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Crohn's Case Study
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1. Examples of extraintestinal symptoms of Crohn's Disease are arthritic, dermatologic and hepatic manifestations which are indicators of malignancy of the disease (Krause 628). There is no evidence of these extraintestinal symptoms in the patient's history or physical. It is important for a dietitian to be aware of extraintestinal symptoms during the Assessment stage of the Nutrition Care process and work with each case on an individual basis, and use lab values and other symptoms to make a correct Nutrition Diagnosis. For example if a patient had manifestations in the mouth or upper esophagus, it may be necessary to use Enteral Nutrition. If a patient has manifestations in the liver, it may be difficult for that individual to break down fats or they may increase the risk of developing gall stones (CCFA). Dermatologic manifestations would be discovered by the dietitian in the subjective assessment portion of the Nutrition Care Process. Knowing that there is a possibility for dermatologic malignancies in a patient with Crohn's Disease will rule out the suspicion of other medical conditions and deficiencies.

2. Potential Nutritional Consequences of Crohn's Disease may include:

- Anemia - This is most often a result of Crohn's Disease because of the blood loss during an exacerbation. It can also because of the inability to absorb Iron and Folic Acid which are both key elements in the synthesis of red blood cells.
- Malnutrition - It is common for patients to develop food aversions, due to past experiences with pain or discomfort from ingesting that particular food. This can lead to malnutrition and can lead to inadequate intake of both macro and micronutrients. These decreases the function of the mucosal, cellular and immune function of the GI tract (Krause 631). Malnutrition in itself can compromise the GI tract and increases the risk of an inflammatory response. It is important to be aware of food aversions and provide appropriate treatment and nutrition during remissions.

- Growth Failure - This can occur in pediatric patients if an exacerbation occurs during a preadolescent stage of life. The main cause of growth failure in pediatric patients is malnutrition. Appropriate nutrients for cell and tissue reproduction are not bioavailable because of malnutrition due to food aversions or exacerbations themselves. Enteral Nutrition is optimal, it is important to have adequate nutrition during remission periods.

- Malabsorption - It is common for fat to be malabsorbed because of hepatic manifestations and the inability to produce bile to break fats down. In Short Bowel Syndrome it is common for fat to bind to calcium, zinc and magnesium and therefore unable to be absorbed. In Crohn's disease if the ileum is removed; malabsorption of B12 and bile salts can occur. Supplementation of foods with medium-chain fatty acids are appropriate to add calories and as a binding agent for fat-soluble vitamins and nutrients.

- Inadequate Oral Intake - This would be a potential overlying problem that may be used as a nutritional diagnosis in a patient with Crohn's Disease. Inadequate Oral Intake in itself will compromise the GI tract. In a exacerbated state it is important to obtain adequate calories during the hyper metabolic state to achieve optimal health and recovery.
- Inadequate Protein Intake - Protein needs are increased as the severity of the manifestations increase. Crohn's Disease causes inflammation and is usually treated with corticosteroids which both put a patient in negative nitrogen balance. The ulcerated mucosa of the intestines

lose protein through the damaged tight junctions and result in protein losses. It is likely that if the patient is malnourished they are experiencing inadequate protein intake as well. Protein is important for tissue repair and recovery especially in a hyper metabolic state. It may be necessary to induce PN in the GI tract is not functional to insure adequate protein intake.

3. The small intestine is typically from 550cm - 750cm long, with the duodenum being .5m long, the jejunum at 200-300cm long and the ileum being 300-400cm long (Krause 9). If we assume that Mr. Smith's small intestine is 550cm long and he has had a 200cm resection, he has had 36.4% of his small intestine removed. If we assume that his small intestine is 750cm long and he has had a 200cm resection he would have 26.7% of his small bowel removed. This resection is significant and Mr. Smith has lost significant surface area.

- Mr. Smiths resection included his jejunum. The jejunum is responsible for releasing Cholecystokinin (CCK), and Gastric inhibitory peptide. CCK stimulates gallbladder contraction and the release of bicarbonate from the pancreas. Gastric inhibitory peptide slows slows gastric secretion of chyme and gastric motility (Krause 637). If this portion of the jejunum was resected Mr. Smith would have problems with malabsorption particularly with lipids and calcium, magnesium and zinc, and fat soluble vitamins. This is because the bile salts are unable to emulsify lipids so they can be digested by pancreatic lipase. Calcium, magnesium and zinc will now be more prone to bind to undigested fat and become unable to be absorbed by the microvillus of the small intestine. Jejunal resections also decrease surface area and can aid to malabsorption. This can also lead to malnutrition, not caused by complete loss of appetite. A person may be eating adequate calories but are unable to absorb certain nutrients because of loss of surface area and develop malnutrition for certain nutrients.
- Mr. Smith also had a portion of his proximal ileum resected. The ileum is responsible for absorbing the 7-10L that are secreted into the GI tract everyday. The main problem in the ileum is at the distal end where bile salts and Vitamin B_{12} are the only place absorbed. This creates problems with malabsorption of fats and fat soluble nutrients. As a result oxalate is more readily absorbed in the colon which in combination with mild-moderate dehydration can lead to renal oxalate stones. However Mr. Smith had a resection of the proximal ileum, so it is assumed he should not have these malabsorptive problems. However I would still monitor his B12 levels and Fat Soluble Vitamin levels and bone density status to ensure he is getting all of the vital nutrients needed.
- Classic Symptoms of SBS include removal of more than 2/3 of the small intestine (70-75%), weight loss, decreased transit time through the GI tract, malabsorption, electrolyte imbalances, diarrhea, and growth failure in children. However SBS does not to be defined soley by these symptoms. SBS can be more appropriately defined as, "The inability to maintain nutrition and hydration needs with normal fluid and food intake, regardless of bowel length" (Krause 637). So technically Mr. Smith would not be classified as having SBS with the percentage of bowel he has lost (26.7-36.4%). However he does have short bowel syndrome because he is unable to maintain healthy nutritional status.

