

Pediatric Diabetes Update
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DISCLOSURES

1. No financial incentives
2. Volunteer Positions
 1. National Certification Board for Diabetes Educators, Chair, Examination Committee
 2. American Diabetes Association: Safe at Schools, Advocacy, and Science/Technology referee for Scientific Sessions, annual ADA meeting (2017-)
 3. Diabetes Clinical Advisory Committee, Washington DC

Learning Objectives

At the conclusion of this webinar, attendees will be able to:

1. Identify signs and symptoms of diabetes in the office setting
2. Describe the latest basal and bolus insulins, and apply insulins to construct insulin regimens
3. Classify and differentiate the different types of diabetes

Case Presentation

Chief Complaint: 4 year old boy presents to your office with history of wetting the bed with increasing frequency over the past 2 weeks.

History of the Present Illness: The child has been drinking more; however, it is summer time so the mother was not concerned. He goes to the bathroom on his own and has been at day camp, so she is unsure how much he is urinating during the day. He does, however, interrupt play to run into the bathroom. His appetite is very good, no fever. He did have a URI several weeks ago, but otherwise has been well

Past Medical History: Frequent episodes of otitis media as an infant, but no major illnesses. He did have Varicella 6 months ago (breakthrough of Varivax vaccine). He is growing well and physically active.

Medications: none

Case Presentation continued...

Immunizations: up to date

Allergies: none

Family History: type 1 diabetes in father (onset age 21), paternal aunt and uncle died from complications of type 1 diabetes in early 20's (aunt- "diabulemia" and uncle "car accident, secondary to hypoglycemia). No history of type 2 diabetes, Plus history of "low thyroid," no celiac disease or JRA.

Social History: child lives with parents and 7 year old sibling. He currently is attending summer camp.

Physical exam:

VS: BP: 100/72, P=90, RR=28 To-98.7, weight: 18 kg, height= 105 cm

Case Presentation continued...

Skin: no rashes, mild dryness, no acanthosis nigricans

HEENT: TM's negative, Pharynx: mild erythema, no exudates.

Neck: palpable thyroid

Lungs: Clear

Cardiac: Regular Rhythm, no rubs, gallops or murmurs

Abdomen: soft, +/-tenderness, ? Rebound, no increased liver or spleen

GU: normal, testes descended, no flank tenderness, no suprapubic tenderness

Extremities: full range of motion, no leg weakness

Neuro: normal mental status, bulk and tone. No spasticity

Differential Diagnostic Considerations

1. R/o family history of nocturnal enuresis
2. R/o UTI
3. R/o Psychosocial issues
 1. New sibling
 2. Divorce
 3. Relocation
 4. Death in the family
 5. abuse
 6. Any of the top 10 stressors
4. R/o Drinking too much before bedtime
5. R/o Neuropathic bladder (spinal cord abnormality etc.)
6. R/o new onset Diabetes Mellitus
7. R/o new onset Diabetes Insipidus

Office Laboratory Evaluation...

1. Urinalysis: 4+ glucose/ moderate ketones, trace protein, negative nitrate, negative LE. Micro: negative, sg: 1030
2. Finger stick glucose (from office glucometer- if available): 300

Diagnostic considerations based on office lab results:

1. Hyperglycemia with ketosis- rule out type 1 diabetes mellitus
2. UTI ruled out
3. Family history significant: no history of nocturnal enuresis, positive family history of T1DM and thyroid disease
4. No evidence of new stressors in family
5. Normal neurological exam
6. No evidence of DI

Next steps...

1. Leading Diagnosis based on presentation, physical exam, family history and office lab evaluation: new onset diabetes, most likely Type 1.
2. Child sent to CN ED for further evaluation:

Laboratory tests	Results
Blood sugar (random)	375
Urine ketones	moderate
Na	132
Cl	3.0
BUN	18
Cr	0.9
pH	7.3
HCO ₃	15
Hb A1c	11%

Diagnostic Criteria:

1. Signs and symptoms of diabetes in association with a random blood sugar ≥ 200 mg/dl (laboratory value, NOT finger stick)- typical presentation for T1DM
2. Fasting blood sugar on 2 occasions >126 mg/dl
3. Oral glucose tolerance test : 2 hour post prandial blood sugar after consumption of 75 grams carbohydrate ≥ 200 mg/dl
4. Hb A1c ≥ 6.5 % (3 month average blood sugar @ 140 mg/dl)

TYPICAL ED CAVEATS THAT MAY BE MISTAKEN FOR NEW ONSET T1DM:

1. stress induced hyperglycemia
2. Steroid induced hyperglycemia
3. Medication induced hyperglycemia

