Diabetes in the 21st Century:
A Clinical and Educational Update

1. Describe impact of diabetes
2. Discuss prevention, management strategies
3. Discuss different types of diabetes
4. Describe insulin therapy
5. Review glucose patterns and determine how to adjust therapy to improve glucose.
6. Discuss medical nutrition therapy
7. Gain understanding of Type 2 Meds.
8. Demonstrate successful teaching strategies

CDC Announces

35% of Americans will have Diabetes by 2050

Boyle, Thompson, Banker, Williamson
2010, Oct 22:8(1)29
www.pophealthmetrics.com
Diabetes in America 2014

- 29 million or > 9.3%
- 27% don’t know they have it
- 1 in 3 of US adults have pre diabetes (79 mil)

Type 2 in Kids

- 7 fold increase 1990
- 1 in 6 overtwt kids (age 12-19) have prediabetes.
- ~2,500 to 3,700 new cases in U.S. annually.
- Highest risk: very obese, minority, female, low socioeconomic status, limited education
- In age range 12-19, less than 1% have Type 2 – NHANES
- Environmental changes to urgently needed

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

The right education for all
Diabetes: protect our future
The right environment for all
Diabetes: protect our future

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: 6.2%
- Hispanics: 12.8%
- Non-Hispanic blacks: 13.2%
- American Indians/Alaska Natives: 15.9%

*Based on the 2000 U.S. standard population.

- Among Hispanic adults, the age-adjusted rate of diagnosed diabetes was 5.3% for Central and South Americans, 9.9% for Cuban, 13.9% for Mexican Americans, and 14.8% for Puerto Ricans.
- Among Asian American adults, the age-adjusted rate of diagnosed diabetes was 4.9% for Chinese, 11.3% for Filipinos, 15.9% for Asian Indians, and 8.8% for other Asians.
- Among American Indian and Alaska Native adults, the age-adjusted rate of diagnosed diabetes was 14.0% in Native American/Alaska Native States, 14.0% in Alaska Natives to 21.4% among American Indians in non-Alaska States.

Why Should Zip Code Determine Life Expectancy?

California Endowment - look up your zip code at www.measureofamerica.org
Role of the Pancreas
Endocrine Functions

**Beta Cells - Insulin**
- Anabolic hormone - helps store glucose as glycogen in muscle, liver
- secreted in response to elevated glucose
- halts breakdown of glycogen in liver
- increases protein synthesis, fat storage
- powerful hypoglycemic

**Beta Cells - Amylin**
- secreted in 1:1 ratio with insulin
- Causes satiety
- Lowers post-prandial glucagon response
- Slows gastric emptying
- Type 1 make none
- Type 2 make less than normal amounts

**Alpha cells - Glucagon**
- Opposes action of insulin at the liver
- stimulated in response to low glucose levels
- stimulates liver to convert glycogen to glucose
- inhibits liver from glucose uptake
- causes hyperglycemia
Hormones Effect on Glucose

<table>
<thead>
<tr>
<th>Hormone</th>
<th>Effect</th>
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<tbody>
<tr>
<td>Glucagon (pancreas)</td>
<td></td>
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<tr>
<td>Stress hormones (kidney)</td>
<td></td>
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<tr>
<td>Epinephrine (kidney)</td>
<td></td>
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<tr>
<td>Insulin (pancreas)</td>
<td></td>
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<tr>
<td>Amylin (pancreas)</td>
<td></td>
</tr>
<tr>
<td>Gut hormones - incretins (GLP-1) released by L cells of intestinal mucosa, beta cell has receptors</td>
<td></td>
</tr>
</tbody>
</table>

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

β Cells: Enhances glucose-dependent insulin secretion

Liver: L-Glucagon reduces hepatic glucose output

Stomach: Helps regulate gastric emptying

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

Bariatric Surgery

- Consider on diabetes pts w/ BMI >35, esp with comorbidities
- Remission (BG normalized)
  - rates range from 40 – 95%
  - Better results with newer diabetes (more beta cell mass)
  - Due to increase incretins (gut hormones)
- Still researching long term benefits, cost effectiveness and risk
Natural History of Diabetes

- **Normal**
  - FBG <100
  - Random <140
  - A1c <5.7%

- **Prediabetes**
  - FBG 100-125
  - Random 140-199
  - A1c ~5.7-6.4%
  - 50% working pancreas

- **Diabetes**
  - FBG 126+
  - Random 200+
  - A1c 6.5% or+
  - 20% working pancreas

Development of type 2 diabetes happens over years or decades.

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Signs of Diabetes

- Polyuria
- Polydipsia
- Polyphasia
- Weight loss
- Fatigue
- Skin and other infections
- Blurry vision

- Glycosuria, H₂O losses
- Dehydration
- Fuel Depletion
- Loss of body tissue, H₂O
- Poor energy utilization
- Hyperglycemia increases incidence of infection
- Osmotic changes

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Diabetes Classifications

- Type 1
- Type 2
- Gestational
- Secondary
Case Study

1. Pt profile: 5’8”, 192 lb male
Diabetes 12 years, on insulin 3 yrs
What type of DM and how do you know?

2. Pt profile: 5’6”, 108 lb female
On insulin 3u Novolog before meals, 10u Lantus at bedtime
What type of DM and how do you know?

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.

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)

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

What Does Type 1 Look Like?

Mary Tyler Moore
Adam Morrison
Nick Jonas
Justice Sonia Sotomayor

From Debbie Nagata’s slide collection

Medalist Study – Harvard Joslin Diabetes Center

- After 50 years with diabetes
  - Many still produced some insulin
  - Many had no eye disease
Type 1 Summary

- Autoimmune
- Complete pancreatic destruction
- Need insulin shots
- Often first present in DKA

Type 1 in Hospital

- 43 yr old admitted to evaluate angina.
- Morning blood sugar is 92.
- Based on Regular insulin sliding scale, no insulin required.
- Breakfast tray shows up and patient says, I need my insulin shot before I eat.

What do you say?