4. Energy Requirements

- **Harris-Benedict Equation**

REE = 66.5 + 13.8(wt in kg) +5(ht in cm) - 6.8(age)

66.5 +13.8(63.64kg) + 5(175.26) - 6.8(35)

1583kcal

I decided to use an injury factor of 1.3 for a major surgery and a non-ambulatory factor of 1.2 because this is within the first 24 hours after surgery.

1583 x 1.3 x 1.2 = 2470kcal/day

- **Mifflin-St. Jeor Equation**

REE = 10(wt in kg) + 6.25(ht in cm) - 5(age) +5
10(63.64kg) + 6.25(175.26cm) - 5(35) +5
1562kcal

I used the same factors as used in the equation above

1562 x 1.3 x 1.2 = 2440kcal/day

- **Ireton-Jones Equations**

Spontaneous Breathing
S = 629 - 11(age) + 25(wt in kg)
629 - 11(35) + 25(63.64)
1835kcal/day

Ventilator Dependent
V = 1925 - 10(age) + 5(wt in kg) + 281(S:1, if male) + 292(T:1, if trauma present) +851(B:1, if burn present)

1925 - 10(35) + 5(63.64kg) + 281(1) + 292(1) + 851(0)
2450kcal/day

I decided to use the Mifflin St. Jeor because equation to determine Mr. Smith's energy needs. A recent study has shown that this equation was most effective in determining energy needs for average sized people (Krause 24). Ireton-Jones equations will not be used because they are more geared towards patients on ventilators and obesity, especially in the sense of permissive underfeeding.

We are going to say that Mr. Smith needs 2440kcal a day as displayed in the Mifflin-St. Jeor equation with factors of 1.2 and 1.3.

5. To calculate protein needs I will use the injury factor of 1.3 and multiply that by 63.64kg, Mr. Smith's body weight.

1.3 x 63.64kg = 83g of protein per day

6. The lab values that are consistent with and exacerbation of Crohn's disease are:
- WBC (White Blood Cell Count) -The normal range for WBC in the body is 4.3-10 x $10^3/mm^3$ Mr. Smith's WBC count is 15.5 x $10^3/mm^3$ which is notably high. This indicates that there is

inflammation occurring in the body. This also means that there is a probability of infection in the body. Both of these are consistent with an exacerbation of Crohn's disease and a high WBC is typical during exacerbation periods.

- HGC & HCT (Hemoglobin Count and Hematocrit) - The normal lab values for HGC and HCT in men are 13.5-17.5 x 10^6 /mm^3 and 40-54 x 10^6 /mm^3 respectively. Mr. Smith's values for HGC and HCT are 12.9 x 10^6 /mm^3 and 38 x 10^6 /mm^3 respectively. When these values are low it can be an indicator of anemia or blood loss. Mr. Smith's values are low, but not significant enough to indicate significant bleeding or loss of blood. During an exacerbation it is possible for the patient to loose significant amounts of blood as the exacerbation worsens. These values are slightly low and should be monitored.

- Plt ct (Platelet Count) - Normal ranges for platelet count is 140-440 x 10^3, Mr. Smith's platelet count is 452 x 10^3. Platelets are the clotting agents in our blood and the high test result for Mr. Smith is diagnostic of an exacerbation. This is the body's compensation in conjunction with WBCs for the healing process of these exacerbations.

- TIBC (Total Iron Binding Capacity) & Ferritin- Normal ranges for TIBC and Ferritin in Men are 75-175 µg/dL and 18-270 µg/dL respectively. Mr. Smiths levels for TIBC and Ferritin are 219 µg/dL and 16 µg/dL respectively. This test may be indicative of an iron defficiency, and would coincide with the effects of malabsorption of Iron during an exacerbation. This may also be a result of Mr. Smith's SBS. These tests indicate iron deficiency and anemia when TIBC is high and Ferritin is low. This means that the body has sites where iron is able to bind and when the TIBC is high it indicates that these sites are not being used. The ferritin level is low because iron is not being transferred throughout the body and ferritin is the transport mechanism for iron. This test cannot indicate an exacerbation by itself, however it can be interpreted with the other blood tests to be diagnostic of an exacerbation.

