Case Study #1: Anemia in Pregnancy

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1. Yes, there are a couple of reasons why she might have developed anemia. The most important being that during her first trimester she had morning sickness, which might have interfered with the absorption of her daily nutrients. Also, the fact that she does not eat properly, in the sense that she is a picky eater, could be a potential reason for her anemia. As her 24-hour recall shows, her diet is very limited in essential nutrients, especially for a pregnant woman. Another reason for her development of anemia could be that she smokes, which can have a negative effect on iron absorption in the body.

2. Mrs. Morris' red blood cell count is low with a value of 3.8 x 10^6/mm3. Her hemoglobin is low with a value of 9.1 g/dL. Her red blood cell count is low due to her low iron intake, causing a decrease in red blood cell production. Her hemoglobin is low for the same reason. Her hematocrit is low at 33% because the red blood cell count is low, causing a decrease in the volume of the cells. Her mean cell volume is low with a value of 72 mcm3 due to a reduction of red blood cells and hemoglobin. Her total iron binding capacity is 465 mcg/dL. This value is high because of her iron intake is low, thus making iron binding more available. Her ferritin is 10 mcg/dL. Her ferritin is low since there is a low iron intake and therefore not a need for production of ferritin, the protein that is in charge of storage of iron. Her folate is 2 ng/dL. Her folate is low because of her poor nutrient intake. Her low folate status also affects the maturation of red blood cells.

3. Mrs. Morris' low hemoglobin is a concern because hemoglobin is the main transporter of needed oxygen to the body. Having low hemoglobin leads to insufficient transportation of oxygen throughout the body. During pregnancy, hemoglobin is very important because it delivers needed oxygen to the fetus as well as the mother. During pregnancy, hemoglobin increases along with the red blood cell count. Also, during pregnancy, plasma volume increases by 50%, red blood cells increase by about 18-30%, hematocrit decreases, platelet count is slightly lower, white blood cell count increases, and coagulating factors are very active.[1]

4. In megaloblastic anemia, the body is unable to produce sufficient healthy red blood cells due to folate deficiency or cobalamin (vitamin B12) deficiency. The red blood cells in this type of anemia are larger than normal, hence the name, megaloblastic anemia. Folate or folic acid is required for the formation of red blood cells and their growth. In pernicious anemia, the body is unable to produce enough healthy red blood cells because it is deficient in vitamin B12. Very often, people with this type of anemia are unable to absorb the vitamin B12 they need in sufficient quantities from the food they consume. Normocytic anemia is most commonly known to develop due to ageing, with studies showing that it is most likely to affect women over the age of 85. Microcytic anemia is a condition in which red blood cells are smaller than what is considered normal. Microcytic anemia occurs due to inadequate supply of iron in the body. Sickle cell anemia is an inherited disorder in which the body produces red blood cells that are abnormal. Their shape is similar to a crescent or a sickle shape, unlike the regular red blood cells that are shaped like a disc. The abnormal shape makes their movement in the blood vessels difficult, blocking blood flow to vital organs, causing pain and even organ damage. These cells are also sticky and stiff. Hemolytic anemia is a condition that occurs when the cycle of red blood cell destruction and replacement gets disrupted. Red blood cells are destructed before the bone

marrow can produce enough new ones to replace them. This leads to the presence of fewer red blood cells in the body to transport oxygen to various tissues in the body.[2]

5. Iron has many roles in the body. Iron aids in the transport of oxygen in the body and in the production of the proteins hemoglobin and myoglobin. Iron is a part of enzymes that are involved in cellular respiration and energy production (ATP). Finally, iron is involved in immune function. During pregnancy, the need for iron increases because now the woman has to produce enough oxygen for both her and the baby. Therefore the mother needs to produce more iron in order to increase the production of hemoglobin to transport oxygen to both herself and the fetus. Iron is also important for growth spurts and physical and mental development of the fetus.[3]

6. Stage I negative iron balance refers to iron depletion. A patient with stage I negative iron balance has reduced iron absorption and moderately depleted iron stores. Stage II negative iron balance refers to severe iron depletion. A patient with stage II negative iron balance does not yet have dysfunction. Stage III negative iron balance refers to iron deficiency. In stage III, the patient has inadequate body iron, dysfunction, and disease. However, in stage III, anemia is not yet present. In stage IV negative iron balance, the patient has inadequate body iron, dysfunction, disease, and anemia is present. During stage I negative iron balance, red blood cell count is normal, transferrin IBC (iron binding capacity) is 300-360 mcg/100ml, plasma ferritin is <25 mcg/L, and ferritin-iron is normal to low. During stage II negative iron balance, red blood cell count is normal, transferrin IBC is 360 mcg/100ml, plasma ferritin is 20 mcg/L, and ferritin-iron is low. During stage III negative iron balance, red blood cell count is normal, transferrin IBC is 390 mcg/100ml, plasma ferritin is 10 mcg/L, and ferritin-iron is very low. During stage IV negative iron balance, where anemia is present, red blood cell count is microcytic/hypochromic, transferrin IBC is 410 mcg/100ml, plasma ferritin is <10 mcg/L, and ferritin-iron is very low.[3]