Diagnosis: New onset diabetes, most likely Type 1 based on criteria #s: 1 and 4

Management of Type 1 Diabetes: Think like a pancreas

BASAL INSULINS

1. Glargine- 24 hour-flat profile
 1. Lantus
 2. Basaglar
 3. Toujeo (3 times concentrated)
2. Detemir- (Levemir) (12-16 hours-flat profile)
3. Degludec-(Tresiba) (48-72 hours-flat profile)
4. NPH- 8-10 hours- peak profile

BOLUS INSULINS

Rapid Acting

1. Lispro (humalog)-1.5 -3 hours profile
2. Aspart (novolog)-1.5-3 hour profile
3. Glulisine (apidra)-1.5-3 hour profile

Fast Acting

4. Regular Insulin: 2-4 hour profile

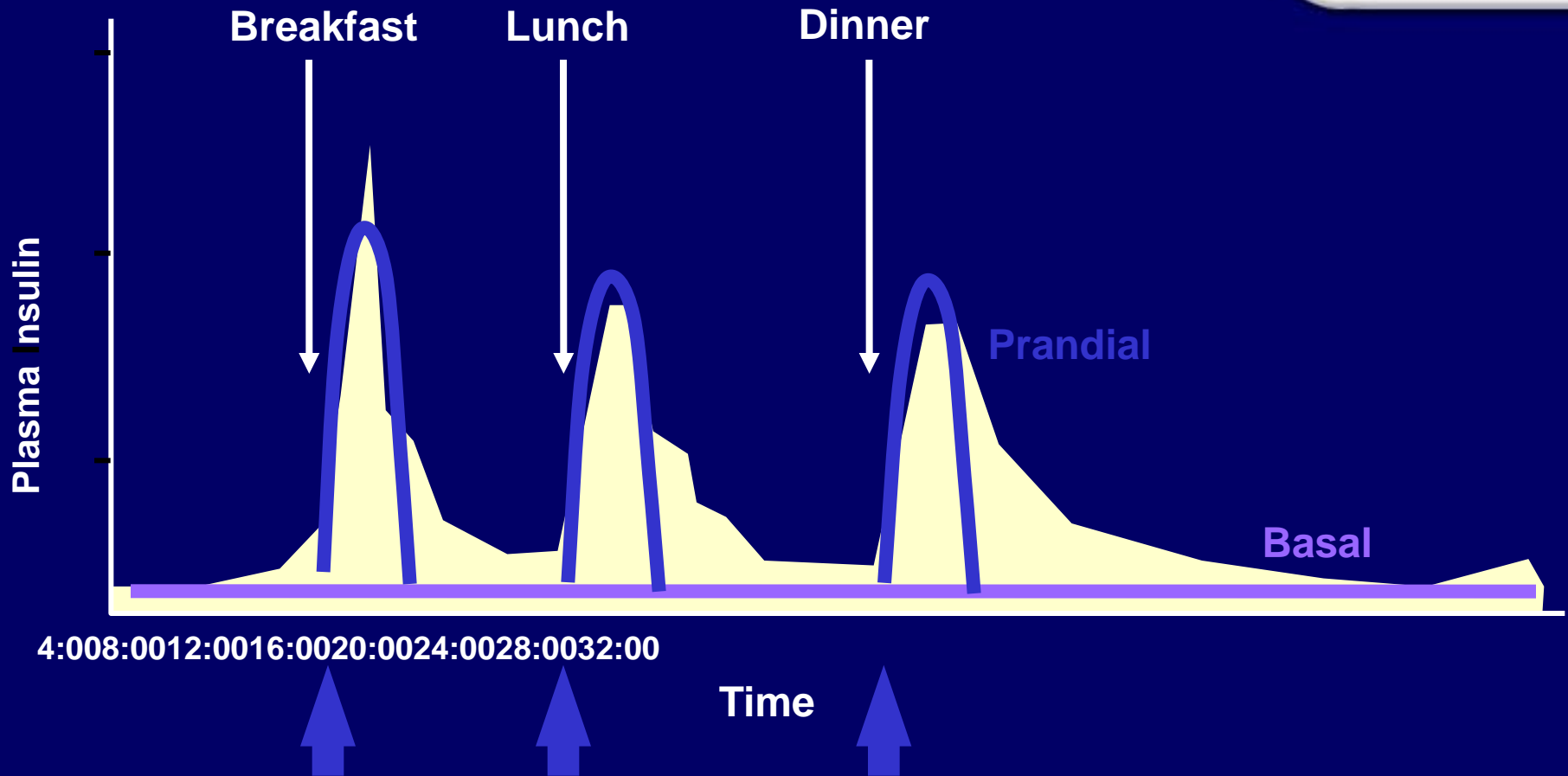
Premixed Insulins

1. Novolog mix 70/30 (attenuated novolog mixed with rapid acting)
2. Humalog mix 75/25 (attenuated humalog mixed with rapid acting)
3. Humulin 70/30 (NPH/regular)

