**Case 11: Inflammatory Bowel Disease: Chron’s Disease Reflux Disease**

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1. **Understanding the Disease and Pathophysiology**
2. *What is inflammatory bowl disease? What does current medical literature indicate regarding its etiology?*

Inflammatory bowl disease (IBD) is an autoimmune disorder that causes chronic inflammation of the entire gastrointestinal tract (GIT). IBD is a general category of conditions that includes two specific diagnosis of either ulcerative colitis (UC) or Crohn’s disease. Although the exact etiology for IBD is unknown, the current hypothesis is that IBD is due to the interactions of the environment and clinical factors that cause an immune response for individuals with predisposed genetics (Nelms, 418). The environmental that are linked to IBD include smoking, infections agents, the intestinal flora, the individuals diet, and the changes in the small intestine, which then triggers this inflammatory response. In addition to the environment, an individual’s genetic composition has a strong correlation to IBD and there is a positive family history in 5%-15% of IBD patients. It is believed that individuals who are at greater risk due to genetics and then are exposed to certain triggers have this chronic inflammation of the GIT (Nelms, 418). IBD causes the “release of cytokines that direct an excessive and abnormal inflammatory reaction that ultimately destroys the intestinal mucosa” (Nelms, 418).

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

It is very possible that Mr. Sims was told to have ulcerative colitis (UC) and then Chron’s because they both are an IBD. Both UC and Chron’s have the intestinal wall that is thinned because of the black of mucosa and therefore can become ulcerated. UD only has damage to the intestinal mucosa of the first two layers of tissue, which includes the mucosa and superficial submucosa within either the colon or rectum. UC is said to only affect one part of the GIT at a time, compared to Chron’s disease can affect multiple parts of the GIT at a time and can skip over certain sections. Specific to Chron’s disease it can affect any part of the GIT from the mouth all the way to the anus but 75% of individuals experience some form of small intestine problems. While UC only damages two layers of the GI mucosa, Chron’s can damage all the layers on the GI mucosa. The inflammation results in the development of fistulas, which are abnormal connections between an organ, vessel or intestine and another structure. Many of the symptoms of UC include abdominal pain, bloody diarrhea, and the urgency for passing a bowl movement (tenesmus). Then compared to Chron’s the patient may experience abdominal pain, diarrhea, and tenesmus. It is clear that the symptoms of both IBD are very similar. Additionally, the radiological testing done for UC includes looking how severe the inflammation of the colon and rectum with thickened walls and ulcerations and see large bowel. The radiological testing done for Chron’s includes the presence of small bowels and abnormalities of the ileum with evidence of strictures. In all IBD the test to measure antibodies is the serological markets to look at the level of cytokines, antiglycan antibodies. We can see the general diagnosis, the signs and symptoms, and testing done are very similar and can be easily confused (Nelms, 419).

1. *A CT scan indicated bowl obstruction and the Crohn’s disease was classified as severefulminant disease. CDAI score of 400. What does a CDAI score of 400 indicate? What does a classification of severe-fulminant disease indicate?*

The CDAI is the Crohn’s Disease Activity Index, which is used as the primary evaluation index to look at the “disease activity at the inclusion of the study and to assess therapeutic success of therapy” (American Gastroenterological Association, 2013). The overall purpose of the CDAI score is to have easy to use straightforward data related to the clinical symptoms of the patient. A CDAI score of less than 150 means that patients could be in remission and still have colonic inflammation. A CDAI score of 200-450 indicates moderate activity have failed to respond to treatment. These patients display symptoms such as fever, significant weight loss, abdominal pain or tenderness, nausea or vomiting or significant anemia. Patients with a CDAI score greater than 450 (up to 600) indicates persistent symptoms even though corticosteroids or other medications have been introduced, have severe activity and have high fevers, persist vomiting, signs of intestinal obstruction, rebound tenderness, cachexia, or evidence of abscess (American Gastroenterological Association, 2009). A severe-fulminant disease is usually a CDAI score of greater than 450, and the patient would display the symptoms within that score category of the symptoms listed previously. With a score of 400 the patient, the patient is diagnosed with severe active crohn’s and will display many of the symptoms associated with it.

