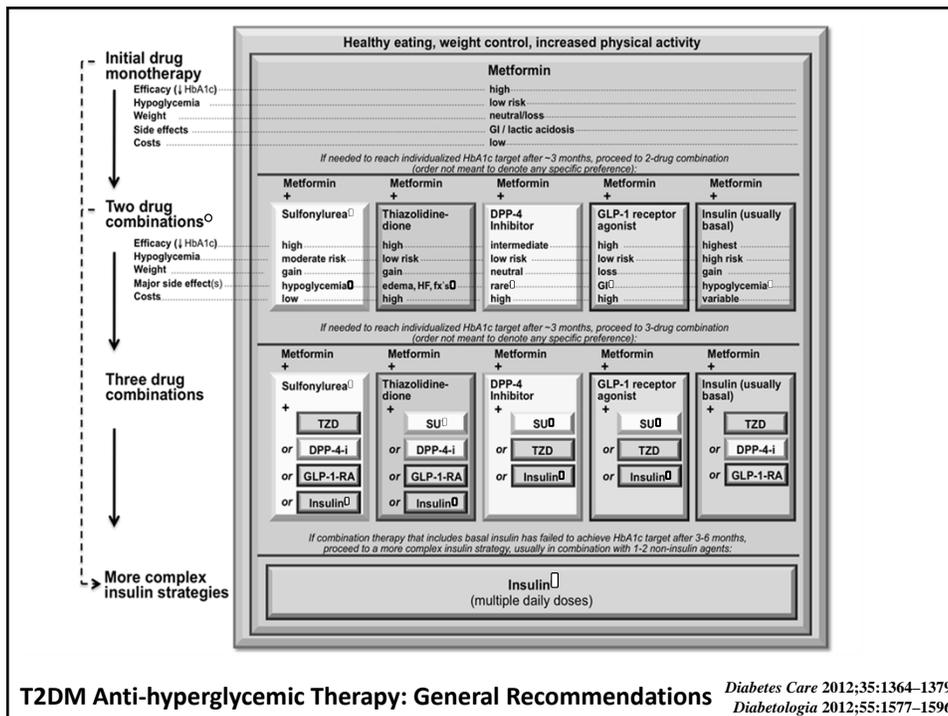
Table 1. Properties of anti-hyperglycemic agents

Diabetes Care 2012;35:1364–1379
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3. ANTI-HYPERGLYCEMIC THERAPY

- Implementation strategies:
 - Initial therapy
 - Advancing to dual combination therapy
 - Advancing to triple combination therapy
 - Transitions to & titrations of insulin

Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596



CONSIDERATIONS

- **Age: Older adults**
 - Reduced life expectancy
 - Higher CVD burden
 - Reduced GFR
 - At risk for adverse events from polypharmacy
 - More likely to be compromised from hypoglycemia



- ✓ **Less ambitious targets**
- ✓ **HbA1c <7.5–8.0% if tighter targets not easily achieved**
- ✓ **Focus on drug safety**

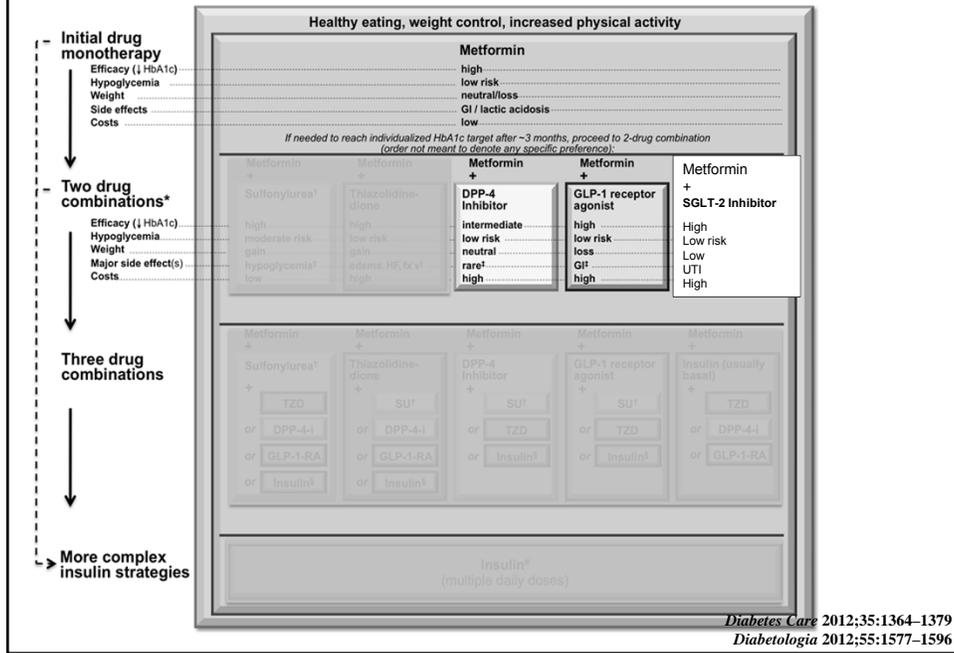
Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

CONSIDERATIONS

- **Weight**
 - Majority of T2DM patients overweight / obese
 - Intensive lifestyle program
 - Metformin
 - GLP-1 receptor agonists
 - ? Bariatric surgery
 - Consider LADA in lean patients

Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

Adapted Recommendations: When Goal is to Avoid Weight Gain



ADA-EASD Position Statement: Management of Hyperglycemia in T2DM

4. OTHER CONSIDERATIONS

- **Comorbidities**

- Coronary Disease
- Heart Failure
- Renal disease
- Liver dysfunction
- Hypoglycemia

- Metformin: CVD benefit (UKPDS)
- Avoid hypoglycemia
- ? Pioglitazone & ↓ CVD events

*Diabetes Care 2012;35:1364–1379
 Diabetologia 2012;55:1577–1596*

4. OTHER CONSIDERATIONS

- **Comorbidities**

- **Coronary Disease**
- **Heart Failure**----->
- **Renal disease**
- **Liver dysfunction**
- **Hypoglycemia**

- Metformin: May use unless condition is unstable or severe
- Avoid TZDs

Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

4. OTHER CONSIDERATIONS

- **Comorbidities**

- **Coronary Disease**
- **Heart Failure**
- **Renal disease** ----->
- **Liver dysfunction**
- **Hypoglycemia**

- Increased risk of hypoglycemia
- Metformin & lactic acidosis
 - US: stop @SCr \geq 1.5 (1.4 women)
 - UK: half-dose @GFR < 45 & stop @GFR < 30
- Caution with SUs (esp. glyburide)
- DPP-4-i's – dose adjust for most
- Avoid exenatide if GFR < 30

Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

4. OTHER CONSIDERATIONS

- **Comorbidities**

- **Coronary Disease**
- **Heart Failure**
- **Renal disease**
- **Liver dysfunction** ---->
- **Hypoglycemia**

- Most drugs not tested in advanced liver disease
- Insulin best option if disease severe

Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

4. OTHER CONSIDERATIONS

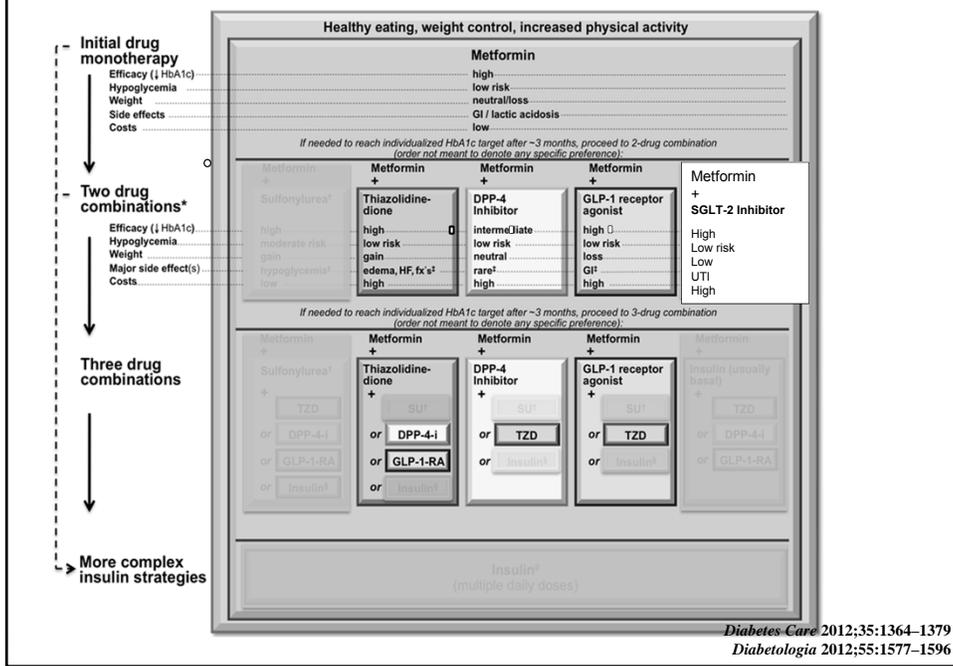
- **Comorbidities**

- **Coronary Disease**
- **Heart Failure**
- **Renal disease**
- **Liver dysfunction**
- **Hypoglycemia** ----->

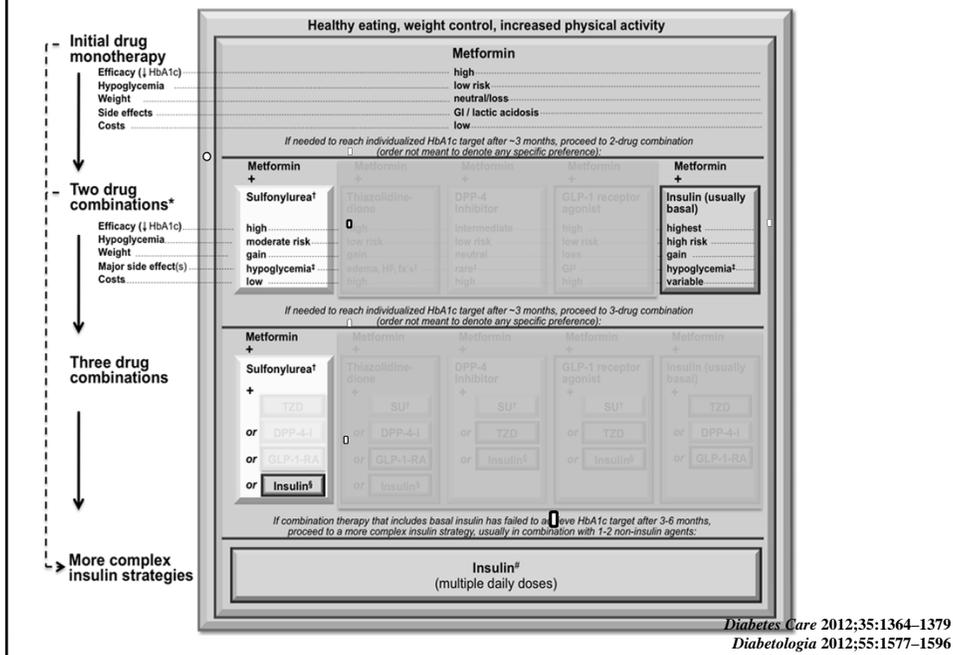
- Emerging concerns regarding association with increased morbidity / mortality
- Proper drug selection is key in the hypoglycemia prone

Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

Adapted Recommendations: When Goal is to Avoid Hypoglycemia



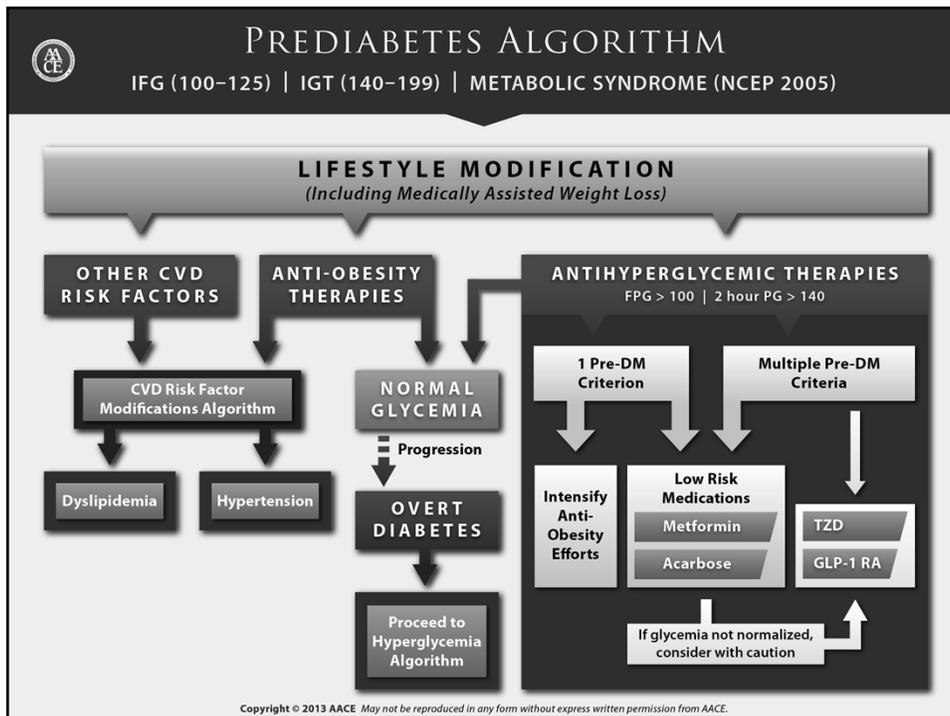
Adapted Recommendations: When Goal is to Minimize Costs

