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Case Study 11
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Case Study 11: Inflammatory Bowel Disease: Crohn's Disease

1. What is inflammatory bowel disease? What does current medical literature indicate regarding its etiology?

Inflammatory bowel disease is defined as “an autoimmune, chronic inflammatory condition of the gastrointestinal tract” (Nelms, 2011, pg. 377). This condition can consist of one of two diagnoses of either ulcerative colitis or Crohn's disease. Ulcerative colitis is a condition in which the inflammatory response is in result of damage to the gastrointestinal mucosa. This tends to be linked with smokers. Crohn's disease is a condition in which there is an abnormal response resulting in inflammatory damage to the gastrointestinal mucosa and is also linked with smoking. The two conditions differ in the signs and symptoms as well as pathology.

Current medical literature indicates that the complete etiology of each condition is still unknown. Suggested factors include environmental factors, smoking, infectious agents, intestinal flora, and physiological changes in the small intestine from which an abnormal response is triggered. Genetics have also been identified to be a strong factor in the determination of an inflammatory bowel disease diagnosis. (Nelms, 2011, 414-417).

2. Mr. Sims was initially diagnosed with ulcerative colitis and then diagnosed with Crohn's. How could this happen? What are the similarities and differences between Crohn's disease and ulcerative colitis?

Ulcerative colitis and Crohn's disease both fall under the category of inflammatory bowel disease. The conditions are very similar but tend to differ in characteristics, signs and symptoms, and treatment methods. Both sexes are affected equally as for both conditions. The onset of ulcerative colitis tends to be between the ages of 20-30 years old, whereas Crohn's is generally earlier around an individual's teens to twenties. About 50% of patients suffering from ulcerative colitis have the disease only impacting the rectum. Typically, ulcerative colitis affects one section of the gastrointestinal tract at a time whereas Crohn's disease often impacts multiple areas of the gastrointestinal tract. Crohn's disease most commonly affects the ileum and the colon. Signs and symptoms of the two conditions are similar in the fact that they both present with diarrhea, abdominal pain, weight loss, and fever. Crohn's disease tends to consist of more long-term symptoms such as chronic diarrhea, anorexia, malnutrition, and delayed growth in adolescents. Both conditions can be diagnosed

with MRI, CT, ASCA/ANCA antibody tests, and calprotectin and polymorphonuclear neutrophil elastase tests. The ASCA/ANCA antibody test can be used to distinguish one disease from the other. A positive test for the ANCA antigen with a negative for ASCA indicates ulcerative colitis, while a test positive for ASCA and negative for ANCA antigen may indicate Crohn's disease (Beth Israel Deaconess Medical Center, 2014). Crohn's disease is rarely cured and almost 70% of cases require surgery. Ulcerative colitis only results in surgery about 30% of the time. Other treatments include a host of medications, often results in surgery, and many diet modifications. (Nelms, 2011, pg. 416-417).

3. A CT scan indicated bowel obstruction and the Crohn's disease was classified as severe-fulminant disease. CDAI score of 400. What does a CDAI score of 400 indicate? What does a classification of severe-fulminant disease indicate?

CDAI stands for Crohn's Disease Activity Index. This index measures the severity of the disease. A score over 150 indicates a flare up of the condition and any score over 300 indicates severe exacerbation of the disease. The patient's score of 400 indicates that he is experiencing severe exacerbation of the disease. Classification of severe-fulminant disease consists of individuals who have persistent symptoms despite of medications or they are those individuals who have high fever, persistent vomiting, evidence of intestinal obstruction, rebound tenderness, cachexia, or evidence of an abscess. (Nelms, 2011, pg. 419).