Patti Labelle "divabetic" -- that's a mix of diabetic and diva
Natural Progression of Type 2 Diabetes

Cardio Metabolic Risk -
5 Hypers -

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

Manifestations of Insulin Resistance
Diabetes 2 - Who is at Risk?
(ADA Clinical Practice Guidelines)

1. Testing should be considered in all adults who are overweight (BMI ≥ 25) and have additional risk factors:
   - First-degree relative w/ diabetes
   - Member of a high-risk ethnic population
   - Habitual physical inactivity
   - PreDiabetes
   - History of heart disease

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 (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
Diabetes Detectives Needed

- On average – takes 6.5 years to diagnose diabetes
- 1/4 of all people with diabetes don’t know they have it

Ominous Octet

- Decreased satiation neurotransmission
- Decreased amylin, β-cell secretion
- 80% loss at dx
- Decreased Gut hormones
- Increased lipolysis
- Decreased glucose uptake
- Increase glucose production

Comparison of Type 1 and Type 2

<table>
<thead>
<tr>
<th></th>
<th>Type 1</th>
<th>Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity</td>
<td>x</td>
<td>xxx</td>
</tr>
<tr>
<td>Insulin dependence</td>
<td>xxx</td>
<td>30%</td>
</tr>
<tr>
<td>Respond to oral agents</td>
<td>0</td>
<td>xxx</td>
</tr>
<tr>
<td>Ketosis</td>
<td>xxx</td>
<td>x</td>
</tr>
<tr>
<td>Antibodies present</td>
<td>xxx</td>
<td>0</td>
</tr>
<tr>
<td>Typical Age of onset</td>
<td>teens</td>
<td>adult</td>
</tr>
<tr>
<td>Insulin Resistance</td>
<td>0</td>
<td>xxx</td>
</tr>
</tbody>
</table>
Diabetes is also associated with:
- Fatty liver disease
- Obstructive sleep apnea
- Cancer; pancreas, liver, breast
- Alzheimer’s
- Depression

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.

Diabetes in pregnant mothers associated with ...
- Offspring
  - Fetal Complications
  - Obesity and diabetes later in life
- Mother
  - More complicated pregnancy and delivery
  - Diabetes later in life
- Intrauterine environment is important
Postnatal Health: Maternal Behavior

- Encourage breastfeeding for one year
  - (25% of women achieving this goal)
- Screening 6-12 weeks post partum using non-pregnant OGTT criteria (50%)
- Repeat at 3 yr intervals or signs of DM
- Encourage weight control and exercise
- Make sure connected with health care
- Preconception counseling

Start Metformin therapy

- For women with PreDiabetes and History of GDM

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
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

DiaBingo

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

Glucose Management and Hospitalized Patients

- In hospitalized patients with critical illness, hyperglycemia is a signal
  that warrants our attention.
Hospitals and Hyperglycemia – What’s the Big Deal?

- Hyperglycemia is associated with increased morbidity and mortality in hospital settings.
  - Acute Myocardial Infarction
  - Stroke
  - Cardiac Surgery
  - Infection
  - Longer lengths of stay

Hyperglycemia*: A Common Comorbidity in Medical-Surgical Patients in a Community Hospital

- 26%
- 12%
- 62%

Umpierrez G et al. J Clin Endocrinol Metab 87:978, 2002

- Normoglycemia
- Known Diabetes
- New Hyperglycemia

* Hyperglycemia: Fasting BG ≥ 126 mg/dl or Random BG ≥ 200 mg/dl X 2

Effect of Hyperglycemia on Hospital Mortality

- Prior history of
  - Normoglycemia
  - Known diabetes
  - New hyperglycemia

- *P<.01 compared with normoglycemia and known diabetes.
BG Above Normal = Trouble

- Pre Diabetes
  - Fasting Glucose = 100-125mg/dl
  - A1c 5.7 – 6.4%
- Diabetes
  - Fasting Glucose = 126 mg/dl +
  - Random Glucose = 200 mg/dl +
  - A1c 6.5% +
- Any blood glucose above 140 requires treatment
  
Umpierrez et al

WHAT SHOULDN'T WE DO?

Critically Ill pts
- BG > 180- Start insulin
- BG goal 140-180

Non Critically Ill patients BG Goals
- Premeal <140
- Post meal <180
- Insulin therapy preferred treatment

Consensus: Inpt Hyperglycemia, Endocr Pract. 2009;15 (No.4)

Management of Hyperglycemia and Diabetes

- Stop oral agents (ie) metformin & sulfonylurea on admission
- “The sole use of Sliding Scale insulin is discouraged” – ADA 2014
- For discharge, oral meds can be resumed

Start Basal/bolus therapy
- NPH and Regular insulin
- Long-acting and rapid-acting insulin
- Premixed insulin
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 cellulitis of her foot. 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?

In Patient Strategies – Start Early, Focus on Survival Skills

Look for “teaching moment” opportunities
Running into Roadblocks?

- **HUG Patients**
- Help with
- Unconditional
- Guidance and Support

Anne Peters, MD, CDE
ADA Post Grad

- **Unconditional Positive Regard** – involves showing complete support and acceptance of a person no matter what that person says or does.
  
  Carl Rogers

No one is Unmotivated

.... to lead and long and healthy life

- **These are the 3 usual Critical Barriers**
  - Perceived worthlessness
  - Too many personal obstacles
  - Absence of support and resources

Bill Polonsky, PhD, CDE

Overcoming barriers

- Confront the key misbelief. Ask the question, does dm cause complications?
- Offer pts evidence based hope message –
  - Frequent contact
  - Paired glucose testing

Bill Polonsky, PhD, CDE

- Ask pt, “Tell me 1 thing that is driving you crazy about your diabetes”
- Discuss medication beliefs
- To improve outcomes, see pts more often
How Often Should I Check?

- Be realistic!!
- Type 1 - as often as needed
- Type 2 - as needed
- Consider:
  - Types and timing of meds
  - Goals
  - Ability (physical and emotional)
  - Finances

How will it help me?

- See if your treatment plan is working
- Make decisions regarding food and/or med adjustment when exercising
- Find out how that pizza affected your BG
- Avoid unwanted weight gain
- Enhanced athletic performance
- Find patterns
- Manage illness

New Meters – a little goes a long way

- 0.3 microliters of blood
- Minimal pain

Customer Service (toll-free): Look for 800 number
Foot Care

Lift the sheets and look at the Feet!

Foot Wounds

- Blisters
- Calluses
- Ulcers
- Bone infection

No Bathroom Surgery
5.07 monofilament = 10gms linear pressure
If pt can’t feel pressure = neuropathy

Free Monofilaments
http://www.hrsa.gov/leap/

3 Most Important Foot Care Tips

› Inspect and apply lotion to your feet every night before you go to bed.

› Do NOT go barefoot, even in your house. Always wear shoes!

› Every time you see your doctor, take off your shoes and show your feet.

Life Study – Mrs. Jones

› How would we manage her BG in hospital?
Now What?

- Nurse had an emergency and pt already ate lunch?
- Nurse administered insulin and pt only ate a few bites of turkey and drank non sugar tea?
- You just gave 3 units of Aspart and patient needs to go to OR NOW!

Medication for Discharge?

- Mrs. Jones is improved and ready to go home.
- What glucose management strategies for home?
- Her A1c is 9.3%

Discharge insulin Algorithm

<table>
<thead>
<tr>
<th>Discharge Treatment</th>
<th>A1C &lt; 7%</th>
<th>A1C 7%-9%</th>
<th>A1C &gt;9%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-start outpatient treatment regimen (Orals and/or insulin)</td>
<td>Re-start outpatient oral agents and D/C on glargine once daily at 50-80% of hospital dose</td>
<td>D/C on basal bolus at same hospital dose. Alternative: re-start oral agents and D/C on glargine once daily at 50-80% of hospital dose</td>
<td></td>
</tr>
</tbody>
</table>
Discharge Teaching

- What supplies will she need?
- What top 5 things do we need to teach her?
- What resources can we provide?
- What referrals?