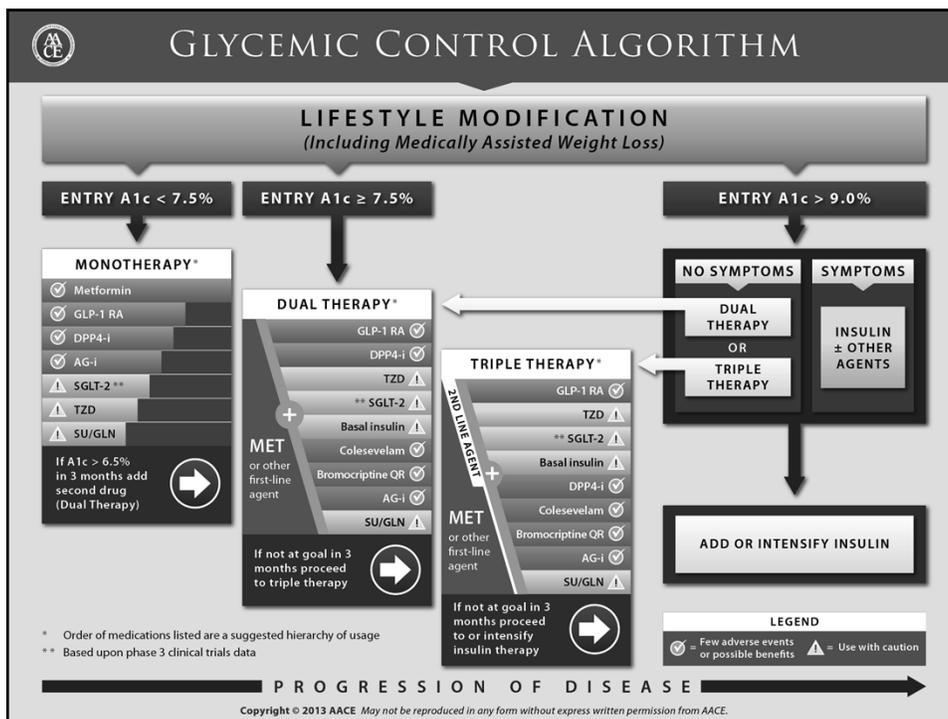


KEY POINTS

- Glycemic targets & BG-lowering therapies must be individualized.
- Diet, exercise, & education: foundation of any T2DM therapy program
- Unless contraindicated, metformin = optimal 1st-line drug.
- After metformin, data are limited. Combination therapy with 1-2 other oral / injectable agents is reasonable; minimize side effects.
- Ultimately, many patients will require insulin therapy alone / in combination with other agents to maintain BG control.
- All treatment decisions should be made in conjunction with the patient (focus on preferences, needs & values.)
- Comprehensive CV risk reduction - a major focus of therapy.

Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596





LIST THE TREATMENT OPTIONS

- 35 yr old, BMI 28, creat 0.8, A1c 6.7%
Sit 1: Wants to try lifestyle changes before meds
Sit 2: Started on Januvia, can't afford it. What alt med?
- 72 yr old, thin, lives alone, A1c 7.3%. History of MI, stroke. On glyburide 10mg a day and beta blocker. Creat 1.4.
- 69 year old male, BMI 25, on Metformin 1000mg BID. AM glucose 120s, A1c 8.1%. Creat 1.3
- 64 yr old on daily; amaryl 4mg, Januvia 100mg, Avandia® 4 mg. A1c 9.2%. Pt c/o of 12 lb wt gain over past month. Creat 1.2, LDL 138
- Pt on Exenatide 10mcg BID, c/o of sudden abd pain.

INSULIN THERAPY FROM ANTS TO ANALOGS:

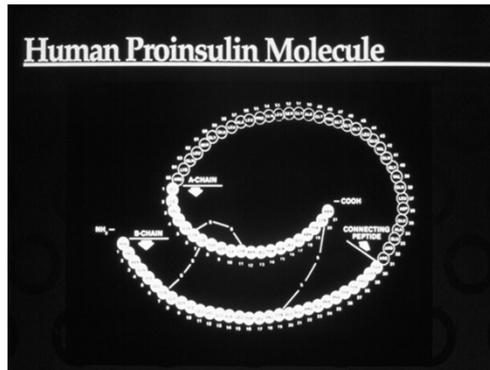


INSULIN – THE ULTIMATE HORMONE REPLACEMENT THERAPY

Objectives:

- Discuss the actions of different insulins
- Describe using pattern management as an insulin adjustment tool.

Human Proinsulin Molecule





INSULIN FINALLY AVAILABLE - 1922



The Miracle of Insulin



Patient J.L., December 15, 1922



February 15, 1923

PSYCHOLOGICAL INSULIN RESISTANCE (PIR)

- ◉ 50% of providers in study threatened pts “with the needle”.
- ◉ Less than 50% of providers realized insulins’ positive effect on type 2 dm
- ◉ Most pts don’t believe that insulin would “better help them manage their diabetes”.
- ◉ Solutions: Find the root of PIR and address it, use more insulin pens



Diabetes Attitudes, Wishes, Needs Study - Rubin

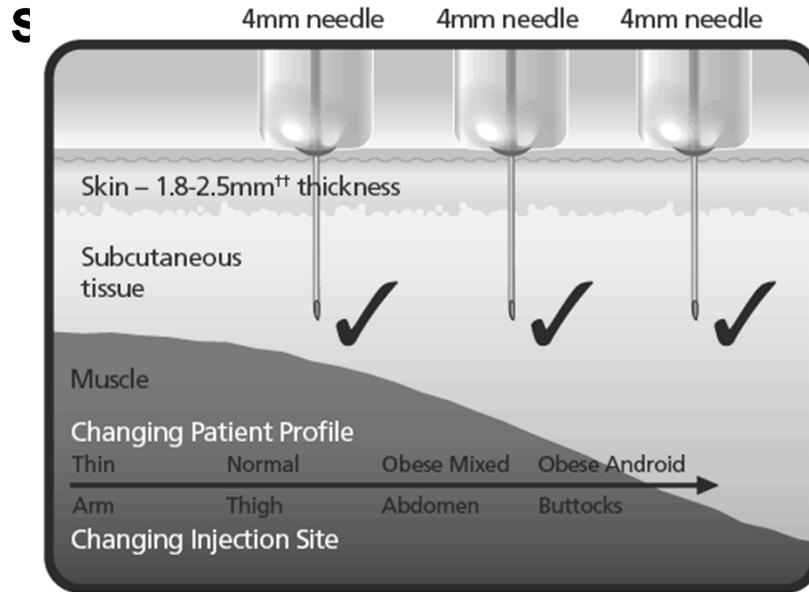
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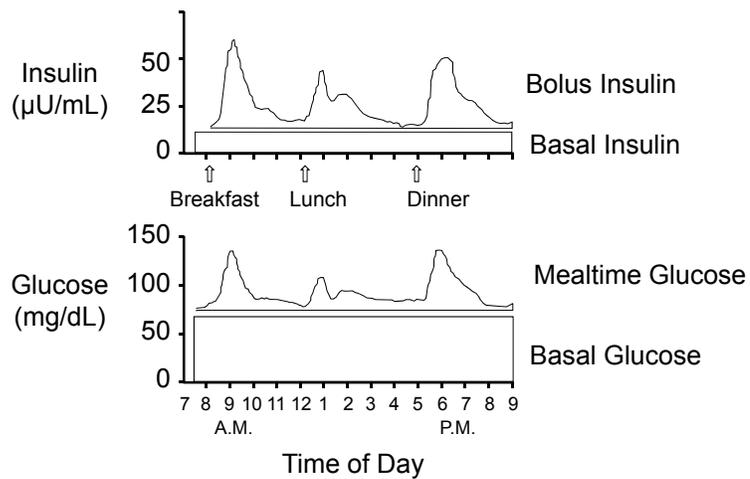


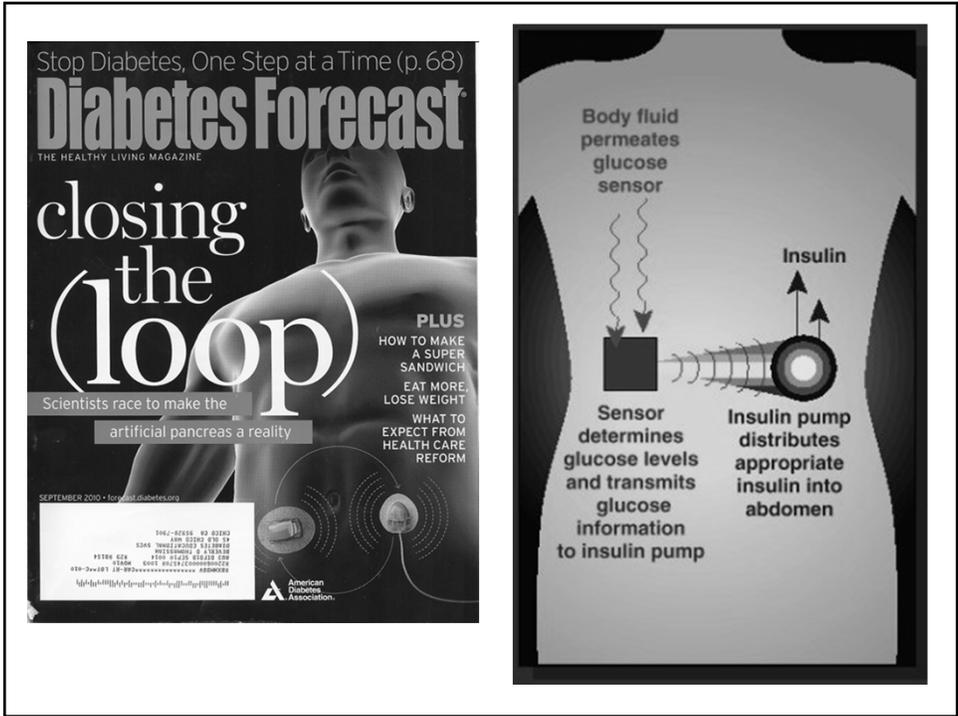
Diabetes Attitudes, Wishes, Needs Study - Rubin

NEEDLE SIZE OFTEN A BARRIER



PHYSIOLOGIC INSULIN SECRETION: 24-HOUR PROFILE





INSULIN ACTION TEAMS

◉ Bolus: lowers after meal glucose levels

- Rapid Acting
 - Aspart, Lispro, Glulisine
- Short Acting
 - Regular



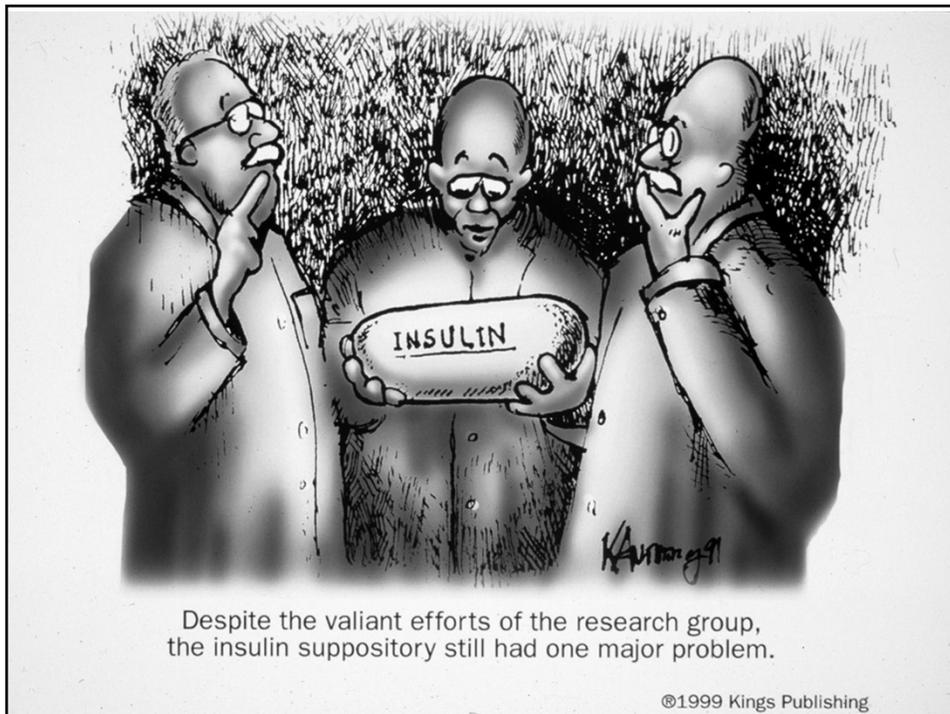
◉ Basal: controls glucose between meals, hs

