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Clinical Module 3 – Diabetes

Module 3 Questions:

I. Abbreviations/Definitions

Ketone Bodies

- Produced by the liver and is used as an energy source when glucose is not readily available.

DKA

- Stands for diabetic ketoacidosis. DKA happens when the body breaks down fat to use for energy (ketones) since there is no glucose readily available for the body to use. The more of these ketones are made, the more they build up in the blood which causes the blood to be more acidic. These high ketone levels can poison the body which can lead to a diabetic coma or death.

Prediabetes

- Prediabetes is a condition in which an individual's blood glucose level is higher than normal but not high enough to be diagnosed as Type 2 diabetes.
  - Results of tests that confirm prediabetes are:
    - A1C: 5.7% - 6.4%
    - Fasting blood glucose: 100 – 125 mg/dL
    - 2-hour oral glucose tolerance test: 140 mg/dL – 199 mg/dL

Incretin

- Type of hormone that is released after eating which then increase insulin secretion. The two types of incretin hormones found in humans are GIP (glucose-dependent insulinotropic peptide) and GLP-1 (glucagon-like peptide-1)

II. Anatomy/Physiology

Describe the primary endocrine and exocrine functions of the pancreas.

The pancreas is composed of exocrine cells that produce enzymes that help digest food.

The endocrine function of the pancreas involved cells called the islets of Langerhans. These cells release hormones like insulin and glucagon into the blood stream. Insulin is released when blood sugar levels are too high while glucagon is released when blood sugar levels are too low. Both hormones are needed to maintain blood sugar levels.

Describe the effects of glucagon, epinephrine, growth hormone, corticosteroids and somatostatin on blood glucose levels.

Glucagon
- Glucagon is released by the pancreas to the bloodstream when blood sugar levels are too low in order to bring it back up to a normal level.

Epinephrine
- Epinephrine is released from nerve endings and adrenal glands to the liver to help with sugar production when blood glucose falls below normal levels.

Growth hormone
- Growth hormone is secreted by the pituitary gland in order to enhance the production of glucose by the liver and also to offset the effect of insulin on fat and muscle cells.

Corticosteroids
- Type of medication that increases blood glucose levels.

Somatostatin
- Somatostatin blocks the secretion of insulin and glucagon right after the other.

III. Pathophysiology

A. Discuss the etiology and clinical symptoms of diabetes. Differentiate between Type 1, Type 2 and gestational diabetes.

Type 1

Etiology:
- The body attacks beta cells in the pancreas which prevents it from producing insulin.

Clinical Symptoms
- Excessive thirst and dehydration (polydipsia)
- Frequent urination (polyuria)
- Hunger plus weight loss
- Blurred vision
- Weakness, tiredness, or sleepiness
- Nausea or vomiting
- Sudden irritability

Type 2

Etiology:
- Insulin resistance. The cells do not respond to insulin signals therefore glucose is not absorbed by some cells.

Clinical Symptoms:
- Polydipsia
- Polyphagia
- Polyuria
- Blurred vision
- Mood changes

Gestational

Etiology:

- Exact cause is unknown. However, it may be due to insulin resistance and the fact that a pregnant woman may need up to 3 times the amount of insulin she normally needs.

Clinical Symptoms

- Sugar in urine
- Polyuria
- Poydipsia
- Fatigues
- Nausea
- Blurred vision
- Frequent vaginal, bladder, and skin infections

B. For each of the following laboratory tests, identify normal values for healthy individuals and the significance of abnormal values in individuals with diabetes.

Laboratory Test	Normal Values	Significance of Abnormal Values
Fasting blood glucose	< 100 mg/dL	100 mg/dL – 125 mg/dL indicates prediabetes 126 mg/dL (2 separate tests) indicates diabetes
2-hour post prandial blood glucose	< 140 mg/dL	140 mg/dL – 199 mg/dL indicates prediabetes ≥ 200 mg/dL indicates diabetes
Serum triglycerides	< 150 mg/dL	≥ 150 mg/dL – 199 mg/dL (borderline) ≥ 200 mg/dL – 499 mg/dL (high) ≥ 500 mg/dL (very high) High triglyceride levels contribute to atherosclerosis which increases the risk of heart disease, heart attack, or stroke.