5 Survival Skills

1. Basics of Diabetes
2. Can patient perform self blood glucose monitoring? Do they need meter?
3. Can pt safely take meds / insulin? Teach side effects.
4. Meal Planning?
5. Self Care including hypo prevent/treat
   - Follow-Up plan - Does pt know who to contact when need help?
   - Diabetes Education and more!

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

- Instructions
  - Prime needle to assure accurate insulin dose given
  - Hold needle in for 5 seconds after injection
  - Roll 70/30 pens
  - Replace large needle cap (white), unscrew and remove needle after injection. Do not leave needle on pen

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)

Medical Waste Management Act Effective Sept 1, 2008

- CA Senate Bill 1305
- New law requires proper disposal of home generated syringes, needles, lancets
- Disposal in solid waste containers no longer permitted
- EPA in 2004 also discourages sharps disposal in trash.
**When to Call Provider?**

- Blood glucose <70
- Blood glucose > 250 twice in a day (adults)
- Blood glucose >240 x 3
- *When sick with fever

*Individualize based on pt/provider

**Mrs Jones – Teaching Priorities**

- Foot Care
- How to use meter
- Insulin Injections
- Signs of Hypo/Hyper
- When and who to call for help
- Follow-up Care

**Based on Mr R’s clinical picture – In hospital**

How Much Insulin Needed?

- Creatinine 1.6
- 76 years old
- Not very hungry
- BMI 21
- Weighs 80kg
- Glucotrol 5mg at home
- A1c 7.2%
How Much Insulin Does a Patient Need?

- It depends, based on:
  - Body weight
  - Overwt, normal wt, or thin
  - Frail, elderly
  - Eating status
    - Normal, poor intake or NPO
  - Renal or hepatic insufficiency
  - Type of Diabetes
  - Current meds; steroids, insulin, oral dm agents
  - Infected or Septic

Insulin Dosing Type 1 & 2

Calculate Daily Insulin Needs

- Based on unique characteristics of pt, where would you start?
  - Body wt in Kg x ________ = total daily dose
  - May need more or less based on clinical presentation
  - Divided into 50% basal and 50% bolus

- Less 0.3 u/kg
- 0.5 u/kg
- More 1.0 u/kg

- Thin, elderly, creat
- Heavy, infection, steroids
Calculate Insulin Needs
Basal/insulin carb/correct

- Body wt in Kg x 0.3
- 80kg x 0.3 = 24 units daily

- Basal = 12 units (50%)
- Bolus = 12 units / 3 meals = 4 units each meal
- What if he is nauseated?

Mr. Rs Pattern
4 unit meal bolus + 12 unit Lantus hs

<table>
<thead>
<tr>
<th></th>
<th>Break</th>
<th>Lunch</th>
<th>Dinner</th>
<th>HS</th>
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</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>admit</td>
<td>219</td>
<td>143</td>
<td>179</td>
</tr>
<tr>
<td>Day 2</td>
<td>58</td>
<td>97</td>
<td>84</td>
<td>95</td>
</tr>
<tr>
<td>Day 3</td>
<td>67</td>
<td>nausea</td>
<td>119 clear liquids</td>
<td>104</td>
</tr>
<tr>
<td>Day 4</td>
<td>74</td>
<td>81</td>
<td>Start tube feeds</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

BG Running Low?

- Possible Causes
  - Too much insulin
  - Premal bolus
  - HS basal
  - Glucose toxicity improving
  - Infection improving
  - Stopped/lowered steroids
  - Poor kidney function
  - Skipped meal, poor PO intake
  - Not eating enough carbs
Hypoglycemia = “Limiting Factor”

- Defined as glucose of 70mg/dl or below
- 50% of episodes occur during the night
- Higher mortality rate with severe hypoglycemia secondary to sulfonylureas
  - Especially (glyburide) Micronase®, Diabeta®
- Blood glucose levels don’t describe severity, response is individual

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
15 - 20 Gms Carb Sources
- 3 - 4 Glucose Tablets
- 8 - 10 Lifesavers candy
- 8 - 10 Hard candies
- 2 Tablespoons Raisins
- 4 - 6 oz’s Nondiet soda
- 4 - 6 oz’s Fruit Juice
- 8 oz Milk (non fat)

BG Too Low? Insulin Adjustment Guidelines
- Before meal Blood glucose <70?
- Implement hypoglycemia protocol
- Evaluate cause and make needed adjustments
  - Missed meal?
  - Too much insulin?
- Morning blood glucose < 90?
  - Decrease evening Lantus by 10%
  - Evaluate trends, provide feedback

3 days poor intake, pt started on Tube Feeding
- If on continuous tube feeding, how would this change his insulin regimen?
- If on intermittent tube feeding, how would this change his insulin regimen?
- If patients tube feeding is interrupted, what precautions would you take?
Glycemic Management During Enteral Nutrition

**Continuous enteral nutrition (EN)**
- Basal insulin: once or twice daily
- Prandial bolus insulin: to match the feeding or 70/30 mix BID

**Cycled enteral nutrition:** Based on situation:
- Basal insulin
- Bolus insulin administered q4 to 6 hours
- Correctional insulin given for BG above goal

**Bolus enteral nutrition**
- Rapid acting analog or short acting insulin given prior to each bolus
- May also need basal on board

If tube pulled out, consider hanging IV D10%

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BG Running High?

- Possible Causes
  - Glucose Toxic
  - Infection
  - Started on steroids
  - Physical stress
  - Insulin dose too low

---

Calculate Daily Insulin Needs

- Based on unique characteristics of pt, where would you start?
  - Body wt in Kg x ________ = total daily dose
  - May need more or less based on clinical presentation

Less 0.3 u/kg 0.5u/kg More 1.0 u/kg

Thin, elderly, creat Heavy, infection, steroids
**Intensify Insulin therapy or start insulin drip**

- 100 units insulin in 100 cc NS Bag
- 1 cc = 1 unit of insulin

*Society of Hospital Medicine listing of sample Insulin Drip Protocols*

---

**Preparation for Surgery**

- Try to schedule surgery in am, resume meds/insulin when eating and stable.
- **Oral medications**: In am, hold all diabetes oral medications
- **Basal Insulin**: Night before
  - type 2s, may need to adjust basal doses
  - type 1s give up to 100% of basal dose.
- **Bolus insulin**: may need mild insulin bolus coverage for type 1 and type 2’s
- Have D5 or D10 IV bags available in case of hypo

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**Special Considerations During Hospital Stay**

- **Hypoglycemia** –
  - treat with 15 gms carb and recheck every 15-30 minutes until BG stable
  - Notify MD to change insulin orders
- **IV Insulin** – look carefully at insulin sensitivity and adjust insulin drip rate based on BG Trends
- **Give basal insulin, even if pt isn’t eating.** Dose may need adjustment.
Bottom Line

- 30-40% of hospitalized patients have diabetes
- 10% aren’t officially diagnosed
- Cardiovascular disease is the leading cause of hospitalization for people with diabetes
- Look for patients with hyperglycemia and cardiometabolic risk factors: smokers, HTN, central obesity, abnormal lipids, Acanthosis.
- Provide education and promote self-advocacy

Diabetes Self-Management

- Prevention
- Goals
- Insulin
- Meal Plan
- Exercise / Activity
- Medications

Financial Advisor

- Mid 30s, friendly, he smiles to greet you and you notice his gums are inflamed. You’d guess a BMI of 26 or so, with most of the extra weight in the waist area.
- If you could give him some health related suggestions, what would they be?
Can we stop pre diabetes from progressing?