- Intermediate
 - NPH
- Long Acting
 - Detemir (Levemir)
 - Glargine (Lantus)

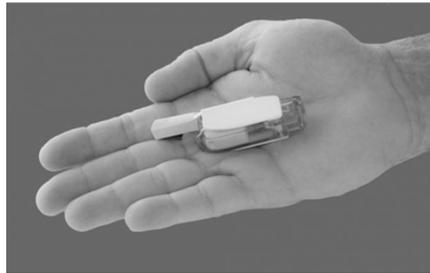
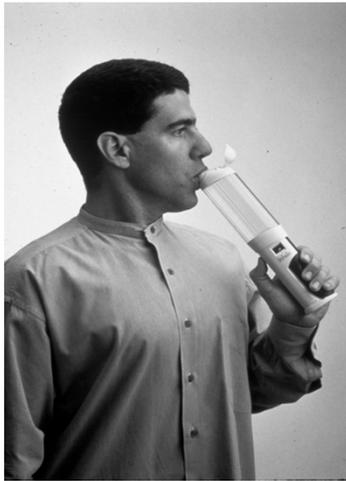


BOLUS INSULINS **($\frac{1}{2}$ OF TOTAL DAILY DOSE \div MEALS)**

<u>Name</u>	<u>Onset</u>	<u>Peak Action</u>
⦿ Lispro (Humalog)	5-15 min	0.5 -1.5 hrs
⦿ Aspart (NovoLog)		
⦿ Glulisine (Apidra)		
⦿ Regular	30 -60 min	2 - 3 hrs

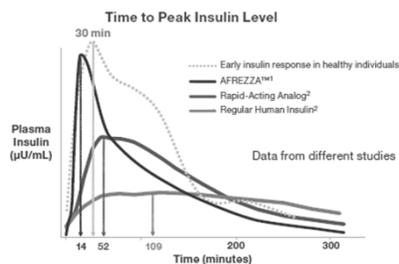


INHALED INSULIN – PAST TO FUTURE

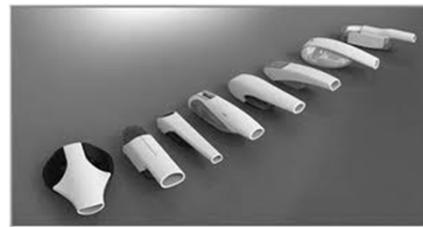


BREATH OF FRESH INSULIN

- ⦿ Afrezza – inhaled insulin (bolus)
- ⦿ Clinical trials – less wt gain and hypo
- ⦿ Not yet FDA approved



1. Non-diabetic obese subjects after 100 g oral glucose. Adapted from Kipnis D. *Ann Intern Med.* 1995;122:901-906.
 2. Insulin Aspart, 0.2 U/kg. Regular Human Insulin, 0.2 U/kg units. Subcutaneous injection in abdomen.
 Adapted from Mudaliar SR et al. *Diabetes Care.* 1999;22:1501-1506.



MannKind Corporation™

BOLUS INSULIN SUMMARY

- Regular, Novolog, Humalog, Apidra,
- Starts working fast (15-30 mins)
- Gets out fast (3-6 hours)
- Post meal BG reflects effectiveness
- Should comprise about ½ total daily dose
- Covers food or hyperglycemia.
 - 1 unit
 - Covers ≈ 10 -15 gms of carb
 - Lowers BG ≈ 30 – 50 points



BOLUS INSULIN TIMING

- How is the effectiveness of bolus insulin determined?
 - 2 hour post meal (if you can get it)
 - Before next meal blood glucose
- Glucose goals (ADA) – may be modified by provider/pt
 - 1-2 hours post meal <180
 - Before next meal – 70 - 130

BOLUS – INSULIN SLIDING SCALE
STARTS AT 150, 2 UNITS FOR EVERY 50 MG/DL
>150

	Break	Lunch	Dinner	HS
Day 1	94 no insulin	212 4 uR	148 no insulin	254 6 uR
Day 2	243 4uR	254 6 uR	201 4uR	199 2 uR
Day 3	189 2uR	243 4uR	162 2uR	244 4uR
Day 4	194 2uR	287 6uR	144 none	272 6uR

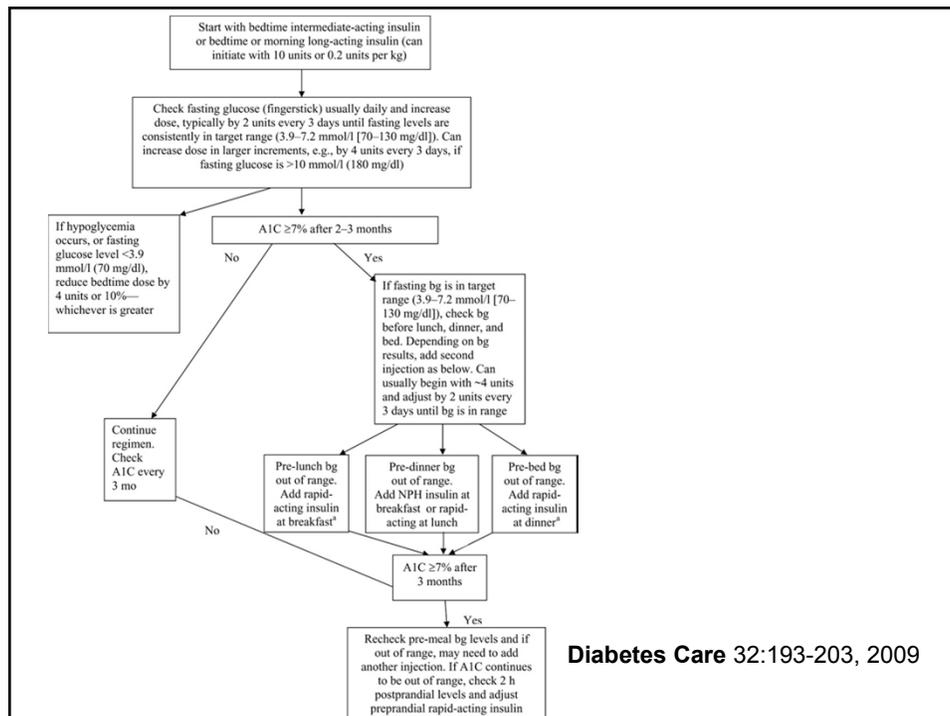
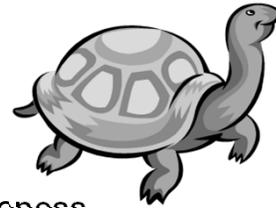
BASAL INSULINS
($\frac{1}{2}$ OF TOTAL DAILY DOSE)

<u>Intermediate Acting</u>	<u>Peak Action</u>	<u>Duration</u>
⦿ NPH	4-10 hrs	10-16
<u>Long Acting</u>	<u>Peak Action</u>	<u>Duration</u>
⦿ Detemir (Levemir)	No peak	6 - 24 hrs
⦿ Glargine (Lantus)	No peak	20- 24 hrs

Fasting BG reflects efficacy of basal

BASAL INSULIN SUMMARY

- ◉ NPH/Lente, Levemir, Lantus
- ◉ Covers in between meals, through night
- ◉ Starts working slow (4 hours)
- ◉ Stays in long (12-24 hours)
 - NPH/ Lente 12 hrs
 - Levemir, Lantus 20-24 hrs
- ◉ Fasting blood glucose reflects effectiveness



TYPE 2, 60KG BASAL ONLY A1C 8.9% AT MONTH 3

	Break	Lunch	Dinner	HS
Mo 1	178	254	276	298 10uLan
Mo 2	166	233	247	233 20uLan
Mo 3	143	213	265	206 30uLan

COMBINATION SQ INSULIN

Insulin Type	Onset	Duration
Humalog Mix 75/25: 75% NPL, 25% lispro 50/50: 50% NPL, 50% lispro	5-15 min	10-16 hrs
NovoLog Mix 70/30: 70% NPA, 30% aspart	5-15 min	10-16 hrs
NPH + Reg Combo 70/30: 70%N /30%R 50/50: 50%N /50%R	30 – 60 min	10-16 hrs

Considerations:

- Pre-mixed, difficult to fine tune therapy

BASAL / BOLUS PREMIXED ACTION INFO

	<u>Brkfst</u>	<u>Lunch</u>	<u>Dinner</u>
<u>HS</u>			
AM Basal (NPH, NPL, NPA)			X
AM Bolus (Reg, Lispro, Aspart)		X	
PM Basal	X		
PM Bolus X			

20U 70/30 PRE BREAKFAST/DINNER

14/6

14/6

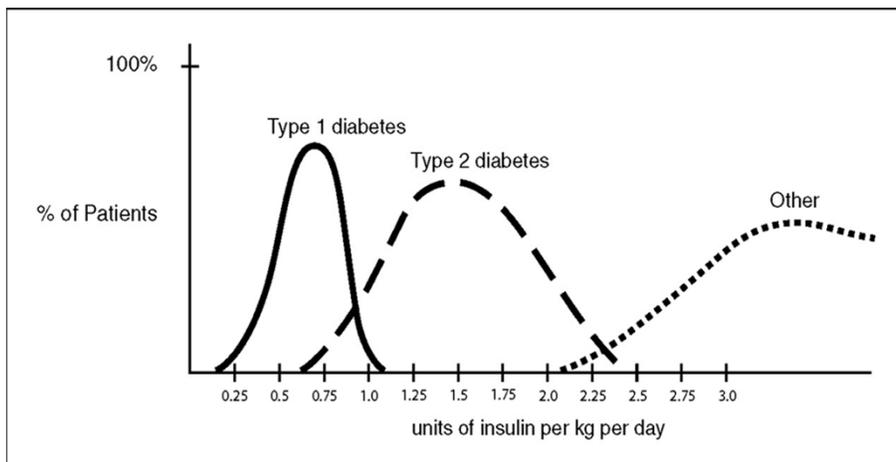
	Break	Lunch	Dinner	HS
Day 1	73	131	92	87
Day 2	162	92	137	109
Day 3	71	129	112	95
Day 4	68	139	132	102

QUICK CALCULATION

- Pt takes:
- 30 units of Humalog at breakfast and dinner.
- 20 units of Humalog at lunch and in between breakfast and lunch if BG over 200.
- A1c 8.7%
- How many vial(s) of insulin would he use a month?



INSULIN DOSING TYPE 1 & 2



U-500 Insulin: When More With Less Yields Success: *Diabetes Spectrum* March 20, 2009 vol. 22 no. 2 116-122



Source: Am J Health-Syst Pharm © 2010 American Society of Health-System Pharmacists

DOSING CONVERSION FOR U-500 USING U-100 SYRINGE

U-500 (unit markings)

- ⊙ 1 unit
- ⊙ 3 units
- ⊙ 6 units
- ⊙ 8 units
- ⊙ _____
- ⊙ _____
- ⊙ 20 units

U-100 (actual units)

- ⊙ 5 units
- ⊙ 15 units
- ⊙ ___ units
- ⊙ 40 units
- ⊙ 60 units
- ⊙ 80 units
- ⊙ ___ units

DOSING CONVERSION FOR U-500 USING U-100 SYRINGE

U-500 (unit markings)

- ⊙ 1 unit
- ⊙ 3 units
- ⊙ 6 units
- ⊙ 8 units
- ⊙ 12 units
- ⊙ 16 units
- ⊙ 20 units

U-100 (actual units)

- ⊙ 5 units
- ⊙ 15 units
- ⊙ 30 units
- ⊙ 40 units
- ⊙ 60 units
- ⊙ 80 units
- ⊙ 100 units

QUICK CALCULATION

- ⊙ Pt takes:
- ⊙ 300 units of insulin a day.
- ⊙ A1c 10.3%
- ⊙ Convert patient to u-500
- ⊙ 60% am / 40% pm
 - Morning dose
 - Before dinner dose



QUICK CALCULATION

- Pt takes:
- 300 units of insulin a day.
- A1c 10.3%
- Convert patient to u-500
- 60% am / 40% pm
 - 180 units in am or 36 units of u500
 - 120 before dinner or 24 units of u500



INTENSIVE DIABETES THERAPY INSULIN DOSING STRATEGY

50/50 Rule

- 0.5-1.0 units/kg day
- Basal = 50% of total
 - Glargine Q day
 - NPH or Detemir BID
- Bolus = 50% of total
 - usually divided into 3 meals

Example

- Wt 50kg x 0.5 = 25 units of insulin/day
- Basal dose: 13 units
 - Glargine 13 units Q day
 - NPH/Detemir 6u BID
- Bolus dose: 12 units
 - 4 units NovoLog, Apidra, Reg, Humalog each meal

