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KNH 411: Case Study #16

Type 2 Diabetes Mellitus- Pediatric Obesity

1. What are the risk factors for developing type 2 DM as a child? What do the current ADA standards of medical care recommend concerning screening at-risk children?

A. The ADA recommends testing for T2DM in children and adolescents who are overweight (a BMI >85th percentile for age and gender, weight for height that is >85th percentile, or weight is >120% of ideal for height) plus have two or more of the following risk factors: family history of T2DM in first- or second-degree relatives; Native American, African American, Latino, Asian American, or Pacific Islander race/ethnicity; display signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, polycystic ovary syndrome, or small-for-gestational-age birth weight); and/or maternal history of diabetes or gestational diabetes mellitus during the child's gestation. Testing should be initiated when the child is 10 years of age or at the onset of puberty, if puberty occurs at a younger age. Testing is recommended every three years after that point. (Standards of medical care in diabetes, 2013)

2. Evaluate Adane's medical record. Identify which risk factors most likely led to the routine screening for DM during her physical.

A. In Adane's medical history, it is specified that her mother had gestational diabetes during the pregnancy and that both her mother and grandmother have T2DM. Along with these risk factors, Adane is of African-American ethnicity and has a BMI of 36.4 kg/m², indicating that she is obese. Adane displays more than

two of the risk factors for developing T2DM as a child, which led to the routine screening for DM during her physical. (Nahikian-Nelms & Roth, 2013)

3. What are the ADA standard diagnostic criteria for T2DM? Which are included in Adane's medical record?
 - A. The American Diabetes Association's criteria for the diagnosis of diabetes includes the following: A1C greater than or equal to 6.5%; fasting plasma glucose (FPG) greater than or equal to 126 mg/dL, with fasting defined as no caloric intake for at least 8 hours; 2-hour plasma glucose of greater than or equal to 200 mg/dL during an oral glucose tolerance test (OGTT); or a random plasma glucose of greater than or equal to 200 mg/dL, in a patient with classic symptoms of hyperglycemia or hyperglycemic crisis (Standards of medical care in diabetes, 2013). Adane's records indicate that her HbA_{1c} was at 6.9%, her estimated average glucose was 151 mg/dL, and her glucose levels were 171 and 155 when tested. (Nahikian-Nelms & Roth, 2013).
4. Adane's physician requested additional testing that included autoantibody levels and C-peptide. Explain why these tests were done and what the results indicate for Adane.
 - A. Autoantibody testing can be valuable in screening individuals at high risk for developing diabetes up to 7 years before the clinical onset. It is performed to differentiate between autoimmune T1DM and diabetes resulting from obesity and/or insulin resistance. Tests used to measure diabetes-related autoantibodies include islet cell cytoplasmic autoantibodies (ICA), insulin autoantibodies (IAA), glutamic acid decarboxylase autoantibodies (GADA), and insulinoma-associated-2 autoantibodies (IA-2A) (Nelms, Sucher, Lacey, & Roth, 2011, pp. 484-485). An

insulin C-peptide test may be performed in patients with T2DM to evaluate if the body is still producing any insulin. The normal range is between 0.5-2.0 ng/mL. Low C-peptide values are an indicator that the pancreas is producing little or no insulin (Topiwala, 2012). Adane's results show that all of her autoantibody measurements came back negative, however her C-peptide level was measured at 2.75 ng/mL A_{1c}, which indicates that her pancreas is working harder to overcome insulin resistance by producing more insulin (Nahikian-Nelms & Roth, 2013).

5. Insulin resistance is a major component of T2DM. Explain this pathophysiology. How could you determine whether Adane is exhibiting insulin resistance?
 - A. Insulin resistance is caused by a cell-receptor defect resulting in the body's inability to use insulin. Cells are no longer able to respond to insulin by translocating glucose transporters to their outer membrane, resulting in their inability to take up glucose from the blood for fuel. Glycogenolysis and gluconeogenesis are normally inhibited by insulin when blood glucose is high, however, defective insulin secretory response results in excess production of glucose from the liver. For T2DM to manifest, both defects must be present. At first, postprandial glucose levels rise due to the inability of the cells to utilize glucose, resulting in hepatic gluconeogenesis compensating for this lack of glucose, resulting in fasting hyperglycemia (Nelms, Sucher, Lacey, & Roth, 2011, pp. 499). To determine whether Adane is exhibiting insulin resistance, her A_{1c}, fasting blood glucose, and C-peptide levels can be tested. If her fasting levels are consistently high, Adane would be experiencing insulin resistance in the form of hyperglycemia.