		Extremely high triglyceride levels may also cause acute pancreatitis.
Urinary glucose	0 – 0.8 mmol/l or 0 – 15 mg/dL	Higher than normal results indicate that the individual either has diabetes, is pregnant, or has a condition called renal glycosuria.
Urinary ketone bodies	Normal values vary depending on the laboratory	Small: < 20 mg/dL Moderate: 30 – 40 mg/dL Large: >80 mg/dL Abnormal results may be due to: -fasting or starvation -high protein or low carbohydrate diet -long periods of vomiting -acute or severe illnesses -high fever -hyperthyroidism
Hemoglobin A1C	< 5.7	5.7 – 6.4 indicates prediabetes ≥ 6.5 indicates diabetes

C. Discuss the etiology, symptoms and treatment of hypoglycemia.

Etiology:

- Occurs when blood glucose levels fall too low.
- For people with diabetes hypoglycemia occurs when the body does not produce insulin at all (Type 1) or the body is resistant to the effects of insulin (Type 2).
- Hypoglycemia may also be caused by:
  - Medications, excessive alcohol consumption, critical illnesses such as severe hepatitis, insulin overproduction, or hormone deficiencies.

Symptoms:

- Irregular heart rhythm
- Fatigue
- Pale skin
- Shakiness
- Anxiety
- Sweating
- Hunger
- Irritability

- Tingling sensation around the mouth
- Confusion and/or abnormal behavior
- Blurred vision
- Seizures
- Loss of consciousness

Treatment:
- Getting glucose levels to normal levels (consuming 15 – 20 g of a fast-acting carbohydrate like fruit juice, soda, or glucose tablets)
- Treating the underlying cause may it be a disease or medication.

D. Discuss the relationship of diabetes to each of the following disorders:

1. Atherosclerosis

- Having diabetes accelerates the development of atherosclerosis (build-up of fats and other substances in the artery also called plaque) since high-blood sugar attracts substances to stick to the endothelium walls, plaque formation can easily happen.

2. Nephropathy

- High levels of blood glucose puts a lot of strain in the kidneys since they would need to filter large amounts of blood. As time passes, the kidneys no longer filter as well as they should, and protein ends up in the urine which signals the beginning of kidney disease.

3. Neuropathy

- Individuals who have had diabetes for a long time develop diabetic neuropathy which is nerve damage caused by high blood glucose levels and high fat levels over time.

4. Retinopathy

- Diabetic retinopathy occurs when high blood sugar levels damage blood vessels in the retina. This can lead to blindness.

5. Cystic Fibrosis

- Cystic fibrosis-related diabetes (CFRD) happens only to people with cystic fibrosis. In CFRD, thick and sticky mucus damages the pancreas which prevents it from producing normal amounts of insulin. Individuals with CFRD also become insulin resistant when they are sick, taking steroid medications, or are pregnant.

IV. Management

A. Describe “pattern management” in diabetes care.

Glucose pattern management (GPM) is a process in which patients are taught to recognize their blood glucose level patterns and what to do to bring their blood glucose back to their target range. Patients learning pattern management learn

how to their every day actions affect their blood glucose levels and are then educated on what they can do to manage their diabetes.

B. List and discuss factors which affect insulin requirements.

- Carbohydrate intake – the more carbohydrates one consumes, the more insulin they would need to take.

- Physical activity – exercise increases the body's need for glucose. During exercise, blood glucose levels drop so glucagon is needed, not insulin. Therefore, insulin requirements during exercise are reduced.

- Illness – Blood glucose levels are increased when one is sick therefore more insulin is needed to bring blood glucose levels back to normal.

- Body mass – The larger the individual is, the more insulin they need.

- Insulin resistance – someone with Type 2 diabetes will need more insulin since they are insulin resistant.

C. When is the use of oral hypoglycemic agents indicated? What adverse side effects are associated with their use?

Oral hypoglycemic agents are used only for Type 2 diabetics who are non-responsive to diet, weight loss, and exercise.