1. *What did you find in Mr. Sims’ history and physical that is consistent with his diagnosis of Crohn’s? Explain.*

Mr. Sims was diagnosed with Crohn’s disease 2 and a ½ years ago. The patient was originally diagnosed with acute disease within the last 5-7 cm of the jejunum and first 5 cm of the ileum. Mr. Sims chief complaint is that his abdominal pain is unbearable and has diarrhea constantly and now running a fever (Nelms, 116). Additaionlly Mr. Sims stated that the pain and diarrhea make his appetite so bad, so therefore it is very difficult for him to eat (Nelms, 119). Symptoms of Cronh’s disease that Mr. Sims displays is abdominal pain, diarrhea, serve abdominal pain, a fever of 101.5°F and decreased oral intake (Nelm, 419). Crohn’s disease presents lab values of low albumin levels, elevated WBC and the presence of Antisaccharomyes cerevisiae antibodies (ASCA) (Nelms, 420). Mr. Sims lab results indicated his albumin levels are 3.2 g/dL is slightly below the normal range of 3.5-5.0 g/dL, then his WBC are 11.1 x 103/ mm3 which is at the upper portion of the normal range from 4.8-11.8 x 103/ mm3, and lastly the ASCA results tested positive for the antibody when it should test negative (Nelms, 120). Additiionaly, based on the patient history, Mr. Sims had weight loss from 168 pounds to 140 pounds in a 6 month time period.

1. *Chron’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 Chron’s disease are any type of disease manifestations that an individual may experience that are outside of the GI tract. Normally these would include osteopenia, osteoporosis, dermatitis, rheumatological conditions such as ankylosing spondylitis, ocular symptoms, and hepatobiliary complications (Nelms, 420). Based on Mr. Sims chart he has no extraintestinal symptoms.

1. *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.*

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| Corticosteroids | Used in acute exacerbations specifically include prednisone and budenoside especially in severe- fulminant disease (Nelms, 420). These may impact nutritional status by either increasing nutrient requirements or worsening nutrient loss. These steroids suppress the entire immune system and not a specific part of the immune system (Chron’s & Colitis Foundation of America, 2015).  |
| Mesalamine | Mesalamine is a Aminosalicylate medication which involves the ileum and colon (Nelms, 420). They work at the lining of the GI tract and decreasing inflmatation and work best in the colon. (Chron’s & Colitis Foundation of America, 2015) |
| Humira  | The generic name for this drug is adalimumab. Adalimumab reduces the substance in the body that can cause inflammation and therefore is used to treat Crohn’s disease (Rxlist, 2015). Other drugs that may interact include prescription, over the counter, vitamin and herbal products (Rxlist, 2015). Adalimumab falls under the category of monoclonal tumor necrosis factor antagonists (anti- TNF) which inactivate one of the primary inflammatory cytokines (Krauses’s, 631).  |

1. *Which laboratory values are consistent with an exacerbation of his Crohn’s disease? Identify and explain these values.*

The laboratory values that are consistent with exacerbation of Mr. Sim’s Crohn’s disease include his level of cytokines (IL-1, IL-6), antiglycan antibodies (ASCA), C-reactive protein and erythrocyte sedimentation rate (ESR), calprotectin (Cal), lactoferrin (Lf), polymorpho-nuclear neutrophil elastase (PMN-e), white blood cell count and leukocytes in stool (Nelms, 419). First Mr. Sims level of protein is 5.5 g/dL, albumin 3.2 g/dL, prealbumin 11 mg/ dL are all too low. Also the c-reactive protein is 2.8 mg/dL is too high. The HDL-C is 38 mg/dL is low, also there is a presence of ASCA , PT is 15 sec, the hemoglobin is 12.9 g/dL, hematocrit is 38 %, transferrin 180 mg/dL, ferritin 16 mg/mL, ZPP 85 μmol/mol, vitamin D 22.7 ng/mL, free retinol 17.2 μg/dL, and ascorbic acid less than 0.1 mg/dL. All of these lab values were abnormal, (low and high respectively) due to malabsorption of nutrients.

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

Mr. Sims may be at risk for vitamin and mineral deficiencies because they have deficiencies in iron, magnesium, zinc, calcium, vitamin D, vitamin B12, folate, water-soluble vitamins and fat-soluble vitamins. These deficiencies can be cause by decreased nutrient intake, mal-absorption, drug-nutrient interactions, and protein- losing enteropathy (Nelms, 421). This can lead to anemia, osteoporosis, poor wound healing and compromised immune system. To prevent further complications on top of the Crohn’s disease is important to be on the necessary vitamin and mineral supplements. Also because of Mr. Sims report of pain from diarrhea and therefore has decreased intake oral intake this pain can cause anorexia, which will then further decrease his disease (Nelms, 421). When there is infection an inflammation of the GIT, the energy needs for that patient need to be significantly increased. Also diarrhea can worsen the loss zinc, potassium and selenium (Krause’s, 632). Also since Mr. Sims is on corticosteroids and result in osteoporosis, hyperglycemia and nitrogen wasting, which further increases his absorption of vitamins and minerals. To combat the corticosteroids, Mr. Sims should be put on a calcium and vitamin D supplement (Krause’s, 632).

