Case 15: Chronic Pancreatitis Secondary to Chronic Alcoholism

1. The pancreas is an exocrine and endocrine gland. Describe the exocrine and endocrine functions of the pancreas.

   The exocrine function of the pancreas is to secrete enzymes, electrolytes, and bicarbonate. Pancreatic enzymes aid in the digestion of carbohydrates, fats, and proteins in the duodenum of the stomach. Acinar cells secrete these enzymes which include lipase, amylase, and protease into the pancreatic duct (PCNA). Bicarbonate is also secreted by the exocrine tissue to neutralize stomach acid in the duodenum.

   The endocrine function of the pancreas is to secrete the hormones insulin, glucagon, pancreatic polypeptide, and somatostatin. The Islets of Langerhans comprise the endocrine tissue of the pancreas and contain four main cell types which each secrete a different hormone (OSU). Glucagon is secreted by alpha cells, insulin by beta cells, somatostatin by delta cells, and pancreatic polypeptide by gamma cells (OSU). Somatostatin regulates the release of insulin and glucagon which regulate blood glucose levels and are important in fatty acid and amino acid metabolism. Pancreatic polypeptide regulates both exocrine and endocrine functions of the pancreas and also affects hepatic glycogen levels and gastric secretions (OSU).

3. Dr. Bennet makes a diagnosis of chronic pancreatitis. Define chronic pancreatitis.

   Pancreatitis is inflammation of the pancreas. Chronic pancreatitis is inflammation of the pancreas which does not heal over time and progressively worsens. This chronic inflammation causes damage to the pancreas and can lead to diabetes, fat malabsorption, and fat-soluble vitamin malabsorption (Nair et. al., 2007).

5. What is the most common etiology for pancreatitis? Explain the physiological consequences of pancreatitis.

   The most common cause of chronic pancreatitis is chronic alcoholism. Damage caused by chronic inflammation and scarring of the pancreas leads to decreased enzyme and hormone production. Without pancreatic enzymes the body is unable to effectively digest macronutrients, especially fat. Lipase deficiency can lead to fat and fat-soluble vitamin malabsorption as well as steatorrhea. Protease deficiency can lead to toxin production and intestinal infections due to partial digestion of proteins and amylase deficiency can cause severe diarrhea (PCNA). Damage to the beta cells of the Islets of Langerhans leads to decreased insulin production which can lead to the development of diabetes mellitus (PCNA).

8. One year ago, Ms. Jordan weighed 140 lbs. On admission, she weighed 112 lbs. Calculate her percent weight loss.

   \[
   \frac{140-112}{140} = \% \text{ weight loss} \\
   = 20\% \text{ weight loss}
   \]

9. Calculate her BMI.

   \[
   \frac{112 \text{ lb.}}{2.2} = 50.909 \text{ kg} \\
   \frac{68 \text{ in.} \times 2.54}{100} = 1.727 \text{ m}
   \]
BMI = $\frac{50.909 \text{ kg}}{(1.727 \text{ m})^2} = 17.14$ (BMI $\leq 18.5$ = underweight)

10. After assessing her weight status, identify nutrition problems using the correct diagnostic term.
   - Malnutrition
   - Altered GI Function
   - Impaired Nutrient Utilization
   - Excessive alcohol intake
   - Inadequate fiber intake
   - Underweight
   - Unintentional weight loss
   - Food- and nutrition-related knowledge deficit
   - Undesirable food choices

11. Using the Mifflin-St. Jeor equation, estimate Ms. Jordan’s energy needs at her current weight.
    
    \[
    \text{REE (kcal/d)} = (10 \times \text{wt kg}) + (6.25 \times \text{ht cm}) - (5 \times \text{age}) - 161
    \]
    
    \[
    = (10 \times 50.909) + (6.25 \times 172.72) - (5 \times 30) - 161
    \]
    
    \[
    = 509.09 + 1079.5 - 150 - 161 = 1277.59
    \]
    
    \[
    = 1277.59 \times 1.3 \text{ (activity factor)} = 1660.867
    \]
    
    \[
    = 1660.867 \times 1.3 \text{ (injury factor)} = 2159.127
    \]
    
    - This patient requires approximately \textbf{2160 kcal/day}.
    - According to the Nutrition Care Manual for chronic pancreatitis, when estimating energy needs injury status is comparable to that of trauma or burn patients. The injury factor assigned to trauma and burn patients is 1.3 (NCM 2012).

12. Calculate Ms. Jordan’s protein needs
    
    \[1.2 - 1.5 \text{ g/kg BW/d}\]
    
    \[1.2 \text{ g} \times 50.909 \text{ kg} = 61.09\]
    
    \[1.5 \text{ g} \times 50.909 \text{ kg} = 76.36\]
    
    This patient needs between \textbf{61 grams and 76 grams} of protein per day (NCM 2013).

