Practical Diabetes Management
Carisse Orsi, MD
Assistant Professor Clinical Endocrinology

Disclosure
- Carisse Orsi, MD has no relationships with commercial companies to disclose.
- Names used in this presentation do not represent any of my personal patients but are merely representative of my favorite names I have seen over the years.

Objectives
- Learn how to properly diagnose and manage patients with new-onset Type 1 Diabetes
- Feel comfortable managing the nuances of Diabetes on the inpatient floor
- Learn about the different types of insulins and their proper uses

Not Today
- Skip discussing incidence
- Skip pathophysiology
- FOCUS on practical approach to patient with diabetes

Case 1: Casper
- Your upper level gets a call from the ED:
  - 14 year old male with a blood sugar of 345 mg/dl
  - He has a history of a 10 lb weight loss
  - pH is 7.2 and his bicarb is 8

Questions to be thinking about...
- It is safe to admit him to the floor?
  - No
- What fluids did he get in the ED?
  - 1 NS bolus 20cc/kg and he is tolerating PO
- Did he get any insulin in the ED, if so, what type and how much?
  - In ED, he received 3 units of regular insulin
**Status of Patient: not sick, sick or really sick**

- **Blood Glucose:**
  - Fasting: >125
  - Random: >200

- **pH:** <7.3

- **Bicarb:** <20

- **ICU:**
  - Insulin Gtt
  - IVFs

- **IMC/Floor:**
  - IVFs
  - SQ insulin

- **Outpatient:**
  - SQ insulin

**Fluid Management**

- **Saline bolus, repeat if necessary**
- **Protocol in ICU**
  - Key is to add dextrose to fluids when glucose levels drop below 200mg/dl
  - Add K+ to fluids once urine output is established
  - Goal to keep Na in upper normal range in 1st 24hrs to avoid rapid osmotic shifts

**Case 1 cont’d**

- Nurse reports the patient is disoriented and confused and later learn he actually received 3 NS boluses in ED

- **What do you want do?**
  - A. Increase the rate of the IVFs
  - B. Disregard since all DKA pts are confused
  - C. STAT head CT
  - D. Evaluate the pt

**Cerebral Edema**

- New-onset diabetic pts are at high risk for cerebral edema especially children younger than 5
- Unsure of etiology
  - Possibly rapid changes in hydration or osmolality
  - Bicarbonate treatment

**Cerebral Edema**

- Watch for development of headache and mental status changes
- Not necessary to send them to CT
- Results will not change your management
- Treatment with mannitol at dose up to 1g/kg

**Case 1: Day 2**

- Pt has been on an insulin gtt for 10 hours and the bicarb is has only increased from 8 to 10
- What could be causing this persistent metabolic acidosis?
  - A. Infection
  - B. Hyperchloridemia
  - C. Not enough insulin via gtt
  - Hyperchloridemia can exacerbate metabolic acidosis
Case 2: Abcde

- 5 yr old female admitted for an asthma exacerbation and new onset diabetes
- On review of her labs from the ED, she has had three high blood sugars: 156, 191 and 185 mg/dl

Does she have Diabetes?

- ADA criteria:
  - Symptoms + Random glucose >200 mg/dL
  - Without symptoms
  - Fasting glucose >125 mg/dL
  - Blood glucose > 200 mg/dL after 2hr OGGTT (Requires a confirmation test)
- Hyperglycemia due to stress
  - No history of polyuria, polydipsia or nocturia
  - A1c should be normal
  - Insulin and c-peptide levels should be elevated

Morning Rounds

- You give an excellent presentation to your team on rounds the next morning and then your attending asks you how you diagnosed Abcde with diabetes...
- TRUST NO ONE

Case 2

- Stress response with hyperglycemia is a common finding
- Many children on steroids while ill will have mild to moderate hyperglycemia
- This does not mean they have diabetes
- Usually they do not have the associated symptoms
- Best to reevaluate as an outpatient when they are off steroids

Case 2

- History:
  - No history of polyuria, polydipsia or nocturia

- Labs:
  - Insulin, c-peptide, A1c before you discharge (if you are truly concerned)

A1c

- In 1979 methods to measure glycosylation were revolutionized
- "the test that doesn’t lie"...
- Gold standard test uses liquid chromatography for the measurement of glycosylated hemoglobin
- In the hospital, it can take 12-48 hours for results
**Role of A1c**

- Hemoglobin A1C
  - 3 month measure of average blood glucose
  - \[\text{A1C} \times 30 + 50 = \text{avg blood glucose (mg/dL)}\]
- A1C > 6.5% (145 mg/dL)
  - Confirm with repeat A1C unless symptoms or glucose > 200 mg/dL
  - Ignore the value given as the average blood sugar given with the A1c

