Objectives for Presentation

• Discuss the differences between Type 1 and Type 2 diabetes
• Discuss advances in diabetes care and management
• Encourage a more positive approach as you work with children and adolescents with diabetes
• Discuss age-related skills and responsibilities

Classification of Diabetes

• Type 1:
  - Immune-mediated β-cell destruction
  - Absolute insulin deficiency
  - Most common type in children and adolescents
• Type 2:
  - Spectrum of abnormal glucose metabolism
    - Insulin resistance
    - Decreased insulin secretion
    - Frequency is increasing in obese adolescents
• Other types:
  - Cystic fibrosis, drug induced, genetic syndromes, gestational
Quick Look At Diabetes

- It is our nation's most costly disease, both in human terms and in economic terms ($245 Billion of diagnosed in 2012)*
- Average diabetes patient incurs $13,700 medical expenditure per year

* American Diabetes Association, 2012

Diagnosis

- **Type 1**
  - Ketoacidosis
  - Elevated blood glucose
  - Positive antibodies
    - Islet cell
    - Glutamic acid dehydrogenase (GAD-65)
    - Insulin auto-antibody 512

- **Type 2**
  - Symptoms of DM plus random plasma glucose ≥ 200 mg/dl (11.1 mmol/l)
  - Fasting plasma glucose ≥ 126 mg/dl (7.0 mmol/l)
  - 2 hour plasma glucose ≥ 200 mg/dl during OGTT

Type 2 Diabetes

- Is increasing in young children associated with increasing obesity rates
  - 16.9% are obese, putting them at risk for diabetes
  - 2 - 19 years: 16.9% at or above 95th percentile (obese); 31.7% at or above the 85th percentile (overweight) (Ogden, C. L. et al (2010)
  - Sedentary Lifestyle
  - Inadequate Exercise
  - "Super-size eating habits"
Type 2 Diabetes
- Puberty exacerbates incidence
  - Growth hormone is counter-regulatory hormone and increases peripheral insulin resistance
  - Focus on pubertal and pre-pubertal children (>10 years of age)
    - Type 2 has been reported in children as young as 4 years

Type 2 Diabetes
- Type 2 diabetes is more common in some ethnic groups
  - Hispanic, African American, Native American, Pacific Islanders
  - Genetic predisposition compounded by lifestyle; insulin resistance

Type 2 Diabetes
- Physical findings
  - Obesity: In type 2 > 90%
  - BMI at diagnosis 85th percentile
  - Acanthosis nigricans
Treating T2DM

- **Lifestyle Modifications**
  - **Nutrition**
    - Work with dietician regularly
  - Energy in
  - Physical Activity
    - Energy out
    - Interactive games, play, sports, etc.

- **5210 (UMA Healthy Lifestyles Committee)**
  - 5 servings of fruits and veggies per day
  - No more than 2 hours of screen time per day
  - 1 hour moderately vigorous activity a day
  - 0 sugar containing beverages per day

- **Medications**
  - Metformin
  - Insulin

Psychosocial Impact of Diabetes

- **Grief**
  - Loss of "healthy child"
- **Anxiety and Stress**
  - Patient, fear of needles/shots
  - Marriage, parents
  - Sibling fears and stress
- **Depression**
  - Both child and parent
- **Social Isolation**
  - Now different from other children
  - School
- **Frustration, Overwhelmed**
- **Eating Disorders**
Type 1 Diabetes

- Type 1 diabetes is the most common chronic disease of childhood
- Increasing 3% per year
- Most common type in Caucasians
- Utah - 33/100,000 children
  - 22% younger than 5 years of age
  - 24/100,000 nationally
- Peak occurrence at ages 5-7 and at puberty

Type 1 Diabetes

- Incidence is increasing with the most marked increase in ages < 5 years
- Has both a genetic component and an environmental component
- Can now predict potential diagnosis
  - Islet cell antibodies
  - Insulin auto-antibodies
  - GAD antibodies

Type 1 Diabetes

- Not related to diet, activity, or weight
- Not preventable
- Evolves over weeks to months
- Absolute insulin deficiency
- Good control of diabetes will decrease the risk of long term complications
  - Diabetes & Complications Trial
  - (DCCT – 1983-1993)
Onset of T1DM

