**Megaloblastic Anemia**
NUTR 48000 MNT I
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**Introduction and Background**

**Introduction**

A 72- year old female patient has been admitted to the hospital for physician noted general pancytopenia after recent abnormal lab work. The patient has complained of being fatigued and having parathesias in hands and feet over the last six months. After looking over her lab work, signs, and symptoms, it seems that she is showing signs of megaloblastic anemia.

**Background**

 Megaloblastic anemia is defined as a condition in which the bone marrow produces unusually large, structurally abnormal, immature red blood cells (megaloblasts), according to The National Organization for Rare Disorders 1. Anemia is a condition characterized by low levels of circulating red blood cells. Bone marrow releases red blood cells into the blood stream and delivers oxygen to tissues throughout the body. When there is a deficiency of fully-mature red blood cells, it lowers the amount of oxygen available to tissues. This reduction of oxygen can result in fatigue, pale skin, lightheadedness and potentially neurological problems, which are all common symptoms of anemia.

 The two main causes of megaloblastic anemia are deficiencies in cobalamin (vitamin B12) or folate (vitamin B9), which both play a major role in producing red blood cells1. Vitamin B12 is required for the development and myelination of the central nervous system2. Therefore, megaloblastic anemia that results from vitamin B12 deficiency can lead to a variety of neurological symptoms. These symptoms can range from tingling or numbness in the hands or feet to confusion or memory loss1. Megaloblastic anemia may occur from inadequate dietary intake of cobalamin and folate, poor absorption in the intestines of these vitamins, or improper use of these vitamins in the body.

 Vitamin B12 can be found in meat, fish, and eggs. Vegans and vegetarians may be at risk for deficiency due to a low intake of animal products. The most common cause of deficiency, however, is malabsorption, which can result from surgery of the intestines or diseases such as Crohn’s or Celiac. Gastric bypass surgery, specifically Roux-en-Y gastric bypass, is meant to reduce weight, but may also lead to nutritional deficiencies due to malabsorption3. Another cause of cobalamin deficiency is pernicious anemia, which is caused by a lack of intrinsic factor. Intrinsic factor is needed by cobalamin for binding so that it may be absorbed by the small intestine1. Therefore, the body cannot absorb enough cobalamin when intrinsic factor is low.

Folate can be found in green leafy vegetables, grains, and nuts. Folic acid deficiency is somewhat rare in the United States because many of the foods are fortified with folic acid4. Deficiency is usually caused by inadequate amounts provided by the diet, however, surgery or diseases of the stomach or intestines can also lead to malabsorption. Alcoholics may also develop deficiency because alcohol can hinder the metabolism of folate in the body1. Folate is especially important for pregnant women, as folate is extremely important in the development of a fetus, especially in the early stages of pregnancy.

Megaloblastic anemia is diagnosed after a clinical evaluation, a review of patient history, findings of characteristic signs and symptoms and blood tests1. Blood tests can confirm abnormal red blood cells and can also confirm whether a deficiency of vitamin B12 or folate is the source of the anemia. A Schilling test may also be performed, which will show whether malabsorption of vitamin B12 is causing the deficiency.

Treatment of megaloblastic anemia can vary based on the cause of the problem. If the cause is vitamin deficiency, then it can be treated by supplementing vitamin B12 and / or folate into the diet. If the cause is malabsorption, then chronic supplementation may be the best source of treatment. If the malabsorption is due to a disease in the GI tract, then the disease should be treated first. In addition, supplements of vitamin B12 or folate may be necessary. Normally, patients with vitamin B12 deficiency are treated with intramuscular or subcutaneous injections of 1000 micrograms/week for 1 month4. Alternatively, in studies on patients with megaloblastic anemia caused by vitamin B12 deficiency, treatment of vitamin B12 by food was just as effective as vitamin B12 intramuscular injections5. Oral treatment may also be cheaper and better tolerated by the patient than injections. Effective treatment will correct vitamin B12 blood levels within two months and signs and symptoms of neurological problems may improve or disappear within six months2.

**Patient Profile**

A 72- year old female patient has been admitted to the hospital for physician noted general pancytopenia after recent abnormal lab work. The patient’s main complaint is that she has been fatigued and has had parathesias in hands and feet over the last six months. Her medical history includes a pregnancy of vaginal delivery at age 32, a vertebral compression fracture L1-L2 secondary to osteoporosis, and osteoarthritis. Her surgical history includes an appendectomy at age 12 and gastric bypass (Roux-en-Y) surgery 25 years ago. The medications she is currently taking include Fosamax 10mg, once daily for treatment of osteoporosis, Celebrex 200mg, once daily for treatment of inflammation, 800g calcium twice daily, and 800 IU vitamin D, once daily. The patient appears to be obese, has a pale color to their skin and is clammy. Her dietary intake is more than double her recommended amount of calories. She has had no changes in eating habits, chewing, swallowing, or appetite. She says that she mostly eats fruits, vegetables, and some grains. She says that she rarely eats meat, but she does enjoy chicken, eggs, and dairy products. The patient should be able to follow a diet prescription. The physician has medically diagnosed her with vitamin B12 and folate deficiency secondary to gastric bypass and malabsorption combined with probably deficient dietary intake.

