PET3932 – SECTION 2

QUIZ 4 STUDY GUIDE

Diabetes Mellitus (**Read ACSM book p.278 – 284; Bb Diabetes Med handout)

- **Diabetes Mellitus (DM):**
  - A group of metabolic diseases characterized by an elevated blood glucose concentration (i.e., hyperglycemia) as a result of defects in insulin secretion and/or inability to use insulin.
  - 7 % of the U.S. population has DM
  - Absolute or insufficient amount of insulin
  - Pancreas isn't producing insulin
  - Insulin is needed as a carrier to take blood from plasma to the muscles
    - Glucose can't be carried without insulin
- **Hyperglycemia** → classic sign of diabetes → elevated blood glucose
- **Type 1 Diabetes** (5 – 10% of all cases)
  - Most often caused by autoimmune destruction of the insulin producing β cells of the pancreas.
  - Primary characteristics: absolute insulin deficiency and a high propensity for ketoacidosis.
  - Need insulin for survival (their pancreas doesn't or hardly produces any insulin)
  - Glucose in urine → need to take insulin on a regular basis
  - Symptomology:
    - Unexpected/unexplained weight loss → can't use glucose as an energy source → use protein/fat instead
    - Tired/irritable
    - Frequent thirst & urination
    - Glucose in urine
  - If a Type 1 has no insulin, plasma glucose increases b/c it can't get into the muscles.
- **Body's natural mechanism** → dilute large amounts of glucose…this is why diabetics get thirsty & urinate a lot…their body tells them to intake water to dilute the glucose & then rid it by urinating… except the problem doesn't resolve itself this way.
- **Type 2 Diabetes** (90% of all cases)
  - Caused by insulin-resistant skeletal muscle, adipose tissue, and liver combined with an insulin secretory defect.
  - Common feature: excess body fat with fat distributed in the upper body (i.e., abdominal or central obesity) → these can also cause progression towards prediabetes.
  - They have receptor sites on their muscle that can't receive insulin/glucose
  - Especially true for them: body uses protein/fat as energy source instead of glucose
  - If a Type 2 isn't on insulin, then they will respond the same way as any other person in terms of glucose levels. ("normal" people get shaky/tired/irritable when they haven't eaten)
  - For a Type 2, receptor sites are still open, so exercise can help them be more receptive.

- **Prediabetes:**
  - Individuals are at very high risk to develop diabetes as the capacity of the β cells to hypersecrete insulin diminishes over time and becomes insufficient to restrain elevations in blood glucose.
  - a condition characterized by:
    - Elevated blood glucose in response to dietary carbohydrate, termed impaired glucose tolerance (IGT) and/or
    - Elevated blood glucose in the fasting state, termed impaired fasting glucose (IFG)
- **HbA1c (glycated hemoglobin)** → test used to look at plasma glucose concentration control over 2 – 3 months (long-term glycemic control).
  - For diabetic, treatment goal is < 6.5 (7)% glucose
    - … so if they're HbA1c is > 7%, they probably have diabetes.
  - For non-diabetic, goal is 4-6 % glucose
- **IGT (Impaired Glucose Tolerance) or IR (Insulin Resistance) Diagnostic Criteria: (p. 279, table 10.5)**
  - Diagnosed with OGTT (Oral Glucose Tolerance Test) → drink it; body should take glucose levels back to normal in 2 hrs if they do not have IGT or IR. (this test isn't used that often)
  - Prediabetes (on way to diabetes) → 140 – 199 mg/dL
  - Diabetes → ≥ 200 mg/dL
- **IFG (Impaired Fasting Glucose) Diagnostic Criteria: (p.279, table 10.5)**
  - Test that most physicians use.
  - Prediabetes → 100 – 125 mg/dL
    - So < 100 mg/dL is good…this would indicate a normal IFG.
  - Diabetes → ≥ 126 mg/dL
- **Goals for fasting plasma glucose (IFG) levels:**
  - Diabetic treatment goal → ≤ 130 mg/dL
  - Diabetic post-meal goal → < 180 mg/dL
- **Hyperglycemia** → impaired fasting glucose > 125 mg/dL or a casual glucose (taken anytime) >200 mg/dL WITH *symptoms*. (notice that this is the same criteria for DM…casual glucose MUST have symptoms included.. patient might have just eaten a dozen donuts so their glucose level might be through the roof, but that doesn't mean they have hyperglycemia b/c they don't have any symptoms…*review symptoms from above for diabetes).
  - Casual glucose levels is that which is measured at any time.
  - Develops gradually over time if the patient can't take insulin (due to economic needs, etc.)
  - Symptoms of hyperglycemia include:
    - Polyuria, fatigue, weakness, increased thirst, and acetone breath (the "fruity" breath that Dr. Kasper described it as).
- **Hypoglycemia** → blood glucose level < 70 mg/dL
  - Is any rapid drop in glucose (happens suddenly)
  - Caused by too much insulin and/or exercise
  - Take glucose tablet or eat fast-acting carb
  - Symptoms include:
    - Shakiness, weakness, abnormal sweating, nervousness, anxiety, tingling of the mouth and fingers, and hunger.

- **The fundamental goal for the management of DM:**
  - Glycemic control using diet, exercise, and, in many cases, medications such as insulin or oral hypoglycemic agents.
- **Oral glucose drug (antidiabetes medications) (p.2 of handout)**
  - Most work on receptor sites (type 2) so they'll except insulin
  - Don't have large effect on sudden drops in glucose
  - Don't interfere with HR, BP, EKG results, etc.
  - Most of these are taken 1 – 3 times a day with a meal.
  - These are the antidiabetes medications:
    - Sulfonylurea: stimulates beta cells to release more insulin
    - Meglitinide: works with similar action to sulfonylureas
    - Nateglinide: works with similar action to sulfonylureas
    - Biguanide: sensitizes the body to the insulin already present
    - Thiazolidinedione: helps insulin work better in muscle and fat; lowers insulin resistance
    - Alpha-glucose inhibitor: slows or blocks the breakdown of starches and certain sugars; action slows the rise in blood sugar levels following a meal.
- **Taking insulin** → pancreas is still putting out insulin (working hard), but gets to a point where it stops → individual hasn't been able to control glucose level (through exercise & diet) → glucose level is "out of control" →don't technicallyyy need it for survival like a type 1 patient b/c they've made certain lifestyle decisions, but if they don't make changes, obviously they need it to survive.
- **Exercise will allow a Type 1 or 2 patient to take less insulin b/c…**
  - Insulin acts like exercise (lowers blood glucose level)
  - Large amounts of both could cause hypoglycemia (dizziness, etc.)
- **3 things that need to be done with a diabetic:**
  - Metabolic control before exercise
  - Glucose monitoring before/during/after exercise
  - Carbohydrate intake monitored
- **Contraindication for exercise for Type 1 diabetic** → 250 – 300 mg/dL → take insulin if they haven't already.
  - If a patient took insulin 10 hrs ago (example) but has a contraindication glucose level → since insulin takes 30 – 60 mins to work & peaks around 1-2 hours, it is okay for the patient to take insulin again.
    - Call their doctor & have someone bring the patient their insulin
    - You want the patient to take insulin & rest for 60 mins, not exercise
  - Never take insulin & exercise
- **Contraindication for exercise for any patient (including those with DM)** → a blood glucose level of < 70 mg/dL (indicates hypoglycemia)
- **Exercise Testing:**
  - It's basically not necessary for DM patients to go through an exercise test if they have a low risk (< 10%) for CVD and are asymptomatic…but you should still start them out at a light-to-moderate intensity.