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Diabetes Case Study

1. What are the standard diagnostic criteria for T2DM? Which are found in Mitch's medical record?

Standard diagnostic criteria for Type II Diabetes Mellitus include one of the following: Fasting Plasma Glucose ≥ 126 mg/dL, casual Plasma Glucose ≥ 200 mg/dL, HgA1c $\geq 6.5\%$, Oral Glucose Tolerance Test (OGTT) 75g load with 2 hour Plasma Glucose ≥ 200 mg/dL. Criteria diagnostic of T2DM found in Mitch's medical record include: HgA1c of 15.2 % and serum glucose of 1524 mg/dL.

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 is a biguanide that decreases hepatic glucose production and increases insulin uptake in the muscles. The possible food-drug interactions that can occur with biguanides are decreases in folate and vitamin B-12 absorption, transient diarrhea, nausea, bloating. Anorexia, flatulence, lactic acidosis, and liver failure.

Glyburide is a second generation Sulfonylurea agent that stimulates insulin secretion. The potential food-drug interaction are hypoglycemia and weight gain. It is important to avoid alcohol when taking sulfonylurea agents. (Nelms, Sucher, Lacey & Roth, 2011)

3. What other medications does Mitch take? List their mechanisms and potential side effects/drug-nutrient interactions.

Mitch is also taking Dyazide and Lipitor once daily. Dyazide works to High Blood Pressure as it is a combination of two diuretics, triamterene and hydrochlorothiazide, so it causes those who are taking it to produce more urine which allows your body to excrete extra salt and water. It also helps reduce edema.

("Dyazide oral,")

Lipitor is a lipid lowering drug that works to inhibit HMG-CoA reductase which catalyzes the conversion of HMG-CoA to mevalonate which is an early rate limiting step in cholesterol biosynthesis. ("Lipitor," 2012)

4. Describe the metabolic events that led to Mitch's symptoms and subsequent admission to the ER with the diagnosis of uncontrolled T2DM with HHS.

Type II diabetes occurs when the tissues in the body become insulin resistant and therefore the body tries to compensate by producing more insulin which eventually causes the pancreas to lose its ability to produce insulin. This causes two metabolic consequences: eventual insulin resistance and insulin deficiency. Once the body is unable to respond to insulin, glucose is unable to be taken up by the cells which ultimately lead to increased glucose production by the body and hyperglycemia. These metabolic events of type II diabetes are what caused HHS to develop in Mitch. (Nelms, Sucher, Lacey & Roth, 2011)

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.

DKA is Diabetic Ketoacidosis and it is an outcome from insufficient insulin resulting from hyperglycemia. The drop in insulin causes gluconeogenesis and lipolysis for glucose production. Lipolysis results in the buildup of ketones in the blood and if left untreated can result in coma or death. This condition is characterized by hyperglycemia, metabolic acidosis, ketogenesis, and occurs mostly in type 1 diabetics but can occur in those who are newly diagnosed type 2 diabetes and are obese, have impaired insulin secretion and action. The causes of DKA include instances of infection, acute illness, psychological stress, lack of Self-Monitoring Blood Glucose (SMBG), insulin omitted, increased insulin needs with growth spurts, pump malfunction and drug abuse. Symptoms associated with DKA include: polyuria, polydipsia, weight loss, vomiting, abdominal pain, dehydration, acetone breath, and kussmaul respirations. (Nelms, Sucher, Lacey & Roth, 2011)

HHS is Hyperglycemic Hyperosmolar Syndrome and this results when insulin is high and inhibits glucagonolysis so the glucose can't get into the cell nor can it be stored so the liver releases more glucose because the body thinks there isn't any too absorb. Hyperglycemia results and worsens. HHS is characterized by blood glucose levels >600 mg/dL, when serum osmolality >320 mOsm/ kg of water, and when there is an absence of significant ketoacidosis. This condition is caused from dehydration due to inadequate fluid intake

or excessive fluid losses as well as prolonged hyperglycemia. Lab results that support the diagnosis of HHS include: blood glucose levels of 1510 mg/dL, osmolality of 360 mmol/kg of water and his urinalysis lab reports negative for ketones. HHS is also characterized by dehydration and his admitting history notes that Mitch has dry mucous membranes including his throat and his skin is warm dry and shows poor turgor (all characteristic of dehydration). Symptoms of HHS includes: polyuria, polydipsia, progressive decline in level of consciousness, fever and volume depletion. Unlike DKA, HHS progresses slowly. (Nelms, Sucher, Lacey & Roth, 2011)

6. HHS is often associated with dehydration. After reading Mitch's chart, list the data that are consistent with dehydration. What factors in Mitch's history may have contributed to his dehydration?