3, 234 people w/ Pre-Diabetes randomized:
  - Placebo
  - Diet/Exercise or
  - Metformin
over a three year period

Diabetes Prevention Program (DPP) 2001

Diabetes Prevention Program

  - Standard Group - 29% developed DM
  - Lifestyle Results - 14% developed DM
    - 58% (71% for 60yrs +) Risk reduction
    - 30 mins daily activity
    - 5-7% of body wt loss
  - Metformin 850 BID - 22% developed DM
    - 31% risk reduction (less effective with elderly and thinner pt's)

Weight loss and Prevention

  - For every 2.2 pounds of weight loss, risk of type 2 diabetes was reduced by 13%.
Control Matters

- Trials
- Practice Recommendations

Complications - Why?

- Degree of hyperglycemia
  “glucose toxicity”
- Duration of hyperglycemia
- Genes
- Multiple risk factors:
  smoking, vascular disease, dyslipidemia, hypertension, other
Diabetes Complications

- Heart disease leading cause of death.
- CAD death rates are about 2-4x’s as high as adults without diabetes (it’s not getting better)
- Risk of stroke is 2-4 times higher
- 60% - 65% of people with DM have HTN.
- DM accounts for 40% of new cases of ESRD
- 60-70% have mild-severe forms of neuropathy
- Diabetes is the leading cause of blindness
- Accounts for 50% of lower limb amputations

Goals of Care

ABCs of Diabetes –

- A1c less than 7% (avg 3 month BG)
  - Pre-meal BG 70-130
  - Post meal BG <180
- Blood Pressure < 140/80
- Cholesterol
  - HDL >40
  - LDL <100 (if CHD, <70)
  - Triglyceride < 150
A1c and Estimated Avg Glucose (eAG) 2008

<table>
<thead>
<tr>
<th>A1c (%)</th>
<th>eAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>97</td>
</tr>
<tr>
<td>6</td>
<td>126</td>
</tr>
<tr>
<td>7</td>
<td>154</td>
</tr>
<tr>
<td>8</td>
<td>183</td>
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<tr>
<td>9</td>
<td>212</td>
</tr>
<tr>
<td>10</td>
<td>240</td>
</tr>
<tr>
<td>11</td>
<td>269</td>
</tr>
<tr>
<td>12</td>
<td>298</td>
</tr>
</tbody>
</table>

\[ eAG = 28.7 \times A1c - 46.7 \approx 29 \text{ pts per } 1\% \]

(Translated the A1c Assay into Estimated Average Glucose Values – ADA Study
Diabetes Care 31, 8, August 2008)

“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

Diabetes Care Guidelines- ADA

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

**Mr. Jones - What are Your Recommendations?**

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

Labs:
- A1c 9.3%
- HDL 37 mg/dl
- LDL 114 mg/dl
- Triglyceride 260mg/dl
- Proteinuria - neg
- B/P 142/92

**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
- My foot hurts

**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
Insulin – the Ultimate Hormone Replacement Therapy

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

The Miracle of Insulin

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

The Nobel Prize in Physiology or Medicine 1923

Born: 14 November 1891, Alliston, Canada
Died: 21 February 1941, Newfoundland, Canada
Affiliation at the time of the award: University of Toronto, Toronto, Canada
Prize motivation: “for the discovery of insulin”
Field: endocrinology, metabolism

Frederick G. Banting
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

Needle Size often a Barrier
Size Does Matter

- Use more short needles – 4 mm
- Effective for pts with BMI of 24-49
- Keeps it subq
- If pt thin, inject at angle
- To avoid leakage, count to 10 before withdrawing needle
- ½ the patients who could benefit from insulin are not using it due to needle phobias
- Consider inhaled insulin

Physiologic Insulin Secretion: 24-Hour Profile

- Insulin (µU/mL)
- Glucose (mg/dL)
- Time of Day
- Basal Insulin
- Bolus Insulin
- Basal Glucose
- Mealtime Glucose
**Insulin Action Teams**

- **Bolus**: lowers after meal glucose levels
  - Rapid Acting
    - Aspart, Lispro, Glulisine
  - Short Acting
    - Regular
  - Afrezza - Inhaled
- **Basal**: controls glucose between meals, hs
  - Intermediate
    - NPH
  - Long Acting
    - Detemir (Levemir)
    - Afrezza
    - Glargine (Lantus)

**Case Study**

- 70 yr old, weighs 100kg
- History of CABG, tobacco
- A1c – 11.3%, BG 400-500 for past weeks
- Insulin – 100+ units Lantus at hs (solostar)
- Oral Meds: Metformin, Invokana
- What is a better insulin dosing strategy?
- Pt can’t afford insulin pen – what other option
- Diabetes Meds on a Budget - 2014 - provides practical and affordable strategies to manage hyperglycemia

**Cost Per Vial in Northern CA**

<table>
<thead>
<tr>
<th>Per vial</th>
<th>Walmart</th>
<th>Walgreens</th>
<th>Costco</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular Insulin</td>
<td>$25*</td>
<td>$92</td>
<td>$99</td>
</tr>
<tr>
<td>NPH</td>
<td>$25*</td>
<td>$92</td>
<td>$99</td>
</tr>
<tr>
<td>70/30</td>
<td>$25*</td>
<td>$92</td>
<td>$101</td>
</tr>
<tr>
<td>Humalog</td>
<td>$200</td>
<td>$220</td>
<td>$178</td>
</tr>
<tr>
<td>Novolog</td>
<td>$197</td>
<td>$217</td>
<td>$178</td>
</tr>
<tr>
<td>Apidra</td>
<td>$180</td>
<td>$246</td>
<td>$178</td>
</tr>
<tr>
<td>Levemir</td>
<td>$300</td>
<td>$300</td>
<td>$300</td>
</tr>
<tr>
<td>Lantus</td>
<td>$226</td>
<td>$221</td>
<td>$206</td>
</tr>
</tbody>
</table>
Afrezza – Inhaled Insulin –
Approved 2014

For adults over 18
Not indicated for pregnancy, while breastfeeding

Bolus Insulins
(½ of total daily dose ÷ meals)

