Pumping Iron:

Basics Facts About Iron Deficiency

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As a nutrition and foodservice consultant, I never know exactly what types of situations in which I may find myself involved. Recently, I received a call from a company seeking a registered dietitian to design weight loss menus. I thought it sounded like an interesting project, and at first glance, it appeared to be a pretty simple task. The meals had to meet certain caloric levels and, of course, 100 percent of the recommended daily allowances (RDA) for vitamins and minerals. No problem. I dreamed up tasty but convenient meals and delicious snacks. I clipped recipes and read cookbooks, watched the Food Network, and searched the Internet.

After a few days, I was ready to begin entering my menus into a computerized nutrition program that would perform a detailed analysis of my menus. As I entered the last menu, I felt a sense of relief that this task was now complete. The final step was to check my printouts and insure that I met the parameters the company desired and then finally submit the menus via e-mail. Unfortunately, this is when my troubles began. Every single menu was deficient in iron. My target was 18mg of iron each day, but I kept coming up short. After hours of recalculating and making food substitutions, I finally found a few tricks that added iron to each meal, but more importantly, I gained a new appreciation for iron. Now I know why so many people are iron deficient. It is just not that easy to obtain sufficient iron from common foods. In fact, iron is the nutrient most commonly deficient in the world affecting approximately 40 percent of the total population.[1] At first glance, in many nursing homes, it appears that almost every resident is iron deficient. Clearly, iron is one mineral that deserves a closer look.

Functions of Iron

Iron is the fourth most abundant element in the earth's crust yet only a trace element in the human body. Iron makes up only 0.0004 percent of the human body's mass, yet it is an essential component or cofactor of numerous metabolic reactions.[2] Iron has many functions in the body, but perhaps its most important role is as a component of a protein called heme. Iron is necessary to manufacture hemoglobin, the protein in red blood cells that carries oxygen from the lungs to the body's tissues. Hemoglobin is the pigment that gives blood its usual red color. Iron also plays a role in immune function and cognitive status and many other reactions including the synthesis of DNA, collagen, and bile acids.

Iron Deficiency

The term *anemia* is used to describe many conditions where red blood cells are not providing adequate oxygen to body tissues. There are many types and causes of anemia, but one of the most common types is iron deficiency anemia. This condition is a decrease in the number of red cells in the blood caused by too little iron. In other words, when there is too little iron available to produce an adequate amount of hemoglobin, anemia results. There are many causes of iron deficiency anemia including too little iron in the diet, poor absorption of iron, and iron lost from the body due to blood loss. For example, blood may be lost due to gastrointestinal bleeding related to ulcers, heavy menstrual bleeding, and certain types of cancer, particularly in the stomach, colon, or esophagus. Table 1 lists the symptoms of iron deficiency. It is important to note that in mild cases of deficiency, no symptoms may be present.

Diagnosing Iron Deficiency Anemia

The first step in any diagnosis is a thorough history and physical. The clinician should ask about blood loss, medications, such as extended usage of nonsteroidal anti-inflammatory drugs (NSAIDs), family history of anemia, any fatigue-related lifestyle changes, and dietary and supplement intake. If anemia is suspected, the physical exam should note any splenomegaly, blood in the stool, pallor, and any other physical symptoms as listed in Table 1. A complete blood count (CBC) should be drawn. The laboratory diagnosis of iron deficiency anemia includes:

- Low hemoglobin (Hgb) and hematocrit (Hct)
- Small red blood cells (microcytic cells)
- Low serum ferritin
- Low serum iron
- High iron binding capacity (TIBC)
- Blood in the stool (visible or microcytic).

Many practitioners simply look at Hgb and Hct, but it is important to remember that iron deficiency occurs in stages. Table 2 outlines the stages of anemia development. The degree of decrease in Hgb and Hct depends upon the length of time the bone marrow has been without sufficient supplies of iron. Other indicators on the CBC should also be reviewed including mean corpuscular volume

(MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC). The MCV measures the mean or average size of individual red blood cells.[3] In iron deficiency, the MCV is low indicating the cells are microcytic or smaller than normal. The MCH measures the amount of hemoglobin present in one red blood cell.[3] The MCHC measures the proportion of each cell taken up by hemoglobin. The results are reported in percentages, reflecting the proportion of hemoglobin in the red blood cell.[3] The MCV, MCH, and MCHC are all decreased in iron deficiency anemia. MCHC will be the last to become lowered. This is due to the fact that as the marrow becomes more and more depleted of iron, it produces smaller cells with a smaller amount of hemoglobin in each cell in an attempt to keep the concentration of hemoglobin normal.[4] There is a growing body of evidence that supports using serum ferritin as an initial indicator of iron deficiency. If iron deficiency is suspected, it may be worthwhile to request a serum ferritin level to supplement the CBC.