Insulin Overview

Insulin Action	BOLUS Insulin	BOLUS Insulin	Intermediate Basal Insulin	24 hour basal Insulin	24-42 hour Basal insulin	24 hour basal insulin	24 hour Basal insulin
	REGULAR	Humalog (lispro) Novolog (aspart) Apidra (glulisine)	NPH	Lantus/ Basaglar (glargine)	Tresiba (Degludec) Very long acting	Toujeo (concentrated Glargine)	Levemir (Detemir)
Onset	30 minutes	5-10 minutes	1-2 hours	1-2 hours	1-2 hours	1-2 hours	1-2 hours
Peak	2-3 hours	1-2 hours	6-8 hours	none	none	none	none
Duration	4-6 hours	3-4 hours	10-12 hours	24 hours	42 hours	24 hours	12-18 hours
Other	<ul style="list-style-type: none"> • Clear • U-100 • Vial • only 	<ul style="list-style-type: none"> • Clear • U-100 • Vial, pen cartridge • Keep pen 1 month only at room temp OR in refrig • Can mix • With NPH only • Open pens • At room temp 	<ul style="list-style-type: none"> • Cloudy • U-100 • Vial or pen • Keep open pen at room temp for 10 days 	<ul style="list-style-type: none"> • Clear • U-100 • Vial or pen • Keep for 1 month only • Do not mix with other insulins in same syringe • Give once a day within 2 hr window • Open pens must be at room temp 	<ul style="list-style-type: none"> • Clear • U-100 or U-200 • Pen only • Good for 56 days (8 wks) @ room temp OR refrigerated • Give @same time each day if possible • Never use a syringe to remove Tresiba from pen • Wait 3-4 days between dose changes 	<ul style="list-style-type: none"> • Clear • U-300 (1.5 ml) 450 units/pen • Pen only • Good for 42 days (6 wks) • Open pens must be at room temp • Give once/day within 2 hour window • Never use a syringe to remove Toujeo from the pen 	<ul style="list-style-type: none"> • Clear • U-100 • Vial or pen • Keep for 42 days (6 weeks only) • Usually 2 injections/day 12 hours apart • Do not mix with other insulins in the same syringe. • May need twice a day • Open pens must be at room temp

Optimized Insulin Replacement Regimen: Mimicking Physiology With Basal and Prandial Insulin Normal



Insulin calculations...

1. Typical starting insulin dose: 0.6-1.0 unit/kg/day in child NOT in DKA
2. Typical initial regimen: modified basal/bolus therapy:
 1. Basal insulin: Lantus/ Levemir/Basaglar : 40-50% of daily dose
 2. Bolus insulin : Humalog/novolog/apidra: 50-60% of daily dose

Total Daily Dose for our 4 year old: $18 \text{ kg} \times 0.85 \text{ units/kg} = 15.3 \text{ units}$

Basal: 6 units hs or am (40% of Total daily dose)

Bolus: 9 units for meals:

Breakfast: 3 units

Lunch: 3 units

Dinner: 3 units

How do you correct for higher blood sugars initially before moving to moving to more intensive insulin therapy?

ADD a sliding scale until family returns for further education to learn Insulin/carb ratios and Correction factors.

Calculating initial sliding scales...

1. Create a target blood sugar- where you wish the child to be!
Our patient: goal blood sugar: 150 mg/dl (based on age)
2. Calculate a correction factor for a sliding scale

1800 (constant) divided by total daily dose= correction factor
or the amount 1 unit of insulin will lower the blood sugar
1800 divided by 15 units (total daily dose)=120 mg/dl

Therefore, 1 unit will lower our patient's blood sugar by 120 mg/dl based on his insulin requirements.

1. Calculation of sliding scale

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or the amount 1 unit of insulin will lower the blood sugar
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Therefore, 1 unit will lower our patient's blood sugar by 120 mg/dl based on his insulin requirements.

Sliding scale calculation:

Sliding scale calculations: Correction factor: 120

Target blood sugar: 150 mg/dl: For blood sugars:

<150: 3 units rapid acting insulin

151-210: 3.5 units rapid acting insulin

211-270: 4.0 units rapid acting insulin

271-330: 4.5 units rapid acting insulin

331-390: 5.0 units rapid acting insulin

or use the following algorithm:

Actual Blood sugar-target (150) divided by Correction factor (120)=
correction insulin added to base of 3 units

350-150 divided by 120= 1.66 units correction insulin

Therefore, meal insulin would be 3 units for food + 1.5 (or 2 units-rounded)=
4.5 or 5 units

Blood sugars are then followed for several weeks and return to class to learn to use Insulin/carbohydrate ratios with correction factors.