INTENSIVE DIABETES THERAPY INSULIN DOSING STRATEGY

50/50 Rule

⊙ 0.5-1.0 units/kg day

⊙ Basal = 50% of total

- Glargine Q day
- NPH or Detemir BID

● Bolus = 50% of total

- usually divided into 3 meals

Example – You Try

⊙ Wt 80 kg x 0.5 = ____
units of insulin/day

⊙ Basal dose: ____ units

- Glargine ____ units QD
- NPH/Detemir ____ BID

⊙ Bolus dose: ____ units

____units NovoLog, Apidra
Humalog each meal

INTENSIVE DIABETES THERAPY INSULIN DOSING STRATEGY

50/50 Rule

⊙ 0.5-1.0 units/kg day

⊙ Basal = 50% of total

- Glargine Q day
- NPH or Detemir BID

● Bolus = 50% of total

- usually divided into 3 meals

Example – You Try

⊙ Wt 80kg x 0.5 = 40
units of insulin/day

⊙ Basal dose: 20 units

- Glargine 20 units HS or
- NPH/Detemir 10u BID

⊙ Bolus dose: 20 units

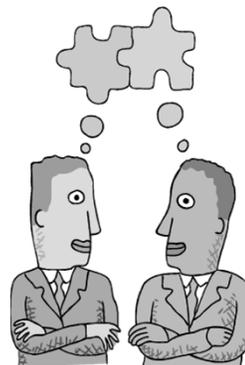
- 6-7 NovoLog, Apidra
Humalog Reg w/meal

PATTERN MANAGEMENT



PATTERN MANAGEMENT

- ◉ ID personal glucose goals
- ◉ Assess ability to self adjust based on BG
- ◉ Frequency of BGM
- ◉ Willingness to keep detailed log
- ◉ Social and Provider support



PATTERN MANAGEMENT

- ◉ Safety 1st!! - Evaluate 3 day patterns
- ◉ **Hypo** eval 1st and fix:
 - If possible, decrease medication dose
 - Timing of meals, exercise, medications
- ◉ **Hyperglycemia:** evaluate 2nd
 - Identify patterns:
 - fix fasting first, r/o Somogyi (check 3am BG)
- ◉ QA: check meter, insulin, meds



PATTERN MANAGEMENT



- ◉ Insulin adjustment general guidelines:
 - 1 unit increments if dose < 10 units
 - 2 unit increments if dose double digit
 - In general, adjust dose 10-20%
- ◉ Evaluate trends
- ◉ Provide frequent follow-up & feedback

**TYPE 2 – NEW DIAGNOSIS – NO MEDS
PATTERNS? QUESTIONS**

	Break	Lunch	Dinner	HS
Day 1	164			181
Day 2		124	106	195
Day 3	149		102	242
Day 4	151	81		211

**TYPE 2 – GLYBURIDE 10MG AM,
DETEMIR 12 UNITS AT HS**

	Break	Lunch	Dinner	HS
Day 1	164	94	66	162
Day 2	169		59	195
Day 3		84	81	242
Day 4	159		43	211

BASAL/ BOLUS – 80KGS

	Break	Lunch	Dinner	HS
Day 1	69 7H	79 5H	245 8H	190 22u Det
Day 2	81 7H	87 5H	170 8H	133 22u Det
DE 5	73 6H	124 7H	134 7H	141 20u Det
DE 7	119 6H	133 7H	172 7H	177 20u Det

TYPE 2 - 70 KG INSULIN: LANTUS AT HS + 10U HUMALOG BREAKFAST/ 5U HUMALOG DINNER

	Break	Lunch	Dinner	HS
Day 1	197 10uH	Felt funny	148 5 H	243 15 Lan
Day 2	243 10uH	94	167 5 H	219 14 Lan
Day 3	189 10uH	87	156 forgot	301 18 Lan
Day 4	127 Held Humalog			

**50/50 RULE -70 KG X .5 = 35 UNITS QD
18 LANTUS HS 17U HUMALOG /3 MEALS**

	Break	Lunch	Dinner	HS
Day 1	127 6uH	87 5uH	92 6uH	184 18 Lan
Day 4	143 6uH	129 Held ins	217 6uH	89 Held Lan
Day 5	194 6uH	137 forgot	234 6uH	301 24uLan
Day 4	127			

**USING 50/50 RULE -70 KG X .5 = 35 UNITS DAY
18 LANTUS HS 17U HUMALOG /2 MEALS**

	Break	Lunch	Dinner	HS
Day 1	142 8uH	133	158 8 H	213 18 Lan
Day 4	148 8 uH	No ck	137 8 H	182 18 Lan
Day 7	139 8uH	127	156 8H	174 18 Lan
Day 9	127 8 uH			

BOLUS BASICS

- ⦿ Carbohydrate/ Prandial Coverage
 - Match the insulin to the carbohydrates
 - 1 unit for 15 gms - Common starting point
- ⦿ Correction Bolus - targets hyperglycemia
 - 1 unit for every 30-50 points over target

- ⦿ Adjust ratios depending on sensitivity and response



ADJUSTING BOLUS AND CORRECTION DOSES CARBOHYDRATE-TO-INSULIN RATIO

Based on three questions before meals:

1. How much carbohydrate am I going to eat?
2. What is my insulin dose for this amount of carbohydrate?
3. Should I lower the dose because I plan to be very active or have recently been active?

CARBOHYDRATE RATIO HOW DOES THAT WORK?

RAPID/FAST ACTING INSULIN

⊙ Dinner (60 gms cho)

- Lemon Chicken
- 1 cup rice pilaf
(45 gms cho)
- Asparagus
- Dinner Roll
(15 gms cho)

Blood Glucose
165mg/dl

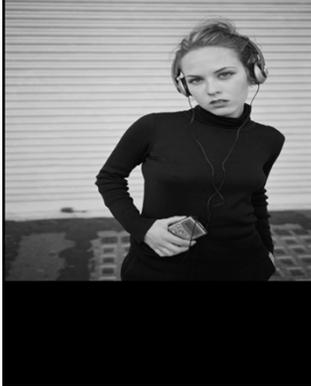
<u>Serving Size</u>	<u>Gms CHO</u>	<u>Insulin</u>
1	15 gms cho	1 unit
2	30 gms cho	2 units
3	45 gms cho	3 units
4	60 gms cho	4 units

CORRECTION BOLUS

RAPID/FAST ACTING INSULIN (1 UNIT:50 MG/DL>150)

Less than 70	Subtract 1 unit
70-150 mg/dl	0 units
151-200 mg/dl	1 unit
201-250 mg/dl	2 units
251-300 mg/dl	3 units
301-350 mg/dl	4 units
351-400 mg/dl	5 units

TYPE 1 AND A TEEN



- Cindy is trying to carb count and adjust her insulin, but is still having trouble. She weighs 60kg.
- What is her daily dose of insulin?
- What is her basal dose?
 1. Pre meal target BG is 120
 2. Post meal goal < 180.
 3. Carb ratio: 1 unit for every 15 gms
 4. Hyperglycemic correction factor is one unit for every 55 above goal (she uses Humalog and 1700 rule)

CORRECTION BOLUS FOR CINDY

ANALOG INSULIN (1 UNIT:55 MG/DL>120)

Less than 70 mg/dl	Subtract 1 unit
70-119 mg/dl	0 units
120-175 mg/dl	1 unit
176-230 mg/dl	2 units
231-285 mg/dl	3 units
286-340 mg/dl	4 units
341-395 mg/dl	5 units

ADJUSTING CINDY'S BOLUS INSULIN WITH RATIOS

BG before lunch 285, she plans to eat 45 gms of carbohydrate.

$$285 - 120 = 165 \text{ over target, } 165 / 55 = 3$$

$$45 \text{ gms} / 15 = 3$$

- 3 units bolus insulin to correct to target
- 3 units bolus insulin to cover carbs in meal

Total adjusted dose: 6 units humalog insulin

ADJUSTING CINDY'S BOLUS INSULIN WITH RATIOS - YOU TRY

BG before lunch 230, plans to eat 60 gms of carbohydrate.

$$\underline{\quad} - 120 = \underline{\quad} \text{ over target, } \underline{\quad} / 55 = \underline{\quad} \text{ units}$$

$$\underline{\quad} \text{ gms} / \underline{\quad} = \underline{\quad} \text{ units ins for carbs}$$

- units insulin to correct for hyperglycemia
- units insulin to cover carbs in meal

Total adjusted dose: units humalog insulin

ADJUSTING CINDY'S BOLUS INSULIN WITH RATIOS - ANSWERS

Fingerstick before lunch 220, plans to eat 60
gms of carbohydrate.

$$220 - 120 = 110 \text{ over target, } 100/55 = 2$$

$$60 \text{ gms} / 15 = 4 \text{ units for carbs}$$

• 2 units insulin to correct hyperglycemia

• 4 units insulin to cover carbs in meal

Total adjusted dose: 6 units humalog insulin

HOW MUCH INSULIN NEEDED?

- ⦿ Morning - BG 173
 - Breakfast – slice cold pizza, ½ c. applesauce
- ⦿ Lunch BG 69
 - Menu- ham sandwich, pear, diet 7-up, mini snickers bar.
- ⦿ 2 hours after lunch, BG 148 - ran track
- ⦿ Before dinner - BG 98
 - Cheeseburger, small fries, chocolate chip cookie
- ⦿ At bedtime, BG 173

HOW MUCH INSULIN NEEDED?

- ⊙ Morning - BG 173
 - Breakfast – slice cold pizza, ½ c. applesauce
 - 45 gms = 3 units 1 unit for hyper total = 4 units
- ⊙ Lunch BG 69
 - Menu- ham sandwich, pear, diet 7-up, mini snickers
 - 60 gms = 4 units -1 unit since < 70 total = 3 units
- ⊙ 2 hours after lunch, BG 148 – ran track
- ⊙ Before dinner - BG 98
 - Cheeseburger, small fries, chocolate chip cookie
 - 75 gms = 5 units 0 units for hyper
- ⊙ At bedtime, BG 173 – 15 unit Lantus

CINDY, 60KG, CARB (1U/15GMS) TARGET 120 PRE MEAL, HYPER 1 FOR 55

	Break	Lunch	Dinner	HS
Day 1	99	154	128	69
Pre meal BG	2uH	6uH	5uH	15 GI
Carb	30gms	75gms	60gms	15gm
Day 2	143 /184	122 /156	220 / 89	228
Pre/ post meal BG	3uH	4uH	5uH	15 GI
Carb	45gms	60gms	45gms	0gm

INSULIN TEACHING KEYS

- ◉ Bolus insulin with meals
- ◉ Basal 1-2xs daily
- ◉ Abdomen preferred injection site
- ◉ Stay 1" away from previous site
- ◉ Don't re-use ultra fine syringes
- ◉ Keep unopened insulin in refrigerator
- ◉ Toss opened insulin vial after 28 days
- ◉ Proper disposal
- ◉ Review patients ability to withdraw and inject.
- ◉ Side effects include hypoglycemia/wt gain
- ◉ Insulin pens –
 - Prime needle to assure accurate insulin dose given
 - Hold needle in for 5 seconds after injection
 - Roll 70/30 pens

SHARPS DISPOSAL: PRODUCT AND INFO



- ◉ Look in the Government section white pages for a household hazardous waste listing for your city or county.
- ◉ Call 1-800-CLEANUP (1-800-253-2687)
- ◉ Search for collection centers on the California Integrated Waste Management Board (CIWMB) Web site:
<http://www.ciwmb.ca.gov/HHW/HealthCare/Collection/>
- ◉

**DIABETES BINGO
“DIABINGO”
SHOUT OUT RIGHT ANSWER**



DIABINGO - I

- I Injected hormone that is an analog of amylin
- I Glargine, Detemir, NPH are types of
- I Breakdown of glycogen into glucose
- I Anabolic hormone
- I Insulin is released when glucose levels are low
- I Once opened, insulin vials are good for one _____
- I Elevated post-prandial glucose indicate need for pre-meal
- I Epinephrine increases insulin resistance
- I Creation of glucose from amino acids and lactate
- I Decreasing renal function for people on insulin can cause
- I Bolus insulins
- I A hormone that increases blood glucose levels

DIABETES SELF-MANAGEMENT

- Self Monitor Blood Glucose
- Meal Plan
- Exercise / Activity
- Medications



CRITICAL ASSESSMENT OF DIABETES AND COMPLICATIONS: HONING YOUR DETECTIVE SKILLS



Beverly Dyck Thomassian,
RN, MPH, BC-ADM, CDE
www.DiabetesEd.net





OBJECTIVES:

Part 1

1. Identify common yet often under diagnosed complications associated w/ type 1 and type 2 diabetes.
2. State strategies to identify previously undiscovered diabetes complications during patient assessments.

Part 2

3. Discuss links between hyperglycemia and other conditions including, cancer, transplant, cystic fibrosis and liver disease.

HONING DETECTIVE SKILLS



During patient interviews, strategies to identify previously undiscovered diabetes complications

WHAT KIND OF DIABETES



AJ, a 22 year old female admitted to the ICU with a blood glucose of 476 mg/dl and a pH of 7.1 and anion gap of 13.