As mentioned before, Mitch's data that is consistent with dehydration includes dry mucous membranes (throat) and his skin is also warm dry and shows poor skin turgor, and the nursing assessment noted his urine was an amber color and cloudy. Factors in Mitch's history that may have contributed to his dehydration is worsening bouts of vomiting that occurred over a 12-24 hour period and he only drank sips of water during this period of sickness. (Nelms, Sucher, Lacey & Roth, 2011)

7. Mitch was started on normal saline with potassium as well as an insulin drip. Why are these fluids a component of his rehydration and correction of the HHS?

Insulin is important in correcting HHS depending on the severity of the hyperglycemic state. The Insulin helps to reduce the hyperglycemia. The normal saline solution is important in rehydration. Normal saline is a 0.9% NaCl solution or 308 mOsm/liter which is closely correlated to the osmolality of blood plasma. Normal saline with potassium is needed to replenish not only fluid status but electrolyte status of the body as HHS causes the body to try and correct acid-base imbalance and hyper osmolality by increasing urine output. Increased urine output coupled with Mitch's excessive vomiting bouts may have cause hypovolemia (extracellular fluid deficit) and loss of electrolytes. The normal saline with potassium allows the body's hydration status to normalize as well as the restoration of electrolytes because when sodium and potassium are in balance, water in the body is balanced. (Young, 1998)

8. 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? Explain what ICR means?

Glargine is long acting insulin which works slowly over a 24 hour period and the onset of its action occurs 2-4 hours after it is administered while Lispro is rapid-acting insulin and the onset of this insulin occurs within 5-15 minutes after one dose is administered and can last from 3-5 hours. Rapid-acting insulin is taken immediately prior to meals while Long-acting insulin is taken in the morning before breakfast and in the evening before dinner to last the night.

ICR stands for Insulin Carb Ratio and this is a mechanism for determining the amount of insulin a person needs to take based on their carbohydrate intake. Generally 1 unit of rapid-acting insulin is taken for every one serving of carbohydrates (15g). (Nelms, Sucher, Lacey & Roth, 2011 p. 488, 493)

9. Mitch was NPO when admitted to the hospital. Why was this done? What are the signs that will alert the RD and physician that Mitch may be ready to eat?

Mitch was put on NPO after being admitted most likely because of the uncontrolled vomiting he was experiencing so feeding him oral with food would not be best but it is important to get his blood glucose levels as close to normal as possible through NPO. Signs that will alert the RD and Physician that Mitch is ready to eat are improved blood glucose levels as well as healthy GI functioning, increased appetite and willingness/ verbal confirmation of wanting to eat.

10. Outline the basic principles for Mitch's nutrition therapy to assist in control of his DM.

There are various principles to assist in controlling Diabetes mellitus. First it is important that Mitch's blood glucose levels are lowered and maintained at normal/ controlled levels. It's also imperative to attain and maintain optimal lipid and lipoprotein levels to help control blood pressure. Controlling and treating Mitch's obesity through exercise and healthy eating habits associated with diabetes will assist in controlling blood glucose and blood pressure/ lipid profile. Next it is important to address Mitch's nutritional needs that will allow him to still enjoy eating. Because Mitch is obese with type 2 diabetes, it is important to start working

towards a reasonable and healthy body weight. This will help in maintaining his blood glucose, blood pressure and cholesterol which all together will help to control his diabetes.

11. Assess Mitch's weight and BMI. What would be a healthy weight range for Mitch?

Mitch weighs 214 lb and his BMI is about 32 which classify him as obese. According to the hamwi equation, Mitch's ideal weight for his height is 160 lb which makes him 133% of his ideal body weight. Although this weight is ideal for his height, it may not be completely reasonable for Mitch so a weight range between 160-170 lb may be more attainable.

12. Identify and discuss any abnormal laboratory values measured upon his admission (5/12). How did they change after hydration and initial treatment of his HHS (5/13)?

Abnormal lab values upon admission included: sodium 131 mEq/L, BUN 31 mg/dL, glucose 1510 mg/dL, osmolality 360 mmol/kg/h₂O. After proper hydration and initial treatment his lab values were as follows: sodium 134, potassium 4.0, BUN 20, glucose 480, inorganic phosphate 2.1 and osmolality 304. The drop in sodium is most likely due to dehydration caused by the excessive vomiting he was experiencing. Determining the renal function is very important especially when someone is extremely hyperglycemic like Mitch because hyperglycemic conditions can damage the structure of glomerular blood vessels and eventually results in impaired filtering ability. The lab values that assess kidney function include BUN and creatinine. When these two values are high it is important to begin to lower and control glucose levels as nephropathy can result and eventually chronic kidney disease (CKD). The elevated osmolality Mitch is experiencing is linked to his diagnosis of Hyperglycemic Hyperosmolar Syndrome (HHS) which occurs when glucose levels exceed 600 mg/dL and serum osmolality exceeds 320 mOsm/ kg of water When comparing these two days it is apparent that treatment helped reduce glucose and osmolality dramatically, helped improve sodium levels even though his new levels are still lower than optimal, reduced BUN and creatinine, and improved inorganic phosphate levels. Sodium was the only lab value that continued to increase but this may be due to the NPO treatment. (Nelms, Sucher, Lacey & Roth, 2011 p. 496- 499)