6. Children with T2DM are at high risk for early cardiovascular disease. Why does this complication occur with diabetes? Evaluate Adane's lipid profile. How does this compare to the lipid goals for children with diabetes?

A. Individuals with T2DM are at high risk for early cardiovascular disease (CVD) because of the conditions that typically result as a consequence of overweight or obese status. These conditions include: hypertension, high cholesterol and triglyceride levels, and abnormal blood sugar levels. Research has found an association between hypertension and insulin resistance, doubling the risk for an individual with diabetes to develop CVD. Patients with T2DM often have high LDL cholesterol and triglyceride levels and low HDL cholesterol, contributing to CVD. Long-term hyperglycemia is a contributor of hypertension and dyslipidemia, which is a lipid disorder associated with insulin resistance in patients with diabetes (Cardiovascular disease & diabetes, 2012). Adane's laboratory results show that her cholesterol level was 210 mg/dL, well above the reference range of <170 mg/dL. Her triglyceride levels were also abnormal at 175 mg/dL, compared to the recommended value of <150 mg/dL (Nahikian-Nelms & Roth, 2013). Recommended LDL cholesterol levels for Adane are less than 100 mg/dL (Standards of medical care in diabetes, 2013).

7. Adane's grandmother asks about medication for treating high cholesterol as her husband is on his medicine. What are the recommendations for the use of statin drugs in children?

A. The use of statin drugs in children is not recommended. Lowering a child's cholesterol with the use of nutrition intervention and increasing physical activity is preferred over the use of any drugs (Should children, 2010). There are no long-

term research studies on the effects of statin therapy in children. However, recent studies have shown short-term safety in lowering LDL cholesterol levels, improving endothelial function, and causing regression of carotid intimal thickening. No statin is approved for use in children under the age of 10 years, and use is not recommended in children with type-1 diabetes prior to this age. Statin therapy may be considered in children over 10 years of age if their LDL cholesterol is >160 mg/dL or LDL cholesterol is >130 mg/dL, and if the child exhibits one or more CVD risk factors after nutrition and lifestyle intervention (Standards of medical care in diabetes, 2013).

8. Adane's urinalysis is positive for protein. What does this mean and how may this be related to her diabetes?
 - A. High blood sugar can overwork the kidneys, causing them to filter an abundance of blood. This causes damage to the kidneys to where they lose their ability to filter out waste products, eventually resulting in kidney disease. With a decreased ability to filter the body's blood, the kidneys leak, resulting in the loss of protein through the urine. (Kidney disease, 2013)
9. Should Adane and her family be taught about self-monitoring of blood glucose (SMBG)? If so, what are the standard recommendations for daily frequency testing? What would be the appropriate fasting and postprandial target glucose levels for Adane?
 - A. Adane and her family should be taught about self-monitoring of blood glucose (SMBG) in order for Adane to strive to achieve her blood glucose level goals and maintain glycemic control. SMBG has been found effective in controlling blood glucose in patients with T2DM. It is recommended that individuals with T2DM

test as often as needed to achieve glycemic goals, before and after physical activity, and to establish existence of hypoglycemia and reaction to treatment. When ill, testing is suggested every 4 to 6 hours. The recommended glycemic goals for Adane to maintain glycemic control are as follows: (Nelms, Sucher, Lacey, & Roth, 2011, pp. 494)

Glycemic Indicator	Normal	Goal
Preprandial glucose	<100 mg/dL	70-130 mg/dL
Postprandial glucose	<140 mg/dL	<180 mg/dL

