Naturally Sweet Children with Diabetes Mellitus

Jules Scadden, Paramedic
Author
Fundamentals of Basic Emergency 3rd Ed
jkscadden@gmail.com

Naturally Sweet-Children with Diabetes Mellitus

Objectives:

- Define Diabetes Mellitus
- Review the pathophysiology of Diabetes Mellitus
- Define types of diabetes mellitus found in children
- Explain risk factors/management priorities –each type of diabetes
- Discuss assessment/management hypoglycemia emergency

Case Study 1

Nikki is a normally precocious 4 year old
who was recently diagnosed with Type 1 Diabetes Mellitus
She was found unconscious by her mother.
Nikki is lying on her bedroom floor, unresponsive.
A primary assessment establishes a patent airway & adequate breathing
Mom states she gave Nikki her insulin approximately 40 minutes ago.
She found her unconscious when she came to
get her for breakfast.

What is Diabetes Mellitus

- "Sugar Diabetes"
- No production of insulin
- Inadequate production or utilization of insulin
- Inadequate metabolism of glucose
- Metabolism of carbs, fats and proteins

End Results: High blood glucose levels

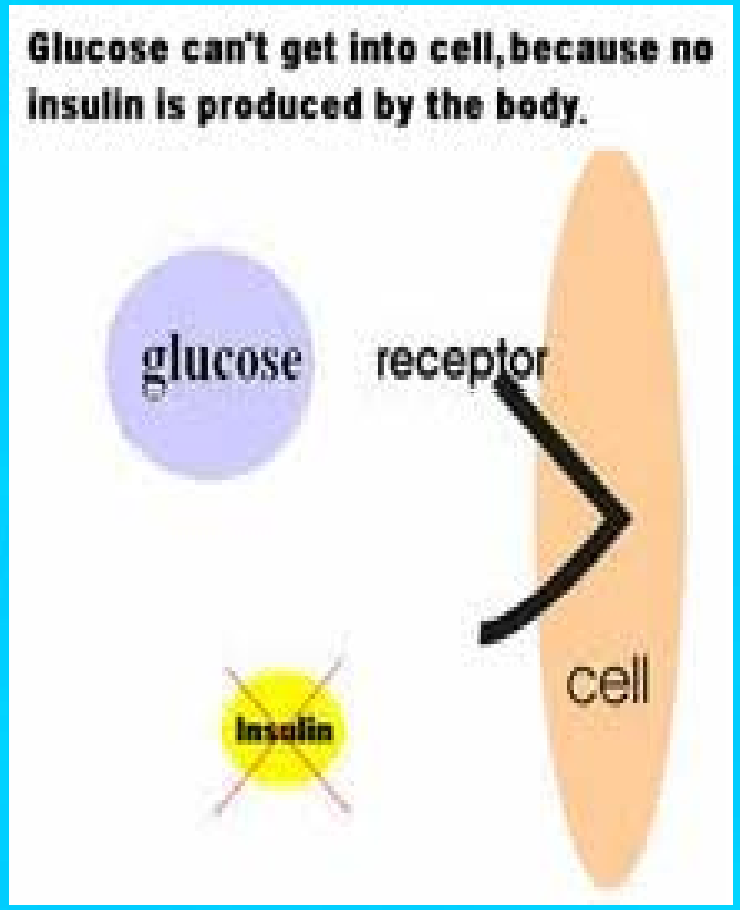
- Insufficient glucose in the cells
  - Inefficient energy production