Side effects associated with oral hypoglycemic agents include dizziness, drowsiness, heartburn, feeling sick, stomach pain, feeling of fullness, stomach discomfort, constipation, and polyuria.

D. What special considerations must be given to children with diabetes?

Children with diabetes may have emotional and social issues. Having this disease is hard enough for adults, I can only imagine how difficult it is for children since they will have to remember about their insulin shots and watch what they eat. It is especially hard for school-aged children with diabetes since it is important that the school nurse, teachers, and other pertinent personnel are aware of their condition and that there is a care plan in place for the child. Schools and caregivers also need to have the proper equipment to care for the child such as blood glucose monitoring kits, insulin and other medication, and snacks.

E. What effect does dietary fiber have on blood glucose levels?

Dietary fiber specifically soluble fiber, which dissolves in water can help lower blood glucose levels. On the other hand, insoluble fiber does not help lower blood glucose levels, but it does help promote regularity. For people with

diabetes, sources of soluble fiber include oats, beans, peas, apples, carrots, barley, and citrus fruits.

F. Discuss the use of sugar substitutes in the diabetic diet. Include in your discussion, safety levels as established by the FDA.

Sugar substitutes are commonly used by people with diabetes. However, it is important to know that these artificial sweeteners are at least 100 times sweeter than regular table sugar therefore, only small amounts are required. Most sweeteners are not broken down by the body and are just excreted. These artificial sweeteners do not contain extra calories. The only exception is aspartame. It is also important for diabetics to know that food products that advertise themselves as “sugar-free”, “reduced sugar”, or “no sugar added”, still contain small amounts of sugars. It is important to read the nutrition label of a food product to know exactly how much sugars certain food products contain.

G. What is the general recommended distribution of macronutrients for patients on diabetic diets? What is the recommended distribution of macronutrients for patients with gestational diabetes?

Macronutrient distribution for diabetic patients:

Carbohydrates: 45 -65%
Protein: 15 – 20%
Fat: 25 – 35%

Macronutrient distribution for gestational diabetes patients:

Carbohydrates: 40 - 45%
Protein: 20%
Fat: 35 – 40 %

H. Briefly describe the following programs which may be used in planning diabetic meal patterns:

1. Exchange list system

- The exchange list system is used in diabetic meal planning. Exchange lists groups foods with comparable amounts of carbohydrate per serving so that when one is planning meals, they can exchange different carbohydrates to have a variety of meals that still have the same amount of carbohydrates.

2. Glycemic Index/ Glycemic Load

- Glycemic index measures how foods that contain carbohydrates raises blood glucose compared to pure glucose. These foods are then categorized in three groups as having high, moderate, or low GI food. For diabetic individuals planning their meals, glycemic index is helpful since

they can pick moderate to low GI foods to in order to control their blood glucose levels.

On the other hand, glycemic load uses the glycemic index of food and the amount of carbohydrate per serving of that food and how quickly they raise blood glucose levels. Both glycemic index and glycemic load are helpful measures to examine the blood glucose raising potential of foods.

3. Carbohydrate Counting

- Carbohydrate counting is exactly what the term implies it is counting the amount of carbohydrates a person consumes in a daily basis. Out of the total daily calories they consume, diabetic individuals should set aside 45% - 65% of these calories for carbohydrates.

I. How might having an eating disorder impact a person with diabetes?

Having an eating disorder while also having diabetes is extremely difficult. Depending on the type of eating disorder, blood sugar levels can either increase or decrease rapidly. For instance, someone with anorexia nervosa restricts the amounts of calories they eat as well as the type of foods they eat. This strict restriction causes blood glucose to decrease rapidly which is extremely dangerous. It is important for individuals who have eating disorders to seek professional help in order to help them manage both their eating disorder and diabetes.

J. Jane is a 24-year-old college senior who was diagnosed as having Type 1 Diabetes at the age of 12. Jane is 5'5" tall and weighs 118 lbs. She takes an injection of 25 units Lantus each evening and 8 units Lispro with each meal.