- ⦿ What further questions and or testing is needed to determine if patient has type 1 or type 2 diabetes?

QUESTIONS AND PRESENTATION

- ⦿ Is she in DKA or HHS?
- ⦿ Signs/Symptoms, body weight, family history, autoimmunity
- ⦿ Not sure, check GAD, ICA, IAA



AUTOANTIBODIES ASSOC W/ TYPE 1

Panel of autoantibodies –

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



AJ – NEXT STEPS?

For AJ, a 22 year old newly diagnosed with diabetes,

1. What baseline lab work, tests, screenings, vaccinations are needed and how often?
2. What would include in your initial physical exam?
3. What referrals would be helpful?
3. Given her age, what special counsel does she require?

DIABETES LAB EVALUATION

<u>Test</u>	<u>Frequency</u>
⊙ A1c	Dx and 2-4 x's a yr
⊙ Fasting lipid profile	Dx and Annually
⊙ Microalbuminuria	Dx and annually
⊙ Creatinine / GFR	Dx and Annually
⊙ Thyroid Stimulating Hormone (type 1, hyperlipidemia, women >50)	Dx and Annually
⊙ Liver function test	Annually
• <i>Screen for Celiac Disease</i>	<i>Type 1 Dx, repeat prn</i>

ADA Clinical Practice Recommendations

COMPREHENSIVE DIABETES EVALUATION – PHYSICAL EXAM

- ⊙ Height, wt, BMI
- ⊙ B/P – orthostatic hypo, hypertension
- ⊙ Fundoscopic Evaluation (referral may be needed)
- ⊙ Thyroid palpation
- ⊙ Skin exam
- ⊙ Comprehensive Foot exam (pulses, inspection, sensation, vibration)

ADA Clinical Practice Recommendations

COMPREHENSIVE DIABETES EVALUATION – REFERRALS

- ⦿ Annual dilated eye exam
- ⦿ Family planning women of reproductive age
- ⦿ Registered Dietitian for MNT
- ⦿ Diabetes Self-Mgmt Program
- ⦿ Dental exam
- ⦿ Mental Health Professional, if needed

ADA Clinical Practice Recommendations

PATIENT IS GAINING WEIGHT

- ⦿ 68 yr old female complains of 4 lb wt gain a week for past month. Wt 140lbs, BMI 27. BG levels 200-300s. B/P 142/96
- ⦿ **Reported** daily meds include:
 - glyburide 10mg ac breakfast
 - Actos 30mg ac breakfast
 - Glargine 30units at night
 - Lispro sliding scale with meals
 - Synthroid (not sure of dose)
 - Lasix 20mg a day



**DIABETES: 30% DEPRESSED
12% OF THOSE, MAJOR DEPRESSION
70% DON'T RECEIVE TREATMENT**



- Treatment includes:
- referral to mental health professional
 - Medications



FLUID WEIGHT GAIN

- People with diabetes at greater risk for Congestive Heart Failure (CHF) due to increased CVD risk factors.
- Actos and Avandia, (TZD's), can cause fluid wt gain and worsen CHF.
- Metformin used cautiously in pt's w/ CHF due to increased risk of renal impairment

THYROID DISEASE AND DIABETES

- ◉ 27 mil Americans have over or under active thyroid glands, but more than half remain undiagnosed.
- ◉ More than 8 out of 10 pts w/ thyroid disease women.
- ◉ 15 to 30% of people w/ diabetes & their siblings or parents are likely to develop thyroid disease (compared to 4.5 percent of the general population).
- ◉ Check TSH on Type 1 & 2 annually or if indicated.

AACE Guidelines

THYROID & TSH* LEVELS



- ◉ *Thyroid Stimulating Hormone - secreted by pituitary gland
 - controls thyroid hormone thyroxine production
 - first and best test
 - TSH Norm = 0.3 and 3 mIU/mL
 - Lower = hyperthyroidism
 - Higher = hypothyroidism
- Treatment depends on levels and symptoms

Link to 2012 AACE Thyroid Guidelines

HYPOTHYROIDISM

- Hashimoto's thyroiditis – autoimmune thyroid
 - most common cause of hypothyroidism w/ dm
- Type 1 and type 2 at greater risk
- Screen annually for thyroid disease in diabetes
- Clinical features: fatigue, wt gain, dry skin, cold intolerance, depression, constipation, dyslipidemia
 - Higher risk of CVD – monitor risk
- Dx: high TSH, then test for free T4, autoantibodies, and thyroid scans as needed
- Tx: replacement with levothyroxine (75-125 ug)

AACE Thyroid Guidelines

NOVEL / ATYPICAL ANTIPSYCHOTICS LINKED TO HYPERGLYCEMIA

- Severe cases of hyperglycemia – even death reported
- Monitor BG regularly for DM patients started on this class of med
- If pt at risk for DM, determine fasting glucose before initiating therapy and monitor closely during treatment
- Weight gain may require increased dosing of diabetes therapies.

Summary of FDA warning statement for atypical antipsychotics, 2004

NOVEL/ ATYPICAL ANTIPSYCHOTICS LINKED TO HYPERGLYCEMIA

- Zyprexa – olanzapine
- Geodon - ziprasidone
- Seroquel – quetiapine
- Risperdal - risperadone
- Clozaril - clozapine
- Abilify – aripiprazole
- Latuda - lurasidone



*Consensus Development Conference on Antipsychotic
Drugs and Diabetes 2004*

NEW INSULIN START – NO ORDERS

- ◎ 71 year old woman, type 2 for 8 years
- ◎ Weight 90 kg
- ◎ DM Meds -
 - Metformin 2000mg day
 - Actos 15 mg (just started)
 - Admits to taking am meds ~ 4 xs a week, but always takes pm meds
- ◎ A1c 10.3% Checks BG ~ 5 xs wk in am (200-250) C/O of Many hyperglycemia SE

OLDER ADULTS AND DIABETES



- ◉ 20% of people over age of 65 have diabetes.
- ◉ 40% of those ages 65-75 years may be affected by hyperglycemia
- ◉ Largest increase in diabetes prevalence occurs at age 70 and older.
- ◉ Often undiagnosed and untreated
- ◉ People are living longer, control matters

OLDER ADULTS – ADA

- ◉ If functional, cognitively intact and have significant life expectancy, use same goals as for young adults.
- ◉ Glycemic goals may be relaxed w/out causing hyperglycemia symptoms
- ◉ Pay special attention to complications that impact functional impairment.



GOALS – KEEPING IT IN PERSPECTIVE



- ◉ Greater reductions in death and complications may result from CV risk factor reduction than tight BG control alone
- ◉ Strong evidence to treat HTN
- ◉ Less evidence for lipid lowering and aspirin therapies
- ◉ Research ongoing

RELAXED A1c GOAL FOR OLDER ADULTS?



- ◉ A1c goal of < 8% may be appropriate:
 - Hx of severe hypo
 - Limited life expectancy
 - Advanced micro/macro vascular disease
 - Extensive comorbidities
 - Longstanding diabetes in whom the A1c goal is difficult to achieve despite everyone's best effort

American Diabetes Association

OLDER ADULT ASSESSMENT

- Take note of initial presentation
 - Mobility and gait
 - Skin integrity and tone
 - Oral care, teeth, breath
 - How are they dressed?
 - Sneak a peak at their feet
 - Affect
 - Who they bring/not bring to appt
 - Other



OLDER ADULT – NEEDS INDIVIDUALIZED ASSEMENT

- Social support
 - Who do they live with?
 - Anyone helping with self-care?
- Finances
 - Housing, food, transportation
- Medications
 - Types
 - Can they afford?

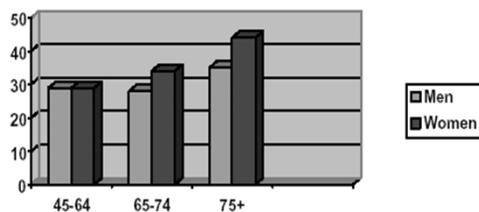


OLDER ADULTS W/ DIABETES AT RISK FOR:

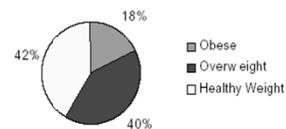
- Level of Depression
 - Can be a barrier to self care
- Cognitive impairment
 - Will influence how complicated the regime can be
 - Ability to check blood glucose
 - Accurate medication type and dosage
- Level of independence and Activity
 - How much self-care is realistic?



PHYSICAL INACTIVITY FOR U.S. MEN AND WOMEN, 2000 (PERCENT INACTIVE)



Percentage of Obese, Overweight, and Healthy Weight Adults > Age 65, 2000



<http://www.ahrq.gov/ppip/activity.htm>

PHYSICAL ACTIVITY BENEFITS

- ⦿ Lower overall mortality.
- ⦿ Lower risk of
 - coronary heart disease.
 - colon cancer.
 - diabetes.
 - high blood pressure
 - risk of obesity.
 - risk of falls and injury
 - Alzheimer's
- ⦿ Improves
 - Mood, relieves depression
 - Improved QOL / function
 - Function in persons with arthritis
 - Mental clarity
- ⦿



<http://www.nia.nih.gov/HealthInformation/Publications/ExerciseGuide>

MEDICATIONS

- ⦿ Med/ Issue
 - Metformin – watch creatinine
 - Actos/ Avandia – CHF risk
 - Sulfonylureas / Insulin – Hypo
 - Insulin – cognition and dexterity
- ⦿ Assess affordability
- ⦿ Get meds from one pharmacy
- ⦿ Keep list of meds



[Download Medication Wallet Card](#)

BLOOD GLUCOSE TESTING



- Can they use their meter?
- Results in log book?
- Do they understand significance of BG?
- Only check as often as needed to achieve blood glucose goals
- Glucose goals may need modification
 - Not less than 100 in am or before bedtime

REDUCING RISK OF HYPO



- Evaluate
 - Kidney function - if creat >1.4
 - Give long acting insulin in morning
 - Made need lower dinner bolus insulin
 - Avoid long acting sulfonylureas –
 - glipizide best choice in am
 - Hypoglycemia awareness and action
 - Activity
 - Nutritional status

NUTRITION CONSIDERATIONS FOR OLDER ADULTS



- Assess malnutrition / wt loss
- Encourage protein rich foods
- Encourage fluid intake
- Evaluate ability to chew and dentition
- Snacks as needed
- Cultural preferences and palatability

ADVOCATING FOR OLDER ADULTS

- advocate for help w/
 - transportation, shopping
 - social contact
 - negotiation with HC systems as needed
 - Brown bag inspection of meds - polypharmacy
- base instruction on pt priorities
- eval cost, access, safety, support before making care recommendations



NEW INSULIN START – NO ORDERS

- ⦿ 71 year old woman, type 2 for 8 years
- ⦿ Weight 90 kg
- ⦿ DM Meds -
 - Metformin 2000mg day
 - Actos 15 mg (just started)
 - Admits to taking am meds ~ 4 xs a week, but always takes pm meds
- ⦿ A1c 10.3% Checks BG ~ 5 xs wk in am (200-250) C/O of Many hyperglycemia SE

WHAT WOULD YOU START HER ON?



- ⦿ Intensive insulin therapy based on her wt?
 - $90\text{kg} \times 0.5 = 45$ units a day
 - 7 units bolus each meal, ~ 20 units basal at hs?
- ⦿ Start w/ 10 units Basal at HS?
- ⦿ What factors would influence your decision?

WHAT WOULD YOU START HER ON?

- ◉ My insulin suggestion
 - Pre Breakfast - 20 units 70/30 insulin
 - 14 units basal / 6 units bolus
 - Pre dinner - 10 units 70/30 insulin
 - 7 units basal/ 3 units bolus
- ◉ BGM suggestion
 - 2 x's a day
 - Before breakfast, 2 hrs after dinner

BEV'S RATIONALE



- ◉ Pt not very connected to diabetes
- ◉ Does not have a scheduled life
- ◉ Limited record keeping skills
- ◉ Overwhelmed with all her the medications she is already taking
- ◉ Start slow, gradually intensify
- ◉ Start where they are at...
- ◉ Safe and feasible short and long term?

PATIENT IS LOSING WEIGHT

SR, 49 yr old woman w/ lean “type 2” 7 yrs.

Monitors BG 1 x daily

A1c 13.9%

Insulin: 14 u Lantus at hs (uses pens)

Humalog if BG > 200 (says too expensive)

Also on Metformin 500mg BID

At 5’7, her usual wt is 120, but now 106 lbs

C/O of nausea, fullness, fatigue

No health insurance



DIABETES DETECTIVE



- ◉What other comorbidities are you suspecting?
- ◉Any labs you would like to check?
- ◉What type of diabetes?
- ◉Medication changes?
- ◉Social situation?
- ◉Consider her lack of insurance and low income level during your discussion.