<table>
<thead>
<tr>
<th>Name</th>
<th>Onset</th>
<th>Peak Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lispro (Humalog)</td>
<td>15-30 min</td>
<td>1-1.5 hrs</td>
</tr>
<tr>
<td>Aspart (NovoLog)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glulisine (Apidra)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Afrezza (Inhaled)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular</td>
<td>30 mins</td>
<td>2-4 hrs</td>
</tr>
</tbody>
</table>

Afrezza Dosing and Considerations

- Bolus regular insulin – inhaled before meals
- Dosing: 4 and 8 unit cartridges
  - Convert with 1:1 ratio to existing insulin dose
- Lung function test before start (incentive spiro)
  - Not for pts w/ chronic lung issues
    - Asthma, COPD, history of lung cancer, smokers
    - Can cause acute bronchospasm
- Side effects:
  - Hypoglycemia, sore throat, cough
Afrezza Inhaler

Know your AFREZZA® inhaler:

Replace inhaler every 15 days

Bolus Insulin Summary

- Regular, Novolog, Humalog, Apidra, Afrezza
- 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 Novolog for every 50 mg/dl >150

<table>
<thead>
<tr>
<th></th>
<th>Break</th>
<th>Lunch</th>
<th>Dinner</th>
<th>HS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>94 no insulin</td>
<td>212</td>
<td>148 no insulin</td>
<td>254 8 uN</td>
</tr>
<tr>
<td>Day 2</td>
<td>243 4uN</td>
<td>254 6 uN</td>
<td>201 4uN</td>
<td>199 no insulin</td>
</tr>
<tr>
<td>Day 3</td>
<td>189 2uN</td>
<td>243 4uN</td>
<td>162 2uN</td>
<td>244 4uN</td>
</tr>
<tr>
<td>Day 4</td>
<td>66</td>
<td>287 6uN</td>
<td>144 none</td>
<td>272 6uN</td>
</tr>
</tbody>
</table>

**Basal Insulins**
(½ of total daily dose)

**Intermediate Acting**
- NPH 4-12 hrs 12-24 hrs

**Long Acting**
- Detemir (Levemir) peakless 20 hrs
- Glargine (Lantus) No peak 24 hrs

*Fasting BG reflects efficacy of basal*

**Basal Insulin Summary**
- NPH, 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
**Basal Only**

**Type 2, 60kg – A1c 8.7%**

<table>
<thead>
<tr>
<th></th>
<th>Break</th>
<th>Lunch</th>
<th>Dinner</th>
<th>HS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mo 1</td>
<td>170s</td>
<td></td>
<td></td>
<td>298</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10uLan</td>
</tr>
<tr>
<td>Mo 2</td>
<td>180s</td>
<td></td>
<td></td>
<td>233</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20uLan</td>
</tr>
<tr>
<td>Mo 3</td>
<td>140s</td>
<td>283</td>
<td>265</td>
<td>206</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30uLan</td>
</tr>
</tbody>
</table>

---

**Combo Sub-Q Insulin**

<table>
<thead>
<tr>
<th>Insulin Type</th>
<th>Onset</th>
<th>Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humalog Mix 75/25: 75% NPL, 25% lispro</td>
<td>0.25 - 0.5 hr</td>
<td>0.5-6.5 hrs</td>
</tr>
<tr>
<td>50/50: 50% NPL, 50% lispro</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NovoLog Mix 70/30: 70% NPA, 30% aspart</td>
<td>0.25 - 0.5 hr</td>
<td>1 – 4 hrs</td>
</tr>
<tr>
<td>NPH + Reg Combo 70/30: 70%N /30%R</td>
<td>0.5 – 1.0 hr</td>
<td>2 - 16 hrs</td>
</tr>
<tr>
<td>50/50: 50%N /50%R</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Considerations:**
- Pre-mixed, difficult to fine tune therapy
10u 70/30 BID
Patterns? Changes needed?

<table>
<thead>
<tr>
<th></th>
<th>Break</th>
<th>Lunch</th>
<th>Dinner</th>
<th>HS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>102</td>
<td>63</td>
<td>92</td>
<td>181</td>
</tr>
<tr>
<td>Day 2</td>
<td>112</td>
<td>67</td>
<td>106</td>
<td>195</td>
</tr>
<tr>
<td>Day 3</td>
<td>98</td>
<td>56</td>
<td>112</td>
<td>201</td>
</tr>
<tr>
<td>Day 4</td>
<td>99</td>
<td>71</td>
<td>132</td>
<td>211</td>
</tr>
</tbody>
</table>

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
  - Before increase insulin, make sure not missing something (carbs, exercise, omission)

Type 2 – New diagnosis – No meds Patterns? Questions

<table>
<thead>
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<tbody>
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<td></td>
<td></td>
<td>181</td>
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<tr>
<td>Day 2</td>
<td></td>
<td>124</td>
<td>106</td>
<td>195</td>
</tr>
<tr>
<td>Day 3</td>
<td>149</td>
<td></td>
<td>102</td>
<td>242</td>
</tr>
<tr>
<td>Day 4</td>
<td>151</td>
<td>81</td>
<td></td>
<td>211</td>
</tr>
</tbody>
</table>
Type 2 – Amaryl 4mg AM, 10u Lantus pm

<table>
<thead>
<tr>
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<td>Day 1</td>
<td>164</td>
<td>94</td>
<td>66</td>
<td>162</td>
</tr>
<tr>
<td>Day 2</td>
<td>169</td>
<td>59</td>
<td></td>
<td>195</td>
</tr>
<tr>
<td>Day 3</td>
<td>84</td>
<td>81</td>
<td></td>
<td>242</td>
</tr>
<tr>
<td>Day 4</td>
<td>159</td>
<td>43</td>
<td>211</td>
<td></td>
</tr>
</tbody>
</table>

Basal Bolus – What Adjustments?
Pt weighs 80kg – Novolog Bolus

<table>
<thead>
<tr>
<th></th>
<th>Break</th>
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<th>Dinner</th>
<th>HS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>69</td>
<td>79</td>
<td>245</td>
<td>190</td>
</tr>
<tr>
<td></td>
<td>7N</td>
<td>5N</td>
<td>8N</td>
<td>22u Det</td>
</tr>
<tr>
<td>Day 2</td>
<td>81</td>
<td>87</td>
<td>170</td>
<td>133</td>
</tr>
<tr>
<td></td>
<td>7N</td>
<td>5N</td>
<td>8N</td>
<td>22u Det</td>
</tr>
<tr>
<td>Day 3</td>
<td>73</td>
<td>94</td>
<td>194</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>7N</td>
<td>5N</td>
<td>8N</td>
<td>22u Det</td>
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</tr>
<tr>
<td></td>
<td>7N</td>
<td>5N</td>
<td>8N</td>
<td>22u Det</td>
</tr>
</tbody>
</table>

Intensive Diabetes Therapy
Insulin Dosing Strategy

50/50 Rule
- 0.5-1.0 units/kg day
- Basal = 50% of total
  - Glargine QD
  - 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 QD
  - NPH/Detemir 6u BID
- Bolus dose: 12 units
  - 4 units NovoLog,
  - Apidra Humalog,
  - Regular each meal
**Intensive Diabetes Therapy**

