OVERVIEW OF PEDIATRIC DIABETES 2011

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Outline of Pediatric Diabetes Presentation

- Types of Pediatric Diabetes
- Incidence and Prevalence
- Co-Morbidities and Complications
- Issues on balance of food and insulin
- Insulin Regimens for Type 1
- Superiority of Multiple Dosing Plans
- Why most people can’t carry out the plan
TYPES OF PEDIATRIC DIABETES MELLITUS

- Type 1 - autoimmune
- Type 2 – genetic plus overweight
- Monogenic (MODYs, Mitochondrial and others)
- Atypical DM (seen with African ancestry)
- Drug-induced (corticosteroids, AAs, and others)
- Cystic Fibrosis
- Pancreatectomy or Severe Pancreatitis
- Gestational Diabetes
PEDIATRIC COMPARISON OF TYPE 1 VS TYPE 2

- Age <40 years old
- Thin vs. overweight
- Wt loss very likely
- Any race/people
- No metabolic syn
- Weak Family Hx
- Ketones very likely
- More likely DKA
- 2-3 islet antibodies

- Age >10 years old
- Obese vs. very obese
- Wt loss less likely
- Non-white
- Met syn/Acanthosis
- Strong Family Hx
- Ketones less likely
- Less likely DKA
- 0-1 islet antibodies
AFTER ~5 YEARS OF AUTOIMMUNE DESTRUCTION

PANCREAS

BETA CELLS IN ISLETS MAKE INSULIN

AFTER ~5 YEARS OF AUTOIMMUNE DESTRUCTION
The main difference between the types of diabetes is whether insulin deficiency is ultimately complete or partial.
Which type is more severe?
A FEW STATS FROM SEARCH

- 5 million youth aged 0-19 yr; 7727 cases
- Incidence: 1 in 4,000 per year
- DM1 peaks at ages 11-13; DM2 ~50% of new cases by age 19
- Prevalence: 1 in 523 (87% DM1, 10% DM2)
- Extremes: in 10-19 yo, type 2 is 6% of DM in NHW pop, but 76% of Native American youth
- 71% DM is in NHW but only 62% of the pop
A FEW MORE STATS WE DON’T WANT TO HEAR

- Obesity + Overweight: 34.7% in T1D; 89.8% in T2D
- Depressed mood: 22.6% higher in T2D
- A1c >9.5%: 17% in T1D; 27% in T2D
- Tobacco (age 15-19): 17% in T1 and T2
- High BP: 23.7% in T2D
- Serious family issues >=1 in 59.4% and >=5 in 8.7%
IMPORTANT MESSAGES TO PATIENTS AND PARENTS ON TYPE 1 DIABETES

- Be clear about the diagnosis of diabetes
- No one did something or didn’t do something to cause type 1 diabetes
- Nothing to be guilty about, though that is what parents do best
- With the right treatment, the prognosis is for a long, happy, and healthy life
- Ignoring diabetes leads to terrible problems in life.
- Diabetes will be cured in our lifetime.
COMORBIDITIES OF TYPE 1

- Thyroid Disease - 5-10%
- Celiac Disease - 5%?
- JRA, MS, Addison, Vitiligo, other - 5%?
- Down syndrome
- Autism?
- Cardiovascular Risk Factors

Complications are slowly developing in those with higher A1cs, but we generally don’t see any
Components of Glucose metabolism

- Food (source of glucose)
- Beta Cells (source of insulin)
- Insulinases (destroyers of insulin)
- Glucose Secretion (primarily liver)
- Glucose disposal (metabolism, muscles)
ACQUIRING FUEL: AUTOMOBILES VS HUMANS

- Gas Pump
- Gasoline
- Gas Tank
- Gas Line
- Fuel Injector
- Engine
- Food
- Glucose
- Digestive Sys/Liver
- Blood stream
- Insulin
- Mitochondria
Major Roles of Insulin

- Fuel Injector 24/7/365
- Prevents complications of diabetes in persons without diabetes through postprandial secretion
- Prevents ketosis from overwhelming us
- Works with other hormones to regulate gluconeogenesis and glycogen turnover
INSULIN PHYSIOLOGY

- We ALWAYS need insulin
- Beta cells increase secretion suddenly in response to many eating-related signals and rising BG
- Insulin is secreted primarily from pre-formed packets in the beta cells into the portal circulation
- The surge of insulin reverts to baseline as the signals and BG levels revert to baseline
Question: How many of your type 2 or pre-diabetic patients do you treat with insulin?
INSULIN PHARMACOLOGY