7. Mrs. Morris states that she is much more tired during this pregnancy than she has been for her previous two pregnancies. Fatigue is a symptom that could be indicative of iron deficiency anemia. Mrs. Morris states that she is experiencing shortness of breath, which is a symptom of iron deficiency anemia. Mrs. Morris is also pale which is a symptom that could be indicative of iron deficiency anemia. Mrs. Morris states that she is a picky eater and there are various foods she doesn't enjoy consuming. This restrictive aspect of her diet could be leading to inadequate iron intake. Mrs. Morris also states that she does not always take prenatal vitamins because they make her nauseous. This could hinder her pregnancy because maternal need for iron increases during pregnancy, and prenatal vitamins contain a sufficient amount of iron. Insufficient dietary intake of iron and not taking prenatal vitamins regularly could indicate iron deficiency anemia. Finally, when looking at Mrs. Morris's chart, her total iron binding capacity is 465 mcg/dL and her plasma ferritin is 10 mcg/dL. These values indicate stage IV negative iron balance or anemia.[3]

8. During pregnancy, the mother's blood volume increases; therefore the demand for iron increases as well. An additional 700-800 mg of iron is recommended for pregnant women. If maternal iron status is low, hemoglobin production may be hindered which can compromise oxygen delivery to the uterus, placenta, and fetus. Continued maternal anemia creates an added

workload to the mother's heart, which can lead to preterm delivery, growth retardation of the fetus, low birth weight of the infant, and poor health of the newborn infant.[3]

9. The DRIs for energy intake are the same for non-pregnant females and females who are in their first trimester of pregnancy. During the second trimester of pregnancy, energy intake should increase by 340-360 kcal/day. During the third trimester of pregnancy, energy intake should increase by an addition 112 kcal/day.[4] The RDA for protein is 0.8 g/kg/day for non-pregnant women and this is the same RDA for pregnant women during the first half of their pregnancy. During the second half of pregnancy, the RDA for protein increases to 71 g/day based on 1.1 g/kg/day of a woman's pre-pregnancy weight.[4] During pregnancy, the RDA for iron is 27 mg/d. A pregnant woman should consume an additional 700-800 mg of iron throughout her pregnancy to meet the needs of her and her baby. The RDA for calcium during pregnancy is 1,300 mg/day for women ages 14-18 and 1,000 mg/day for women ages 19-50. The RDA for zinc during pregnancy is 12 mg/d for women ages 14-18 and 11 mg/d for women ages 19-50. The RDA for folate during pregnancy is 600 mcg/d for women of all ages. The RDA for Vitamin B12 during pregnancy is 2.6 mcg/d for women of all ages. The RDA for Vitamin C during pregnancy is 80 mg/d for women ages 14-18 and 85 mg/d for women ages 19-50.[3]

10. The best dietary source of iron is animal liver. Other good dietary sources of iron include fish, lean meat, poultry, dried beans, eggs, vegetables and fruits. Enriched grain products such as bread and cereal are also high in iron. Heme iron is found in animal products such as liver, meat, fish, and poultry. Non-heme iron is predominantly in food sources such as eggs, grains, vegetables, and fruits; however it can also be found in meat, fish, and poultry. Heme iron sources are much better absorbed in the human body than non-heme iron sources.[3]

11. When digested in the stomach, the acidic environment of the stomach reduces ingested iron Fe3+ (ferric iron) to Fe2+ (ferrous iron). Iron in the ferrous state is the preferred state for iron absorption, through the enterocytes of the small intestine. Heme iron and non-heme iron are absorbed differently. In order to enter the enterocytes, iron must cross the brush border membrane where heme iron enters by vesicle formation and non-heme iron enters by facilitated diffusion. Once in the enterocytes, heme iron goes through enzymatic digestion whereas Non-heme iron binds to apoferritin. At this point, both forms of iron are "free" and form ferritin. Ferritin acts as a ferry and carries iron to the basolateral membrane of the enterocyte. Iron exits the enterocyte at the basolateral membrane through active transportation and finally enters into the bloodstream.[3]

12. Mrs. Morris's height is average for females at 5'5" along with her weight of 135 lbs. Her BMI using her non-pregnant weight is 22.5, which is in the normal range for a healthy female. Her current pregnancy weight is 142 lbs. Mrs. Morris has only gained 7 pounds when the recommended weight can for 23 weeks of gestation is 12-15 pounds. Mrs. Morris's % UBW is 105%. Her % UBW is over 100% because she is pregnant. It should be higher because she has not gained sufficient weight for 23 weeks of gestation.

