Vitamin B12 Deficiency

Iron: A nutrient essential for the body. Essential nutrients include: Iron (largely dependent on Vitamin B12), which is required for the production of Red Blood Cells (RBCs). Iron is found in meat (heme iron) and in plant sources (non-heme iron).

Nutritional Anemia: This is a variety of Anemia specifically related to inadequate intake or malabsorption of an essential nutrient. Essential nutrients include: Iron (largely dependent on Vitamin B12), Vitamin B12, and Folic Acid.

Iron Deficiency Anemia: This is the leading cause of anemia worldwide, AND the most common nutritional deficiency in developed countries.

- S/Sx: Acute: Tachycardia, SoB, Dyspnea, Angina Chronic: Fatigue, HA, Weak, Pallor
- High Risk Cohort: Children (nutrition), Elderly (cognitive effects, poor intake), Pregnancy, Boozers, Obesity
- Labs: Serum Ferritin Total Iron Binding Capacity (TIBC): In iron deficiency, it is LOW.
  - Factors: Iron intake ≠ Iron absorbed. Absorption depends on the storage, rate of RBC production, diet, and substances that enhance or inhibit absorption. But the body normally compensates, as internal levels decrease, GI absorption increases.
- Intake: Depends on the individual. 27mg if pregnant, 18mg if menstruating, 8mg if a dude or menopause.
  - Dietary Heme-Iron: Meat, fish, poultry. Heme Iron is 3x more absorbable than non-heme.
  - Dietary Non-Heme Iron: Veges, fruits, beans, nuts, grains. This is poorly absorbed, but can be improved by having good supplies of gastric acid. Vitamin C supplementation can improve non-heme absorption, so go tell your menstruating vegetarian friends to get some C. (naturally in red peppers, oranges)
  - Why is it poorly absorbed? Non-heme iron forms insoluble complexes. These insoluble complexes develop more readily with tea (tannins) or coffee.
- Oral Supplementation: Iron-replacement therapy depends on the patient’s ability to tolerate it. Start low.
  - Pregnancy: 30mg/Daily
  - At risk children: Ferrous sulfate 1mg/kg/day
  - Adults: 200mg elemental iron daily in divided doses.
  - AE: Discoloration of stool (dark), constipation, NVD.
  - DDI: PPI, H2RA, Tetracyclines will decrease the absorption of the iron product.
- Counseling: Take it 1 hour before meals, may benefit from taking concurrent Vit-C. GI complications due to iron absorption, so go tell your menstruating vegetarian friends to get some C. Drink water and stool softener. Wait 2 hours before/after to take a calcium supplement, it can bind to iron and reduce its availability.
- IV Supplementation: Reserved for those who are intolerant to PO, Malabsorption, long-term non-adherence.
- Preferred: Iron Dextran. Do a test dose and observe for 1 hour (BBW – Anaphylaxis).

Vitamin B12 Deficiency: Rare deficiency with low prevalence, usually due to malabsorption
- S/Sx: Neurologic: Numbness, Ataxia, Tingly, Bad vision Psychiatric: Irritability, depression, psychosis
- Labs: [B12], Homocysteine - (Folate conversions), Methylmalonic Acid (specific indicator)
- Malabsorption factors: Gastric-acid suppressing agents, H. pylori, Auto-immune mechanisms (pernicious anemia)
- Intrinsic Factor Pathway: A story of cobalamin being carried to the distal ileac lands by Intrinsic factor
  - Ingested Cobalamin (B12) binds to R-protein complex of the parietal/salivary cells.
  - The duodenum degrades that complex, releasing free cobalamim- which binds to intrinsic factors
  - Cobalamin-Intrinsic Factor attaches to the mucosal cell receptors in the distal ileum
Intrinsic factor is discarded, and cobalmin binds to transcobalamin I and III

- **In pernicious anemia, there is a problem with the Intrinsic Factor pathway**
- **Intake:** Generally has the same sources as iron – makes it easy! Only 33-50% is absorbed due to its solubility
  - High [B12] Foods: Clams, Beef liver, breakfast cereal, SOCK EYE SALMON
- **Treatment:** Indicated for B12 Deficiency presenting with:
  - Megaloblastic Anemia: Huge RBC being made by bone marrow
  - Hematological Abnormalities
  - Neurological Disease
- **Supplementation:** PO is just as effective as IM. PO is preferred.
  - PO: 1000mcg for 1 to 2 weeks, with a maintenance of 1000mcg daily [OTC]
  - IM: PO is preferred. IM is only indicated in cases of Hematologic or Oral issues.
    - 100mcg daily x6-7 days, then maintenance 100mcg/qmonthly
  - IN: PO is preferred. Intranasal is only for long-term maintenance patients. Qweekly

**Folic Acid Deficiency:** Common in the US, due to boozers and pregnant women

- **S/Sx:** Fatigue, gray hair, mouth sores, growth problems, tongue swelling, pallor
  - Symptoms resolve when you replace folate UNLESS there is an underlying B12 deficiency (fix that first)
- **Labs:** Folate∥, B12~, Mean Cell Volume∥, Homocysteine∥, Methylmalonic Acid~
  - Cx: Due to inadequate intake (booze, socioeconomic, fad), malabsorption, or increased requirements (preg)
    - Use the labs to rule out B12 deficiency (MMA)
  - **Absorption Pathway:** Folic acid is polyglutamated, degraded to monoglutamate, absorbed in SI, converted to tetrahydrofolate via cobalamin-dependent rxn
- **Intake:** In 1997, the US started fortifying a lot of foods with folic acid, helped improve neural tube defects
  - Foods high in Folate: Beef liver, cereal, lentils, chick peas
- **Supplementation:**
  - Oral: 0.4 – 0.8mg Qdaily for maintenance of women in childbearing age (Higher if deficient)
  - In cases of malabsorption, may require 1-5mg Qdaily

During Pregnancy, The goals for IRON and FOLIC ACID,,,,,, not B12,,,, are increases exponentially during pregnancy