DIABETES DETECTIVE

- ⦿ Other comorbidities?
 - Gastroparesis, eating disorder
- ⦿ Any labs you would like to check?
 - GAD, ICA, IAA
- ⦿ What type of diabetes? - LADA or Type 1
- ⦿ Medication changes? Stop metformin, change insulin to regular, NPH
- ⦿ Social situation – Takes care of elderly father – husband has drinking problem
- ⦿



SUGGESTED CHANGES

- ⦿ Regular insulin 3 times a day – 3 units if don't check BG (eat 45 gms of carb)
- ⦿ If check BG, add 1 unit for each 50 pts above 150
- ⦿ Try and eat 3 times a day – use liquid calories as needed, low fiber
- ⦿ Check BG at least once a day
- ⦿ Weekly phone call check in

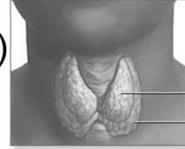


HYPERTHYROIDISM

- ⊙ Graves Disease (most common)
- ⊙ 0.5 – 2.0% risk in type 1
- ⊙ Autoimmune disorder:
 - Symptoms: wt loss, hypermetabolism, tremor, exophthalmos, palpitations, tachycardia, heat intolerance, nervousness, hyperglycemia
 - Diagnosis: Dx: low TSH, then check T3 & T4, autoantibodies, and thyroid scans
 - Treatment: antithyroid drugs, surgery, radioactive iodine. After treatment, may need thyroid replacement therapy



Exophthalmos (bulging eyes)



Graves' disease is a common cause of hyperthyroidism, an over-production of thyroid hormone, which causes enlargement of the thyroid and other symptoms such as exophthalmos, heat intolerance and anxiety

Normal thyroid
Enlarged thyroid

Diffuse goiter

©ADAM

AACE Thyroid Guidelines 2013

GASTROPARESIS



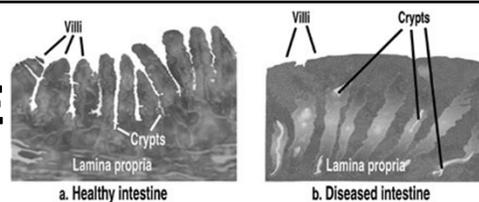
- ⊙ Gastroparesis: affects 20 – 30% of pt's w/ longstanding dm
- ⊙ Delayed emptying of stomach contents due to nerve damage
- ⊙ S/S include early satiety, fullness, postprandial hypo, vomiting
- ⊙ Diagnosis: gastric emptying studies, post-prandial hypoglycemia
- ⊙ Tx: improve BG, small, low fat & fiber meals meds: reglan, erythromycin

SR STRUGGLING W/ EATING

- ◉ Gained 20 lbs
- ◉ Low blood sugar after meals
- ◉ Doesn't feel very hungry
- ◉ Doesn't want to check BG
- ◉ A1c 9.7%
- ◉ Strategies?
- ◉ Worries?



CELIAC DISEASE



- ◉ Type 1 – Affects 1-16%
- ◉ Immune reaction to gluten - affects function of villi in intestine, decreasing nutrient absorption
- ◉ S/S: bloating, malabsorption, wt loss, fatty stools, diarrhea, muscle tenderness, failure to thrive
- ◉ Diagnosis: measure either anti-endomysial antibodies (EMA) titers or tissue transglutaminase.
- ◉ If positive, refer to GI specialist for endoscopy and biopsy of small intestine to confirm diagnosis.

TREATMENT – GLUTEN FREE FOR LIFE

○ Avoid

- wheat (einkorn, durum, faro, graham, kamut, semolina, spelt),
- rye,
- barley



ASSOCIATED AUTOIMMUNE DISORDERS

- Insulin-dependent Type 1 Diabetes Mellitus, Liver diseases, Thyroid Disease-Hashimoto's Thyroiditis, Lupus (SLE), Addison's Disease, Chronic Active Hepatitis, Rheumatoid Arthritis

EX OF GLUTEN CONTAINING FOODS

- Brown rice syrup
- Breading & coating mixes
- Croutons
- Energy Bars
- Flour or cereal products
- Imitation bacon
- Imitation seafood
- Marinades
- Pastas
- Processed luncheon meats
- Sauces, gravies
- Self-basting poultry
- Soy sauce or soy sauce solids
- Soup bases
- Stuffings, dressing
- Thickeners (Roux)
- Communion wafers



CELIAC DISEASE RESOURCES

- ◎ Celiac Association www.csaceliacs.org
- ◎ Gluten intolerance group www.gluten.net
- ◎ Gluten-Free Mall www.glutenfreemall.com
- ◎ www.Celiac.org
- ◎ Gluten Free Diet: A Comprehensive Resource Guide – Shelley Case
- ◎ New laws mandate labeling for “gluten free”



SOMETHING'S NOT RIGHT

Type 2 pt referred to you for MNT and DSMT. BMI 23, on max dose glyburide and Actos, but blood glucose levels are climbing. A1c at diagnosis 6.8%, 6 months later, 8.2%. Pt has maintained weight and is exercising 30 minutes 4 times a week.

Diabetes Types *Key characteristics of type 1, LADA (latent autoimmune diabetes in adults), and type 2.*

	Type 1	LADA	Type 2
Typical age of onset	Youth or adult	Adult	Adult
Progression to insulin dependence	Rapid (days/weeks)	Latent (months/years)	Slow (years)
Presence of autoantibodies*	Yes	Yes	No
Insulin dependence	At diagnosis	Within 6 years	Over time, if at all
Insulin resistance	No	Some	Yes

*Proteins that indicate the body has launched an autoimmune attack on the insulin-producing beta cells in the pancreas.

**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
- No need for insulin in first 6 mos



J Clin Endo Metab, 2009 Jerry P. Palmer, MD



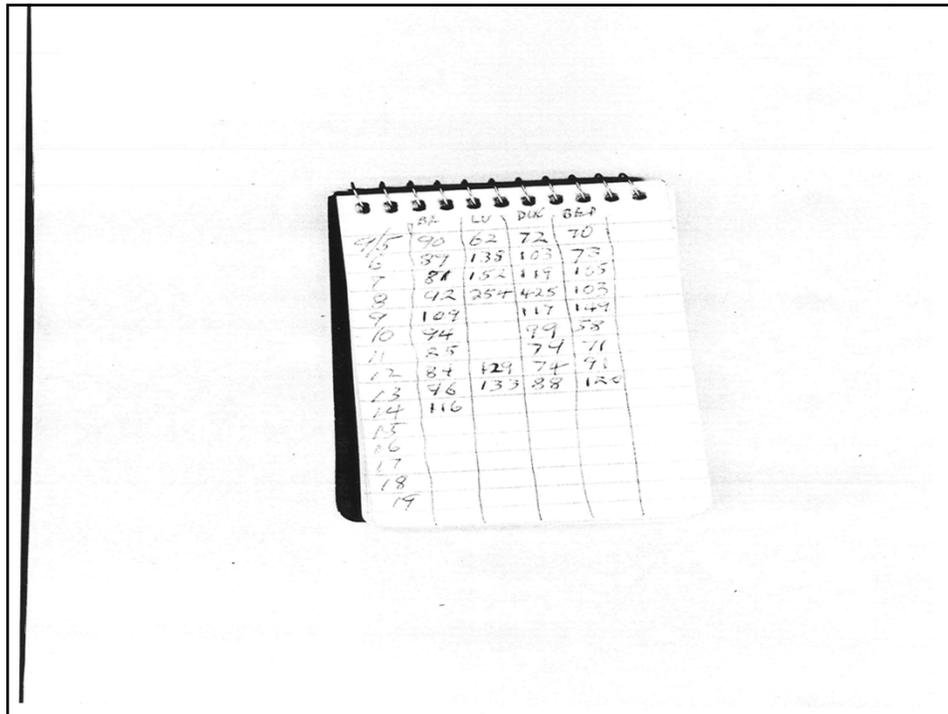
DON'T FEEL IT

- 78 year old man, w/ type 2 for 20+ years. History of heart attack. Admitted to hospital for hypoglycemia (BG 38). He tells you, "I didn't feel any signs of low. During assess, he tells you, when I exercise on treadmill, my heart rate never goes above 100.
- Meds
 - Detemir 10 units, BID Novolog sliding scale
 - Atenolol (Tenormin) Lipitor ASA

QUESTIONS – "DON'T FEEL IT"



- Why doesn't he feel low blood glucose?
- Should we be concerned about his heart rate during exercise?
- Would you make any changes in his medication regimen?



CAN CARDIAC AUTONOMIC NEUROPATHY

- **Silent ischemia** – delays treatment
 - Consider chest pain in any location to be of myocardial origin in diabetes pts
 - Also carefully assess unexplained:
 - Fatigue, confusion, tiredness, edema, hemoptysis, N/V, diaphoresis, arrhythmias, cough or dyspnea
- EKG testing, refer to specialist for at risk pts
- Assess for resting tachycardia

CAN CARDIAC AUTONOMIC NEUROPATHY

- **Fixed heart rate**(~100 beats per min)
 - Doesn't change w/ exercise or anything
 - "cardiac denervation"
- **Orthostatic hypotension:**
 - Fall in B/P >20mm/Hg systolic upon standing
 - Due to diminished epinephrine response
 - S/S include lightheadedness, presyncopal symptoms
 - Treatment; increase B/P, avoid situations that can trigger syncopal episodes, adjust B/P meds



QUESTIONS – “DON’T FEEL IT”



- Why doesn't he feel low blood glucose?
- Should we be concerned about his heart rate during exercise?
- Would you make any changes in his medication regimen?

PART 2



HYPERGLYCEMIA AND SPECIAL SITUATIONS



- ◉ Cancer
- ◉ Post transplant hyperglycemia
- ◉ Cystic Fibrosis
- ◉ Liver Disease

DIABETES AND CANCER

People with diabetes have a

- ◎ 2 fold higher risk for cancers of
 - the liver, pancreas and endometrium
- ◎ 1.2 to 1.5 fold risk of cancers of the
 - colon, breast and bladder.
- ◎ Lower risk of prostate cancer only.

Diabetes and Cancer: A Consensus Report Cancer J Clinic 2010
Joint statement American Cancer Society and American Diabetes Assoc



LINKS



- ◎ Cancer is the 2nd leading cause of death in U.S.
- ◎ Diabetes is the 7th leading cause of death
- ◎ *Cancer and diabetes diagnosed within the same individual more frequently than would be expected, even after adjusting for age.*

RISK FACTORS COMMON TO BOTH DISEASES

- ◉ Aging
- ◉ Sex
- ◉ Obesity
- ◉ Diet
- ◉ Physical inactivity
- ◉ Smoking
- ◉ Alcohol



Biologic links incompletely understood

POSSIBLE MECHANISMS FOR A DIRECT LINK

- ◉ Hyperinsulinemia
- ◉ Hyperglycemia
- ◉ Inflammation



WHAT CAN HEALTH PROFESSIONALS DO?



- ◉ Promote healthy diet, physical activity and weight management.
- ◉ Encourage appropriate screening for cancer and to report any symptoms
- ◉ Studies indicate metformin may decrease cancer risk
- ◉ Focus on DM **prevention**



CYSTIC FIBROSIS RELATED DIABETES (CFRD)

- ◉ Cystic fibrosis
 - Affects >30,000 in U.S.
 - ◉ 1000 children dx each year
 - Abnormally thick mucus clogs lungs
 - Partial fibrotic destruction of islet cell mass leads to hyperglycemia
 - Due to improved treatment, survival rates improving

CYSTIC FIBROSIS RELATED DIABETES (CFRD)



- CFRD distinct clinical entity
 - Insulin deficient but not prone to ketosis
 - Slow moving – 2-4 yrs before diagnosis
 - Abnormal glucose tolerance associated with progressive clinical deterioration
 - Associated w/ poor nutritional status, lung disease, resp failure
 - Lowers survival rate at 30 yrs
 - Only 25% live to 30 w/ CFRD
 - 60% live to 30 years when no CFRD



CYSTIC FIBROSIS RELATED DIABETES (CFRD)

- CFRD Magnitude with CF
 - 20% of adolescents
 - 40% of adult pts, develop CFRD
 - CFRD Consensus Panel recommends:
 - FPG yearly after 14 yrs age or symptoms
 - Monitor BG closely during steroid therapy
 - A1c may not be accurate (false low)
- [Clinical Practice Recommendations for CFRD 2010](#)

CYSTIC FIBROSIS RELATED DIABETES (CFRD)



- ⊙ Treatment Philosophy
 - “Eat, we will cover”
- ⊙ Goal of therapy: maintain glucose/ weight
 - Daily cals – 120 to 150% RDA (2,400 – 3000)
 - 40% fat, 15-20% protein,
 - May be on steroid pulses
- ⊙ Med regimen needs flexibility
 - Bolus insulin w/meals, carb counting + basal
- ⊙ Monitor BG levels annually or if s/s of DM

NONALCOHOLIC FATTY LIVER DISEASE (NAFLD)



- ⊙ Increasing worldwide prevalence
 - 25% of adults
 - 75% of people w/ DM or obese
 - Up to 50% of obese children
- NAFLD = greater than 5.5% fat in liver that can't be attributed to other cause .
- Due to Insulin Resistance and Obesity*

The Metabolically Benign & Malignant Fatty Liver - 2011

DM & FATTY LIVER

- ◉ Fatty Liver and hepatic inflammation is associated with insulin resistance and measures of visceral adiposity
- ◉ It also predicts:
 - Incidence of type 2 diabetes
 - Heart disease
- ◉ Fatty liver disease is directly involved in the pathogenesis of these diseases. Maybe a cause?