10. Outline the basic principles for Adane’s nutrition therapy to assist in control of her T2DM.

A. The primary goal for nutrition therapy in T2DM is cessation of excessive weight gain, promotion of normal growth and development, and the achievement of blood glucose and A1C goals. This can be done by supporting and facilitating lifestyle and behavior modifications that will result in improved metabolic control. General behavior modifications should include decreasing the intake of high-caloric, high-fat foods, while encouraging healthy eating habits and regular physical activity for the entire family (Mahan & Escott-Stump, 2004). Total carbohydrate dietary intake in grams needs to be monitored through the use of the exchange system or carbohydrate counting, in order to achieve glycemic control. Protein intake is recommended to be less than 20% of total calories consumed each day to decrease the risk of developing nephropathy. Total fat intake should not exceed 25-35% of total kcal, and saturated fat intake should not exceed 7%. A diet that includes fiber-containing foods such as legumes, fiber-rich cereals, and

fruits and vegetables is recommended. The U.S. Dietary Guidelines recommends consuming 14 grams of fiber for every 1000 kcal consumed. (Nelms, Sucher, Lacey, & Roth, 2011, pp. 505-506).

11. Using the charts on pp. 188-189, assess Adane’s height/age, weight/age, and BMI. What is her desirable weight?

A. Adane falls on the 50th percentile line according to her stature-for-age, based on her height of 52” and her age of 9 years. In evaluating her weight of 140 lbs for her age of 9 years and assessing her body mass index-for-age, Adane places above the 97th percentile for both categories. In order to fall onto the 50th percentile line according to her height-for-age, Adane’s desirable weight would be between 60 and 70 lbs. (Nahikian-Nelms & Roth, 2013)

12. Identify any abnormal laboratory values measured upon her admission. Explain how they may be related to her newly diagnosed T2DM.

A. The following chart displays Adane’s abnormal laboratory values upon her admission:

Chemistry	Ref. Range	8/3 0800	8/4 0940
Glucose (mg/dL)	70-110	171	155
Cholesterol (md/dL)	<170	210	
Triglycerides (mg/dL)	<150	175	
HbA _{1c} (%)	3.9-5.2	6.9	
EAG	-	151	
C-peptide (ng/mL)	0.51-2.72	2.75	
Urinalysis			
Protein (mg/dL)	Neg	tr	
Glucose (mg/dL)	Neg	+	
Prot chk	Neg	+	

Adane's high cholesterol and triglyceride levels are most likely associated with her high BMI of 34.6 kg/m^2 . Her elevated glucose levels indicate that her body is not able to provide enough insulin to utilize the blood glucose for energy. HbA_{1c} levels provide an overview of her blood glucose control over the past 3 months. High HbA_{1c} levels are indicative of diabetes. An insulin C-peptide test may be performed in patients with T2DM to evaluate if the body is still producing any insulin (Topiwala, 2012). Adane's C-peptide level was measured at 2.75 ng/mL . A_{1c} , which is an indicator that her pancreas is working harder to overcome insulin resistance by producing more insulin (Nahikian-Nelms & Roth, 2013). High blood sugar can overwork the kidneys, causing them to filter an abundance of blood. With a decreased ability to filter the body's blood, the kidneys leak, resulting in a loss of protein and glucose through the urine (Kidney disease, 2013).

13. Determine Adane's energy and protein requirements. Be sure to explain what standards you used to make these estimations. Should weight loss be a component of your estimation of energy requirements?

A.

i. TEE for Overweight Females Aged 3-18 years (Nelms, Sucher, Lacey, & Roth, 2011, p. 243)

1. $\text{TEE} = 389 - 41.2 \times \text{age} + \text{PA} \times 15.0 \times \text{weight} + 701.6 \times \text{height}$

a. $\text{Weight} = 140 \text{ lbs.} / 2.2 \text{ lbs.} = 63.6 \text{ kg}$

b. $\text{Height} = 52'' \times 2.54 \text{ in.} = 132.1 \text{ cm} / 100\text{cm} = 1.32 \text{ m}$

c. $\text{PA} = 1.18$ for low active

d. $\text{TEE} = 389 - 41.2 \times 9 \text{ years} + 1.18 \times 15.0 \times 63.6 \text{ kg} + 701.6 \times 1.32 \text{ m} = 2,070 \text{ kcal}$