4. What did you find in Mr. Sims' history and physical that is consistent with his Crohn's? Explain.

Mr. Sims' history indicates that his diagnostic workup shows the acute disease within the last 5-7cm of the jejunum and the first 5cm of the ileum. This is consistent with the evidence that Crohn's disease impacts multiple parts of the gastrointestinal tract. The patient also complains of severe abdominal pain, constant diarrhea, and a fever, symptoms all consistent with the Crohn's diagnosis. Mr. Sims' fever was running at about 101.5 °F according to his vitals. His physical assessment determined that he has distension in the abdomen with extreme tenderness with rebound and guarding along with minimal bowel sounds. These symptoms are also considered to be consistent with his diagnosis. Finally, Mr. Sims labs evidenced that he is positive for the ASCA antigen, which is a strong indicator of Crohn's disease. Mr. Sims' low albumin levels and elevated white blood cell count are also consistent with his diagnosis. Though the white blood cell count is still within the normal limits, it does fall on the higher end of the range.

5. Crohn's patients often have extraintestinal symptoms of the disease. What are some examples of these symptoms? Is there evidence of these in his history and physical?

Extraintestinal symptoms of the disease exist in the form of osteopenia, osteoporosis, dermatitis, rheumatologic conditions, ocular symptoms, and hepatobiliary complications. After reading through Mr. Sims' physical assessment and medical history, it does not appear that he has experienced any of the extraintestinal symptoms that are often linked with Crohn's disease.

6. Mr. Sims has been treated previously with corticosteroids and mesalamine. His physician had planned to start Humira prior to this admission. Explain the mechanism for each of these medications in the treatment of Crohn's.

Corticosteroids are typically used in acute exacerbation of the condition. They work to inhibit the overall inflammatory response by suppressing the activated inflammatory markers in chronic inflammatory diseases by reversing histone acetylation of activated inflammatory genes (Barnes, 2006). They rearrange white blood cells thus reducing the amount lymphocytes as well as increased neutrophils and decreasing the production of prostaglandins. Mesalamine is also known as 5-aminosalicylic acid. Aminosalicic acid is employed in the treatment of Crohn's disease, which works as an inflammatory agent in the colon and may even work as an immune suppressant. (Nelms, 2011, pg. 389-390). Lastly, Humira is a type of biologic therapy called tumor necrosis factor (TNF) blockers. TNF attacks the gastrointestinal tract, thus resulting in inflammation. The blockers then work to bind with excess TNF in order to prevent the inflammation that occurs during Crohn's disease. (How Humira Works, 2013).

7. Which laboratory values are consistent with an exacerbation of his Crohn's disease? Identify and explain these values.

Mr. Sims labs evidenced that he is positive for the ASCA antigen, which is a strong indicator of Crohn's disease. Mr. Sims' low albumin levels and elevated white blood cell count are also consistent with his diagnosis. Though the white blood cell count is still within the normal limits, it does fall on the higher end of the range.

8. Mr. Sims is currently on several vitamin and mineral supplements. Explain why he may be at risk for vitamin and mineral deficiencies.

Crohn's disease often causes a host of malnutrition and other deficiencies due to a variety of complications. These complications include overall decreased nutrient intake, malabsorption, drug-nutrient interactions, anorexia and protein losing enteropathy. Patients suffering from IBD are at a higher risk for deficiencies in B₁₂ and iron. A normal small intestine has a receptor site that allows for

B₁₂ absorption. Because Crohn's disease affects the ileum, it tends to interfere with B₁₂ absorption in the ileum. Specifically, Mr. Sims complains of severe abdominal pain as well as severe diarrhea, which also contribute for the risk of facing deficiencies due to a limited intake because of a loss of appetite due to the conditions. (Nelms, 2011, pg. 420).

9. Is Mr. Sims a likely candidate for short bowel syndrome? Define short bowel syndrome and provide rationale for your answer.

Short bowel syndrome is defined as the decreased digestion and absorption that results from large resection of the small intestine. The prevalence of the condition is only about 4 cases per million individuals per year. The most common causes are malignancy or damage from radiation therapy. Due to the lack of evidence in Mr. Sims' file on the diagnosis of short bowel syndrome, I would not consider him a likely candidate for short bowel syndrome. Mr. Sims also has not undergone any GI tract resections. (Nelms, 2011, pg. 425).