13. Determine Mitch's energy and protein requirements for weight maintenance. What energy and protein intakes would you recommend to assist with weight loss? Finally, calculate the percent of kcals from protein according to your estimated needs. (remember to provide rationale)

Using the Mifflin St. Jeor equation and an activity factor of 1.3 because he is not normally confined to a bed, I estimated Mitch's energy requirements for maintenance to be 2,272 calories.

$$[10(97.3) + 6.25 (175.26) - 5(63) + 5] \times 1.3 = 2,272$$

To assist in weight loss I would recommend Mitch to subtract 500 calories from this caloric amount either through decreasing 500 calories from food consumption or by splitting it between decreasing food consumption and burning calories through exercise. This allows for a safe and moderate weight loss of 1 pound per week and will lead to a 10% weight loss of his total body mass in 6 months. As for his protein requirements I would recommend he consume .8g of protein per kg of his body weight. I would do this because he is at risk for nephropathy and higher protein intake may increase this risk. This would mean he needs to eat 78g of protein each day which is equal to 311 calories or about 13% of his estimated calorie need of 2,272. Consuming less protein than this is not recommended as protein related malnutrition may result. (Nelms, Sucher, Lacey & Roth, 2011)

14. Using a computer dietary analysis program or food composition table, calculate the kcalories, protein, fat, CHO, fiber, cholesterol, and Na content of Mitch's diet. Fill-in the blanks.

kcal = 1960; compared to kcal needs of 2272 (.86 % of needs)

protein = 105 g and 21% kcal; compared to protein needs of 78 g (134% of needs)

fat = 72 g and 33 % kcal; compared to fat needs of 30-35 % kcal

Saturated fat = 20 g and 9 % kcal; compared to SFA needs of 7 % kcal

CHO = 227 g and 46 % kcal; compared to CHO needs of 50 % kcal

What about consistency of CHO at mealtimes?

Breakfast = 1g CHO, Lunch = 132 g CHO, Dinner = 95 g CHO

fiber = 16 g; compared to fiber needs of 20-35 g (45-80% of needs)

chol = 294 mg; compared to cholesterol needs of <200 mg (147 % of needs)

Na = 3233 mg; compared to Na needs of <2300 mg (140 % of needs)

15. Prioritize two nutrition problems and complete the PES statement for each.

Inconsistent carbohydrate intake related to Diabetes Mellitus type 2 as evidenced by carbohydrates eaten at an irregular basis and are mostly simple carbohydrates (white hamburger roll, soda, white rice, etc.), verbalizes lack of education beyond what physician had told him upon diagnosis, had been diagnosed with type 2 diabetes and is class I obese.

Obesity related to food and nutrition- related knowledge deficit as evidenced by BMI more than normative standard for age and sex (BMI of 32, Obesity class I), 133% of his normative standard weight for height, overconsumption of high-fat fast foods every day for lunch, regular soda for lunch and dinner, often eats out for dinner.

16. Determine Mitch's Nutrition Prescription using his diet history as well as your assessment of his energy requirements.

Nutrition Prescription = Consistent carbohydrate diabetic diet based off a 2,272 calorie diet

50% of total calories = Carbohydrates Na = <2400 mg 20- 35g dietary fiber

15-20% of total calories = Protein <200 mg = cholesterol

30-35% of total calories = Fat SFA = <7% of total calories, MUFA = 20% of total calories, PUFA = 10% total calories

Modify sugary beverages with diet versions and more water, use artificial sweeteners in place of sugar, smaller more frequent meals made up of complex carbohydrates, fiber and protein to slow absorption of glucose and help treat hyperglycemia, restrict caffeine, and reduce sodium consumption.

17. Outline the steps you would use to teach Mitch about nutrition and diabetes during an initial 15 minute nutrition education session at bedside. (Hint: what are key concepts you want him to leave with that will help him in the week or two before he sees an outpatient RD/CDE).