i. TEE= 2,000- 2,100 kcal

ii. Protein Requirements= 0.95 g/kg/day

1. $0.95 \text{ g} \times 63.6 \text{ kg} = \mathbf{60.42 \text{ g/day of Protein}}$

iii. For children who are overweight but are still growing and developing, weight loss is not recommended, therefore, weight loss is not a component of Adane’s estimated energy requirements. The treatment goal is to slow down her rate of weight gain and to maintain a baseline weight, while she continues to grow normally in height. This can be done by changing Adane’s physical activity status and altering her eating habits. When Adane is done growing, slow changes can be made in her diet and exercise patterns to achieve slow weight loss if necessary. (The Surgeon General’s call, 2013)

14. Using Adane’s diet history, assess the approximate number of kilocalories her intake provided, as well as the energy distribution of calories for protein, carbohydrate, and fat using the exchange system. Compare this to the recommendations that you made in question #10.

Food	Exchange	Protein	Carbohydrates	Fat	Calories
Breakfast					
Fruit Punch- 1 cup	1 cup= 2 CHO choices	0 grams 0 kcal	30 grams 120 kcal	0 grams 0 kcal	120
Frosted Flakes- 2 cups	2 cups= 4 starch choices	4 grams 16 kcal	60 grams 240 kcal	4 grams 36 kcal	292
Whole Milk	1 cup= 1 milk choice	8 grams 32 kcal	12 grams 48 kcal	8 grams 72 kcal	152
Midmorning					
Toast- 2 slices	2 slices= 2 starch choices	0 grams 0 kcal	30 grams 120 kcal	0 grams 0 kcal	120
Butter	1 tsp.= 1 fat choice	0 grams 0 kcal	0 grams 0 kcal	5 grams 45 kcal	45
Jam	1 tbsp.= 1 CHO choice	0 grams 0 kcal	15 grams 60 kcal	0 grams 0 kcal	60

Snacks					
Chocolate Chip Cookies- ~2 cookies	2 cookies= 2 CHO choices and 1 fat choice	0 grams 0 kcal	30 grams 120 kcal	5 grams 45 kcal	165
Cheetos- 2 small bags	2 oz.= 2 starch and 4 fat choices	4 grams 16 kcal	30 grams 120 kcal	20 grams 180 kcal	316
Fruit Punch- ~3 cups	3 cup= 6 CHO choices	0 grams 0 kcal	90 grams 360 kcal	0 grams 0 kcal	360
Popsicles- 2	2= 1 CHO choice	0 grams 0 kcal	15 grams 60 kcal	0 grams 0 kcal	60
Lunch					
Peanut butter- 2 tbsp.	2 tbsp.= 4 fat choice	0 grams 0 kcal	0 grams 0 kcal	20 grams 180 kcal	180
Bread- 4 slices	4 slices= 4 starch choices	0 grams 0 kcal	60 grams 240 kcal	0 grams 0 kcal	240
Mayo- 1 tbsp.	1tbsp.= 3 fat choices	0 grams 0 kcal	0 grams 0 kcal	15 grams 135 kcal	135
Banana- 1	8 oz. banana= 2 fruit choices	0 grams 0 kcal	30 grams 120 kcal	0 grams 0 kcal	120
Fruit Punch- 2 cups	2 cups= 4 CHO choices	0 grams 0 kcal	60 grams 240 kcal	0 grams 0 kcal	240
Chips	1 oz= 1 starch and 1 fat choice	1 gram 4 kcal	15 grams 60 kcal	5 grams 45 kcal	109
Dinner					
Fried Pork Chop- ~2 oz.	2 oz.= 2 high-fat meat choices	14 grams 56 kcal	0 grams 0 kcal	16 grams 144 kcal	200
Greens	1 cup raw= 1 nonstarchy vegetable choice	2 grams 8 kcal	5 grams 20 kcal	0 grams 0 kcal	28
Potatoes	½ large= 2 starch choices	2 grams 8 kcal	30 grams 120 kcal	0 grams 0 kcal	128
Cornbread	1¼ inch cube= 1 starch choice	0 grams 0 kcal	15 grams 60 kcal	5 grams 45 kcal	105
Butter	1 tsp.= 1 fat choice	0 grams 0 kcal	0 grams 0 kcal	5 grams 45 kcal	45
Iced tea with sugar	1 tbsp sugar= 1 CHO choice	0 grams 0 kcal	15 grams 60 kcal	0 grams 0 kcal	60
Bedtime					
Pizza Rolls	4½ oz.= 3 CHO, 1 lean meat, 2 fat choices	7 grams 28 kcal	45 gram 180 kcal	10 gram 90 kcal	298
Coke	1 can= 2.5 CHO choices	0 grams 0 kcal	37.5 grams 150 kcal	0 grams 0 kcal	150
		Protein	Carbohydrates	Fat	Calories
Totals:		168 kcal 4% of total kcal	2,498 kcal 67% of total kcal	1,062 kcal 29% of total kcal	3,728