10. What type of adaptation can the small intestine make after resection?

After resection, the small intestine undergoes a three-phase adaptation. The first period can range from 7-10 days and is characterized by extensive fluid and electrolyte losses within a large amount of diarrhea. Patients must depend on parenteral nutrition at this phase. The second phase is characterized by the reduction in diarrhea volumes. At this point, enteral nutrition should be introduced and gradually transition back to an oral diet. This period can last several months. Finally, the third phase the remaining bowel continues to adapt. Increased blood flow, secretions, and mucosal cell growth characterizes the third phase. Enteral nutrition aids in the adaptation in this phase.

11. For what classic symptoms of short bowel syndrome should Mr. Sims' healthcare team monitor?

Classic symptoms of short bowel syndrome include the inability to maintain protein, energy, fluid, electrolyte, and micronutrient balances while on a relatively normal diet. Mr. Sims' healthcare team must monitor all of these categories to ensure that he does not have short bowel syndrome. Important micronutrients to consider are his absorption of B₁₂ as well as fat-soluble vitamins. Loss of the ileum prevents the reabsorption of bile salts, which further contributes to fat malabsorption. Finally, other micronutrients that are lost with severe diarrhea are calcium, sodium, magnesium, zinc, iron, and selenium. (Nelms, 2011, pg. 425).

12. Mr. Sims is being evaluated for participation in a clinical trial using high-dose immunosuppression and autologous peripheral blood stem cell transplantation. How might this treatment help Mr. Sims?

Though the clinical trial is still being tested, the treatment may help Mr. Sims because it has been shown that employing high-dose immunosuppression and autologous peripheral blood stem cell transplant may induce remission in patients. The treatment is still being studied on the mechanisms that would cause the remission, but Mr. Sims could benefit from the decrease of symptoms of Crohn's disease. (Hasselblatt, et. al., 2012).

13. What are the potential consequences of Crohn's disease?

Crohn's disease greatly impacts the ability of the body to absorb nutrients properly, which may result in a whole host of other complications. The complications such as malnutrition, insufficient calorie intake, decreased protein intake, fluid and electrolyte imbalances, iron deficiency, as well as many other micronutrient deficiencies. Protein deficiencies often occur in patients with Crohn's disease due to increased protein needs attributed to losses from the GI tract caused by inflammation. Severe diarrhea and steatorrhea can aggravate the condition of nutrient deficiency. These deficiencies each have their own host of complications for a patient. (Nelms, 2011, pg. 425).

14. Mr. Sims underwent resection of 200 cm of jejunum and proximal ileum with placement of jejunostomy. The ileocecal valve was preserved. Mr. Sims did not have an ileostomy, and his entire colon remains intact. How long is the small intestine and how significant is this resection?

The small intestine is divided into three parts: the duodenum, the jejunum, and the ileum. The entire small intestine is about 18-25 ft. long and most digestion occurs within the first 100cm. This would mean that Mr. Sims' ileum remained unaffected by the resection; therefore he should still be able to absorb the vitamin B₁₂ and bile salts, which can only occur in this site. The ileum will also adapt and function as the jejunum in time so he will still be able to absorb the nutrients that his body needs. (Nelms, 2011, pg. 378).

15. What nutrients are normally digested and absorbed in the portion of the small intestine that has been resected?

The nutrients that are typically digested and absorbed in the portion of the small intestine that has been resected are proteins and carbohydrates. The ileum is responsible for fats bound to bile salts, fat-soluble vitamins, and vitamin B₁₂. Much of the fluid and electrolyte absorption occurs in the ileum as well. The ileum readily takes over the function of the jejunum in the case of resection once it has been adapted. (Jeejeebhoy, 2002).

16. Evaluate Mr. Sims % UBW and BMI.

Percent Usual Body Weight

$$\%UBW = (\text{current weight}/\text{usual body weight}) \times 100$$

$$\%UBW = (140\text{lb}/166\text{lb}) \times 100 = 84\%$$

$$\%UBW = (140\text{lb}/168\text{lb}) \times 100 = 83\%$$

Percent Weight Change

$$\% \text{ Change} = 100 - \%UBW$$

$$\% \text{ Change} = 100 - 84 = 16\%$$

$$\% \text{ Change} = 100 - 83 = 17\%$$

Body Mass Index

$$BMI = \text{weight (kg)} / [\text{Height (m)}]^2$$

$$\text{Weight} = 140\text{lb}/2.2\text{kg} = 63.6 \text{ kg}$$

$$\text{Height} = 69\text{in}/(39\text{in}/\text{m}) = 1.75 \text{ m}$$

$$BMI = 63.6 \text{ kg} / [1.75\text{m}]^2 = 20.8 \text{ kg}/\text{m}^2$$

Mr. Sims appears to have lost 16-17% of his usual body weight over the past several months. His BMI is 20.8 kg/m², which is considered to be on the very low end of a normal body weight after his weight loss.