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

Short bowl syndrome (SBS) is “intestinal failure from the result form a large resection of the small intestine, congenital defect or disease-associated loss of absorption and characterized by the inability to maintain protein, energy, fluid, electrolyte, or micronutrient balances when on a normal diet” (Nelms, 426). With result of the surgery and only 100 cm of the small intestine is left, malabsorption will occur. The severity of the signs and symptoms of short bowl syndrome is dependent on the presence of the ileocecal value and the colon (Nelms, 426). Some of the signs and symptoms include malabsorption of macronutrients/ micronutrients, frequent diarrhea, and weight loss, which all of these symptoms Mr. Sims displays (Krause’s, 637). One of the most common causes of SBS is Crohn’s disease. Mr. Sims is a potential candidate for this surgical resection of the small intestine based upon the fact he is unable to maintain his nutritional and hydration needs with normal food and food intake (Krause’s, 637). Currently, he is not a candidate for SBS due to not yet having surgery.

1. *What types of adaptation can the small intestine make after resection?*

After resection the small intestine can be explained in three post- operative phases. The first period occurs for 7- 10 days and has extensive fluid and electrolyte losses within large volumes of diarrhea. A patient in this state would be completely dependent on parenteral nutrition which includes nutrient requirements but as well as water and electrolyte balance (Nelms, 427). An enteral feeding is a feed directly into the gut through a tube to receive all necessary micronutrients and macronutrients. The early exposure to an enteral feeding will support the best adaptation for the small and large intestine (Nelms, 427). The second phase that patient will go through can last for several months and the main characteristic is the reduction in diarrhea volumes with the initial stages of adaptation of the remaining bowel. During this stage the patient will still be on the enteral nutrition but will be introduced with a gradual transition to an oral diet (Nelms, 427). The last stage is the continued adaption of the remaining bowel, which can last anywhere from 1-2 years. The progress that will be made in the small intestine is increased blood flow, secretions and mucosal cell growth. Inside of the small lumen of the small intestine the diameter will increase and will have increased villi, which will then allow for a greater area of absorption (Nelms, 427). After a resection the small intestine is able to adapt to the changes and unless more than 50% is removed then there will not be significant nutrient deficit, but the rate of absorption may be compromised (Krause’s, 637).

1. *For what classic symptoms of short bowl syndrome should Mr. Sims’ health care team monitor?*

The classic symptoms of short bowl syndrome that Mr. Sims’ health care team needs to monitor are vitamin and mineral losses. Due to the loss of the ileum this prevents B12 from being absorbed and therefore bile salts can not be reabsorbed. Therefore because the bile salts are not reabsorbed there is a reduction in quantity. Bile salts are especially important for absorbing fats, and will cause the small and large intestine the inability to absorb the necessary amount of vitamins A,D, E and K (Krause’s, 637). The levels of these vitamins, along with nutrients including sodium, magnesium, iron, zinc, selenium and calcium will need to be evaluated. The main focus that the medical care team will focus on is watching the fluid and electrolyte balance through parenteral nutrition and intravenous support (IV), and by oral rehydration if possible. Also the rate of motility will need to be monitored to treat the symptoms of diarrhea or thicken the stool consistency. There are certain medicines that Mr. Sims could be put on such as LoMotil, Immodium, paregoric, codeine, Tincture or Opium, Kaopectate or bismuth subsalicylate. Also Octreotide could be used to reduce the level of growth hormone to treat diarrhea. All of these mediations help with the control of symptoms by improving digestion by increasing the amount of time the nutrients and enzymes are exposed within the bowl. There is a new class of medication called somatropin that could also be used to enhance the cell proliferation of the intestines. With all of these mediations it is very important to monitor the vitamin, mineral, fluid and electrolyte balance to ultimately slow GI motility, decrease secretions or treat the bacterial overgrowth (Krause’s, 637).