The patient is hospitalized for fatigue, numbness in feet and hands, and abnormal blood lab values. The patient likely has megaloblastic anemia due to malabsorption of nutrients from her gastric bypass surgery 25 years ago. Surgeries that involve the GI tract, often lead to malabsorption problems. She is probably also not consuming enough vitamin B12, if she rarely eats meat. Vitamin B12 can lead to neurological problems, which can be of concern and would be a reason for hospitalization. The patient entered the NCP based on a referral from the medical doctor. The nutrition consult was a part of the assessment and plan for treatment along with supplementation of intramuscular cyanocobalamin and folate.

**Nutrition Care Process**

**Nutrition Assessment**

*Anthropometric*

 The patient stands at 61 inches (1.5494m) and weighs 165 pounds (75kg). This gives her a BMI of 31.2, which classifies her in the NHLBI standards as Obese Class I. Her BMI can be calculated by dividing kg/m^2, which is 75kg/ (1.5494m ^2) = 31.2. After her gastric bypass surgery, she lost 150 pounds. Since then her weight has fluctuated between 150 and 175 pounds. For the last five years, her weight has stabilized at 165 pounds. Weight fluctuations are very common after bariatric surgery.

 I calculated her estimated nutrient needs using the Mifflin-St. Jeor equation. After searching the Nutrition Care Manual, there is nothing within the anemia section that indicates that you use a special equation to find the estimated energy needs. The Mifflin St. Jeor equation for women is as follows: 10 (weight(kg)) + 6.25(height(in)) – 5(age(years)) – 161. Her estimated needs would be 10 (75kg) + 6.25(154.94cm) – 5(72 years) – 161= 1197 calories or about 1200 calories per day. I also did not find any information in the NCM about an increase for protein in patients with Megaloblastic anemia. I used the equation 0.8g/kg to find the minimum amount of protein needed. I calculated 75kg (0.8g) = 60g of protein per day. I used the equation of 30-35ml per kg for her estimated fluid needs. I calculated 30ml(75kg) = 2250ml and 35ml(75kg) = 2625ml for a range of 2250-2625ml of fluid per day.

*Biochemical*

 According to her lab work, she has an elevated mean cell volume, mean cell hemoglobin, mean cell hemoglobin content, red blood cell distribution, and methylmalonic acid(MMA). These elevated values of hemoglobin and red blood cell distribution are all signs of anemia. The elevated MMA is an indicator of megaloblastic anemia because it is caused by a vitamin B12 deficiency. She also has decreased platelet counts, vitamin B12, and folate. Decreased values of vitamin B12 and folate, could indicate megaloblastic anemia. This anemia often causes the production of abnormal red blood cells, which can be due to the fact that these vitamins are a major part of the production of red blood cells.

*Clinical*

 Upon admission, the patient appears to have pale skin color and be obese. Her skin is clammy and diaphoretic. Her head, eyes, ears, nose, and throat appeared to be within normal limits. Neurologically, she was alert and oriented. Her respiration rate is rapid, but is clear to auscultation and percussion. She also has hypoactive bowel sounds. During the doctor’s visit, her respiration rate was 18, which is within the normal range. Her increased respiration rate, could have been due to nerves from being admitted into the hospital.

*Dietary*

 Using the SuperTracker website, I calculated the patient’s current intake based on her 24-hour recall. Her energy intake was 2108 calories5. This is much higher than her estimated energy needs of about 1200 calories. She consumed 117g of protein, which is much higher than her needs of 60g of protein. Her overall energy intake is too high and if she lowers her intake than her protein levels should be within normal range. Her 24- hour recall showed that she was OK in folate and vitamin B12, even though her lab values show that she is low in both3. This shows that her average intake is probably not always consistent with the 24-hour recall that she provided. Her sodium levels are almost double the recommended value. She is currently getting 4000mg of sodium daily, while the RDA is 2300mg. A high sodium diet can lead to high blood pressure and hypertension. Her diet is also low in iron, which could also be a source of her anemia. Based on her intakes and outtakes, she was getting 1570mL of water and her estimated fluid needs are of 2250-2625ml of fluid per day. Overall, she needs to lower her caloric and sodium intake and increase her iron, vitamin B12, folate, and fluid intake.

**Nutrition Diagnosis**

**1.** Decreased levels of Vitamin B12 and Folate related to malabsorption secondary to gastric bypass twenty-five years ago as evidenced by fatigue, clammy skin, and parathesias in hands and feet.

**Nutrition Intervention**

*Nutrition Prescription*

 Consume at least 2.4 micrograms of vitamin B12 and at least 400 micrograms of folate daily in regular diet to provide 1200 calories, 60 grams of proteins, 2300ml of fluid.