Epidemiology-Children with Diabetes

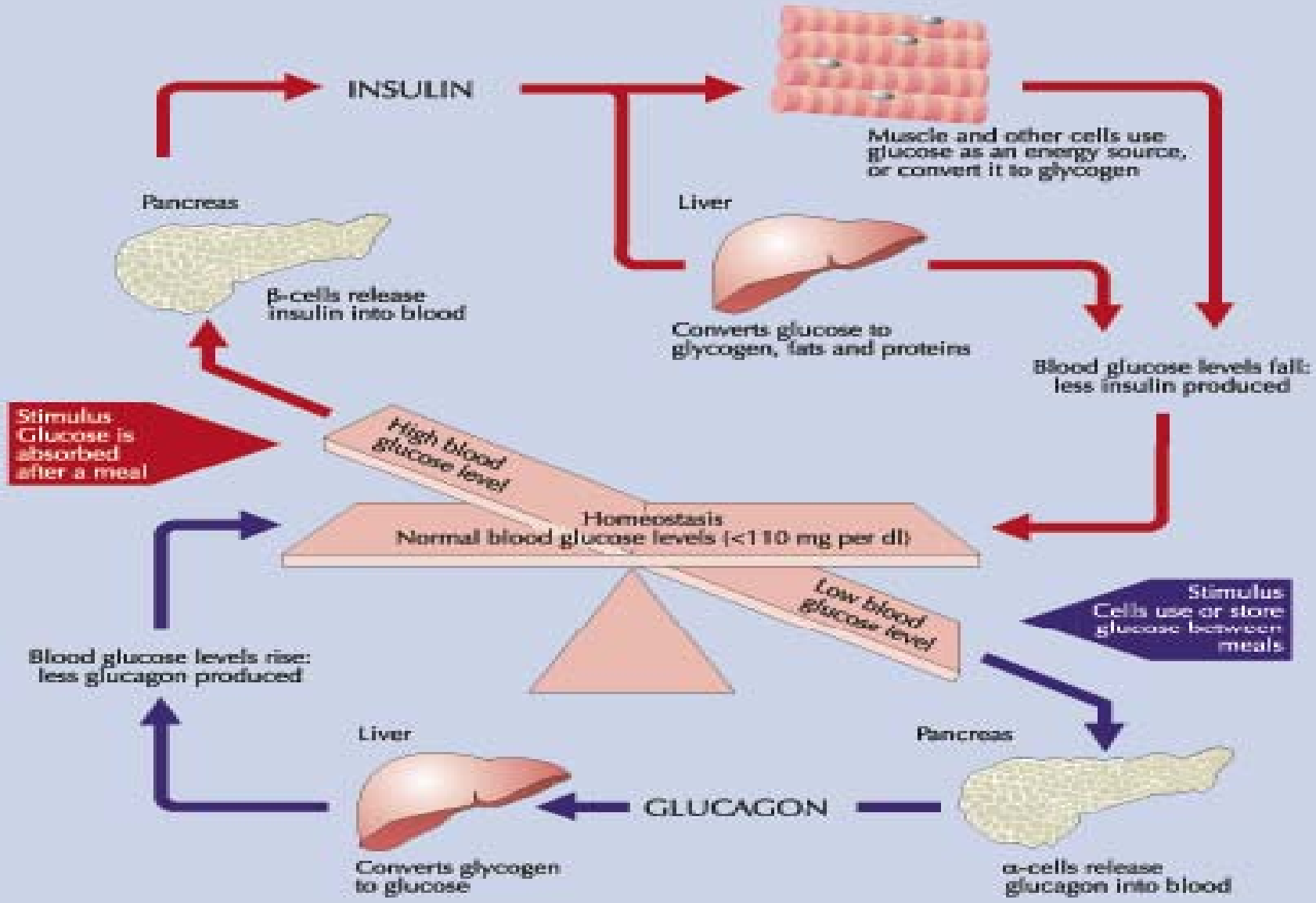
- Most common chronic diseases seen in children
- Has increased 3 times in last 30 years
- Type 1 diabetes <5%/year-pre-school children in India.
- Estimated 151, 000 children, <20 years in U. S.
- > 20% new diabetes in kids have Type 2 DM
- Contributed to > obesity

Pathophysiology

- Glucose is required by cells to produce energy
- Insulin-hormone that "unlocks" the cells
  - Insufficient or no insulin cells remain locked
- Fat and Protein metabolism
  - Ketones



Pathophysiology



Associated Complications-Long Term

- Retinopathy-Cataracts
- Hypertension-Vascular disease (PVD)
- Progressive renal failure
- Early coronary artery disease
- Neuropathy
- Increased risk of infection
- Autoimmune diseases
- 20%=Thyroid autoantibodies