Diabetes –not all Type 1 or Type 2: how to differentiate

1. T₁ DM

Rapid onset, polyuria, polydipsia, weight loss. Generally autoimmune in origin (HLA region). Positive GAD-65 antibodies. Risk of DKA, thin phenotype. Treated with insulin. Not all +GAD

2. T₂ DM

Gradual onset, obese phenotype with evidence of insulin resistance (acanthosis nigricans), possible weight loss, may present with ketones and DKA, no autoimmunity, family history, metabolic syndrome. Treated with Metformin/ and insulin if necessary

3. Type 1.5 DM

Combination of type 1 and 2 with phenotype of T₂ and autoimmunity of type 1

4. Monogenic diabetes

Includes neonatal diabetes- presents from birth to 12 months, MODY (maturity onset diabetes of youth)

Etiology: genetic defect in insulin receptor

Diabetes- Not all Type 1 or Type 2- how to differentiate

5. Medication Induced Diabetes

Etiology due to steroids, chemotherapy etc. Often requires insulin therapy

6. Cystic Fibrosis Related Diabetes (CFRD)

Related to destruction of pancreatic cells (exocrine and endocrine) – treated with insulin

7. Diabetes secondary to pancreatectomy

Loss of beta cells treated with insulin – pancreatectomy secondary to hyperinsulinemia

Technology and Diabetes

1. Insulin pump therapy

1. Metronic Minimed *Hybrid* Pancreas-
2. Tandem T-slim- touch screen
3. Omnipod- tubeless pump

2. Bionic pancreas- in trials- uses insulin and glucagon

3. Continuous Glucose Monitors (CGMs)

1. DEXCOM Share
2. Freestyle libre

DEXCOM G4 SHARE



Continuous Glucose Monitoring

- New Technology
- Systems:
 - DexCom G4-G5
 - DexCom Share
 - Freestyle libre-
 - MiniMed / Enlite sensor/Hybrid artificial pancreas

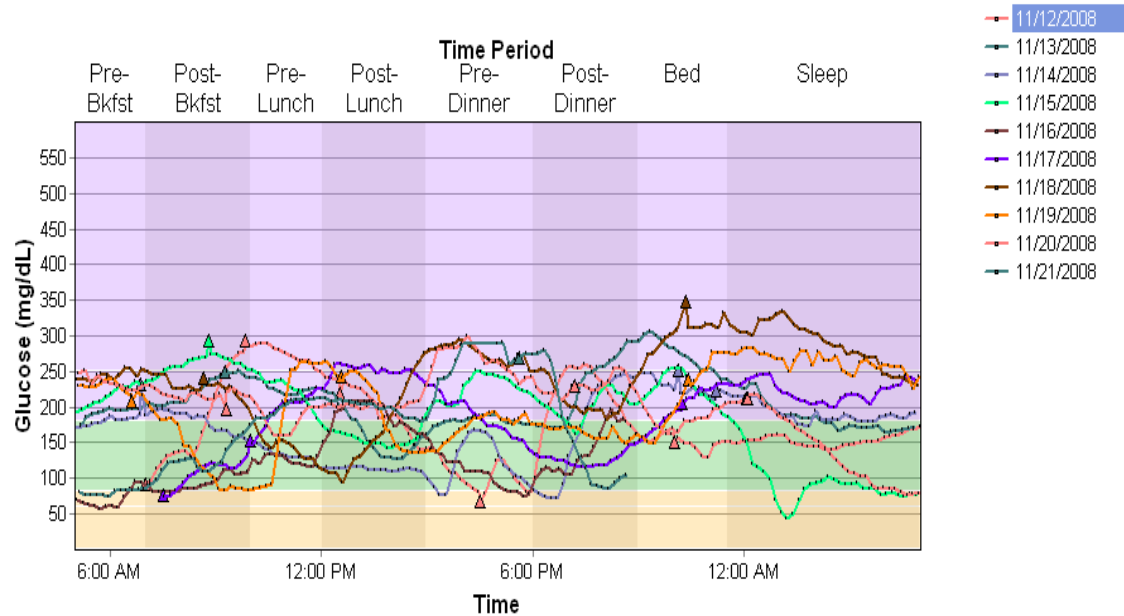


(courtesy C L Henderson RN, CDE, CPT)

Continuous Glucose Monitoring: 3 day report

Glucose Modal Day Report

11/12/2008 - 11/21/2008



Questions??