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

High-dose immunosuppressions are mediations that an individual who has a transplant takes to prevent acute body’s rejection of a transplant and maintain long-term survival of the transplant (Nelms, 550). Autologous peripheral blood stem cell transplantation (auto PBSCT) is using CH34 stem cells has been shown to be effective for inducing remission for patients with Crohn’s disease (National Library of Medicine, 2012). The main goal of this procedure would be to reset the immune system cells, which is believed that these cells will mature into immune cells without the inflammation that is present in Crohn’s disease (Children’s Hospital of Pittsburgh, 2015). To understand how stem cells in the small intestine would be utilized it is important to look at the anatomy of the small intestine. The small intestine is made of finger-like projections called villi, and the villi is covered of fine hairs called microvilli. This surface area of the small intestine is called the brush border and creates a huge surface area for absorption within the small intestine. Between each villi are spaces called crypts, and within the crypts is the location of where the stem cells of the small intestine are located (Nelms, 379). Within each villi the stem cells travel up villi and serve a particular function and are then sloughed off and replaced with new enterocytes. It is known that enterocytes have a rapid turn-over rate because they have a high nutrient need that must be met to maintain the health of the small intestine. Because Mr. Sims nutritional status is decreased, this malnutrition decreases the regeneration of these cells, which reduces the height of villi therefore effecting absorption (Nelms, 379). With the decreased health of the villi, this therefore decreases the small intestines ability to properly absorb and digest all macronutrients and micronutrients. It is suggested that Mr. Sims would receive auto PBSCT to reset the enterocytes in his small intestine and ultimately increase his ability to absorb and digest food to improve his nutritional status. Using high-dose immunosuppression with the autoPBSCT this would help his body to accept the new stem cells.

1. **Understanding the Nutrition Therapy**
2. *What are the potential nutritional consequences of Crohn’s disease?*

There are many potential nutritional consequences of Crohn’s disease include nutrient deficiency of calories, protein, fluid and electrolytes, iron, magnesium and zinc, calcium and vitamin d, B12, folate, water-soluble vitamins, and fat-soluble vitamins. There would be insufficient calories because of the insufficient intake of calories, anorexia, increased energy requirements and fair of abdominal pain and diarrhea after eating. The protein intake needs to be increased because of possible causes of the losses from GI tract caused by the inflammation, catabolism from taking steroids, healing from surgery. The fluid and electrolytes would need to be increased because of having short bowel syndrome and a high volume of diarrhea. The iron intake would need to be increased because of the possible cause of blood loss, and malabsoprtion. Magnesium and zinc also is a concern for a nutrient deficiency which could be from intestinal losses, especially from short bowl syndrome or high-volume diarrhea. The calcium and vitamin D would need to be increased due to long-term steroid use, and decreased intake of dairy food as a result of lactose-restricted diets. Additionally, B12 would be a deficiency due to surgical resections of stomach from the loss of intrinsic factors and the terminal ileum, which provides the site of absorption. Folate, would also be another nutrient that would be deficient because of Crohn’s disease, which would be due to the medications used to treat IBD. Both water-soluble and fat-soluble vitamins would also be deficient. The cause of a deficiency of water-soluble vitamins is due to surgical resections from the loss of the terminal end of the ileum. Lastly fat-soluble vitamins would be deficient because of steatorrhea, which is the excess amount of fat in the stool (Nelms, 420).

1. *Mr. Sims underwent resection of 200 cm of jejunum and proximal ileum with placement of jejunostomy. The ileocecal value 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 a totally of 365-600 centimeters long divided into three sections. The duodenum is 25-30 centimeters long, the jejunum is 200-250 centimeters long and the ileum is 350 centimeters long (New World Encyclopedia, 2011). In both the duodenum and the jejunum, carbohydrates and proteins are absorbed (Nelms, 385). The ileum breaks down and absorbs fat, monosaccharides, amino acids, small peptides, bile-salts and acids, and vitamin B12 (Nelms, 387). Both the ileum and the colon are important in regulating fluids and electrolytes that are absorbed. The significant of this resection is that when there is more than 50% of the small intestine has to be removed before any significant resection in its capability is observed (Nelms, 381). and therefore will result in nutrition related deficient and malabsorption (Nelms, 427). Because only 200 cm of the jejunum is removed the ileum will adapt to perform the function of the jejunum (Krause’s, 637).

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

The small intestine is made up of three sections. Mr. Sims had resections on the jejunum and proximal ileum. The duodenum and the jejunum are responsible fore absorbing macronutrients such as carbohydrates and protein (Nelms, 387). The ileum is responsible for the absorption of lipids, vitamin B12, and bile-salts. The “ileum can accommodate absorption of many nutrients if foodstuffs remain there long enough” (Nelms, 383). The hormones present in the ileum help regulate gastric emptying and the movement of food through the gastrointestinal tract (Nelms 383).