Classification of Diabetes

- Type 1 diabetes
- Type 2 diabetes
- Gestational diabetes

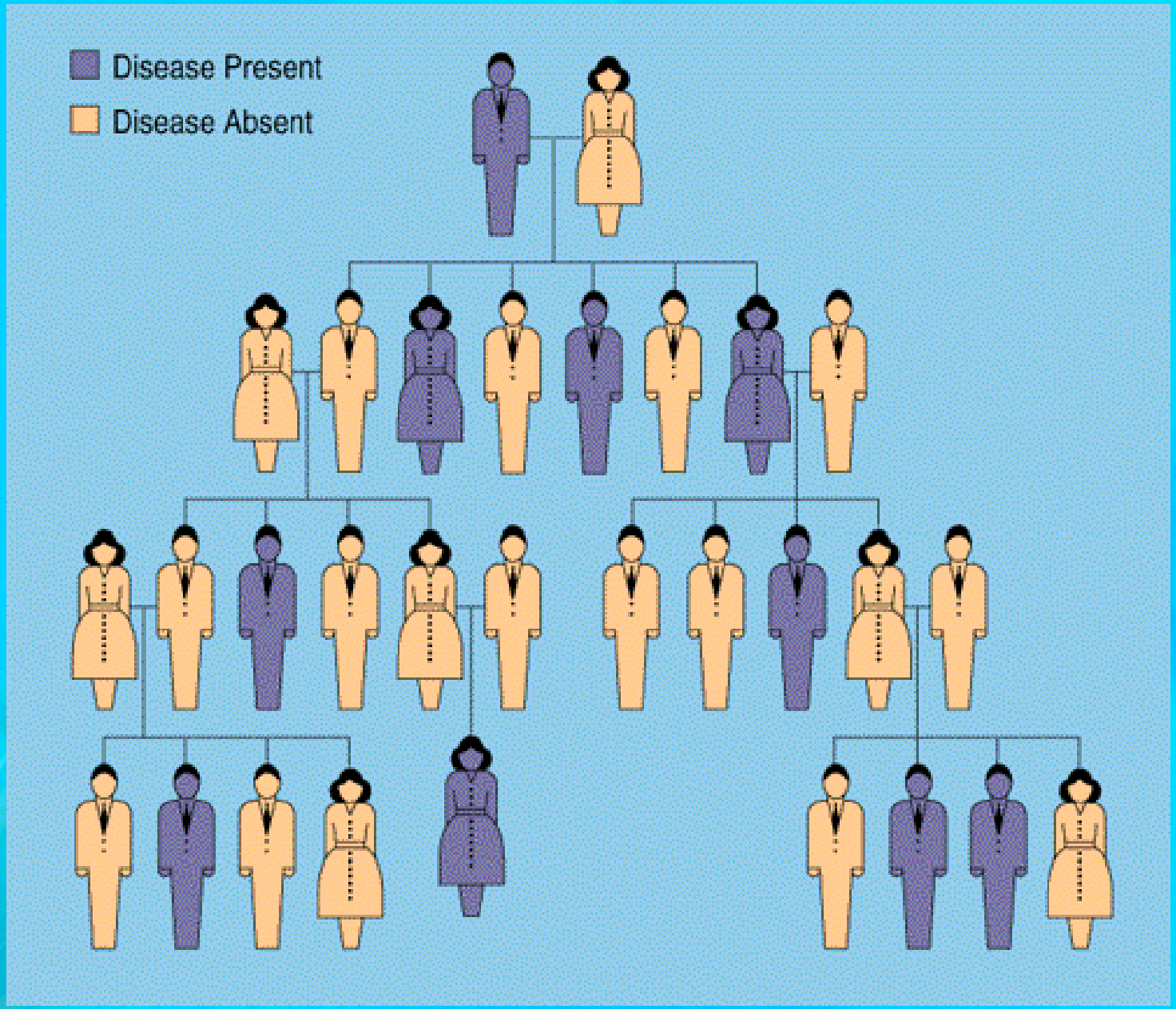
Other types of Diabetes

- ✓ *Genetic*
- ✓ *Malnutrition related*
- ✓ *Drug induced*

Type 1-Insulin Dependent Diabetes Mellitus

- Begins years before recognizable symptoms
- Destruction of beta cells in the pancreas
- "Juvenile-onset" diabetes
- 5-10 % of all forms of diagnosed DM
- Leading cause of diabetes in children
- Autoimmune disease
  - Genetically predisposed
  - Precipitating event-Viral infections