13. According to the prenatal weight gain chart from the Institute of Medicine, Mrs. Morris's weight gain is inadequate for 23 weeks of gestation. According to the chart, she should have gained around 12-15 pounds, but has only put on 7 pounds. With her previous pregnancies she

was slightly under the normal weight gain of 25 pounds, gaining only 15 and 20 pounds throughout her full pregnancy.[5]

14. Mrs. Morris's estimated requirements for energy and protein were calculated. Her required energy intake is 2274.9 kcal/d which was calculated by [354 - 6.91 X 31 + 1 X (9.36 X 61.24 + 726 X 1.65)] + 184 + 180 = 2274.9 kcal/d. Her protein requirement is 71 g/day, which is the recommended intake for all women during the second half of their pregnancy for fetal development.[3]

15. Mrs. Morris is not acquiring nearly enough nutrients for her current state of pregnancy. According to her 24-hr recall, she only consumed 1,444.6 kcal and 49.7 g of protein. According to the above values in question 14, she is 830.3 kcal shy of her recommended intake, and missing 21.3 g of the protein recommendations for pregnancy.[6]

16. The RDA for iron during pregnancy is 27 mg a day. Mrs. Morris did not meet this recommendation and only consumed 19.2 mg of iron in a day according to her 24-hr recall. Though this system may not be the most accurate due to forgetful patients or errors in analysis, we can assume that a dietary intervention needs to occur for Mrs. Morris to have a healthy and successful pregnancy.

17. The main nutritional concern with Mrs. Morris is the lack of iron she is consuming in her diet and absorbing into her body. With her ferritin levels being lower than normal at 10 ug/dL and her iron binding capacity being higher than normal at 465 ug/dL, it is apparent that she is not consuming or absorbing enough iron into her system. Mrs. Morris' diagnosis is hypochromic microcytic anemia.

18. Inadequate iron intake R/T inadequate energy intake AEB 24 hour recall with 1,444.6 kcal consumed and 19.2 mg of iron consumed. NI-5.10.1.3

19. Ferrous sulfate has some potential side effects including stained teeth from the liquid, constipation, and upset stomach. Serious side effects are rare but possible, so it is important to pay attention to any changes that may occur. Antacids are prohibited while taking this medication, as they can bind to the ferrous sulfate and prevent iron absorption into the body. There are other medications for which consumption is recommended at least three hours before or two hours after taking ferrous sulfate. Some of these specifically include cinoxacin (Cinobac), ciprofloxacin (Cipro), demeclocycline, doxycycline, enoxacin (Penetrex), levofloxacin (Levaquin), lomefloxacin (Maxaquin), methacycline, minocycline, nalidixic acid (NegGram), norfloxacin (Noroxin), ofloxacin (Floxin), oxytetracycline, sparfloxacin (Zagam), or tetracycline. Important information to give Mrs. Morris while she is taking this medication is to take it three times per day on an empty stomach between meals. Also, Mrs. Morris must be sure to swallow the pill whole or mix the drops in some sort of fruit juice. Mrs. Morris should not crush or open the pills. If Mrs. Morris is following all these recommendations, there should be an improvement in iron levels within a few days. However, due to Mrs. Morris' severe iron deficiency anemia, it could take up to six months for her to have appropriate iron levels.[7]

20. Prenatal vitamins are extremely important to consume throughout pregnancy. These supplements contain many vitamins and minerals that are necessary for the health and development of the baby and the mother. Some of these vitamins and minerals include folic acid, iron, calcium, vitamin C, zinc, and Vitamin D. Nausea can be a side effect of prenatal vitamins and Mrs. Morris states that prenatal vitamins are making her stomach hurt. However, there are different kinds of prenatal vitamins, like chewable or liquid forms, which may relieve the upset stomach symptoms. It is also important that Mrs. Morris take her prenatal vitamins on a full stomach, which could help prevent the pills hurting her stomach.[3]

21. To properly assess Mrs. Morris' pregnancy, nutritional, and iron status, it is important to pay attention to the signs and symptoms and how they change. The easiest signs to pay attention to are physical signs such as the color of her skin and the steadiness of her breathing. Asking the patient questions like how fatigued she feels is another great way to assess her. It is also extremely important to examine new blood labs to see what/if anything has improved. Specific results to look at include ferritin levels, folate levels, iron binding capacity, red blood cell count and red blood cell distribution. These results will show how Mrs. Morris' iron status is improving (or digressing) throughout her pregnancy.

22. See attached ADIME note.

Works Cited

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