Case Study #17: Adult Type II Diabetes Mellitus: Transition to Insulin

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1. **What are the Standard Diagnostic Criteria for T2DM? Which are found in Mitch’s medical record?**

   The criteria for diagnosis for T2DM, as with T1DM, include symptoms of diabetes (polyuria, polydipsia, and unexplained weight loss) accompanied with a casual (any time of day, regardless of meal times) plasma glucose of greater than or equal to 200 mg/dL; or, a fasting (8-hour+) plasma glucose greater than or equal to 126 mg/dL; or, a 2-hour post-prandial glucose that is greater than or equal to 200 mg/dL during an oral glucose tolerance test. The patient came to the ER with a casual serum glucose of 1524 mg/dL, which greatly exceeds the 200 mg/dL criterion for a diagnosis of diabetes.

   Hb A1c - shows glucose attachments to the RBC in a span of 3 months

2. **Mitch was previously diagnosed with T2DM. He admits that he often does not take his medications. What types of medications are metformin and glyburide? Describe their mechanisms as well as their potential side effects/drug-nutrient interactions.**

   Metformin and glyburide are often used in conjunction with each other to control blood glucose levels in individuals with type 2 diabetes. Metformin is a class of medication called biguanides and works to suppress gluconeogenesis, and inhibit some absorption of ingested glucose. Some side effects of metformin include gastrointestinal discomfort such as diarrhea, bloating and heartburn. Metformin can interact with H2RA drugs, which are used to treat heartburn; both of these drugs are excreted via the same mechanism in the kidney, however, the channels have a higher affinity for the H2RA drug causing a buildup of metformin in the blood. Too much metformin in the blood can lead to lactic acidosis, due to the restriction of gluconeogenesis.

   Makes insulin work better and decreases the insulin excreted by the liver?

   Glyburide is a drug that acts directly on the pancreas to produce more insulin. It is classified as a sulfonylurea. Glyburide acts on ATP potassium channels in the beta cells of the pancreas, ultimately leading to an influx of calcium to the cell thus causing a release of insulin into the bloodstream. Some side effects of this include hypoglycemia, particularly if taken with metformin, nausea, diarrhea, and cholestatic jaundice. This type of jaundice is caused by the thickening of bile or restriction of bile ducts. This drug can interact with hypertension drugs such as Bosentan and cause jaundice, upset stomach, and fever. The conjunctivitis medication, Gatifloxacin, can enhance the effects of hypo- or hyperglycemia as well.
• T1DM: cannot take these drugs. These drugs only increase your body’s own insulin production. T1DM do not produce insulin so this drug is useless.

5. **HHS and DKA are the common metabolic complications associated with diabetes. Discuss each of these clinical emergencies. Describe the information in Mitch’s chart that supports the diagnosis of HHS.**

HHS or hyperosmolar hyperglycemic state is one of two serious metabolic derangements that occurs in patients with DM that can be a life-threatening emergency. It is more common in patients with T2DM who have some associated illnesses that lead to reduced fluid intake. HHS is characterized by high plasma glucose level of 600 mg/dL or higher, serum pH greater than 7.30, dehydration, effective serum osmolality of 320 mOsm/kg or greater, small ketonuria and absent-to-low ketonemia, and some alteration in consciousness.

DKA or diabetic ketoacidosis is when cells start to break down fat as an energy source because cells cannot get enough glucose due to low insulin. Ketones are produced and acidify the blood. DKA can occur to anyone with DM, but it is rare for people with T2DM due to the fact that individuals with Type II diabetes still produce insulin. Some signs and symptoms of DKA are dry mouth, high blood glucose, high ketone levels in the urine, frequent urination, nausea, vomiting, constant fatigue, and confusion.

Mitch’s chart showed high glucose at 1524 mg/dL (normal is 70-110 mg/dL), high osmolality at 360 mmol/kg/H2O (normal is 285-295 mmol/kg/H2O), and mild confusion which all support the HHS diagnosis. Furthermore, Mitch reported dry mucous membranes without exudates or lesions which indicate dehydration along with irregular intake of medication for diabetes also support the diagnosis of HHS.

9. **Describe the insulin Therapy that was started for Mitch. What is Lispro? What is glargine? How likely is it that Mitch will need to continue insulin therapy?**

Lispro is a rapid acting insulin that works a lot faster than normal insulin, but the effects do not last as long. Glargine is a long-acting type of insulin that is similar to normal insulin, but it works more slowly and lasts longer.

Mitch’s therapy is comprised of using glargine to get his blood glucose levels controlled throughout the night and lispro will be injected during his active hours. His blood glucose will then be checked hourly and MD will be notified if blood glucose levels are >200 or <80. He will also be in rehydration to supplement his insulin therapy.