- Exogenous insulin will never work as well as nature does it, but using it properly works well.
- Technology/Research continues to get us closer but since 1921, advances have been modest.
- At any moment, too little insulin causes high BG, too much insulin causes low BG - cannot be avoided but can be minimized.
MAIN FACTORS AFFECTING BLOOD GLUCOSE

- **INSULIN**  ↓↓↓↓
- **FOOD**    ↑↑↑↑
- **EXERCISE**  ↑  then  ↓

By checking blood glucose frequently and responding to it, you can greatly improve the efficiency of the system.
OTHER FACTORS AFFECTING BLOOD GLUCOSE

- Absorption of insulin
- Potency of insulin
- Measuring insulin
- Late injections
- Missed injections
- Speed of digestion
- Delayed effects of exercise
- Hyperglycemia
- Ketosis
- Other Medicines
- Infections
- Unauthorized food
- Internal release of hidden insulin
- Dawn phenomenon
- Hormones/menses
- Stress
CALORIES AND CARBS

- **FAT (30%)** ➔ **10% Glucose**
- **PROTEIN (15%)** ➔ **50% Glucose**
- **CARBS (55%)** ➔ **100% Glucose**

- About 70% of a healthy diet is pure glucose
- But without fiber, fat, and protein, it cannot be balanced well
NUTRITION TIPS FOR BALANCE

- Goal is healthy diet first and foremost
- Insulin is slow so food needs to be slow
- Carb counting is a good technique but only with healthy balanced diet, isn’t for everyone, and isn’t a prerequisite for success.
- Schedule/Routine is a secret of success
- Vigorous exercise requires fuel
INSULIN ACTION

Insulin

Time after breakfast

Breakfast

Natural
INSULIN ACTION

Time after breakfast

- Regular
- NPH
- Fast
- Natural
- Basal
INSULIN ACTION

Time after breakfast

- Fast
- Natural
- Basal
INSULIN STRATEGIES RANKED

- #1: Insulin pump or MDI With Basal preferred
- #2: Breakfast/Dinner injections can work with good attention to detail and may be preferred for those who cannot follow the rules for #1 or where school attendance creates barriers.
- Extras - coverage insulin, afternoon snack insulin, other extra food insulin, glucose sensor will always help if used properly
INSULIN ALWAYS WORKS!!!
TOP REASONS TO THINK ABOUT WHEN INSULIN DOESN’T WORK

- Not taking it
- Not taking enough
- Usually taking it too late
- The injected substance isn’t insulin
- Nutrition is very bad
- Poor monitoring of BG levels
MOST IMPORTANT THINGS FOR PEOPLE TO DO

- Eat healthy at same times each day.
- NEVER MISS AN INJECTION!!!
- Give rapid insulin before you eat.
- Adjust insulin frequently based on blood glucose patterns and your goals.
- Accept hypoglycemia and plan for it.
- Use KNOWLEDGE!!
GOALS FOR TREATMENT

- A1c <=7.5% (8.5% if very young)
- BG Target ~70-150 mg/dL; 70-200 if <5 yrs
- Avoidance of seizures
- Hypoglycemia approx 3-5 times per week
- Excellent quality of life
- Excellent sense of well-being
- Appropriate monitoring for complications
CHARACTERISTICS OF SUCCESSFUL PEOPLE

- Enjoy a higher quality of life than those who are not
- Do not view their situation as a punishment
- Have faith and believe in the future
- Feel good when they do the right thing
- Family is strong, close, and eats together
- Their parents don’t keep asking them “Did you take your blood sugar?”
MOTIVATING ADHERENCE IN NORMAL CHILDREN/TEENS

- Fear of Complications, Punishment, and Negative Reinforcement haven’t had too much success in the past 90 years.
- Conditional Positive Reinforcements only has time-limited success (e.g., do better so we will let you have a driver’s license).
- Weekly follow up from health professionals? Any ideas out there?
Abnormal Reasons that Prevent Success

- Dysfunctional Families
- Depression
- Anxiety
- Eating Disorders
- Oppositional Defiance Disorder
13 Normal Reasons that Prevent Success

- Insufficient parental guidance
- Normal forgetfulness, stubbornness and refusal
- Lack of knowledge despite education
- Limited sense of future
- Lack of Sufficient Health Care Insurance
- Lower socioeconomic status
- Fear of euglycemia
Normal Reasons- continued

- Difficulty discarding ideas that do not work
- Think about the 1% of the time and forget about the 99%.
- Perceived peer pressure
- Fear of repeated failure
- Tuning out the broken record of health providers advising better control
- Inability of most humans to carry out the treatment.
DIABETES IS NOT BRITTLE, PEOPLE ARE