*Nutrition Intervention*

 The patient should receive nutrition education on foods that are high in folate and vitamin B12 and should learn how to implement these into her diet. The goal is for the client to be able to make choices on foods that are high in folate and vitamin B12. She should strive to obtain 1000-2000 micrograms per day orally. She also should lower her energy intake and increase her fluid needs to meet her estimated needs. The goal for the client is to have an intake of 1200 kcals per day and at least 2250 ml of fluid per day. Based on MNT guidelines for post bariatric surgery the patient should be given nutritional supplementation guidance and should be monitored regularly for lab values and physical and mental well-being6. The patient should also receive nutrition education and show signs of behavior modification. Taking daily micronutrient supplements and eating foods high in vitamins and minerals is an important part of the weight loss from the bariatric surgery and is also the best way to avoid vitamin deficiencies3.

**Monitoring and Evaluation**

 The patient should come in for a check-up after one month to monitor her folate and vitamin B12 levels4. Using blood tests, her lab values should be obtained. Her vitamin B12 and folate levels should increase. Her vitamin B12 level should be between 24.4 and 100ng/dL and her folate level should be between 5 and 25ng/dL. If cobalamin and folate increase, then there should also be a decrease in mean cell volume, mean cell hemoglobin, mean cell hemoglobin content, red blood cell distribution, and methylmalonic acid. The patient’s dietary intake should be observed by a food log because a 24-hour recall does not provide enough nutritional information on her intake of different nutrients. The intake of vitamin B12, folate, and calories should be specifically monitored.

**Discussion**

The patient entered the nutrition care process after being referred for a nutrition consult by a physician. The nutrition care process consists of Assessment, Diagnosis, Interventions, Monitoring and Evaluation. In the Nutrition Assessment, we found that the patient was obese class I. She had gastric bypass surgery 25 years ago and her weight has fluctuated between 150 and 175 pounds since then. We found that her estimated needs were 1200 calories, 60 grams of protein and 2250-2625ml of fluid per day. She has as an elevated mean cell volume, mean cell hemoglobin, mean cell hemoglobin content, red blood cell distribution, and methylmalonic acid(MMA). These elevated values of hemoglobin and red blood cell distribution are all signs of anemia. The elevated MMA is an indicator of megaloblastic anemia because it is caused by a vitamin B12 deficiency. She also has decreased platelet counts, vitamin B12, and folate, which can be indicators of megaloblastic anemia. Her skin color was pale and she was clammy and diaphoretic. Her current dietary intake was about 1000 calories more than her estimated needs and her sodium intake was almost double the recommended amount. In the Nutrition Diagnosis, the patient had decreased levels of vitamin B12 and folate related to malabsorption caused by gastric bypass surgery. In the Nutrition Intervention, it was recommended that she receive nutrition education on foods high in vitamin B12 and folate and she learn how to implement these foods into her diet. She also should lower her caloric intake to 1200 calories a day. In Monitoring and Evaluation, her blood work should be monitored. Her vitamin B12 and folate levels should be lowered with her lower intake, but she should be continually monitored. A food log should be evaluated for effectiveness of her diet in normalizing her lab values.

In the meal plan I provided my patient, I tried to increase her amount of foods high in vitamin B12 and folate. These included multigrain cereal, egg salad, broccoli, whole grain pasta, chicken breast, etc. My other goal was to decrease her caloric intake to 1200 calories a day, which I got it to about 1500 calories. It was somewhat difficult to meet her micronutrient needs without going over her estimated energy needs. I got her Vitamin B12 to 5.4 micrograms, over the recommended amount of 2.4 micrograms. I got her Folate to 605 micrograms, over the recommended amount of 400 micrograms. Her sodium was decreased significantly and was under the recommended 2300mg per day. If the patient follows this meal plan, it should help in increasing her vitamin B12 and folate and lowering her caloric and sodium intake. Increasing the vitamin B12 and folate could eliminate her symptoms of megaloblastic anemia. Decreasing her caloric intake could reduce her weight and her BMI, which will reduce her risk of many health problems associated with obesity. Lowering her salt intake, will also lower her blood pressure and her risk for cardiovascular disease.

Gastric bypass surgery has been known to cause malabsorption of nutrients, such as vitamin B12 and folate3. This is the likely cause of her deficiencies and the megaloblastic anemia. It may also be due to an insufficient intake of vitamin B12 and folate. Oral treatment of 1000 micrograms of vitamin B12 per week for 1 month has shown an increase in cobalamin levels and a decrease in associated vitamin B12 deficiency problems4. Intramuscular injections may be helpful as well. With an increase of vitamin B12, she may be able to reverse her neurologic symptoms of deficiency such as numbness and tingling in the hands and feet. Her energy level may also increase. Megaloblastic anemia is reversible with proper care and lifestyle changes by the patient.

**References**

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