**Insulin Dosing Strategy**

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

**Example – You Try**
- Wt 60 kg x 0.5 = ___ units of insulin/day
- Basal dose: ____ units
  - Glargine ____ QD
  - NPH/Detemir ____ BID
- Bolus dose: ____ units
  - ___ units NovoLog, Apidra, Humalog, Reg each meal

---

**Basal Bolus – Using 50/50 Rule - Pt weighs 80kg – Novolog Bolus**

<table>
<thead>
<tr>
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<th>Lunch</th>
<th>Dinner</th>
<th>HS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>84</td>
<td>6N</td>
<td>7N</td>
<td>145</td>
</tr>
<tr>
<td></td>
<td>6N</td>
<td>7N</td>
<td>7N</td>
<td>190</td>
</tr>
<tr>
<td>Day 2</td>
<td>81</td>
<td>6N</td>
<td>7N</td>
<td>107</td>
</tr>
<tr>
<td></td>
<td>97</td>
<td>7N</td>
<td>7N</td>
<td>133</td>
</tr>
<tr>
<td>Day 3</td>
<td>79</td>
<td>6N</td>
<td>7N</td>
<td>124</td>
</tr>
<tr>
<td></td>
<td>104</td>
<td>7N</td>
<td>7N</td>
<td>110</td>
</tr>
<tr>
<td>Day 4</td>
<td>69</td>
<td>6N</td>
<td>7N</td>
<td>208</td>
</tr>
<tr>
<td></td>
<td>103</td>
<td>7N</td>
<td>7N</td>
<td>193</td>
</tr>
</tbody>
</table>
DiaBingo - I
1. Injected hormone that is an analog of amylin
   - GLP-1, Detemir, NPH are types of
2. Breakdown of glycogen into glucose
3. Anabolic hormone
4. Insulin is released when glucose levels are low
5. Once opened, insulin vials are good for one ____
6. Elevated post-prandial glucose indicate need for pre-meal
7. Epinephrine increases insulin resistance
8. Creation of glucose from amino acids and lactate
9. Decreasing renal function for people on insulin can cause
10. Bolus insulins
11. A hormone that increases blood glucose levels

Medical Nutrition Therapy

“Let food be thy medicine and medicine be thy food.”
“Walking is man’s best medicine.”
— Hippocrates

Obesity in America

- 68% overweight or obese
- 34% BMI 30+ - 34% BMI 25-29
- 1/3 of all overweight people don’t get diabetes
- We burn 300 cals less a day at work
- Overall, food costs > 10-15% of income
- Calorie intake is on the rise
Average American Consumes 25 teaspoons of sugar a day (400 cals)

- Warning label on sodas proposed
- One soda has 12 teaspoons soda
- On avg, 1 person consumes 40 gallons of soda each year
- ADA guidelines “limit sodas and beverages with sugar, High Fructose Corn Syrup, (HFCS)

BMI – Visual Image

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 – ADA 2014

- 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%

Sodium, Fat and Fiber

- Sodium – Try and keep less than 2,300 mg a day
- Vitamin and mineral supplements not recommended -lack of evidence.
- Fat - same as recommended for general population
  - Less than 10% saturated fat,
  - Limit trans fats
  - Less than 300 mg cholesterol daily
  - Mediterranean Diet looks like good option
- Fiber 25 -38 gms a day

Approach Depends on Patient

- New Type 2
  - Portion Control
  - Plate Method
  - Record Keeping
  - Education
- On Insulin?
  - Carb counting
  - Post prandial checks
Losing 2-8kg 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.

- To lose one pound – avoid 3,500 cals
  - Decrease intake 250-500 cals daily + exercise

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

Diabetes Prevention Program
Focus on fat = wt loss success

To help you lose weight and improve your health, stay as close as possible to your fat and calorie goals. Find your starting weight below. Your fat and calorie goals are in the same row. Circle your fat and calorie goals.

<table>
<thead>
<tr>
<th>Weight (lb)</th>
<th>Fat Goal (grams)</th>
<th>Calorie Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>120-174</td>
<td>23</td>
<td>1,200</td>
</tr>
<tr>
<td>175-219</td>
<td>42</td>
<td>1,500</td>
</tr>
<tr>
<td>220-249</td>
<td>50</td>
<td>1,800</td>
</tr>
<tr>
<td>&gt;250</td>
<td>55</td>
<td>2,000</td>
</tr>
</tbody>
</table>

Public Health Issue?

- 66% of our people are obese/overweight
- Rates of gestational diabetes on rise
- 30% of kids are obese/overweight

How nutrients affect blood sugar

Teaching About Eating Healthy

Major food groups
“Handy Diet”
Plate Method
Exchange Lists
Food Diaries / Glucose Records
Carbohydrate Counting
Assess what is best for the situation.
Move toward the Tomato

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
**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.

---

**Another plate example**

**Mindful Eating**
Nutrition Facts

Serving Size: 1/2 cup (114 g)
Servings Per Container: 4

Amount Per Serving

Calories: 90
Calories from Fat: 30

% Daily Value*

Total Fat: 3g 5%
Saturated Fat: 0g 0%
Cholesterol: 0g 0%
Sodium: 300mg 13%
Total Carbohydrate: 13g 4%
Dietary Fiber: 3g 12%
Sugars: 3g
Protein: 3g

Vitamin A: 80%
Vitamin C: 60%
Calcium: 4%  *
Iron: 4%  *

Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

- Calories: 2000, 2500
- Total Fat: Less than 65g, 80g
- Sat Fat: Less than 20g, 25g
- Cholesterol: Less than 300mg, 300mg
- Sodium: Less than 2400mg, 2400mg
- Total Carbohydrate: 300g, 375g
- Fiber: 25g, 30g

Calories per gram: Fat 9, Carbohydrates 4, Protein 4

Fooducate App – gives grade and nutrition info.