**Case 2**

- After you finish rounding, you get a call from the floor nurse that your patient has a blood sugar of 45mg/dl
  - What is your next step?
    - A. give a Dextrose bolus
    - B. 15 gram of juice
    - C. repeat with venous sample
    - D. Give Glucagon 0.5mg IM

**Hypoglycemia**

- Glucose <70mg/dl
- Symptoms
  - Sweating, trembling and hunger
  - Palpitations
  - Headache, lightheadedness
  - Seizures

**Hypoglycemia**

- Treatment
  - Mild to moderate hypoglycemia
    - Give 15-30g of oral glucose
  - Severe hypoglycemia
    - Unable to take PO or seizing
    - Glucagon 0.5 to 1.0 mg IM

**Case 3: L-A**

- 11 yr old female with T1DM for 2 years was admitted overnight to the PICU in DKA and placed on an insulin gtt
  - She was started on the DKA protocol
  - On admission you note she had the following abnormal labs...
    - On admission
      - Na 131
      - Glucose 680
      - K+ 3.5
      - Cl 112
    - 10 hours later
      - Na 135
      - Glucose 225
      - K+ 3.0
      - Cl 125

**Pseudohyponatremia**

- Osmotic effect of glucose drawing water into the vascular space
  - Na corrected upward 1.6 mEq/L for every 100 mg/dL glucose over 100 mg/dL
Hypokalemia in DKA

- Initially you may not have added K⁺ to IVFs for DKA pt
- With an initial K⁺ of 3.5, you will want to start K⁺
- K⁺ may drop after insulin administered due to the extracellular shift
  - Total body K⁺ is low
  - HypoMg can worsen K⁺ loss

Case 3

- She was on an insulin gtt for 24 hours and was switched to PO and SQ insulin this morning
- You get a call from the floor nurse letting you know L-A has a blood sugar of 455 mg/dl and wants to transfer her back to the ICU for DKA.

Case 3

- The next steps...
- Don't panic. It's easy to get caught up in the panic of others
- One high blood sugar is not going to cause DKA
- Ask questions. This is usually when I learn that the patient snuck in food and didn't cover it with insulin or the carbs where not counted correctly

Case 3

- Talk with the PICU nurse caring for her
- When transitioning off the gtt, there can be a delay in giving the long-acting insulin
- Ideally, you would given Lantus/Levemir 1 hour prior to stopping the gtt
- If the transition occurs in the morning, give half of the pm dose in the am, then that night resume normal dosing
  - Eg. She takes 30 units at night. In PICU, give 15 units prior to stopping the gtt and then give the full 30 units tonight

Case 3

- Most common error
- Lunch tray comes in and the carbs are already counted
- She eats a hamburger and fries with ketchup listed at 4 carbs
- She has a 1:15 gram carb ratio
- Insulin covered for carbs is zero!
- 4 carbs is incorrect. This is based on "old school" ways where all CHO ratios were 1:15. This actually means 60 grams of carbs

Case 3

- Time for a quick nutrition lesson...
What is a carbohydrate?

- Three types
  - Starches (complex)
  - Sugars
  - Fiber

Starch

- Starchy vegetables: peas, corn, lima beans and potatoes
- Dried beans, lentils, and peas such as pinto beans, kidney beans, black eyed peas, and split peas
- Grains like oats, barley, and rice.
  - The majority of grain products in the US are made from wheat flour
  - Eg. pasta, bread, and crackers
- The grain group can be broken down even further into whole grain or refined grain.

Sugars

- May be referred to as simple or fast-acting carbohydrate.
- There are two main types: naturally occurring sugars such as those in milk or fruit and added sugars such as those added during processing such as fruit canned in heavy syrup or sugar added to make a cookie
- On the nutrition facts label, the number of sugar grams includes both added and natural sugars
- Eg. of common names are table sugar, brown sugar, molasses, honey, beet sugar, cane sugar, confectioner’s sugar, powdered, raw sugar, maple syrup, high-fructose corn syrup, agave nectar, and sugar cane syrup.
- Chemical name: sucrose
- Fruit: fructose; Milk: lactose

Fiber

- Fiber comes from the indigestible part of plant foods, including fruits, vegetables, whole grains, nuts, and legumes
- When you consume dietary fiber, most of it passes through the intestines and is not digested

Beans and legumes: black beans, kidney beans, pinto beans, chick peas (garbanzos), white beans, and lentils.

Fruits and vegetables, especially those with edible skin (for example, apples, corn and beans) and those with edible seeds (for example, berries).

Whole grains such as whole wheat pasta

Whole grain cereals

Whole grain breads (To be a good source of fiber, one slice of bread should have at least 3 grams of fiber. Another good indication: look for breads where the first ingredient is a whole grain.)

Nuts — try different kinds. Peanuts, walnuts and almonds
Apps to help out

- CalorieKing Food Search
- Glucose Buddy Diabetes Logbook

Case 4: Jed I

- 15 yr old male with Type 1 DM in mild DKA is being admitted to the IMC. He weighs 45 kg
- Your upper level wants you to start writing the orders and you have never written for insulin before.
- Your options look like this...