Adane's diet is within the recommended fat intake of 25-35% of total kcal, however, after evaluating her food choices, she is most likely consuming an excess amount of saturated fat. Adane is consuming less than 20% of her total calories from protein, however 4% is not an adequate amount for her diet. Adane's carbohydrate intake is also abundant, with 67% of her total calories coming from carbohydrates. Overall, Adane needs to decrease her intake of high-calorie, high fat foods. (Nelms, Sucher, Lacey, & Roth, 2011, pp. A109-A122)

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

A. Excessive Energy Intake (NI-1.4) (Academy of Nutrition and Dietetics, 2013. pp. 156-157)

i. Excessive energy intake related to poor food choices and food and nutrition related knowledge deficit concerning energy intake as evidenced by the consumption of 3,698 kcal in 24-hour recall and a BMI score of 36.4 kg/m².

B. Overweight/Obesity (NC-3.3) (Academy of Nutrition and Dietetics, 2013. pp. 254-255)

i. Overweight/obesity related to physical inactivity and excessive energy intake as evidenced by patient's BMI of 36.4 kg/m², categorizing the patient above the 97th percentile for her BMI-for-age.

16. Determine Adane's initial nutrition therapy prescription using her diet record from home as a guideline, as well as your assessment of her energy requirements.

A. My initial nutrition therapy prescription for Adane would be a 2,000-2,100 kcal/day diet, which was calculated to meet Adane's energy requirements based on her current weight and height, and a low-activity factor. Of these total calories,

the goal would be for Adane to consume 20% from protein (or her calculated needs of 60.42 grams/day), 25-35% from fat (with less than 7% coming from saturated fats), and the remaining 45-55% of her total calories coming from complex carbohydrates. I would recommend that Adane replace her high-fat food choices with lower fat options, such as reduced fat milk, eliminating fried foods, and replacing the highly processed snacks with fruits and vegetables. I would also recommend that instead of consuming sugar-dense drinks, she switch to water, 100% fruit juices, and low-fat milk. To incorporate more fiber into her diet, Adane could use whole wheat bread for her sandwiches, and again incorporate more fruits and vegetables.

17. Outline the initial steps you would use to teach Adane and her family about nutrition and diabetes. What education materials could you use?

A. The first thing I would emphasize when educating Adane and her family about nutrition and diabetes is the importance of involving the entire family throughout the nutrition therapy process. Providing Adane with guidance and support is the key to managing her diabetes and weight. I would educate the client, along with her family, on how to use the exchange system and the importance of monitoring carbohydrate intake. I would instruct the family on what is considered a carbohydrate choice through the use of food models and serving sizes. I would also distinguish the differences between fast acting and slow acting carbohydrates and how they affect blood glucose levels. An additional educational material that the family may find useful is a sample menu of what a diabetic friendly meal could look like. I would also stress the importance of physical activity and show

the family the SuperTracker application through the choosemyplate.gov website, where it offers suggestions on how to increase your physical activity level.

18. Considering that Adane will not be started on medication, is it necessary to teach her and her family about hypoglycemia, sick-day rules, and exercise?