Carbs affect Post meal Blood Glucose

- Starch
- Fruit
- Milk
- Desserts

Carbohydrate Needs for Most Adults

<table>
<thead>
<tr>
<th>Grams</th>
<th>Servings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each Meal</td>
<td>45-60 gm</td>
</tr>
<tr>
<td>Snacks</td>
<td>15-30 gm</td>
</tr>
</tbody>
</table>

Carbs affect Post Meal Blood Glucose
Choose Healthy Carbs

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

Handy Meal Plan

- Per Meal Serving
  - Each finger = 15 gms carb (can have 3-4 servings/meal)
  - Palm of hand = 3 oz’s protein
  - Thumbnail = 1 tsp fat serving

Carb Counting - Starch

- Each Food has:
  - 80 Calories
  - 15 grams carb

- 5/2 cup cooked beans
- 1/2 cup cooked rice
- 1/2 cup cooked pasta
- 3/4 cup cold cereal
- 1 small potato
- 1/2 English muffin
- 1 small tortilla
- 5-6 small crackers
- 1/2 cup cooked corn
- 1/2 cup cooked lentils
Carb counting- fruit

Each Food has:
60 Calories
15 grams carb

- 1 small fresh fruit
- 1/4 cup fruit juice
- 1/4 banana
- 1/4 cup unsweetened apple sauce
- 1 slice bread
- 17 small grapes
- 1/4 cup dried fruit
- 2 tbsp raisins
- 1 1/4 cup strawberries
- 1 cup melon

Carb Counting - Milk

Each Food has:
90-150 calories
12-15 grams carb

- 8 oz buttermilk
- 1 packet diet hot cocoa
- 1 slice bread
- 8 oz non-fat yogurt
- 6 oz plain yogurt
- 6 oz light fruit yogurt
- 8 oz milk

Carb Counting - Sweets

Each Food has:
Calories vary
15 grams carb

- 2 inch square cake or brownie, unfrosted
- 1/4 cup chocolate pudding
- 1/4 cup regular jelly
- 2 tbsp light syrup
- 1 slice bread
- 2 small cookies
- 1 tbsp syrup, jam, jelly, table sugar, honey
- 1/4 cup ice cream or frozen yogurt
- 1/4 cup sherbet
- 1/4 cup cream or frozen yogurt
Using Alcohol Safely

- Women - 1 or fewer alcoholic drinks a day
- Men - 2 or fewer alcoholic drinks a day
  - 1 alcoholic drink equals
    - 12 oz beer, 5 oz glass of wine, or 1.5 oz distilled spirits (gin etc)
- If drink, limit amount and drink with food.
- Ask HCP if safe for you to drink. Tell them your usual quantity and frequency.
- Can cause hypo and worsen neuropathy

Ms. Gonzales’ Daily Meal plan

<table>
<thead>
<tr>
<th>Break</th>
<th>Lunch</th>
<th>Dinner</th>
<th>Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 corn tortillas,</td>
<td>Sandwich, low fat</td>
<td>Lg bowl low salt soup,</td>
<td>1 bowl of cereal</td>
</tr>
<tr>
<td>1/2 c. beans, salsa,</td>
<td>potato chips, 1 c.</td>
<td>1 c. rice, BBQ meat,</td>
<td></td>
</tr>
<tr>
<td>peppers, egg beaters</td>
<td>juice, 2-4 lowfat</td>
<td>salad &amp; cooked veggies</td>
<td></td>
</tr>
<tr>
<td>Avg BG 120’s</td>
<td>cookies</td>
<td>1 glass wine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Avg BG 200’s</td>
<td>Avg BG 180’s</td>
<td></td>
</tr>
</tbody>
</table>

Resources

- [www.eatright.org](http://www.eatright.org) American Dietetic Association website for nutrition information, resources, and access to Registered Dietitians
- [www.diabetes.org](http://www.diabetes.org) American Diabetes Association website, advocates to prevent, cure and improve the lives of all people affected diabetes
- [www.americanheart.org](http://www.americanheart.org) American Heart Association website; resources, recipes and tips; learn about efforts to reduce death caused by cardiovascular disease
Resources

- www.nhlbi.nih.gov contains information for professionals and the general public about heart and vascular diseases, lung diseases, blood diseases.


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 equals ______ kilo/calories
N Metabolic syndrome = hyperglycemia, hyperlipidemia, hypertension
N 1% A1c = ______ of Blood Glucose

Diabetes Meds for Type 2:

Objectives

1. Describe the main action of the 5 different categories of type 2 diabetes medications.
2. Discuss strategies to determine the right medication for the right patient.
3. List the side effects and clinical considerations of each category of medication.
Diabetes Agents Considerations

- Diabetes medications can be used as monotherapy, in combo or with insulin
- Combining agents from different classes has additive effect
- Most reduce A1c 0.5 – 2.0%
- Not to be used during preconception, pregnancy or when breastfeeding

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.

Action/Classes of Type 2 Meds

1. Suppressor
   - Biguanide – Metformin
2. Squirter
   - Sulfonylureas
   - Meglitinides
3. Satiators
   - AmylinoMimetics
   - Incretin Mimetics
   - DPP-4 Inhibitors
4. Sensitizer
   - Thiazolidinediones (TZD)
5. Glucoretics
6. Circadian Switchers
7. Slower
   - Alpha-glucosidase inhibitors
Biguanides – Suppressor
Metformin (Glucophage®)

- **Action:** suppresses release of glycogen from the liver
- **Who?**
  - Fasting hyperglycemia
  - Dysmetabolic Syndrome
  - For pediatrics starting age 10
    - (XR age 17)

Glycogen Stopper

Biguanides - Metformin

- **Action:** decrease hepatic glucose (glycogen)
- **Names:**
- Metformin (Glucophage)
  - Starting dose: 500 BID, max 2500mg daily
  - Metformin XR - extended release – less GI upset
  - Starting dose 500mg at dinner, max dose 2000 to 2500 mg daily
- **Efficacy:**
  - Decrease fasting plasma glucose 60-70 mg/dl
  - Reduce A1C 1.0-2.0%

Biguanides - Metformin

- **Benefits**
  - Decrease LDL cholesterol and triglycerides
  - No weight gain, possible modest weight loss
  - Cancer protective?
- **Concerns**
  - Diarrhea and abdominal discomfort – Use XR
  - Lactic acidosis if improperly prescribed
  - Watch for B12 deficiency
  - Hold prior to IV contrast dye studies and use caution during acute illness. Resume when kidney function adequate
Considerations
Biguanide - Metformin (Glucophage®)

- Contraindications due to lactic acidosis:
  - creatinine >1.4 females, >1.5 males
  - liver disease
  - alcohol abuse
  - over 80 years old
  - risk of acidosis
  - during IV dye study
  - CHF requiring meds

Metformin – How does it rate?

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause hypoglycemia?</td>
<td>No</td>
</tr>
<tr>
<td>Cause weight gain?</td>
<td>No</td>
</tr>
<tr>
<td>Affordable?</td>
<td>Yes</td>
</tr>
<tr>
<td>Lowers CV risk?</td>
<td>Yes</td>
</tr>
<tr>
<td>Can most tolerate /use?</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>

What is next step?

69 year old male, BMI 25, on Metformin 1000mg BID.
AM glucose 120s, A1c 8.1%.
Creat 1.3
Sulfonylureas –

- Action: tells pancreas to squirt insulin all day
- Who?
  - Lean type 2

Sulfonylureas - Squirts

- Action: Increase endogenous insulin secretion
- Efficacy:
  - Decrease FPG 60-70 mg/dl
  - Reduce A1C by 1.0-2.0%
- Secondary failures: 5-10% shortly after initial response, many more later
  - Usually after 5 or more years of therapy due to natural history of DM 2

Sulfonylureas: 2nd Generation

<table>
<thead>
<tr>
<th>Generic</th>
<th>Trade</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glyburide</td>
<td>Diabeta, Micronase, Glynase Prestabo</td>
<td>12-24 hrs</td>
</tr>
<tr>
<td>Glipizide*</td>
<td>Glucotrol, Glucotrol XL</td>
<td>12-24 hrs</td>
</tr>
<tr>
<td>Glimepiride</td>
<td>Amaryl</td>
<td>16-24 hrs</td>
</tr>
</tbody>
</table>
Sulfonylureas

- Other Effects
  - Hypoglycemia
  - Weight gain
  - Cleared by kidney, use caution for pts with kidney problems
  - Generally the least expensive class of medication
  - Amaryl safest for those with CV Disease

Squirters – How does they rate?