15. Estimate Ms. Jordan’s usual dietary intake for the following:

<table>
<thead>
<tr>
<th></th>
<th>At Home</th>
<th>On the Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>45.43 g</td>
<td>69.57 g</td>
</tr>
<tr>
<td>Alcohol kcal</td>
<td>318 kcal</td>
<td>487 kcal</td>
</tr>
<tr>
<td>Total energy</td>
<td>1401 kcal</td>
<td>1986 kcal</td>
</tr>
<tr>
<td>% energy as alcohol</td>
<td>22.7%</td>
<td>24.52%</td>
</tr>
<tr>
<td>Protein</td>
<td>65 g</td>
<td>49 g</td>
</tr>
</tbody>
</table>
From nutrient report (at home):
- Total kcal = 1401
- Total alcohol kcal = 318
- Calculations:
  - 318 kcal / 7 kcal/g = 45.43 g
  - 318 kcal / 1401 kcal = 22.7%

From nutrient report (on the road):
- Total kcal = 1986
- Total alcohol kcal = 487
- Calculations:
  - 487 kcal / 7 kcal/g = 69.57
  - 487 kcal / 1986 kcal = 24.52%

16. Hospital day 2: Patient remains stable on IV fluid. Her pain has been somewhat controlled with parenteral analgesics, but she is still unable to eat. Dr. Bennet consults you to evaluate the parenteral nutrition she has suggested: a dextrose-based parenteral solution with 4.25% amino acids, 25% dextrose, electrolytes, vitamins, and trace elements at a rate of 85 cc/hr with 500 cc/day of 10% lipids. Will this meet the patient’s protein and energy needs?
- Total volume = 85 mL x 24 hr = 2040 mL
- 1.1 kcal x 500 cc lipid = 550 kcal from lipid
- 2040 mL - 500 mL lipid = 1540 mL remaining
- 1540 mL x 0.25 = 385 g dextrose x 3.4 kcal/g = 1309 kcal from dextrose
- 1540 mL x 0.0425 = 65.45 g amino acids x 4.0 kcal/g = 261.8 kcal from amino acids (61-76 grams of protein required/day)
  - Total kcal provided = 2120.8 kcal (Energy requirement: ~2160 kcal/day)
  - Yes. This parenteral solution will provide adequate amounts of both energy and protein needs.

17. When developing parenteral regimens during pancreatitis, you may find that patients have difficulty with high-dextrose solutions as well as lipid emulsions. What guidelines exist for handling these situations?
   Current recommendations are to ensure appropriate infusion rates for both dextrose solutions and fat emulsions and temporarily to discontinue infusion if persistent hypertriglyceridemia occurs. Initiate TPN at half the goal rate to prevent hyperglycemia and refeeding syndrome in severely malnourished patients with a maximum of 15-20 kcal/kgBW. Critically ill patients should receive no more than 2 mg/kg/min dextrose or 100-200 g/d. Lipids should constitute <30% of total calorie intake and should be infused continuously (Nelms 2011).
   Patients with a history of chronic alcoholism should also be supplemented with thiamin (100 mg), a multivitamin and mineral supplement, and K, Mg, and P if needed prior to feeding (NCM 2012).
23. **Dr. Bennet specifically wanted to see Ms. Jordan’s blood glucose level. Why?**

   The pancreas normally aids in food digestion and blood glucose control. Chronic pancreatitis can lead to decreased insulin production by beta cells of the Islets of Langerhans and therefore blood glucose levels increase leading to hyperglycemia. Assessing a patient’s blood glucose levels can provide information regarding pancreatic endocrine function. Also, poor glucose control is associated with increased infection rates, organ failure, days on ventilation and even mortality (Nelms et. al, 2011). Ensuring a patient’s glucose levels are under control is a pertinent component of patient care.

25. **Why were thiamin, folic acid, and a multivitamin supplement ordered on admission?**

   Patients with alcohol-related pancreatitis are at highest risk for refeeding syndrome and vitamin and nutrient deficiencies, and malnutrition is also an additional high-risk factor. Alcoholism is most commonly associated with thiamin and folic acid. Micronutrient deficiencies common in patients who are chronic alcoholics also include pyridoxine, vitamin C, A, and K, zinc, and magnesium (AND, 2013).

27. **Ms. Jordan’s mean corpuscular volume (MCV) was elevated on admission. What might cause this?**

   Elevation of a patient’s mean corpuscular volume (MCV) is an indication of many possible nutrition-related problems. Vitamin B12 deficiency, folic acid deficiency, liver disease, alcohol abuse, reticulocytosis, hypothyroidism, and myelofibrosis are the most common causes of elevated MCV levels (Sun et. al., 2005). Ms. Jordan’s MCV elevation was most likely a result of chronic alcohol abuse and possibly partly due to folic acid deficiency. The hematology panel for Ms. Jordan does not include a plasma folate level.
References