7. I agree with the team's decision to initiate PN post operatively, it is vital to restore and maintain the nutritional status of Mr. Smith and will result in quicker recovery if he is getting adequate nutrition. He will not want to eat orally right after operation so PN is necessary to obtain all the required nutrients.

Calculation to determine if the order is meeting Mr. Smith's calorie and nutrient needs.

- Mr. Smith was prescribed 200gm dextrose/L ($D_{20}W$), 42.5g amino acids/L (4.35% AA) and 30g lipid/L (500ml of 30% lipid). They want to initiate the feeding at 50mL/hour and eventually have a continuous feed of 85mL per hour. To determine if Mr. Smith's energy needs will be met, the calculation will be based off of the goal feeding of 85mL/hour over a 24 hour period.

85mL x 24 hours = 2,040mL/day

- Assuming that the lipid solution is a piggyback we will subtract it from the overall volume per day to determine the content of the AA/Dextrose solution.

2,040mL-500mL(lipid solution) = 1,540mL (1.54) $D_{20}W$/4.25% AA solution

- Now calculate the grams and kcals from the $D_{20}W$ solution

200g dextrose x 1.54L = 308g dextrose

308g dextrose x 3.4kcal/g = 1047kcal from dextrose

- Now calculate the grams and kcals from the 4.25% of AA

42.5g AA x 1.54L = 65.45g AA

65.45gAA x 4kcal/g = 262kcal

- Now we will calculate the kcals from lipid

500mL x 3.0kcal/mL = 1500kcals

Total kcals in 2040mL of $D_{20}W$/4.25% AA/500mL of 30% lipid:
1047 + 262 + 1500 = 2809kcal

- To determine fluid needs the 1mL of fluid for 1kcal will be used. If the hospital gives Mr. Smith the solution above he will need about 2801mL of fluid per day, he will only be getting about 2040mL from the solution alone.

2801mL-2040 = 761mL
Mr. Smith needs an additional 761mL of sterile water/fluid daily.

- It was determined from the Mifflin-St. Jeor Equation that Mr. Smith would be needing 2440kcal/day. The solution and rate that the hospital prescribed would provide Mr. Smith 2809kcal. This would be providing Mr. Smith with an additional 369kcal/day (2809-2440=369). So they are meeting and exceeding his caloric needs, which the excess calories are unecessary especially because they are not meeting his protein needs. Mr. Smith needs 83g of protein per day. The solution is providing him with 65.45g of protein per day leaving 17.5g of unanswered protein that Mr. Smith needs for recovery (83-65.45=17.5). I would suggest to use a higher concentrated AA solution and a lower concentrated lipid solution, this would both improve the amount of protein and slightly lower the caloric content. This is the medium that would be more beneficial for the patient to be at maximum nutritional status.

8. To reintroduce an oral diet I would keep Mr. Smith on PN and introduce a clear liquid diet to determine if he is ready for EN. On a clear liquid diet Mr. Smith would be able to consume jello, non-pulp juices, broths and liquids that do not contain residue, especially lactose. If diarrhea is not present and the patient tolerates the clear liquid diet it may be necessary to try a lactose free oral supplement. If the patient is not ready for an oral supplement a feeding tube may be necessary. It also may be necessary to use elemental formulas until the bowel is at full function because of the inability to breakdown certain nutrients. These EN methods can be used in conjunction with PN until the patient is well enough to get all protein and caloric needs orally.

Works Cited

Crohn's and Colitis Foundation of America. Web. 20 Jan. 2012. <http://www.ccfa.org/info/about/complications/liver>.

Evans, Paul E., and Darrell S. Pardi. "Extraintestinal Manifestations of Inflammatory Bowel Disease: Focus on the Musculoskeletal, Dermatologic, and Ocular Manifestations." PubMed. 19 Mar. 2007. Web. 20 Jan. 2012. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1925026/>.

Gaith Semrin, MD,Douglas S. Fishman, MD, Athos Bousvaros, MD, MPH, Anna Zholudev, MPH, Andrew C. Saunders, BS,† Catherine E. Correia, BS, Elizabeta Nemeth, PhD, Richard J. Grand, MD, and David A. Weinstein, MD, MMS. "Impaired Intestinal Iron Absorption in Crohn's Disease Correlates with Disease Activity and Markers of Inflammation." PubMed. 12 Dec. 2006. Web. 20 Jan. 2012. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2788427/>.

Lab Tests Online. Web. 20 Jan. 2012. <http://labtestsonline.org>.

Lee, Robert D., and David C. Nieman. Nutritional Assessment. Boston, MA: McGraw-Hill, 2007. Print.

Mahan, L. Kathleen., Sylvia Escott-Stump, Janice L. Raymond, and Marie V. Krause. Krause's Food & the Nutrition Care Process. St. Louis, MO: Elsevier/Saunders, 2012. Print.