1. What would be the appropriate diet prescription for Jane?

CBW = 118 lbs / 2.2 = 54 kg
BMI = 703 x 118 lbs / 65 in^2 = 19.6 normal wt

Recommended calories: 30 – 35 kcals/kg = 1620 kcals – 1890 kcals

For this patient, I will be using 1800 kcals.

2. Using the principles of CHO counting, translate this diet prescription into a meal pattern.

Total calories: 1800 kcals

Protein = 1800 x .20 = 360 kcals / 4 g/kcals = 90 g
Fat = 1800 x .30 = 540 kcals / 9 g/kcals = 60 g
Carbohydrates = 1800 x .50 = 900 kcals / 4 g/kcals = 225 g

Calculating Carbohydrate exchanges:
225 g of carbohydrate / 15 g per carbohydrate exchange = 15 exchanges

Meal breakdown:
Breakfast: 75 g (5 exchanges)
Lunch: 60 g (4 exchanges)
Dinner: 60 g (4 exchanges)
Snack: 30 g (2 exchanges)

3. Using the principles of CHO counting, plan a menu for one day for Jane.

Sample 1800 kcal menu	
Breakfast	CHO exchanges
1 cup of oatmeal	2
1 cup of milk	1
1 egg (scrambled)	-
1 small apple	1
½ cup orange juice	1
Lunch	
1/3 cup brown rice	1
Grilled chicken	-
1 ½ cup spinach (cooked)	1
1 ½ cauliflower (cooked)	1
¾ cup blueberries	1
Sugar-free jello	-
Coffee (black)	-
Dinner	
½ cup baked sweet potato	1
½ cup kidney beans	1
Baked tilapia with lemon wedge	-
1 ½ broccoli	1
Sugar-free ice cream	1
Snack	
2/3 cup plain yogurt	1
1 ¼ cup strawberries	1

K. Mr. Doe, age 39, is a bank executive who has just been diagnosed as having Type 2 Diabetes. Mr. Doe is 5'11" tall and weighs 205 lbs. His blood glucose level is 190 mg/dl. Neither insulin nor an oral hypoglycemic agent is ordered.

1. What would be the appropriate diet prescription for Mr. Doe?

CBW = 205 lbs / 2.2 = 93 kg
BMI = 703 x 205 lbs / 71 inches^2 = 28.6 overweight
IBW = 106 lbs + 6 lbs (11) = 172 lbs / 2.2 = 78 kg

Recommended calories: 20 – 25 kcal/kg = 1860 – 2325 kcals

Pt is overweight so 250-500 kcals less than daily intake. I would recommend 2000 kcals for this patient.

2. Using the principles of CHO counting, translate this diet prescription into a meal pattern.

Protein: 2000 x .20 = 400 kcals = 100 g
Fat: 2000 x .30 = 600 kcals = 67 g
Carbohydrate: 2000 x .50 = 1000 kcals = 250 g
250 g / 15 g per carbohydrate exchange = 17 carbohydrate exchanges

Breakfast: 75 g (5 exchanges)
Lunch: 60 g (4 exchanges)
Dinner: 60 g (4 exchanges)
Snack 1: 30 g (2 exchanges)
Snack 2: 25 g (1 ¼ exchanges)

3. Using the principles of CHO counting, plan a menu for one day for Mr. Doe.

Sample 2000 kcal menu	
Breakfast	**Carbohydrate Exchanges**
1 English muffin	2
1 egg (scrambled)	-
Margarine	-
1 small banana	1
½ cup apple juice	1
1 small pear	1
Lunch	
Tuna	-
2 slices whole-wheat bread	2
1 cup raw baby carrots	5 g of CHO
1 cup raw red bell peppers	5 g of CHO
1 cup raw cucumbers	5 g of CHO
½ cup of hummus	1
Sugar-free jello	-
Dinner	
Baked salmon	-
1/3 cup brown rice	1
½ cup brussel sprouts (cooked)	5 g of CHO
½ cup mushrooms (cooked)	5 g of CHO
½ cup summer squash (cooked)	5 g of CHO
1 orange	1
1 small unfrosted cake	1
Snack 1	
1 granola bar	1
1/3 cup low-fat yogurt	1
Snack 2	
2 oz tortilla chips	2
Salsa	-