Genetic predisposition (probably key, but no definite associations)

Silent, asymptomatic process
Antibody markers present (2 or more islet autoantibodies)
Mild abnormalities of glucose

Precipitating Event: "Second hit"

Destruction of islet cells starts → Onset of diabetes

Risk:

- No family history: 0.4%
- Mother with T1DM: 1-4%
- Father with T1DM: 3-8%
- Both parents: as high as 30%
Diagnosis

• New Onset
  - Classic triad: polyuria, polyphagia, polydypsia
  - More DKA and dehydration in pediatric population

• Diagnostic Criteria
  - Fasting Plasma Glucose (FPG) ≥ 126 mg/dl
  - Random venous plasma glucose ≥ 200 mg/dl
  - Plasma glucose ≥ 200 mg/dl 2 hrs after glucose load (1.75 g/kg or 75 grams max)
  - Hgb A1C ≥ 6.5% (used more for dx of T2DM)

New Approach to Diabetes Management & Care

Diabetes Control & Complications Trial (DCCT) findings provide firm basis for advocating tight blood glucose control

• 10 year study (1983-1993)
• Reduced risk findings
  - Eye disease 76%
  - Nerve disease 60%
  - Kidney disease 50%
  - Cardiovascular disease 35%

Major Goals at Diagnosis

• Maintain Growth
• Avoid frequent extremes - hyperglycemia/hypoglycemia
• Maintain a 'normal' lifestyle
Management & Care Advancements

• Blood glucose monitoring
• New insulin analogs
• Insulin delivery systems
• Nutritional guidelines and improved food labeling

Blood Glucose Meters Monitoring

- OneTouch Ultra2
- Bayer Contour
- Freestyle Lite
- AccuChek Aviva
- AccuChek Compact Plus
- OneTouch UltraMini

Insulin Regimens

• Long acting basal insulin - Lantus / Levemir
  - Given once daily to provide low level of background insulin
  - Usually accounts for about 50% of the total daily insulin
• Short acting bolus insulin - Humalog, Novolog, Apidra
  - Given with food
  - Provides “burst” of insulin to cover food intake and prevent post-prandial hyperglycemia
Insulin Dosing

- Basal – low level of continuous insulin
  - Glargine provides 20-24 hour peakless coverage
  - Detemir provides 12-16 hours coverage
- Bolus – given to provide extra insulin when eating
  - Short acting insulin given before food intake
  - Meals and snacks require an injection of insulin
  - Dose for amount of food eaten (carbs) and correction of “out of range” glucose
- Increased injections provide increased flexibility
  - Time and quantity of food are flexible
  - Result in better control

Insulin Delivery Systems

- Insulin Pens
  - Old Standard: Vial and Syringe
  - New Standard: Insulin Pens

Insulin Pumps

- THEN
- NOW
Pump Therapy

Pumps
- Continuous infusion of short acting insulin (novalog or humalog)
  - Basal insulin is provided by frequent small doses, e.g., 0.5 units per hour
  - Bolus insulin provided with meals
- If the pump stops working, ketosis develops rapidly, on the order of 3-6 hours.
- Pumps are mechanical devices and can fail
  - Hospital does not stock spare pumps
  - Pharmacy does not stock pump supplies

CSII (Continuous Subcutaneous Insulin Infusion) Insulin Pumps
Continuous Blood Glucose Monitoring Systems (CGMS)

DexCom G4 or G5 System

Medtronic Guardian
(Sensor only)

Medtronic 530G REAL-time System
Pump/Sensor System

School Response With CGM

- Respond to alarm
- Verify with meter check
- Treat lows
- Notify parent for high glucose
Blood Glucose

- Target range varies with age:
  - 100-200 mg/dl if age < 7
  - 80-180 mg/dl in 7-12 yo
  - 70-180 age > 13 years
- Target range is individualized
  - Modify based upon child’s maturity and ability
to recognize hypoglycemia (low blood sugar)
- Even in the best of all worlds, no one can achieve target range 100% of the time