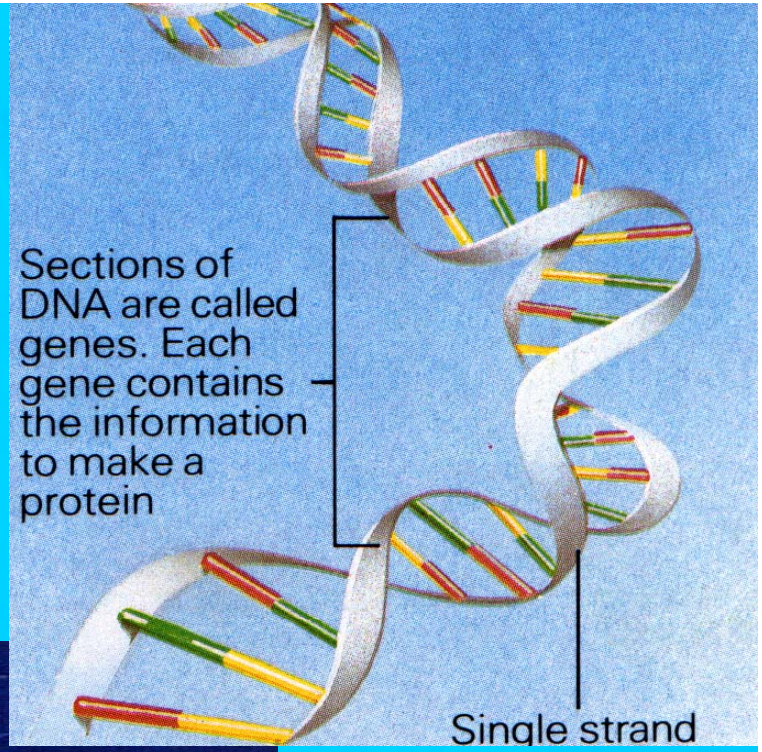
Heredity

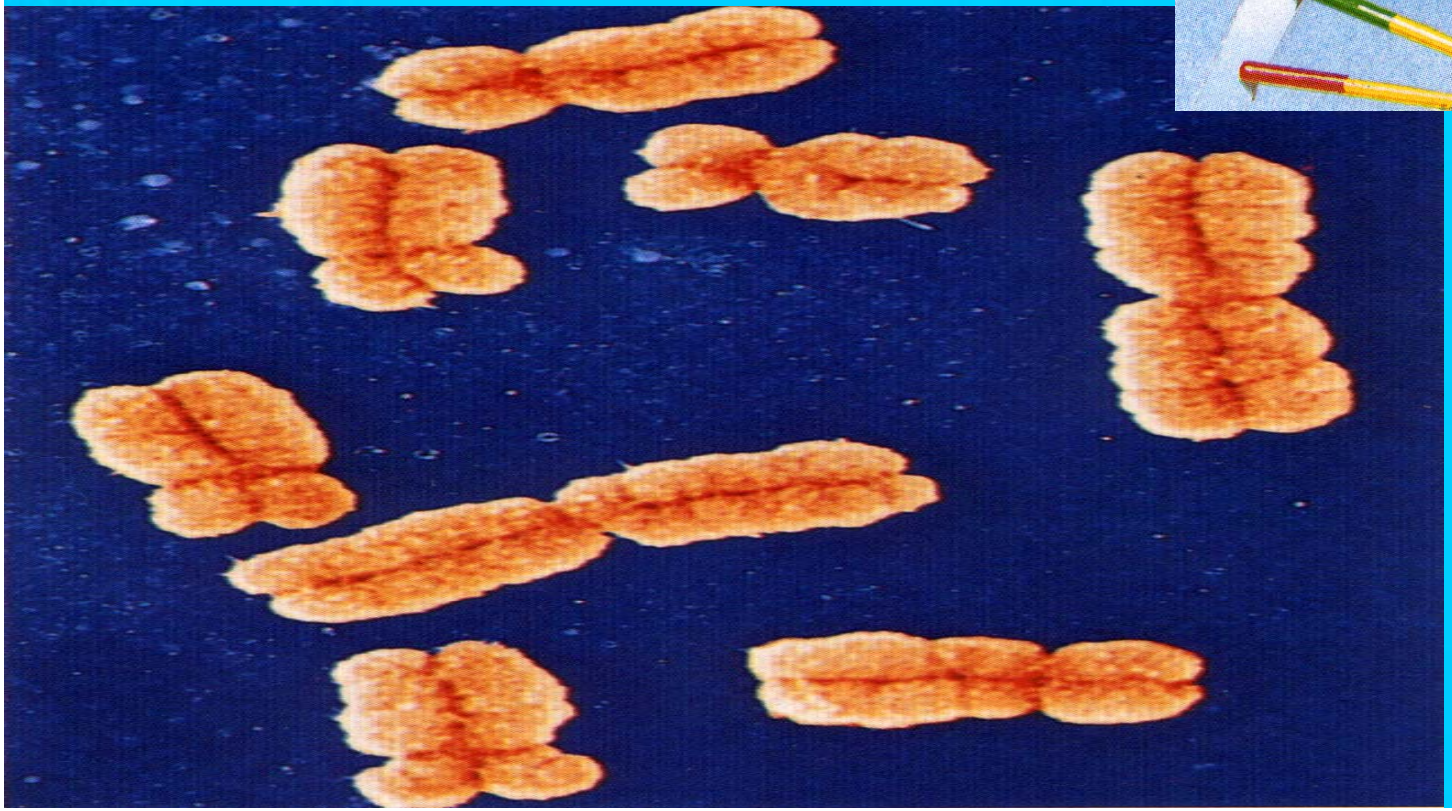


Genetics

FOR INSULIN IDENTIFIED (CHROMOSOME 6)

- Human Leukocyte Antigen (HLA-DR3 and DR4)
- DR3 & DR4 are present in 95% of Type 1
    - 30% have inherited both DR3 & DR4





Environmental factors

- Viral infection
- Dietary factors are also relevant.
- Breastfed infants <risk for Type I (IDDM)
- Chemical Causes
  - Rat poison - damage islet cell

Diagnostic range of blood sugar (plasma glucose)

	Normal glucose tolerance	Impaired glucose tolerance	Diabetes mellitus
Fasting plasma glucose (mg/dL)	<110	110-126	>126
Between 0-120 min (mg/dL)	<200	<200	200 at least once
2 hours after glucose load (mg/dL)	<140	>140, but <200	>200

- Values are internationally accepted for plasma glucose
- Corresponding whole blood glucose values are lower

Diagnostic and Monitoring

- Blood glucose monitoring
  - Checks 2-3+ per day
  - Sliding scale insulin administration
- A1C-Glycated hemoglobin
  - Average BGC for past 2-3 months
  - Measures % of glycated hemoglobin (HbA1c)
  - Checked twice a year
  - Does NOT replace self-testing

Blood Glucose Levels-Norms by age

Age	Before Meals	Bedtime
<6	100-180	110-200
6-12	90-180	100-180
13-19	90-130	90-150

Health care specialists at UCSF Benioff Children's Hospital.