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</tr>
<tr>
<td>Can most tolerate /use?</td>
<td>Yes/No</td>
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</tbody>
</table>

What Medications Cause Hypoglycemia?

- Insulin
- Sulfonylureas
- Meglitinides
  - Or any combo medication that includes these
What questions?


DPP-4 Inhibitors — “Incretin Enhancers”
Januvia (sitagliptin) – Tradjenta (linagliptin)
Onglyza (saxagliptin) – Nesina (alogliptin)

- **Action:**
  - Increase insulin release w/ meals
  - Suppress glucagon
- **Dosing:**
  - Januvia – 100mg a day
  - Onglyza – up to 5mg a day
  - Tradjenta – 5mg a day
  - Nesina – up to 25 mg a day
- **Efficacy:** Decreases A1c by 0.6 - 0.8%
- **Indication:** For type 2s

DPP-4 Inhibitors — “Incretin Enhancers”
Januvia (sitagliptin) – Tradjenta (linagliptin)
Onglyza (saxagliptin) – Nesina (alogliptin)

- Januvia, Onglyza eliminated via kidney, lower dose needed
- Do not cause wt gain or hypoglycemia
- Side effects – headache, runny nose, sore throat - watch for pancreatitis
- Cost $100 - $150 mo
DPP-IV Inhibitors – How do they rate?

<table>
<thead>
<tr>
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<th>Answer</th>
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<td>No</td>
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<tr>
<td>Can most tolerate /use?</td>
<td>Yes</td>
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</tbody>
</table>

If on Metformin and Sulfonylurea – BG still high, other options? Pt overweight.

Incretin Mimetics – “Gut Hormone Imitators” GLP-1 Agonists

<table>
<thead>
<tr>
<th>How do they work?</th>
</tr>
</thead>
</table>
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

Stomach:
Helps regulate gastric emptying

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

Incretin Mimetics
Exenatide (Byetta), Exenatide XR (Bydureon)

Action:
- Insulin release in response to meal
- Slows gastric emptying
- Causes Satiety
- Preserves Beta Cells

Exenatide Dosing:
- 5-10 mcg before break, dinner
- Long acting version - 1x week (available in pens in 2015)

Efficacy: Decreases A1c by 0.7%, wt by 3lbs

Indication: For type 2s only - mono or in combo

Incretin Mimetics – Albiglutide - Tanzeum

Once a Week Dosing: 30 – 50mg

Efficacy:
Decreases A1c by ~ 1%, wt by ~2lbs

Indication: For type 2s only

Other: Pen injector

Caution: not indicated for those with history of medullary thyroid tumor - pancreatitis warning
**Trulicity - Easy to Use Once-a-Week Injector - GLP 1 Agonist**

Patient Friendly Injector - El Lilly received FDA Approval for their Ready-to-Use once weekly GLP-1 agonist, dulaglutide (Trulicity). The unique quality about this injector is that unlike the other once weekly GLP-Agonists, which require mixing of powder and fluid, it comes in a single-dose pen and does not require mixing, measuring or needle attachment. And the needle is hidden from the user and retracts after use. This definitely makes it a stand out amongst it's competitors and is a leap forward in terms of convenience.

It comes in both .75 and 1.5 mg doses. Given its ease of use, efficacy and weight loss benefits, maybe we will start seeing Trulicity used earlier in the course of diabetes care.

---

**For all the Previous DPP-IV and GLP-1 Agonists**

- **Pancreatitis Warning**
  - Please tell all patients to report signs right away and discontinue meds
  - Signs include:
    - Sudden abdominal pain, nausea and vomiting

---

**Incretin Mimetics – How do they rate?**

<table>
<thead>
<tr>
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<tr>
<td>Can most tolerate /use?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>(GI)</td>
<td></td>
</tr>
</tbody>
</table>
Next Step?

- 69 year old male, BMI 25, on Metformin 1000mg BID and Exenatide 10mcg before breakfast and dinner.
- Pt overweight - A1c 8.1%. Creat 1.2

SGLT2 Inhibitors- “Glucoretics”

- Action: “Glucoretic” decreases renal reabsorption in the proximal tubule of the kidneys (reset renal threshold and increase glucosuria)

<table>
<thead>
<tr>
<th>SGLT2 Inhibitors</th>
<th>Conagliflozin (Invokana)</th>
<th>Canagliflozin (Jardiance)</th>
<th>100-300 mg once daily</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dapagliflozin (Farxiga)</td>
<td></td>
<td>5-10 mg once daily</td>
</tr>
<tr>
<td></td>
<td>Empagliflozin (Jardiance)</td>
<td></td>
<td>10-25 mg once daily</td>
</tr>
</tbody>
</table>

For all, monitor B/P, K+ and renal function. If GFR<40, stop Farxiga. If GFR<40, stop Invokana. Do not start pts w/GFR<40 on Jardiance. Side effects: hypotension, UTI, increased urination, genital infections. Avoid Farxiga in pts w/bladder cancer. Lowers A1c 0.7%–1.5%, lowers wt 1–3 lbs.

Considerations

- Monitor B/P, K+ & renal function.
- Side effects: hypotension, UTI, increased urination, genital yeast infections.
- Improves beta cell function?
  - Reverses glucose toxicity by increasing GLUT4 transport in muscle
  - Increase liver sensitivity to insulin and decreases gluconeogenesis.
### SGLT2 Inhibitors - How do they rate?

<table>
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</tr>
<tr>
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</table>

### Indications for Insulin Sensitizers

**Rosiglitazone (Avandia), Pioglitazone (Actos)**

- **Action:** decrease insulin resistance by making muscle and adipose cells more sensitive to insulin. Decrease free fatty acids
- **Names:**
  - pioglitazone (Actos) – bladder cancer warning
  - Dosing: 15-45 mg daily
  - rosiglitazone (Avandia) – restriction relaxed
  - Dosing: 4-8 mg daily
- **Efficacy/Considerations**
  - Reduce A1C ~0.5-1.0%
  - 6 weeks for maximum effect
  - $100 a month
  - Can cause fluid retention, not indicated w/ CHF

### TZDs – How do they rate?

<table>
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</tr>
<tr>
<td>Affordable?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Lowers CV risk?</td>
<td>??</td>
</tr>
<tr>
<td>Can most tolerate /use?</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>