17. Calculate Mr. Sims' energy requirements.

Mifflin-St. Jeor REE for Men

$$10 (\text{W in kg}) + 6.25 (\text{H in cm}) - 5(\text{age in yrs}) + 5$$

$$\text{Weight} = 140\text{lbs}/(2.2\text{kg}/\text{lb}) = 63.6 \text{ kg}$$

$$\text{Height} = 69\text{in}/(39\text{in}/\text{m}) = 1.77\text{m} = 177\text{cm}$$

$$REE = 10(63.6\text{kg}) + 6.25(177\text{cm}) - 5(35) + 5 = 1572 \text{ kcal}$$

$$TEE = 1572 \times 1.5 = 2358 \text{ kcal}$$

18. What would you estimate Mr. Sims' protein requirements to be?

Due to Mr. Sims' low protein levels to begin with in his lab results, it seems as though he would need a greater protein amount.

Estimated Protein Needs

$$(63.6\text{kg} \times 1.5\text{g}) = 95.4\text{g}$$

$$(63.6\text{kg} \times 1.75\text{g}) = 111.3\text{g}$$

Based on his current protein levels and his BMI, his estimated protein needs to be 95.4 – 111.3 g of protein per day based on the 1.5-1.75g protein/kg per day as recommended for an adult patient with his condition.

19. Identify any significant and/or abnormal laboratory measurements from both his hematology and his chemistry labs.

Mr. Sims labs evidenced that he is positive for the ASCA antigen, which is a strong indicator of Crohn's disease. Mr. Sims' low albumin

levels and elevated white blood cell count are also consistent with his diagnosis. Though the white blood cell count is still within the normal limits, it does fall on the higher end of the range. Mr. Sims' labs also showed his C-reactive protein to be high, which is also indicative of Crohn's disease. His HDL levels also appear to be low which may be an indication of fat malabsorption. As far as his hematology labs, Mr. Sims shows low levels of hemoglobin and hematocrit. These levels often signify anemia. On the other hand, his levels of transferrin, ferritin, and zinc protoporphyrin are markers for iron deficiency. Mr. Sims low vitamin D₂₅, free retinol, and ascorbic acid are all signs of vitamin deficiencies in vitamin D, vitamin A, and vitamin C.

20. Select two nutrition problems and complete the PES statement for each.

Altered GI Function (NC-1.4) –

Altered GI function related to abdominal pain and diarrhea as evidenced by diagnosis of Crohn's disease.

Inadequate Protein-Energy Intake (NI-5.3) –

Inadequate protein-energy intake related to the increased protein requirements as evidenced by Crohn's disease diagnosis and loss of appetite with diarrhea.

21. The surgeon notes Mr. Sims probably will not resume eating by mouth for at least 7-10 days. What information would the nutrition support team evaluate in deciding the route for nutrition support?

The nutrition support team would evaluate Mr. Sims overall energy intake and fluid and electrolyte balances are very important when deciding the route for nutrition support. The team must also consider Mr. Sims' protein-energy intake, his vitamin abnormalities, as well as a goal weight. The nutrition support team would also need to consider the amount of functioning gastrointestinal that is left after the resectioning. As established before, Mr. Sims' ileum was not resectioned so absorption should not be a strong complication in his case. The beginning phase of adaption for the gastrointestinal tract includes an excessive fluid and electrolyte loss with frequent diarrhea. These will all be important considerations when deciding the route for nutrition support and once all realms of intake have been considered, it is then that the nutrition support team can make their final parenteral prescription.

22. The members of the nutrition support team note his serum phosphorus and serum magnesium are at the low end of the normal range. Why might that be of concern?