**III. Nutrition Assessment**

1. *Evaluate Mr. Sims’ % UBW and BMI.*

%UBW = (Current Body Weight / UBW) x 100

%UBW = (140 lbs. / 168 lbs.) x 100

**%UBW = 83.33%**

Ht: 5’9”; Wt: 140 lbs.

BMI = wt. (kg) / ht. (cm)2

BMI = [(140 lbs. / 2.2 kg) / (69 in. x 2.54 cm)2]

BMI = 63.6 kg / (175.26 cm)2

BMI = 63.6 kg / (1.75)2

**BMI = 20.7**

1. *Calculate Mr. Sims’ energy requirements.*

Hamwi Method:

IDB = 106 lbs. + (6 lbs. x inch. over 5 ft.)

IDB = 106 lbs. + (6 lbs. x 9 in.)

**IDB = 160 lbs.**

**IDB =** 160 lbs. / 2.2 kg = **72.7 kg**

Adjusted Body Weight:

ABW = IBW + 0.25 (UBW - IBW)

ABW = 160 lbs. + 0.25 (168 lbs. - 160 lbs.)

ABW = 160 lbs. + (0.25 x 8 lbs.)

ABW = 160 lbs. + 2 lbs.

**ABW = 162 lbs.**

**ABW =** 162 lbs. / 2.2 kg = **73.6 kg**

Mifflin St. Jeor:

EER = [10 x ABW (kg) + 6.25 x ht (cm) - 5 x age (yrs) + 5] x PAL

EER = [10 x 73.6 kg + 6.25 x 175.26 cm - 5 x 35 + 5] x 1.2

EER = [736 + 1095.375 - 175 + 5] x 1.2

EER = [1661.38] x 1.6

EER = 2658.20 kcal

**EER Range = 2,600- 2,700 kcal**

1. *What would you estimate Mr. Sims’ protein requirements to be?*

Protein Requirements:

PRO = Factor x ABW

Protein range= 1.0-1.5 g/kg (Nelms, 421)

PRO = 1.0 g/kg/day x 73.6 kg PRO = 1.5 g/kg/day x 73.6 kg

PRO = 73.6 g/kg/day PRO = 110.4 g/kg/day

**PRO = 73.6 g/kg/day – 110.4 g/kg/day**

**PRO= 70 g/kg- 110 g/kg**

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

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| **Chemistry** | **Reference Range** | **2/15 1952** | **Explanation**  |
| Protein, total (d/dL) | 6-8 | 5.5 | A decreased level show malabsorption of protein |
| Albumin (g/dL) | 3.5-5 | 3.2 | A decreased level show malabsorption of protein |
| Prealbumin (mg/dL) | 16—35 | 11 | A decreased level show malabsorption of protein |
| C-reactive protein (mg/dL) | <1.0 | 2.8 | A decreased level show malabsorption of protein |
| HDL-C (mg/dL) | >55 F, > 45 M | 38 |  |
| ASCA | Negative | + | Positive results indicates the antibody that is a biomarker that tests for the presence of the disease |
| **Hematology** |  |  |  |
| Hemoglobin (Hgb, g/dL) | 12-15 F, 14-17 M | 12.9 | A decreased level indicates anemia  |
| Hematocrit (Hct, %) | 37-47 F, 40- 54 M | 38 | A decreased level indicates anemia |
| Transferrin (mg/dL) | 250-380 F, 215-365 M | 180 | Decreased level indicates malabsorption of iron  |
| Ferritin (mg/dL) | 20-120 F, 20-300 M | 16 | Decreased level indicates malabsorption of iron |
| ZPP (μmol/mol) | 30-80 | 85 | Decreased level indicates malabsorption of iron |
| Vitamin D 25 hydroxy (ng/mL) | 30-100 | 27.7 | A decreased level indicated a malabsorption of Vitamin D |
| Free retinol vitamin A; μg/dL | 20-80 | 17.2 | A decreased level indicated a malabsorption of Vitamin A |
| Ascorbic acid (mg/dL) | 0.2-2.0 | 0.1 | A decreased level indicated a malabsorption of Vitamin C |

**IV. Nutrition Diagnosis**

1. *Select two nutrition problems and complete the PES statement for each.*
* Inadequate oral intake (NI-2.1) related to previous diagnosis of inflammatory bowl disease three years ago and patient report of abdominal pain and diarrhea evidence by 26 pound weight loss over 6 month period.
* Inadequate protein intake (NI-5.7.1) related to IBD and Crohn’s disease as evidence by total protein of 5.5 (g/dL), albumin 3.2 (g/dL) and prealbumin 11 mg/dL.