Mitch will most likely be continuing his insulin therapy for a long time due to his inability to regulate his blood glucose levels and is currently diabetic.
11. **Outline the basic principles for Mitch’s nutrition therapy to assist in control of his DM.**

Basic principles for Mitch’s nutrition therapy to assist in control of his DM:
- Encourage exercise and increasing physical activity
- Carbohydrates will be distributed evenly throughout the day
- Carbohydrates will be adjusted at a more consistent amount for every meal and glucose tolerance
- Modify fat intake (lower intake of foods high in sat and trans fat)
- Incorporate simple carbohydrates in his meal plan (fruits, milk, and vegetables)
- Learn to restrict and stabilize caloric intake
- Learn to check blood glucose levels and when to take insulin

12. **Assess Mitch’s weight and BMI. What would be a healthy weight range for Mitch?**

Weight: 214 lbs/2.2 = 97.27 kg  
BMI: 5’9” = 69” x .0254 M = 1.75 M -> 97.27 kg/(1.75 m²) = 31.76 (Obesity Class I)

A healthy weight range for Mitch for his height would be between 125 lbs. and 168 lbs.

13. **Identify and discuss any abnormal laboratory values measured upon his admission. How did they change after hydration and initial treatment of his HHS?**

Upon admission, the patient was extremely hyperglycemic (1524 mg/dL) and hyperosmolar, with an osmolality of 360 mmol/kg/H₂O, far exceeding the reference range of 285-295 mmol/kg/H₂O. After treatment, these values were improved but still high, indicating successful treatment and progress toward normal levels. Serum creatinine and BUN were also high upon admission, appearing so due to dehydration, while inorganic phosphate and sodium were low due to losses in the urine with osmotic diuresis. Treatment for dehydration improved these numbers, which remained slightly out of normal ranges a day after admission, indicating improved hydration status.

HbA₁C was quite high, indicating a history of hyperglycemia in the past 3 months. Hyperlipidemia along with high WBC and Hematocrit may be related to hydration status. Urinalysis results upon admission indicated hyperglycemia, ketonuria (likely related to insulin-resistance), low pH and high protein and specific gravity due to dehydration. There were no post-treatment values for these labs.

14. **Determine Mitch’s energy and Protein requirements for weight maintenance. What energy and protein intakes would you recommend to assist with weight loss?**
Total Energy Expenditure: 1086-(10.1 x 53yr)+1.12 x (13.7 x 97.27kg+416 x 1.75m)
TEE ~ 2859 kcal/day to maintain Mitch’s weight at a low physical activity level.
0.8 g x 97.27 kg = 77.8 g of protein. for weight maintenance.

Since no physical activity level was noted he was calculated to have a low physical activity level (PA = 1.12). In the beginning stages of weight loss, a goal of consuming approximately 2359 kcal/day (a 500 kcal reduction), is attainable. In fear of the onset of a nephropathy, no more than 10% of those calories should be from protein; approximately 59 g/day ((2359 x .10)/4).

*Use Harris-Benedict formula. Pick the appropriate activity factor for the individual, then subtract 250-500 calories for weight loss.*

15. **Prioritize two nutrition Problems and Complete the PES statement for each.**
   Problem 1:
   - Obesity related to excessive energy intake and lack of physical activity as evidenced by BMI of 25.

   Problem 2:
   - Inadequate knowledge of diabetes self-care related to lack of appropriate diabetes education, as evidenced by failure to take diabetes medications as prescribed and uncontrolled T2DM.

16. **Determine Mitch’s initial CHO prescription using his diet history as well as your assessment of his energy requirements.**

   Based on Mitch’s diet history, he had no formal consultation in regards to a prescription CHO intake. In an attempt to get Mitch to an ideal weight range of 125 to 168 lbs, he must lose 89 to 46 lbs. Approximately three to four servings of carbohydrates (or 45 to 60 grams) is ideal per meal at regular times throughout the day

17. **Identify two initial nutrition goals to assist with weight loss.**

   A calorie restricted diet is advised for weight loss. An ideal goal would be to restrict 500 to 1000 kcal/day. Approximately 50% of the pt’s total calories for the day should be derived
from healthy CHO sources such as whole grains, and fresh fruits, in conjunction with consistent medication use and physical activity.

Another goal to assist with weight loss is to increase physical activity. Proper exercise should be implemented starting from a low intensity and gradually increasing activity level as patient progresses. An exercise physiologist should be consulted and met to monitor weight loss and health progress. Fast food chains and other unhealthy food sources should also be lessened and discouraged.