Rapid-Acting (Humalog/Novolog)
- Short-Acting (Regular)
- Intermediate-Acting (NPH)
- Long-Acting (Lantus/Lente)

Aspart, lispro, glulisine
**Total Daily Insulin**

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Dose</th>
<th>Units/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-7 yrs</td>
<td>kg x 0.5</td>
<td></td>
</tr>
<tr>
<td>8-11 yrs</td>
<td>kg x 0.6</td>
<td></td>
</tr>
<tr>
<td>12-18 yrs</td>
<td>kg x 0.7</td>
<td></td>
</tr>
</tbody>
</table>

**Application of Basal Therapy**

- **Basal Therapy**
  - Glargine (Lantus®), Detemir (Lememir®)
  - Dosed based on wt & pubertal staging
  - Typically given in the evening
  - Can be given in the morning or anytime of the day as long as given consistently at that time

**Estimate Long-acting Insulin**

- 45kg male x 0.7 = 31.5
- Estimate long-acting insulin to be ½ of total daily insulin
- Lantus/Levemir 15 units

**Application of Bolus Therapy**

- **Bolus Therapy**
  - Lispro, Aspart, Glulisine
  - Dose based on the combination of the Carb Ratio and Correction Factor
  - Based on wt and pubertal staging
Calculating Bolus Therapy

- Insulin Sliding Scale aka Correction factor aka sensitivity factor
  - 1800 / Total daily insulin
  - Eg: 1800/31.5 = 57
  - Start ISS at 1:50>150

- Carbohydrate ratio aka carb ratio
  - 500/Total daily insulin
  - Eg: 500/31.5 = 15.8
  - Start 1:15 grams of CHO

Eg:

- 1800/31.5 = 57
- Start ISS at 1:50>150

- 500/31.5 = 15.8
- Start 1:15 grams of CHO
Case 5: Ben-Jamen

- 9 yr old male with T1DM is in the ED with a blood glucose of 450mg/dl. He uses an insulin pump and currently is wearing it.
- He is tired but is not Kussmaul breathing and does not have nausea or vomiting

Case 5

- Next step?
- Two options:
  - 1. Give a bolus via the pump
  - If family suspects a pump malfunction, choose option 2
  - 2. Give a SQ shot
  - Use the sliding scale on the pump to guide your dose
- Most importantly, never delay treatment because you don't know what an insulin pump is.
**Insulin Pumps**

- Pump settings:
  - 24 hours of basal using a short-acting insulin
  - CHO
  - ISS with target range

**Example of settings**

- Basal rates
  - MN-3am: 0.3 units/hr
  - 3am-6am: 0.4 units/hr
  - 6am-3pm: 0.35 units/hr
  - 3pm-MN: 0.275 units/hr
  - total basal = 7 units

- CHO
  - 1 unit for 20 g of Carbs
  - Target range
    - 70-180 mg/dl
  - Sliding Scale/Sensitivity Factor
    - 1 unit for 60

**Case 5**

- Pt was given a SQ shot of fast acting insulin. BG improved and he was sent home
- Unfortunately, he was sent home without Rx for SQ insulin and continued using his pump
- He returned the ED later that night in DKA
- If you discover the pump is not working, need to switch to SQ insulin (not just for bolus but also for basal)

**Case 6 - Franswa**

- You are working in a health clinic in the middle of nowhere, TX and your first patient of the day is a 5 yr old male with a 20 lb weight loss, bedwetting and constant thirst now with nausea and vomiting. You check his urine for a UTI and find he has large ketones and a large amount of glucose.
- You check your cell phone for the Endo pager and your phone is dead.
- You decide to admit the patient to the local ED with orders for labs and insulin doses

**Patient Orders:**

- 20 kg pt with a pH of 7.2 and bicarb of 15
- Fluids: NS 20cc/kg bolus.
- Labs:
  - Long-acting insulin:
  - CHO ratio:
  - Sliding Scale:

- Fluids:
  - D50 + 40 meq KCL and 40 kphos
  - NS + 40 meq KAcetate and 40 kphos
- Labs:
  - Insulin, GAD and Islet cell antibodies
  - Asc
  - Consider screening for thyroid disease and celiac disease
● Long-acting insulin:
● Total daily insulin: 20 x 0.5 = 10
● LA: 10/2 = 5 units SQ QHS or QAM
● CHO ratio: TDI = 10
  ▪ 500/10 = 50 CHO 1:50
● Sliding Scale:
  ▪ 1500/10 = 150 ISS 1:150 >200

● Always err on lower dose of insulin. You can always titrate up
● Rare that you would be treating DM on your own
● Most important is that you are using the correct types of insulin

Questions:

References