FINDING LIVER DISEASE

- ◉ No makers are accurate for diagnosing NASH – only biopsy
- ◉ Obese pts or those with metabolic syndrome should be evaluated
- ◉ Signs of advanced disease include:
 - Portal hypertension, spider angiomas, reddening of palms, declining platelet counts an family hx

TREATING NAFLD

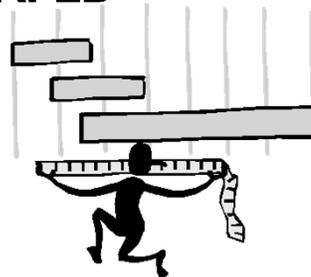
- ◉ Since there is no approved treatment for NAFLD and almost every patient with NAFLD will have to change their lifestyle – lose weight, exercise, and eat a healthy diet – it is not necessary to biopsy routinely." *NIH Clinical Center, Dr. Yaron Rotman*
Wt loss of 7-10% linked with a 50% drop in liver fat

Clinical Endocrinology News 12/12



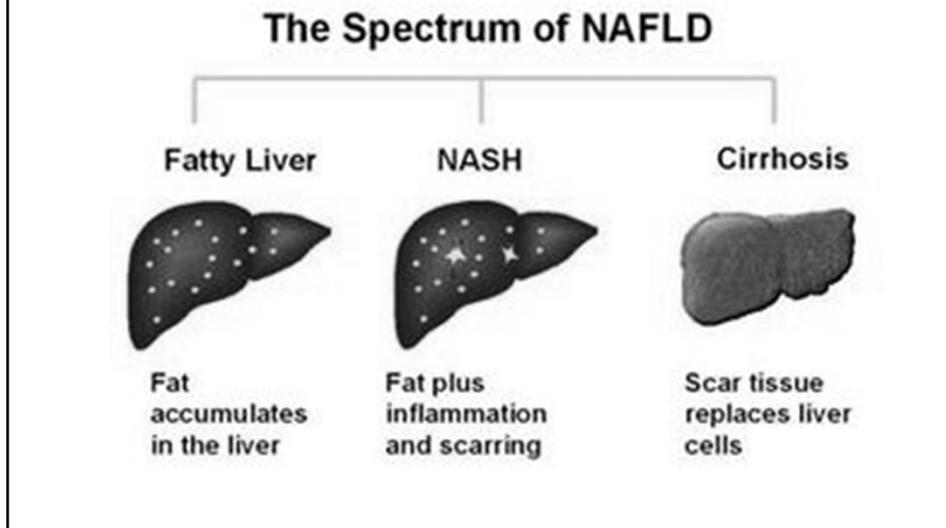
NATURAL HISTORY OF NAFLD -

- ◉ Over 3.5 - 11 year period
- ◉ “Benign” Group
 - 60% remain stable
 - 13% have improvement
- ◉ “Malignant” Group
 - 28% progress to liver damage



The Metabolically Benign & Malignant Fatty Liver - 2011

NATURAL HISTORY OF NAFLD TO NASH



DIABETES + OBESITY = PROGRESSESION TO NASH

- 50% progress from “Benign” fatty liver to Steatohepatitis.
- 2-4 fold risk of developing advanced liver disease compared to those without diabetes.
- About 15% develop cirrhosis and are at increased risk for liver cancer

NASH

◎ *Represents the hepatic manifestation of metabolic syndrome:*

- Abdominal obesity
- Hypertension
- Diabetes
- Dyslipidemia

25 million Americans will develop NASH progressing to cirrhosis, cancer or



**OVER TIME LEADS TO
NASH OR STEATOHEPATITIS**

...

- Fibrosis and Cirrhosis
- Liver Cancer
- Liver Failure

Future epidemic of liver transplants??

LIVER DISEASE & GLUCOSE

- Hepatitis-C > 40, 3x's rate of diabetes
 - Increased risk if familial history
- Cirrhosis: 80% of pts have glucose intolerance
- Hepatic failure: associated w/ hypoglycemia due to destruction of hepatocytes, increased insulin production, inadequate storage of glucose
- Hemochromatosis – up to 75% have diabetes
 - Condition characterized by excessive production and accumulation of iron in liver & other tissues. “bronze diabetes”

Levinthal, Gavin, Tavill, Anthony: Liver Disease and Diabetes Mellitus *Clinical Diabetes* 1999, v17, n2
Annals of Internal Medicine 2000;133:592-599.



**Lets take a
look at his
Lower
Extremities
and
Assess**

LOWER EXTREMITY COMPLICATIONS

- ◉ Combination of vascular, neurological, and musculoskeletal dysfunction
- ◉ After Lower Extremity Amputation (LEA), people have higher mortality rates and subsequent amputation



LOWER EXTREMITY AMPUTATIONS DROPPING OVER PAST 10YRS

- ◉ 60% of amputations in 7% of pop
- ◉ Higher in men, elderly, minorities, Chronic Kidney Disease (CKD)
- ◉ Lower extremity complications represent 20% of hospitalizations for elderly
- ◉ Amputations cost \$40,000
- ◉ Amputation associated w/ earlier death compared to revascularization
- ◉ 10 yr survival after LEA

DIABETES AND LOWER EXTREMITY ULCERS

- ◉ Up to 15% of DM patients have ulcers in their lifetime
- ◉ Mortality with foot ulcers is twice usual



RISK FACTORS FOR FOOT ULCERS/ AMPUTATION



- ◉ Previous amputation
- ◉ Past foot ulcer history
- ◉ Peripheral neuropathy
- ◉ Foot deformity
- ◉ Peripheral vascular disease
- ◉ Visual impairment
- ◉ Diabetic nephropathy (especially patients on dialysis)
- ◉ Poor glycemic control
- ◉ Cigarette smoking
- ◉ ADA Task Force - 2008

PATHWAY TO AMPUTATION –

PECORARO, FRYKBERG

Minor Trauma (environmental)

+

Faulty Healing (intercurrent
pathophysiology: circulation,
WBC/platelet function)

+

Ulceration

Predicts 72% of amp



WHAT LEADS TO ULCERS

◎ 86% single precipitating event leading to ulcer

1. Tight shoe

3 classes

1. Neuropathic

2. Ischemic (hard to heal)

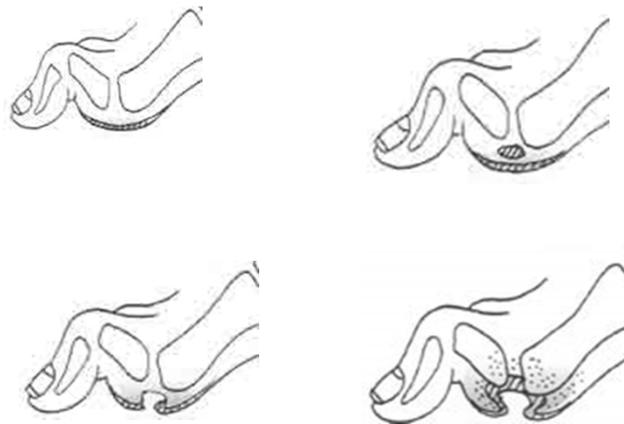
3. neuro-ischemic (worst)

“I DIDN’T NOTICE”

- ◉ Needle in foot
- ◉ Pebble in shoe
- ◉ Stepped on a nail
- ◉ Cut too deep
- ◉ Shoes were rubbing
- ◉ Others?



PRESSURE AREA BREAKDOWN



WALKING CAST FOR NEUROPATHIC ULCERS



Emotional aspects

Impact on BG

NEUROPATHY LEADS TO LOWER EXTREMITY COMPLICATIONS

Neuropathies

◎ Sensory

- loss of sensation, painless trauma, repetitive low grade stress

◎ Motor

- muscle atrophy, unbalanced tendon pulling, bone/gait changes, deformities, claw foot

◎ Motor + Sensory changes = ulcerations

◎ Autonomic

- decreased perspiration, fissures, Charcot's foot

STAIRWAY TO AMPUTATION

© Neuro + Peripheral Arterial Disease

Injury or callus

Wound

Infected

Cellulitis

Gangrene

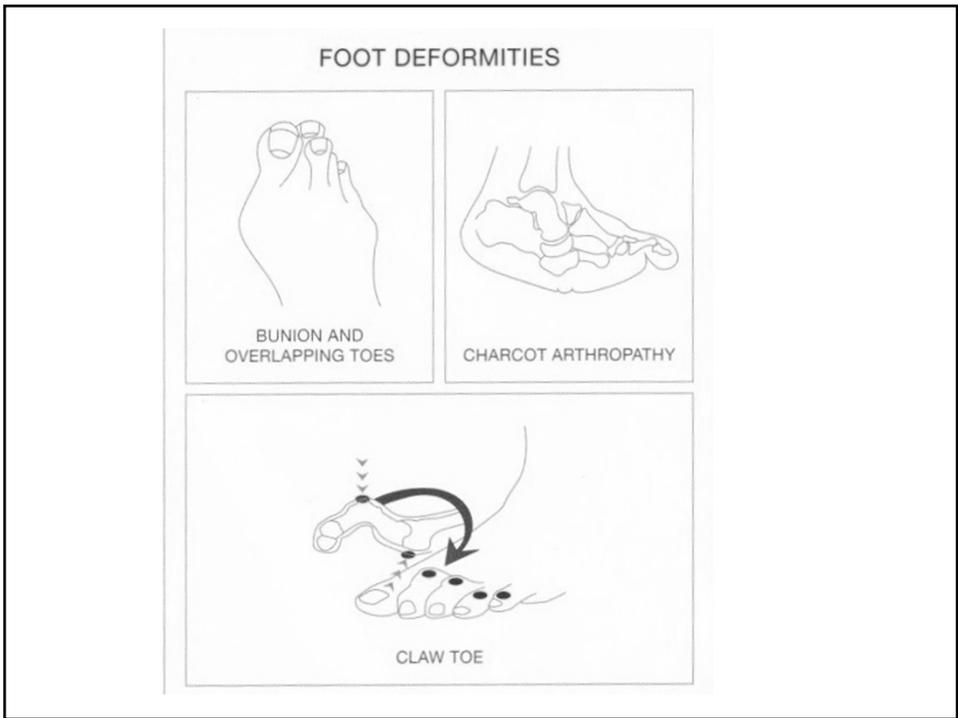
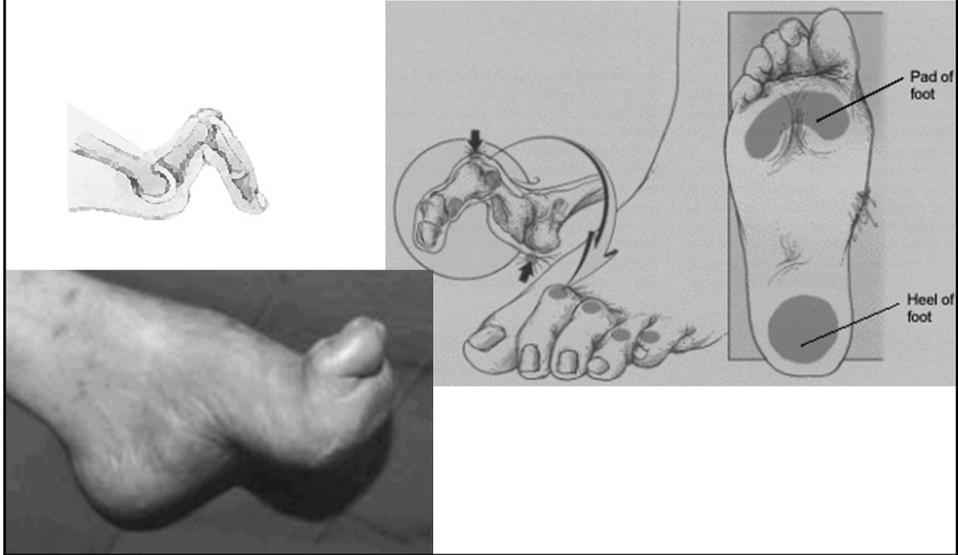
Amputation



NEUROPATHIC DIABETES FOOT ULCERS



FOOT MOTOR/NERVE DEFORMITIES



CIRCULATION ISSUES LEAD TO LOWER EXTREMITY PROBLEMS

- ⦿Peripheral Arterial Disease
- ⦿Vascular Disease
- ⦿Smoking

Peripheral Arterial Disease Assessment



PITTING EDEMA

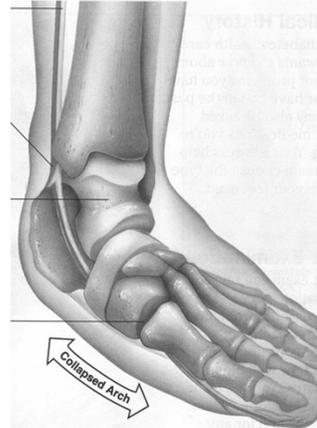


VENOUS ULCERATION



DIABETES AND CHARCOT FOOT

- ◉ Damaged nerves
- ◉ Blocked blood vessels
- ◉ Shifting bones
- ◉ Collapsed arch joints



CHARCOT'S

- **Neurotraumatic theory:**

bony destruction due to loss of pain sensation and proprioception + repetitive and mechanical trauma to foot.