Serum phosphorus and serum magnesium being at the low end of a normal range may be a concern because of these help to regulate electrolyte balance. These electrolyte balances differ from a normal

level because of the variable of absorption. The recommendation for magnesium in parenteral nutrition is 8 to 20 mEq and the recommendation for phosphorous is 20 to 40 mmol. Electrolyte fluctuations are a critical concern in the cases of parental nutrition. . (Nelms, 2011, pg. 92).

23. What is refeeding syndrome? Is Mr. Sims at risk for this syndrome? How can it be prevented?

Refeeding syndrome is the metabolic alterations that may occur during nutritional repletion of starved patients. Complications include low serum levels of magnesium, potassium, and phosphorous with potentially lethal conditions if the infusions are too rapid. Mr. Sims may be at risk for this syndrome because he is experiencing malabsorption causing him to rely on parenteral nutrition. All patients depending on parenteral nutrition are at some level of risk for developing this complication. It can be prevented through close monitoring of electrolyte and fluid balances.

24. Mr. Sims was placed on parenteral nutrition support immediately postoperatively, and a nutrition support consult was ordered. Initially, he was prescribed to receive 200 g dextrose/L, 42.5 g amino acids/L, and 30 g lipid/L. His parenteral nutrition was initiated at 50cc/hr with a goal rate of 85 cc/hr. Do you agree with the team's decision to initiate parenteral nutrition? Will this meet his estimated nutritional needs? Explain. Calculate: protein (g); CHO (g); lipid (g); and total kcal from his PN.

I do agree with the team's decision to initiate parenteral nutrition. Post-operatively, it is very unlikely that Mr. Sims would meet intake requirements through oral consumption therefore he must rely on parenteral nutrition. Mr. Sims estimated kcal/day is 2358 kcal and his protein intake is between 95.4g and 111.3g of protein per day. The PN seems to exceed his energy requirements and fall short of his estimated protein needs.

50cc/hr = 1,200 cc/day = 1.2 L/day

1.2 L (200g dextrose/L) = 240 g dextrose/day

240g (3.4 kcal/g) = 816 kcal

1.2 L (42.5g amino acid/L) = 51 g amino acid/day

51g (4 kcal/g) = 204 kcal

1.2L (30g lipid/L) = 36 g lipid/day

36g (9 kcal/g) = 324 kcal

Total kcal/day = 1344 kcal

85cc/hr = 2040 cc/day = 2.04 L/day

2.04 L (200g dextrose/L) = 408 g dextrose/day

408g (3.4 kcal/g) = 1387 kcal

2.04 L(42.5g amino acid/L) = 86.7 g amino acid/day

87.6g (4 kcal/g) = 346 kcal

2.04 L (30g lipid/L) = 61.2 g lipid/day

61.2 g (9kcal/g) = 550 kcal

Total kcal/day = 2528

(Nelms, 2011, pg. 95-97).

25. For each of the PES statements you have written, establish an ideal goal (based on the signs and symptoms) and an appropriate intervention (based on the etiology).

Goal 1

Due to the patient's altered GI function, his weight status has decreased. The main objective would be to correct his GI function through the bowel resectioning and to normalize his weight. This will be completed through the correct parenteral nutrition prescription. I would suggest the weight gain of 1lb per week by increasing his energy consumption by 500kcal/day once he is stable and can begin oral nutrition.

Goal 2

Based on the patient's low protein-energy intake, I would increase his PN protein intake in order to achieve adequate protein requirements for his condition. Monitoring laboratory results in the areas of protein, albumin, and prealbumin will be vital for the patient to successfully meet this goal.

26. Indirect calorimetry revealed the following information. What does this information tell you about Mr. Sims?

Indirect calorimetry measures a patient's energy expenditure through the body's oxygen consumption and carbon dioxide production. Based on Mr. Sims results state that his oxygen consumption is 295mL/min and when divided by his CO₂ production of 261 mL/min, his respiratory quotient was calculated to be 0.88. This RQ value of 0.88 indicates that Mr. Sims is primarily burning protein during metabolism. This also shows that his estimated energy intake should be 2022 kcal/day to meet his needs. (McClave, 2003).