**V. Nutrition Intervention**

1. *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?*

Since Mr. Sims will not resume eating for at least 7-10 days the nutrition support team would need to evaluate the patient based on the jejunostomy that the patient had. Enteral nutrition is “using the GIT via tube feeding when the location of nutrient administration and type (Krause’s, 309). There are two types of eternal feedings which include open or close bag system. If Mr. Sims needed to go on a tube feed for his jejunostomy long term, a percutaneous endoscopic gastrostomy (PEG) would be used, which is nonsurgical techniques for placing a tube directly into the stomach through the abdominal wall (Krause’s, 310). Since this procedure has already been completed it would be appropriate to use this tube to do a feeding by injecting from a syringe or connect it to a feeding bag. It would be important to ensure post surgery that the tube is in working condition and nothing went wrong during the procedure. There are risk associated with this type of feeding including risk of irritation and infection from the insertion site, the risk of clogging may be greater and it requires a pump administrated. All of these areas would need to be monitored and evaluated accordingly. Additionally, once that was checked, the nutrition care team would need to watch how the patient is tolerating the feed. Before the nutrition care team decided to make this decision they should consult Mr. Sims about his ethical considerations on the matter. Overall if the team did choose this method, it makes it much easier for Mr. Sims nutrition needs to met since the nutrition care team can select the product with the proper proportions of protein, carbohydrates, fat, vitamins, minerals, water and electrolytes (Krause’s, 93). In comparison to enteral nutrition, parenteral nutrition (PN) is the process of providing nutrients directly into the bloodstream intravenously (Krause’s 314). PN can be used with EN to meet nutritional needs of Mr. Sims (Krause’s 314).

1. *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?*

Patients that experience short bowl syndrome have a major loss of vitamins and minerals because of the large volumes of diarrhea (Nelms, 427). Serum phosphorus is dependent on the intestinal absorption and exchange between extracellular fluid and bone along with renal secretion. Phosphorous and calcium exist in a reciprocal relationship and therefore it would be important to also watch Mr. Sims serum calcium levels as well (Nelms, 133). Magnesium is necessary from cellular energy metabolism and it is closely related to calcium, potassium and phosphorus. Since half of all magnesium is absorbed in the small intestine and Mr. Sims had his surgery it would be important to monitor that the body’s levels do not get low (Nelms, 140). A condition called hypomagnesemia is there is excessive loss of magnesium through the urine. There can be malabsorption syndromes in calcium, and magnesium because of steatorrhea (Nelms, 140). An individual with hypomagnesemia will show signs and symptoms of nausea, vomiting, facial flushing and hypotension (Nelms, 141). The patient is also at increased risk for cardiac function and lead to cardiac arrest if it is not corrected (Nelms, 141).

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

Refeeding syndrome is defined as the metabolic alterations that may occur during nutritional repletion of patients who are malnourished or in a state of starvation (Nelms, 89). Refeeding syndrome can occur to individuals who have malnutrition, history of long-term inadequate oral intake and have had minimal intake for several days as a result of NPO or poor appetite. When a patient has had starvation the body shifts in the way it functions. First liver glyconeogenesis slows, free fatty acids are used to produce energy in the form of ketones and the basal metabolic rate is decreased, in order to preserve energy. When carbohydrates are introduced, the ketones are shifted to glucose as the primary form of energy. When glucose is the main energy source this requires a large amount of phosphorus. At the same time the body is trying to meet anabolic needs, it therefore requires greater amounts of magnesium, potassium, and thiamin, which then in turn decreases the amount of phosphorous. When the phosphorous levels are decreased this can result in hemolysis, impaired heart function, and impaired respiratory function. Other further complications of low phosphorous levels are hypokalemia, and thiamin deficiency. As evidence by Mr. Sims inadequate oral intake he is at risk for refeeding syndrome due to his decreased levels of serum phosphorous, and serum magnesium. Also since Mr. Sims has been on only a clear liquids diet and NPO post operation, this could be another indication. The best way to preventing refeeding syndrome is through supplementation, and monitor his levels of phosphorus, magnesium, and potassium. Also the nutrition support team should begin feedings slow and avoid overfeeding to prevent the refeeding syndrome (Nelms, 103).