Hyperglycemia

- Does not require leaving school
  - Allow free access to water and bathroom
  - Notify parent if vomiting or ill
- Notify parent of blood glucose
- Etiology
  - Stress
  - Extra food
  - Intercurrent illness

Correction Doses

- Do not correct any more often than every 3 hours.
  - Before meals and at bedtime
  - SC insulin has a half life of approximately 3 hours
- Corrections can be given at lunch only or,
  if on a pump, give per pump calculation only
  at non-meal time
Hypoglycemia: Blood sugar 50-70

- Important not to overtreat:
  - 15-15 rule, follow with snack if not eating within 30 min.
- No one can prevent all lows.
  - Recurrent episodes may be preventable
  - Recurrent mild episodes may be evident as poor school performance
- Never send child out of classroom alone

Hypoglycemia: Blood sugar < 50

- Alert, able to cooperate and take po
  - 15-15 rule: 15 gms carbohydrate and recheck BS in 15 min.
  - Give a snack if not eating within 30 min.
  - Check on child later
  - Notify parent
- Unconscious / Severely Impaired
  - Glucagon and call 911

What is Glucagon?

- Pancreatic peptide hormone
- "Anti-insulin" in that it acts to raise the blood glucose level
  - Release of glucose from the liver
  - Onset of action is rapid-few minutes
  - Duration of action is short - 15-20 minutes
  - Effects are the same in diabetic and non-diabetic individuals
- Side effects are minor
  - Nausea and vomiting
Why Give Glucagon?

• Deficiency of glucose to the brain can result in severe brain damage or death if not treated quickly
  - Quickly treated, severe hypoglycemia has no long term consequences

• Glucagon is the fastest means of treating hypoglycemia
  - Safe with virtually no side effects

When Should Glucagon Be Given?

• Glucagon should be given when the hypoglycemia is severe enough that the individual cannot swallow safely
  - Ideally, a blood glucose is done to confirm hypoglycemia, but it is not necessary
  - Individuals with signs of severe hypoglycemic including being combative, disoriented and confused, loss of consciousness, convulsions

Diabetes Related Developmental Issues

• Age-related responsibilities and traits

• Ages for diabetes-related skills
Infant & Early Childhood
- Role of siblings
- Daycare, baby sitters, grandparents
- Erratic physical activity and appetite
- Parenting styles and coping skills
- Parents concerns of invasive procedures
- Parents fears of hyperglycemia and long-term complications
- Temper tantrums vs. reactions
- Choices: helping children feel in control of their world by offering controlled choices
- Not making eating a control issue
- Transition issues: getting back home after hospitalization; regression, day care

School Age
- Self-esteem
- Development of self-care skills, according to the developmental status of patient
- Peers: how to talk to friends about diabetes, teasing
- School issues: educating teachers and school personnel
- Eating at parties, church, school, friends homes
- Transition issues: beginning school, increased self-care

Adolescents
- Peers: research regarding importance of emotional support, invite peers to clinic
- Parents: communication - how does the family talk about diabetes (without WW III starting)
- Egocentric
- Fictitious blood glucose records
- Risk taking behaviors: sexual, diabetes related, drugs
- Erratic schedules
- More responsibility for self-care
- Transition issues: puberty, drivers license, dating, sexuality, changing schools, shift in responsibility of care (however, should not mean absence of family involvement)
General Family Issues

- Who is supporting Mom?
- What is Dad’s involvement?
- Siblings
- Open communication
- Not letting diabetes be used as a control or manipulation issue
- Grief issues
- Finances/insurance
- Camp
- Parents finding a healthy balance while providing support to the child

Support Systems & Resources

- PCMC Outpatient Diabetes Clinic
  Nurse On call service
- Foundation for Children and Youth with Diabetes (FCYD)
  Summer and winter camping program
  (801) 566-6913

Support Systems & Resources

- American Diabetes Association Family Resource Network
  (801) 363-3024
- Juvenile Diabetes Research Foundation Bag of Hope for newly diagnosed patients
  (801) 530-0660
Questions?

• CGM - school responsibility
• Bathroom privileges
• Meal testing - leave classroom early
• Office Supervision
  • Pump dosing
  • Injections
  • CHO counting
• CGM - not to dose from