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Case Study 2

You've noticed over the summer how the star
little league pitcher Kevin seems to be losing weight.
While you and Kathy (Kevin's mom) chat,
she mentions that Kevin seems to be going
to the bathroom all the time, and drinking a lot more.
She also mentioned he is sitting closer to the computer,
seems very tired early in the day and
is eating constantly.

Symptoms of Type 1 Diabetes

- Age 5 to 30 years
- Excessive urination
- Excessive hunger
- Excessive thirst
- Bed wetting
- Unexplained weight loss
- Dehydration
- Coma

Abdominal pains, headaches and behavior problems along with the usual symptoms of diabetes like weight loss, thirst, tiredness and frequent urination.

Hyperglycemia

Signs and symptoms

- Frequent urination (Polyuria)
- Increased thirst (Polydipsia)
- Increased hunger (Polyphagia)
- Fatigue/weakness
- Weight loss
- Blurry vision
- •Slow or confused thinking

Ketoacidosis (DKA)

- Ketoacids build up-Excreted thru urine and breath=Fruity/Acetone smell
- Dehydration worsens
  - Shortness of breath
  - Abdominal pain
    - Vomiting with frequent urination
- Diabetic coma results without treatment
  - Kussmaul's respirations
  - Orthostatic hypotension

Assessment Hyperglycemia & DKA

Assessment---History

- Recent DX
- Last meal
- Last insulin
- Recent illnesses
- Behavior changes
- Stress related events

Management Hyperglycemia and DKA

- Management: Fluid replacement
- Oxygen
- Blood Glucose analysis
- ECG
- Fluid replacement
  - Stable: 20 cc/kg over one hour NS
  - Shock: 20 cc/kg bolus
- Transport:
- Shock/Altered LOC
  - Rapid to appropriate facility
  - Repeat fluid bolus 20 cc/kg enroute

Hypoglycemia

- Low blood glucose (sugar)
- Too much insulin
- Missed a meal/snack
- Strenuous exercise
- No apparent reason
  - Need to change insulin doses
    - Growth and development phases

Hypoglycemia

- Hypoglycemic unawareness
  - Children <6 or 7
  - Lack cognitive recognition/reaction
    - Higher risk group
- Inborn metabolic errors
- Ingestion of alcohol
- Beta blockers
- Viral gastrointestinal infections
- Sepsis

Hypoglycemia

Signs and Symptoms

- Altered mental status
- Hunger, shakiness, weakness, dizziness/light-headed, sweating
- Tachycardia & Shallow tachypnea
- Vomiting
- Loss of consciousness/seizures

- Hypoglycemia during sleep
  - Crying out or nightmares
  - Sheets and pjs damp
  - Feeling tired, irritable or confused after waking up

Hypoglycemia

Assessment: SAMPLE History

- Pertinent questions:
- Diagnosed Diabetic?
- Child been sick with fever, vomiting or infection?
- Eating properly?
- Rigorous activities without eating or after taking insulin?
- Family members with history of DM?

Diabetic Emergency-management

Management: Return BGL within normal range

- A & O: sugar by mouth
- Altered LOC-NPO

- BLS Management:
  - ABCs –Oxygen prn-Assist ventilations prn
  - Glucose check per local protocol
    - Awake-suspect DKA or Hyperglycemia
      - NON-sugar fluids
    - Hypoglycemia
      - Awake: Oral glucose/sugar
  - Transport-ALS intervention

Diabetic Emergency Management

Advanced Life Support

- ABCs—protect airway, assist ventilations as required
- Establish IV-Normal Saline—20cc/kg-bolus as indicated
- Check BGL
  - <60 IV dextrose 2-4 cc/kg (0.5 to 1 g/kg) D25
  - Infant less than 30 days old: 2-4 cc/kg (0.2-0.4 g/kg) of D10
- Unconscious child without IV access:
  - Administer glucagon:
    - < 10 KG=0.1 mg/kg IM
    - > 10 KG=1.0 mg IM

Cautions: Hypertonic solutions: D25 & D50—very hyperosmolar
Administer through patent IV site SLOWLY

Type 2-Non-Insulin Dependent DM

Epidemiology: "Pre-Diabetes

- Commonly associated adults "adult onset DM"
  - 90-95% of all cases of DM
  - ~half of new DM in children =elements consistent with Type 2
- Insulin resistance-Body doesn't use insulin efficiently
  - Pancreas secretes insulin sluggishly= change in carbohydrate metabolism
  - Body tissues require an excessive amount of insulin
  - Secreted insulin is destroyed or made inactivate
- Some insulin deficiency may exist
- Commonly older than 10 and/or experiencing puberty

Type 2 Diabetes in Children-Risk Factors

Obesity

- 1:5 children in America
- Chances of DM double

- Family history of diabetes
- Female gender
- Specific ethnic groups (American Indian, African-American, Asian, or Hispanic/Latino)
- Other problems with insulin resistance