1. *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 50 cc/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: pro(g); CHO (g); lipid (g); and total kcal from his PN. (page 109)*

50 cc/hr x 24 hr= 1200 cc/ day= 1.2 L/ day

85 cc/hr x 24 hr= 2040 cc/ day= 2.04 L/ day

Protein Requirements (g)

42.5 g/L x 1.2 L= 51 g/L

51 g/L x 4.3 kcal/g= **219.5 kcal**

42.5 g/L x 2.04 L= 86.7 g/L

86.7 g/L x 4.3 kcal/g= **372.8 kcal**

Average: (219.5 kcal+ 372.8 kcal) /2= **296.15 kcal**

Carbohydrates (g)

200 g/L x 1.2 L= 240 g/L

240 g/L x 3.4 kcal/g= **960 kcal**

200 g/L x 2.04 L= 408 g/L

408 g/L x 3.4 kcal/g= **1632 kcal**

Average: (960 kcal+ 1632 kcal) /2= **1296 kcal**

Lipids (g)

30 g/L x 1.2 L= 36 g/L

36 g/L x 10 kcal/g= **396 kcal**

30 g/L x 2.04 L= 61.2 g/L

61.2g/L x 10 kcal/g= **673.2 kcal**

Average: (396 kcal+ 673.2 kcal) /2= **534.6 kcal**

Total Caloric Needs

296.15 kcal + 1296 kcal + 534.6 kcal = 2126.75 kcal

Range: **2100-2200 kcal/day**

1. *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).*

Inadequate oral intake (NI-2.1) related to previous diagnosis of inflammatory bowl disease three years ago and patient report of abdominal pain and diarrhea evidence by 26 pound weight loss over 6 month period.

* Ideal Goal: Increase Mr. Sims weight back his usual body weight of 166 pounds; 26 pound weight gain in 6 months.
* Appropriate Intervention: Once patient is returns to oral diet, reduce foods that will irritate the GI tract such as whole grains, and fruits and vegetables with skins to only 1-2 per week, and increase antioxidant and omega-3 fatty acids with food such s fish, tuna, salmon, vegetable oil, and nuts to 1-2 times per week (Nelms, 422).

Inadequate protein intake (NI-5.7.1) related to IBD and Crohn’s disease as evidence by total protein of 5.5 (g/dL), albumin 3.2 (g/dL) and prealbumin 11 mg/dL.

* Ideal Goal: Increase protein consumption to 40 grams per day.
* Appropriate Intervention: Once patient returns to oral diet, increase low fiber protein source such as chicken, tofu, or ground meat once a day (Nelms, 421).

**VI. Nutrition Monitoring and Evaluation**

1. *Indirect calorimetry revealed the following information:*

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| **Measure**  | **Mr. Sims’ data** |
| Oxygen consumption (mL/min) | 295 |
| CO2 production (mL/min) | 261 |
| RQ | 0.88 |
| RMR | 2022 |

*What does this information tell you about Mr. Sims?*

An indirect calorimetry is a measurement an individual’s energy requirements for critically ill patients. This formula is based upon the fact that energy expenditure is proportional to the body’s oxygen consumption and carbon dioxide production. Expire air contains less oxygen and more carbon dioxide than inspire air. When you know the amount oxygen and carbon dioxide that is inhaled and exhaled, along with the volume of are you are able to measure the body’s expenditure of energy (Nelms, 254). Based on the measurements, Mr. Sims oxygen consumption if elevated, so we know he is has a higher energy expenditure than normal.

1. *Would you make any changes to his prescribed nutrition support? What should be monitored to ensure adequacy of his nutrition support? Explain.*

Based on the calculations his prescribed nutrition support is just fine. I think depending on how he is tolerating the feedings, that the grams of protein could be increased by 5-10 grams. Since Mr. Sims is new to the tube feeding he should be closely monitored throughout (Nelms, 100). It is important the Mr. Sims is receiving the prescribed enteral nutrition and that the patient is advancing at the goal rate based upon how he handles the feed. One of the side effects of gastrointestinal complications include diarrhea, constipation, bloating, and gas. Especially in enterally fed patients diarrhea will result (Nelms, 101). It is suggested that stool samples are taken to evaluate the absorption of the small intestine (Nelms, 102). A way in which the diarrhea can be reduced is a manipulation of the formula rate, the strength and the type is a great way to control it.