Before the patient is discharged from the hospital it is important to address the importance of consistent carbohydrates at each meal and Self-Monitoring Blood Glucose (SMBG) based on the type they have (Type 1 Or Type 2). If the patient had type 1 I would educate them on the importance of monitoring their blood glucose levels 4 times per day and keeping a record of these levels (fasting BG levels upon

waking up, before and after lunch and in the evening before bed. If they have type 2 diabetes I would recommend they monitor their Blood Glucose levels 1-4 times per day, 3-4 days per week. I would also teach them that SMBG is critical before and after exercise and that when planning to exercise it is important to eat an extra 15g of carbohydrates for every 1 hour of exercise they will be participating in (before or after). Strenuous exercise requires 30 g of carbs per hour.

One of the most important things you want to educate a diabetic patient on before they leave the hospital is the importance of maintaining carbohydrate consistency on sick days. Most people do not have much of an appetite on sick days but keeping up with regular carbohydrate counting throughout the day is important in controlling glucose levels. I would recommend the patient to consume at least 150-200 grams of carbohydrates on sick days and that eating full sugar foods and refined carbohydrates such as apple sauce, regular soda and crackers is recommended as small amounts contain higher amounts of carbohydrates. Educating Mitchel on the importance of maintaining consistent carbs on sick days is critical because when he was sick he didn't eat which only makes things worse so educating him on what to do will give him a good foundation if he gets sick again before seeing an outpatient RD.

18. What would you monitor at a 3-day follow-up in the hospital? What would you monitor at a 3 month follow-up at an out-patient diabetes clinic?

During a 3-day follow up I would want to monitor and check his glucose levels and hydration status. Both of these will help me determine if his hyperglycemic state/HHS has been treated. More can be monitored at the 3 month follow-up because there has been sufficient time to see if more long term changes have made progress. I would monitor weight loss, blood pressure, his lipid and lipoprotein profile as well as his blood glucose levels. Another thing I would monitor for a 3 month follow up would be a his food log/journal to see if he has learned how to properly adhere to consistent carbohydrates throughout the day and if he is making healthier food and beverage choices. Assessing a food log/ journal will help me determine if he needs further nutrition education.

19. Write an ADIME note for your initial nutrition assessment.

A: 63 y/o male, 214 lb, 5'9", BG levels 1524 mg/dL upon admission, diagnosed 1 yr ago w/ DM type 2, prescribed glyburide and metformin, past medical history of HTN, hyperlipidemia and gout, smoked 1 ppd for 20 years now quit, family history of type 2 DM (mother), pt experienced vomiting for 12-24 hours, dry mucous membranes w/o exudates or lesions, dry skin, poor skin turgor, previously drowsy with mild confusion, dehydrated, Obese class I. Estimated kcal and protein needs= 2272 kcals & 78g PRO. Typically eats 2 meals per day, consumes about 1960 kcals/day, 86% of his total kcal needs, 46% of kcals from CHO, 33% kcal from fat, 21% kcal from PRO, 9% kcal from sat. fat, 294 mg cholesterol, 16 g fiber (simple CHO sources), 3233 mg sodium, pt says tdoesnt add salt, tries to avoid high cholesterol foods and stays away from sugar.

Labs: BG 1510 mg/dL, osmolality 360 mmol/kg of water, urinalysis lab reports NEG. for ketones, sodium 131 mEq/L, cholesterol 205 mg/dL, triglycerids 185 mg/dL, HgA1C 15.2%, protein urinalysis 10mg/dL, glucose urinalysis 1 mg/dL

Current Medications: 20mg Glyburide daily, 500 mg Metformin 2x daily, Dyazide daily (25 mg hydrochlorothiazide and 37.5mg triamterene), 20 mg Lipitor daily.

D: Inconsistent carbohydrate intake related to Diabetes Mellitus type 2 as evidenced by carbohydrates eaten at an irregular basis and are mostly simple carbohydrates (white hamburger roll, soda, white rice, etc.), verbalizes lack of education beyond what physician had told him upon diagnosis, had been diagnosed with type 2 diabetes and is class I obese.

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Modify sugary beverages with diet versions and more water, use artificial sweeteners in place of sugar, smaller more frequent meals made up of complex carbohydrates, fiber and protein to slow absorption of glucose and help treat hyperglycemia, restrict caffeine, and reduce sodium consumption.

Nutrition Education – purpose is to educate client and wife about importance and purpose of consistent carbohydrate diet in relation to their individual needs, importance and timing of SMBG, using exchange lists to plan meals and consistent CHO. Educate client about weight loss and its effects on type II DM and lipid profile.

Recommend moderate weight loss of 1-2 lb./week. Also educate pt and wife about SMBG and recording levels for future outpatient visits and self-awareness

M/E: Every 2-3 months monitor lipid profile, FBG, HgA1C at least 2x per yr., SMBG records to help identify effect of food and eating patterns on glycemic control. Measure pt weight and BMI to monitor weight loss or weight maintenance efforts. Monitor blood pressure, total cholesterol, LDL and HDL levels a least 2x/yr.

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