Physical Signs of Type 2 Diabetes

Physical signs

- Dark, thick, velvety skin
  - Neck or in armpits
- Excessive hair
- Excessive Acne
- Absent or infrequent periods
- High Cholesterol
- High Triglycerides
- Hypertension

Signs & Symptoms of Type 2 Diabetes

The symptoms of Type 2 diabetes in children develop slowly

Symptoms

- Unexplained weight loss
- Increased hunger or thirst, even after eating
- Dry mouth
- Frequent urination
- Fatigue
- Blurred vision
- Heavy breathing
- Slow healing of sores or cuts
- Itchy skin
- Numbness or tingling in the hands or feet

Type 2 Diabetes in Children

Long-term complications and conditions:

- Hypertension
- Heart disease
- High cholesterol

Management:

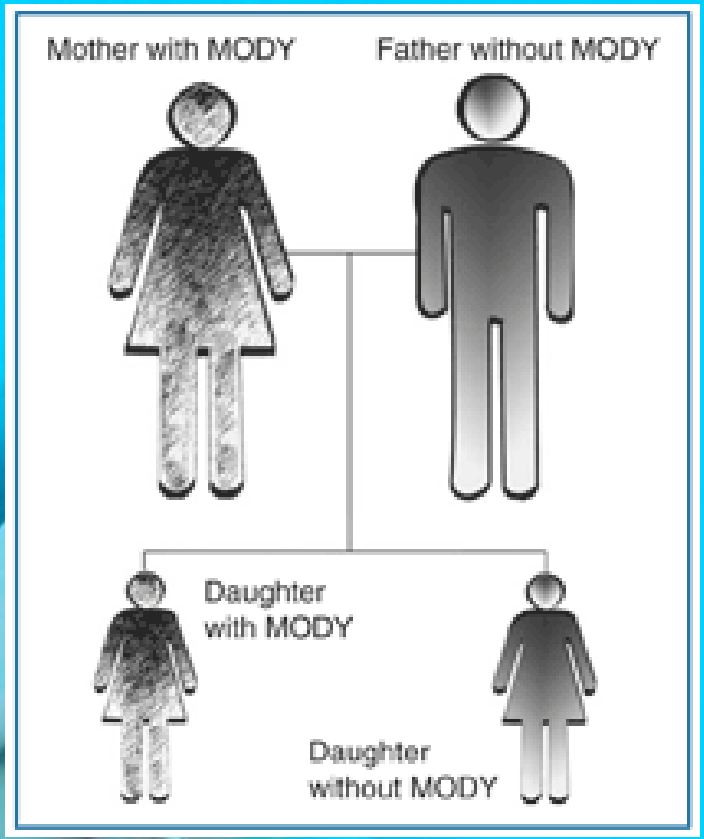
- Preventative:
  - Healthy eating
  - Exercise
- Oral medications to lower BG
  - Overdose
  - Non-compliance
  - Growth & development

"Other" Diabetes

- "Hybrid" or "Mixed" Diabetes
  - Seen in Teenagers
  - Insulin resistance (Type 2)
    - Obesity
  - Pancreatic islet cell antibodies (Type 1)
    - Autoimmunity
  - Signs & Symptoms-Type 1 & Type 2
  - Management
    - Which type is present at diagnosis
      - Likely both insulin and oral medications

EMS Concerns??

"Other Diabetes"--Monogenic



- Maturity-Onset Diabetes of the Young (MODY)
  - Rare form found in children with single gene defect
    - Faulty insulin secretion
  - Defined by early onset
    - Usually before age 25
    - Absence of ketosis
    - Autosomal dominant inheritance
      - Parent with MODY – 50%
  - Accounts for 2 to 5 % of all diabetes
    - Often undetected
- Treatments: same as all types

Gestational Diabetes

One of the most common health problems of pregnancy.

- Hormonal changes cause cells less responsive to insulin
- Pancreas can't keep up with increased insulin demand
- Usually A-symptomatic
  - Develop 24-28 weeks
- Transient
  - Increased risk DM
- Risk Factors: BMI > 30
- Family HX of DM

Gestational Diabetes

Affects on Baby:

- Macrosomic baby—Big baby
  - Too large for birth canal
- Head passes/shoulder dystocia
- Excessive fat stores=Obesity
- Infant experiences hypoglycemia after birth
- Lung immaturity/respiratory difficulty
- Increased risk of jaundice
- Polycythemia (+ RBC)
- Hypocalcemia (- calcium)
- Poor heart function
- Still birth (last 2 months)
- Increase risk of preeclampsia
- Increased risk of Type 2 DM development for child

"Other" Diabetes--Monogenic

Neonatal Diabetes Mellitus (NDM)

- Occurs within first 6 months
- Rare: 1 in 100,000 to 500,000 births
- Do not produce enough insulin
  - High BGL
- Type 1 diabetes?
- Transient-disappears during infancy
  - Reappear later—transient neonatal DM (TNDM)
  - ½ result in life-long-permanent neonatal DM (PNDM)