27. Would you make any changes to his prescribed nutrition support? What should be monitored to ensure adequacy of his nutrition support? Explain.
- After reviewing the PN protein prescription and his estimated protein intake of 95.4-111.3g protein per day, I would increase the protein in Mr. Sims' solution. I would also increase his intake of amino acids so that he receives at least 95 g of protein per day. To ensure adequacy of his nutrition support, I would closely monitor his laboratory results to track his protein absorption along with monitoring his input/output, weight status, and other vitamin and mineral levels.

28. What should the nutrition support team monitor daily? What should be monitored weekly? Explain your answers.

The nutrition support team should monitor hyperglycemia levels daily and serum, electrolyte, BUN, creatinine, magnesium and phosphorus daily in order to be sure that his fluid and electrolyte levels are balanced. Weight, input/output, fluid status, and bowel movements should also be monitored daily. Weekly monitoring should occur for other lab values because those will have a more gradual change if there are complications rather than a daily fluctuation.

29. Mr. Sims' serum glucose increased to 145 mg/dL. Why do you think this level is now abnormal? What should be done about it?

A serum glucose level of 145mg/dL indicates that Mr. Sims' blood glucose levels are high. The level is now considered abnormal. In order to correct this problem, the PN prescription should decrease the dextrose concentration Mr. Sims is receiving until his blood glucose levels have been stabilized.

30. Evaluate the following 24 hour urine data: 24 hour urinary nitrogen for 12/20:18.4 grams. By using the daily input/output record for 12/20 that records the amount of PN received, calculate Mr. Sims' nitrogen balance on postoperative day 4. How would you interpret this information? Should you be concerned? Are there problems with the accuracy of nitrogen balance studies? Explain.

$$N_2 \text{ balance} = (\text{dietary protein intake}/6.25) - \text{urine urea nitrogen} - 4$$

$$N_2 \text{ balance} = (86.7\text{g}/6.25) - 18.4\text{g} - 4 = -8.5\text{g}$$

(Nelms, 2011, pg. 67).

An nitrogen balance of -8.5g indicates that his nitrogen balance is negative. This means that the individual is excreting more nitrogen than they are taking in. This condition is commonly attributed to patients with trauma or illness. I would be concerned because this may indicate many nutrient inadequacies. However, The apparent accuracy of 24-hour urine nitrogen as a biological marker led to the suggestion that it be used to validate estimates of protein intake from various dietary survey methods. The use of 24-hour urine nitrogen depends on the assumption that subjects are in nitrogen balance and there is no accumulation due to growth or repair of lost muscle tissue or loss due to starvation, dieting or injury. (Bingham)

31. On post op day 10, Mr. Sims' team notes he has had bowel sounds for the previous 48 hours and had his first bowel movement. The nutrition support

team recommends consideration of an oral diet. What should Mr. Sims be allowed to try first? What would you monitor for tolerance? If successful, when can the parenteral nutrition be weaned?

First Mr. Sims should follow a low-residue, lactose-free diet with small, frequent meals. As Mr. Sims begins to tolerate an oral diet, small amounts of fiber and lactose may be gradually increased. Gas producing foods such as spicy foods, fried foods, and caffeinated beverages should be avoided. If successful, Mr. Sims' can be weaned immediately as tolerated as long as levels are stabilized. (Nelms, 2011, pg. 421).

32. What would be the primary nutrition concerns as Mr. Sims prepares for rehabilitation after his discharge? Be sure to address his need for supplementation of any vitamins and minerals. Identify two nutritional outcomes with specific measures for evaluation.

Mr. Sims should be concerned with obtaining enough energy intake, protein intake, fluid and electrolyte balance, normal intake/outtake. He must also continue with vitamin supplementation to ensure adequate intake until he is digesting and absorbing the vitamins and minerals on his own. Two nutritional outcomes with specific measures for evaluation would be to increase his protein intake to at least 95g of protein per day that can be tracked through a food log and to increase his weight status back to his normal weight of 166-168lbs that can also be tracked daily by logging his weight.

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