A. The management of T2DM is important to prevent further health complications.

Even though Adane is not on any medications, it is necessary to teach her and her family about hypoglycemia, sick-day rules, and exercise. Physical activity is highly recommended for individuals with T2DM, due to its positive effect on blood glucose levels by enhancing muscle blood glucose uptake during or shortly after activity and by improving insulin sensitivity. It is also recommended that individuals with T2DM test before and after physical activity to prevent hypoglycemia, although this is rare in individuals T2DM not being treated with insulin or insulin secretagogues. When ill, testing should take place every 4-6 hours to prevent hyper- and hypoglycemia. (Nelms, Sucher, Lacey, & Roth, 2011, pp. 500)

19. Adane's mom is worried that none of the children will ever be able to have birthday cake or other sweet treats. She feels that she cannot offer these to the other children if Adane cannot have them. What would you tell her?

A. Although foods containing high amounts of sugar can rapidly raise blood glucose levels, the quantity of the food eaten has a bigger impact. It is not recommended that an individual with T2DM consume large quantities of sugar, but it is appropriate to consume sweets on special occasions and in small servings. Be aware of the number of carbohydrate servings in order to properly monitor your

blood glucose levels. Also be aware that there are diabetic-friendly dessert products and recipes available to keep your sugar consumption in control. (Sugar and desserts, 2013)

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

A.

Assessment:

- i. Patient's mother and grandmother brought patient in after T2DM diagnosis during patient's school physical.
- ii. 9 yo female DX: Type 2 Diabetes Mellitus; obesity
- iii. Height: 52" Weight: 140# BMI: 36.4 kg/m²
- iv. Labs: HbA_{1c} 6.9%; EAG 151; C-peptide 2.75 ng/mL A_{1c}; Glucose 171 and 155 mg/dL; Cholesterol 210 mg/dL; Triglycerides 175 mg/dL; Urinalysis: Protein- trace, Glucose- +
- v. EER: 2,000-2,100 kcal EPR: 60.42 grams

Diagnosis:

- vi. Excessive energy intake related to poor food choices and food and nutrition related knowledge deficit concerning energy intake as evidenced by consumption of 3,698 kcal in 24-hour recall and BMI of 36.4 kg/m².
- vii. Overweight/obesity related to physical inactive and excessive energy intake as evidenced patient's BMI of 36.4 kg/m², categorizing the patient above the 97th percentile for her BMI-for-age.

Intervention:

- i. Provide patient and family with education materials on how to manage T2DM. Educate them on use of the exchange system and carbohydrate serving portions.
- ii. Provide information on how client can achieve recommended energy requirements (2,000-2,100 kcal/day) and meet nutrition goals, specifically by choosing lower-fat, less processed food options, decreasing the number of sugar-sweetened beverages consumed, and increasing her intake of fruits and vegetables.
- iii. Recommend a minimum of 30 minutes of physical activity per day for client, specifically walking or riding a bike to and from school with family if possible or playing outside after school.

Monitoring/Evaluation:

- i. Measuring patient's weight at each follow-up to ensure weight maintenance.
- ii. Request 24-hour recall to evaluate if the patient has incorporated dietary changes.
- iii. Reevaluate patient's lab results, specifically the ones that were abnormal as stated in assessment, to see if patient is maintaining glycemic control and if the dietary changes are having a positive impact on her lipid profile.

21. Adane's grandmother suggests that perhaps Adane should have "stomach surgery" so that she will lose weight more quickly. What are the recommendations for pediatric bariatric surgery?

A. Weight-loss surgery is not typically considered appropriate for obese adolescents under the age of 13 years. Significant short-term and long-term weight-loss through surgery has been found to be effective in adolescents who meet recommended criteria. Potential candidates should be referred to centers with multidisciplinary weight management teams. To be considered for weight-loss surgery, an adolescent must have:

- Failed at least six months of monitored weight-loss attempts.
- A BMI of 40 or greater with serious obesity-related medical complications or a BMI of 50 or greater with less-severe co-morbidities.
- Co-morbidities related to obesity that might be resolved with a significant weight loss.
- Attained a majority of skeletal majority (13 years old for girls and 15 years of age for boys).
- A commitment to psychological and medical evaluations.
- A decisional capacity.
- A supportive family environment.
- A multi-disciplinary team involved in the process.

(Pediatric weight management (PWM) adjunct therapies, n.d.)

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