Symptoms of NDM

- Thirst, frequent urination, and dehydration.
- Elevated BGL in blood or urine.
- Insulin Deficiency
  - Ketoacidosis.
- Most fetus do not grow well in the womb
- Intrauterine growth restriction.
- After birth, some infants fail to gain weight and grow normally

Malnutrition-related Diabetes

- Developing countries= India
  - 1% DM population
- Designated in 1995-WHO
- Young-malnourished individuals
  - Onset before age 30
- Fibro Calculous Pancreatic Diabetes
  - Tropical/Developing
  - Recurrent abdominal pain
  - Chronic pancreatitis

DM & Special Needs Children

Case Study 3

You are called to the local state park for an 8 y/o child not acting right.

You see a young boy sitting against the tree, staring into space.

You are told by a parent chaperone that Justin had wondered off from the rest of the kids and she found him this way.

No matter what she tried, he wouldn't answer her.

Justin doesn't seem to notice your arrival. His work of breathing rapid and shallow and he is skin is pale and moist.

You hear the child making a very soft, low humming noise intermittently.

What do you want to know about Justin?

DM & Special Needs Children

Children with special needs have a higher chance of developing DM

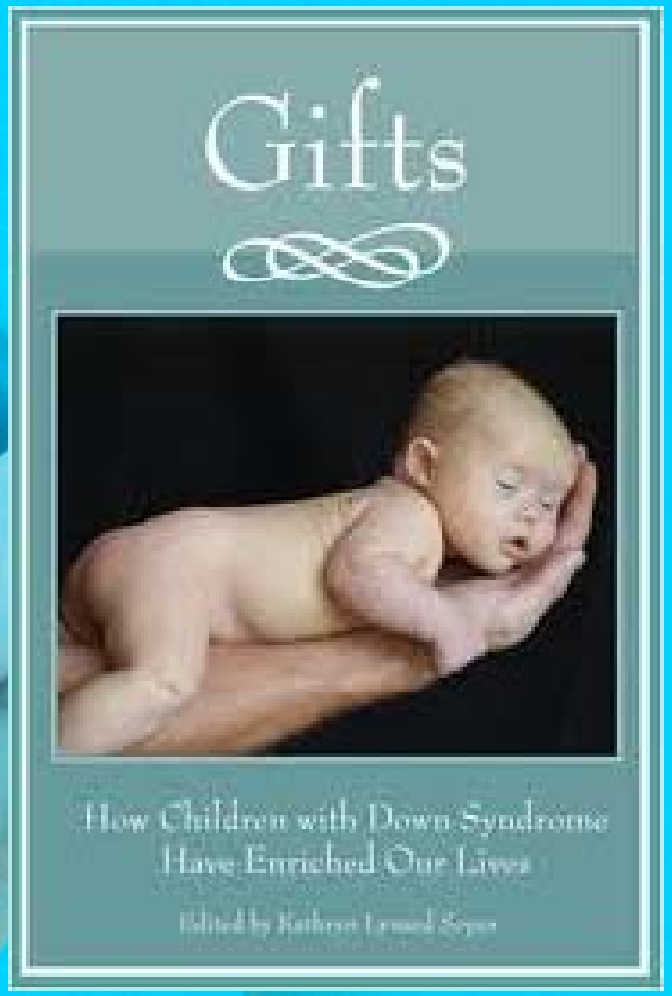
Children with Autism

- Autoantibodies connection
  - Autoimmune connection ?
  - Autism and diabetes
    - Differentiating behavior
    - Communication
- Lack of cognitive ability to manage
- Sensory abnormalities

Diabetic Emergencies present what challenges?

DM & Special Needs Children

Down Syndrome: Approximately 2% of children up to 14 y/o



Shared processes involving antibodies/autoimmune difficulties
Most commonly insulin dependent (Type 1)
Type 2—Obesity
Hypothyroidism- both produce antibodies which destroy tissue

- Thyroid gland
- Beta-cells in pancreas

Diabetes and Down Syndrome-Treatment concerns

- Concentration on prevention of complications
- May lack cognition to recognize level changes
- May not be diet compliant
- Learning to how to manage injections-- Insulin pens