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

It is very important that the nutrition support team needs to monitor that Mr. Sims is meeting his energy requirements each day. Depending if Mr. Sims is still on PN or is moving over to an oral diet, or even a combination of both it is important that Mr. Sims is consuming all energy requirements. It is also important that he is consuming 70-110 grams of protein a day to support his healing and repair. Depending on the type of diet, PN or EN the diet he is on, it is important to watch for compilations the patient may have from this type of feeding and ensure they are tolerating it well. Each day it would be important to ensure that the patient has a bowel movement each day and is not having diarrhea or any other abdominal pains. Since the main goal is to get the patient to start feeling better, it is important to ensure the patient is physically feeling better without the symptoms he was suffering prior to his hospitalization. Also it would be important to weight Mr. Sims each day and see any weight gain. Although this may not happen right away, it may be appropriate to weigh him each week. In addition, the patients hydration and fluid status would need to be monitored daily. Lastly the vitamins and minerals of the patient should be monitored daily including BUN, creatinine, magnesium, phosphorous and calcium daily (Nelms, 91).

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

Mr. Sims glucose is currently at 145 mg/dL. A normal glucose level is from 70-110 (Krause’s, 481). Based upon Mr. Sims glucose level he could possibly be diagnosed as being pre-diabetic. Pre-diabetic is defined as impaired fasting glucose or impaired glucose tolerance (Krause’s, 480). It is not a definite that Mr. Sims would be diagnosed as pre-diabetic because this is only one blood glucose reading, and it could be elevated due to his current stress levels. Being in the hospital adds a lot of extra stress on the body, which would affect his liver and increase his blood glucose levels. It is suggested to be re-tested the blood glucose levels every 4 hours for the following 3-4 days and see if those blood glucose levels are consistent with the 145 mg/dL that Mr. Sims originally had.

1. *Evaluate the following 24-hour urine data: 24-urine 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.*

The nitrogen levels are calculated from the following formula:

N2 Balance = (Protein requirement/ 6.25)- 18.4 -4

N2 Balance = (93.2 g/6.25)-18.4-4

N2 Balance = **-7.5 grams**

Based on the calculation the nitrogen level in the body is a negative value, which is low because the excretion is greater than the nitrogen intake. Assessing ones nitrogen levels measures the overall protein status of the patient and indicate if they are taking in an adequate amount. Low nitrogen levels indicate inadequate protein intake, malabsorption, or possible infection (Nelms, 57).

1. *On post-up 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?*

Mr. Sims will first be on a clear liquid diet, and then moved to a full oral diet that is low-residue and lactose-free diet. Lactose should be avoided because it may cause abdominal discomfort due to bloating and diarrhea. When the patient is moved to a full oral diet they should have small frequent meals throughout the day possibly with a modified consistency (Nelms, 421). Additionally, restricting fiber is recommended in the beginning, and then eventually small amounts can be added as tolerated. Foods that should be totally restricted include gas- producing foods, spicy or fried foods, caffeinated beverages, or any other foods that specifically cause problems for the patient. It would be important to monitor that the patient is not having abdominal pain or diarrhea. The parenteral nutrition will be weaned off when the patient is consuming enough food orally that will provide him with enough calories to meet his caloric needs. If he can not consume enough through oral nutrition, both oral and PN can be used in combination to need caloric needs (Nelms, 421).

1. *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.*

The primary nutrition concern that Mr. Sims has as he prepares for rehabilitation after his discharge is that he is meeting his EER requirements so he is able to gain the appropriate weight and is rebuilding protein stores and increase muscle mass. Post discharge it would be recommended that the patient would keep a diet log and track all of his foods in an application such as supertracker to ensure he is meeting all macronutrients and micronutrients. Another nutritional goal is to ensure the patient is not suffering from malabsopriton anymore and they should keep a stool log to report the frequency and consistency of each stool. Also in this log that patient should report any discomfort that he had before, during and after having a meal and what specific foods he had during that time period. The consumption of foods high in antioxidants and omega-3 fatty acids should be included in the diet to protect again inflammation. Also foods that are high in oxalate may increase the risk for urolithiasis which can occur in IBD patients. It would be suggested to avoid foods that include cocoa, tea, wheat germ, strawberries, nuts, spinach, beets, baked beans, peanut butter, tofu, and high doses of vitamin C (>2 g/day) (Nelms, 423). Lastly foods that use probiotics and prebiotics, which are found to enhance the normal flora of the GI and decrease symptoms. There are many types of vitamins and minerals that the patient will need to supplement including vitamin D with 50,000 IU once per week, calcium with calcium citrate of 1200-1500 mg per day, zinc 12-15 mg/liter of stool output per day, magnesium 15-30 mEq/day, and copper 0.5-1.5 mg/day (Nelms, 422).

**Resources**

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