Treatment

Treatment of iron deficiency depends on the cause. For example, if the cause is blood loss, it is important to identify the source of blood loss and correct the problem. In many long-term care facilities, poor intake and poor absorption are often the cause of anemia. Many residents have less than desired meal consumption and are not consuming foods that are high in iron. These foods include liver, eggs, kidney, beef, dried fruits, enriched whole grain cereals, enriched flour, lentils, molasses, and oysters. To compound the problem, many of these foods are not the typical foods found on healthcare menus. In all practicality, the best food choices for iron are enriched products and meats. Fortified ready-to-eat cereals usually contain at least 25 percent of the US RDA for iron. Iron is found in the diet in two forms: heme iron, which is well absorbed, and non-heme iron, which is poorly absorbed. Vitamin C enhances the absorption of non-heme iron from the intestine, so it may be helpful to combine foods with iron and vitamin C to increase the amount of iron absorbed. For example, a recommended nutritional intervention is to serve orange juice with meals to increase absorption of non-heme iron. Although citrus fruits are well known for their vitamin C content, many vegetables are also a good source of vitamin C, such as tomatoes, cauliflower, broccoli, and potatoes. These can also be utilized to increase absorption.

The issue of iron supplementation is one that should be approached with caution. Many residents receive a daily multivitamin, which contains 18mg of iron. In addition, medical nutrition supplements provide additional iron. For example, Ensure (Ross Products Division, Abbott Laboratories, Columbus, Ohio) provides 4.5mg iron per eight-ounce can while Boost (Mead Johnson Nutritionals, Evansville, Indiana) provides 3.6mg iron per serving. This means a typical resident may receive approximately 30mg of iron before consuming even one bite of food just from vitamins and Ensure three times per day. Additional iron supplements should only be prescribed if the anemia has been conclusively defined as iron deficiency. Iron supplements may cause side effects, such as constipation, black stools, diarrhea, nausea, and leg cramps. Many residents may find iron very difficult to tolerate. Enteric-coated supplements may be easier to tolerate, but they are not recommended because they may not be adequately absorbed. Liquid iron tends to stain the teeth, so it is best to mix it with juice and use a straw. Table 3 lists additional food and drug interactions.

The Iron-Clad Care Plan

The treatment of iron deficiency anemia takes a team approach. Each discipline has something to offer to the anemia care plan. The nursing staff may be the first to identify low levels of Hgb and Hct on the lab reports and notify the physician. The physician may order multivitamins. The nutrition professional should monitor the meal intake and recommend appropriate food choices and vitamin C to increase absorption. The consultant pharmacist should follow the supplementation schedule and alert the team to any food or drug interactions. The social worker can provide resident and family education and coordinate communication about the team's plan and progress. It is a myth that anemia is a normal part of aging and is simply something to expect and accept. With a little effort and a little knowledge, we can all be pumping iron for life.

References

1. Escott-Stump S. *Nutrition and Diagnosis-Related Care, Fifth Edition*. Philadelphia, PA: Lippincott, Williams, & Wilkins, 2002:472.
2. Uthman E. Nutritional anemias. Available at: http://web2.iadfw.net/uthman/nutritional_anemia/nutritional_anemia.html. Accessed September 9, 2003.
3. CBC Interpretation. Available at: http://www.medical-library.net/sites/_cbc_interpretation.html. Accessed September 9, 2003.
4. Rice FA. Iron deficiency anemia. Available at: http://www.cariboo.bc.ca/schs/medtech/rice/irondeficiency.html. Accessed September 9, 2003.

Table 1: Symptoms of Iron Deficiency

Pale skin color (pallor)
Fatigue
Irritability
Weakness
Shortness of breath
Sore tongue
Brittle nails
Unusual food cravings (pica)
Decreased appetite
Headache (frontal)
Blue tinge to sclerae (whites of eyes)
Note: There may be no symptoms if anemia is mild.

Source
1. Adapted from http://www.nlm.nih.gov/medlineplus/ency/article/000584.htm. Last accessed September 4, 2004.

Table 2: Iron Deficiency Anemia Development Stages

1. Depletion of iron stores, decreased ferritin levels, no anemia
2. Increased transferrin levels, no anemia
3. Fall in serum iron, no anemia
4. Development of normocytic, normochromic anemia
5. Development of microcytic, hypochromic anemia

Source
1. Rice FA. Iron deficiency anemia. Available at http://www.cariboo.bc.ca/schs/medtech/rice/irondeficiency.html. Accessed September 9, 2003.

Table 3: Food and Drug Interactions With Iron Supplements

- Acetohydroxamic acid (e.g., Lithostat): Use with iron supplements may cause either medicine to be less effective
- Antacids: Use with iron supplements may make the iron supplements less effective; iron supplements should be taken one or two hours before or after antacids
- Dimercaprol: Iron supplements and dimercaprol may combine in the body to form a harmful chemical
- Etidronate, fluoroquinolones (e.g., ciprofloxacin, enoxacin, lomefloxacin, norfloxacin, ofloxacin), or tetracyclines (taken by mouth): Use with iron supplements may make these medicines less effective; iron supplements should be taken two hours before or after these medicines
- The following foods should be avoided or only taken in very small amounts for at least one hour before or two hours after you take iron:
  - Cheese and yogurt
  - Eggs
  - Milk
  - Spinach
  - Tea or coffee
  - Whole-grain breads and cereals and bran

Source
1. Available at: http://www.drugs.com/xq/cfm/pageID_0/htm_202305/type_cons/bn_Iron%20Supplements/micr_medex/qx/index.htm. Accessed September 4, 2003.

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