Case Study 1 Revisited

Nikki is a normally precocious 4 year old
who was recently diagnosed with Type 1 Diabetes Mellitus
She was found unconscious by her mother.
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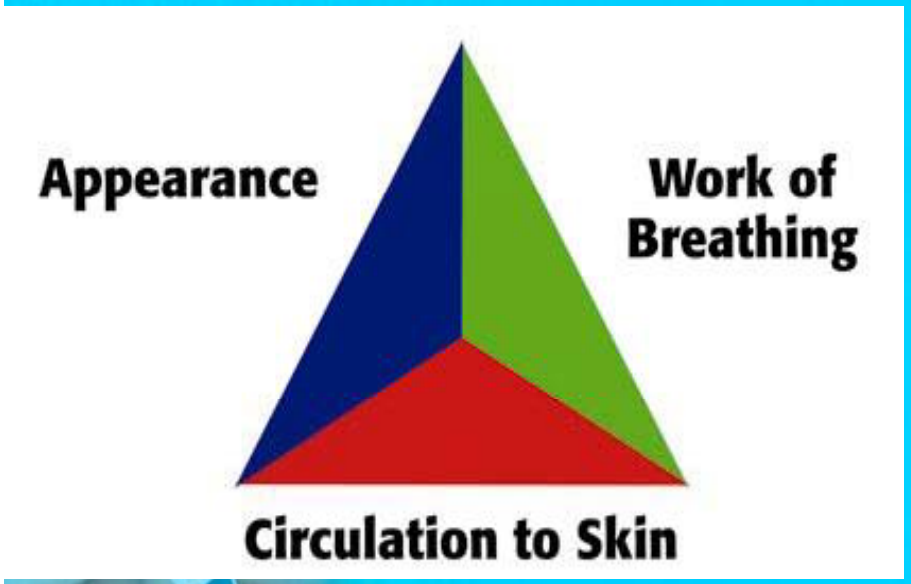
Case Study 1-Revisited



Patient Assessment Triangle

General findings

- Appearance-Unresponsive
- Work of Breathing
  - Shallow tachypnea to snoring
- Circulation to Skin
  - Pink-warm-moist/wet

Case Study 1-Revisited

Primary Assessment

- A---Patent
- B—RR 30: clear with good air movement: Oximeter 97% on room air
- C—HR 130: strong radial pulse: Cap refill 2 sec; sweaty skin; BP 96/50
- D—AVPU: Withdraws from pain
- E-- No signs of trauma or rashes

Case Study 1--Revisited

Management Priorities: Stay or Go?

- Focuses history?
  - AEIOUTIPS
    - Alcohol
    - Epilepsy, endocrine, electrolytes
    - Insulin
    - Opiates
    - Uremia
    - Trauma, temperature
    - Infection
    - Psychogenic, poison
    - Shock, space occupying lesion, subarachnoid hemorrhage

Case Study 1

Blood glucose check shows a BS of 30 mm/dl.

You established in IV and administer D25, slowly to avoid extravasation.

As the dextrose infuses Nikki wakes up and states she is hungry.

You prepare Nikki for transport to the pediatric hospital that is familiar with her medical history.

The 40 minutes following insulin administration without breakfast had caused Nikki's blood glucose level to drop below normal.

You closely monitor for any change in her level of consciousness or fall in blood glucose level enroute to the hospital

Diabetes Mellitus-Summary

Diabetes Mellitus is a common chronic disease being seen increasingly in children

Type 1 "Juvenile Onset" is the most commonly seen DM in children

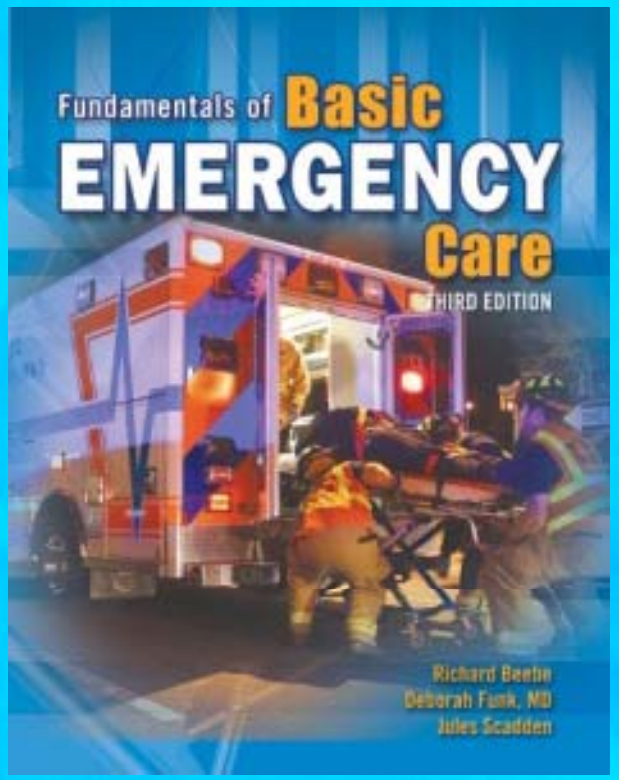
Treatments for Hyperglycemia & DKA follow the same guidelines as for Adults

Hypoglycemia is often seen during the adjustment phase, growth spurts and excessive exercise

Type 2 DM -"adult" onset is increasing in children and attributed to childhood obesity

EMS Practitioners may be the first healthcare provider to recognize the differentiating symptoms that lead to an early diagnosis and appropriate management of DM in children.

Thank You!



Jules Scadden, PS
jkscadden@gmail.com