- **Neurovascular theory:**

joint destruction secondary to autonomically stimulated hyperemia and periarticular osteopenia associated with trauma.



45 yr old, type 2 on orals, Random BG 201mg/dl



Tx during acute phase = Casting for 3-6 mo's then custom footwear

**FOOT EXAMINATION
POCKET CHART**

THE DIABETIC FOOT EXAMINATION

ASSESSMENT	TESTS	SIGNIFICANT FINDINGS
Patient history		<ul style="list-style-type: none"> Previous foot ulceration Previous amputation Diabetes > 10 years A1C > 7% Impaired vision Neuropathic symptoms Claudication
Dermatologic examination		<ul style="list-style-type: none"> Dry skin Appearance of hair Ingress nail edges, long or sharp nails Interspace maceration Ulceration
Screening for neuropathy	<ul style="list-style-type: none"> Semmes-Weinstein monofilament (10-g) Vibration perception threshold testing Tuning fork (128 Hz) 	<ul style="list-style-type: none"> Lack of perception at one or more sites Vibration perception threshold > 25 volts Abnormal perception of vibration
Vascular examination	<ul style="list-style-type: none"> Palpation of dorsalis pedis and posterior tibial pulses Ankle-brachial index (ABI) 	<ul style="list-style-type: none"> Absent pulses ABI < 0.90, consistent with peripheral arterial disease
Biomechanical foot assessment	<ul style="list-style-type: none"> Plantarflexion/dorsiflexion of ankles and great toes Watching patient ambulate Inspection of patient's shoes Inspection for deformity 	<ul style="list-style-type: none"> Diminished joint mobility Decreased vision, gait imbalances, need for assistive devices Ill-fitting footwear Patient's inability to see and reach his or her feet Corns, calluses, bunions Prominent metatarsal heads Hammer toes, claw toes



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To order ADA books and other materials, visit <http://store.diabetes.org> or call 1-800-523-4673

Comprehensive Foot Examination and Risk Assessment

A report of the Task Force of the Foot Care Interest Group of the American Diabetes Association, with endorsement by the American Association of Clinical Endocrinologists

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Foot problems is the first step in preventing such complications, this report will focus on key components of the foot exam.



1ST STEP – WATCH PT WALK

FOOT EXAM – PATIENT HISTORY

- ⦿ Previous foot ulceration
- ⦿ Previous amputation
- ⦿ Diabetes > 10 years
- ⦿ A1c \geq 7%
- ⦿ Impaired Vision
- ⦿ Neuropathic Symptoms
- ⦿ Claudication



FOOT EXAM – DERMATOLOGIC EXAM

- ⦿ Dry Skin
- ⦿ Absence of hair
- ⦿ Ingrown nail edges, long or sharp nails
- ⦿ Interspace maceration
- ⦿ Ulceration
- ⦿ Cleanliness



FLEXIBILITY ASSESSMENT STIFF JOINT SYNDROME



VISUAL INSPECTION/PALPATION

- Breaks in the skin
- Erythema
- Trauma
- Pallor on elevation
- Dependent rubor
- Changes in the size or shape of the foot
- Nail deformities
- Extensive callus
- Tinea pedis
- Pitting edema

VA Guidelines 2004



FOOT EXAM – SCREENING FOR NEUROPATHY

Test

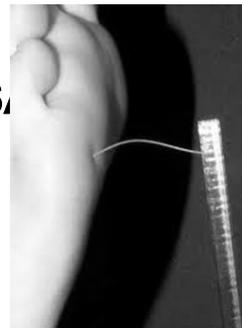
- ◉ Semmes-Weinstein monofilament 10g
- ◉ Vibration perception threshold testing
- ◉ Tuning Fork 128 Hz

Significant Finding

- ◉ Lack of perception at one or > sites
- ◉ Vibration perception threshold >24 volts
- ◉ Abnormal vibration perception

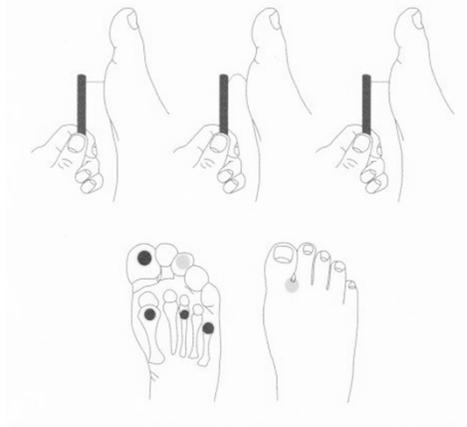
LOSS OF PROTECTIVE SENSATION

- ◉ Monofilament Testing
 - 5.07 touched to plantar surface and top of foot
 - C shape delivers 10 gms pressure
 - Test four sites
 - Plantar surfaces of
 - Each great toe
 - 1st, 3rd and 5th metatarsal head



MONOFILAMENT TESTING

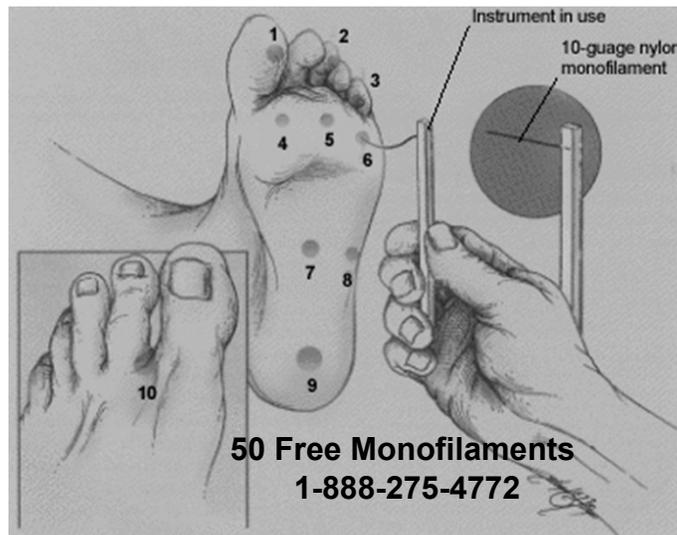
SEMMES-WEINSTEIN MONOFILAMENT
(SWMF) TEST



MONOFILAMENT (MF) PROCEDURE *(INT CONSENSUS GRP)*

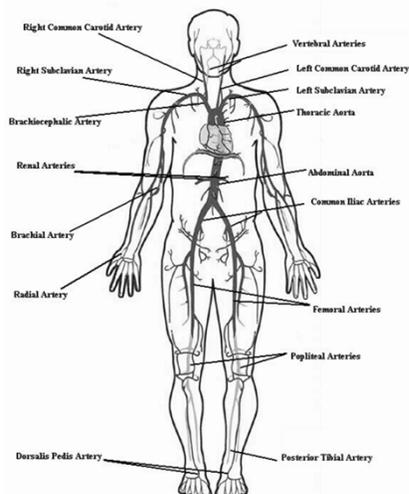
- ⦿ Demonstrate procedure on pts forearm or hand
- ⦿ Have pt close their eyes
- ⦿ Test four sites in random sequence
 - (if callus or ulcer, test adjacent surface)
- ⦿ Bow the MF and ask, “Do you feel it touch you, yes or no?”
- ⦿ Randomly test at each site 3 times (one of which is a “sham” application – MF not applied)

5.07 MONOFILAMENT = 10GMS LINEAR PRESSURE

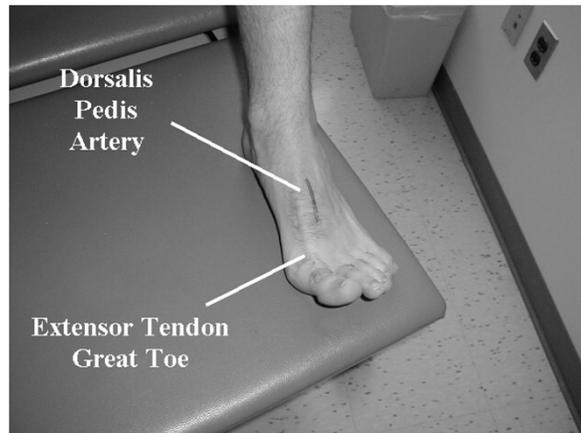


VASCULAR STATUS ASSESSMENT

- Posterior tibial pulse
- Dorsalis pedis pulse
- Temperature
- Appearance



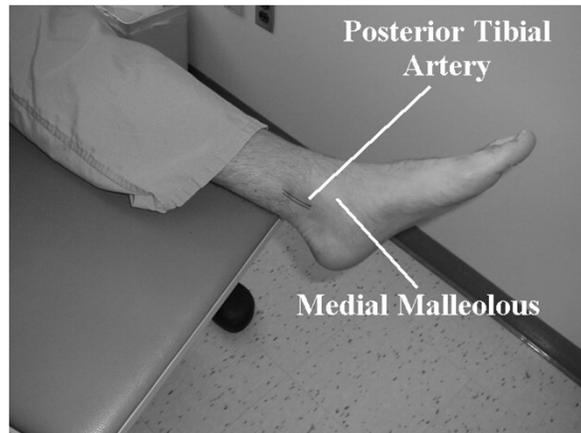
DORSALIS PEDIS PULSE



TAKING THE DP PULSE



POSTERIOR TIBIAL PULSE



TAKING THE POSTERIOR TIBIAL PULSE



IMPORTANT STUFF TO REMEMBER

- ◉ Always start with where the patient is at!
- ◉ Consider the entire milieu
- ◉ Listen
- ◉ Keep it simple
- ◉ Check in often
- ◉ Open lines of communication with medical team



INDIVIDUALIZE – THE BEST STRATEGY FOR ALL AGES

- ◉ Consider the individual
- ◉ Be sensitive to their unique issues /needs
- ◉ Identify polypharmacy/ financial problems
- ◉ Recognize psychological concerns
- ◉ Emotional support
- ◉ Realistic goal setting
- ◉ Follow-up and resources



DIABETES BINGO “DIABINGO” SHOUT OUT RIGHT ANSWER



DIABINGO

- B** Frequent skin and yeast infections
- B** A BMI of ____ or greater is considered overweight
- B** To reduce complications, control **A1c**, **B**lood pressure, **C**holesterol
- B** PreDiabetes – fasting glucose level of ____ to ____
- B** Erectile dysfunction indicates greater risk for ____
- B** Diabetes – fasting glucose level ____ or greater
- B** Type 1 diabetes is best described as an _____ disease
- B** People with diabetes are _____ times more likely to die of heart dx
- B** Elevated triglycerides, < HDL, smaller dense LDL
- B** Each percentage point of A1c = ____ mg/dl glucose
- B** At dx of type 2, about __% of the beta cell function is lost
- B** Diabetes – random glucose ____ or greater

DIABETES BINGO "DIABINGO" SHOUT OUT RIGHT ANSWER



DIABINGO- G

- G ADA goal for A1c is less than ____%
- G People with DM need to see their provider at least every month
- G Blood pressure goal is less than
- G People with DM should see eye doctor (ophthalmologist) at least
- G The goal for triglyceride level is less than
- G Goal for my HDL cholesterol is more than
- G The goal for blood sugars 1-2 hours after a meal is less than:

- G People with DM should get this shot every year

- G People with DM need to get urine tested yearly for _____

- G Periodontal disease indicates increased risk for heart disease

- G The goal for blood sugar levels before meals is:
- G The activity goal is to do ___ minutes on most days

DIABETES BINGO "DIABINGO" SHOUT OUT RIGHT ANSWER



DIABINGO - N

- N Injected hormone called an incretin mimetic
- N DPP demonstrated that exercise and diet reduced risk of DM by ___%
- N An _____ a day can help prevent heart attack and stroke
- N Rebound hyperglycemia
- N Scare tactics are effective at motivating patients to change behavior

- N Losing ___ % of body weight, can improve blood glucose, BP, lipids
- N Drugs that can cause hyperglycemia
- N 2/3 cups of rice equals _____ serving carbohydrate
- N A1c of 7% equals glucose of _____
- N One % drop in A1c reduces risk of complications by ___ %

- N 1 gm of fat equal _____ kilo/calories
- N Metabolic syndrome = hyperglycemia, hyperlipidemia, hypertension
- N 1% A1c = _____ of Blood Glucose

THANK YOU



Questions?

Email –

bev@diabetesed.net

Web-

www.diabetesed.net

**We are happy to
help**

