

Iron Deficiency Anemia: The Silent Thief of Health

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IRON DEFICIENCY ANEMIA

- Anemia refers to a condition in which blood has a lower than normal number of red blood cells.
- Iron is an essential mineral that is needed to form hemoglobin, an oxygen carrying protein inside red blood cells.
- Condition in which the body lack enough red blood cell to transport oxygen-rich blood to body tissues



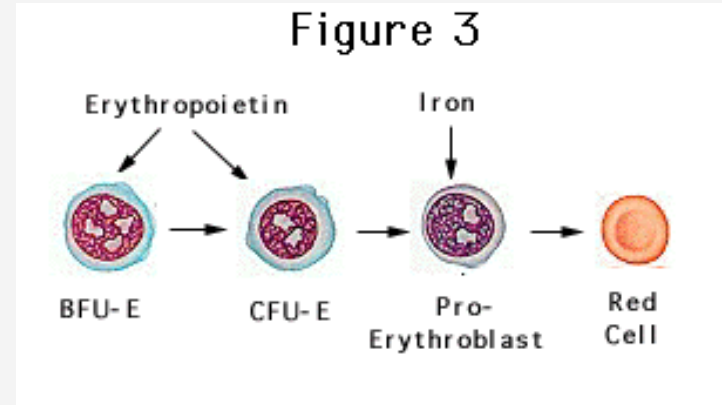


EPIDEMIOLOGY

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- Affects a large proportion of the world's population, females of childbearing age, children.
 - Hispanic Americans – 5.1 percent
 - Black Americans – 4.3 percent
 - Asian Americans – 2.1 percent
 - White Americans – 2.0 percent
 - Native Americans- 5.2 percent
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Pathophysiology

- Iron deficiency anemia is the most common form of anemia
- Body uses up all the iron it has stored in the liver, bone marrow and other organs.
- If erythropoietin is present without sufficient iron, there is insufficient fuel for red blood cell production.
- The red blood cells are abnormal and do not have a normal hemoglobin-carrying capacity.



Etiology

Decreased iron absorption

Celiac disease

Atrophic/autoimmune gastritis

Helicobacter pylori

Bariatric surgery

Medications that reduce gastric acidity (unlikely to be the sole cause)

Genetic disorders such as IRIDA (rare)

Blood or iron loss

Heavy menstrual bleeding

Pregnancy and lactation

Gastric ulcer disease or gastritis

Colorectal cancer

Gastrointestinal telangiectasias, HHT

Bleeding disorders such as VWD

Gastrointestinal parasites

Frequent blood donation





Surgical blood loss

Iatrogenic (frequent blood draws)

Hemodialysis



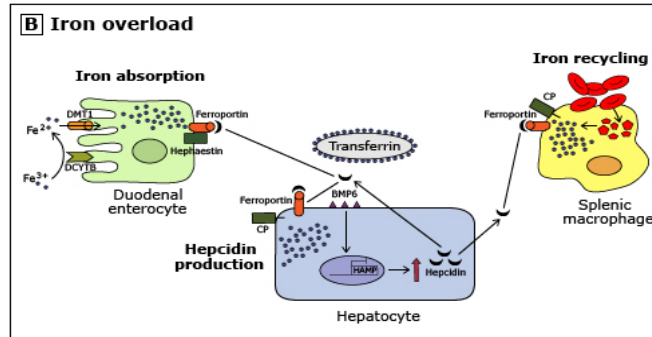
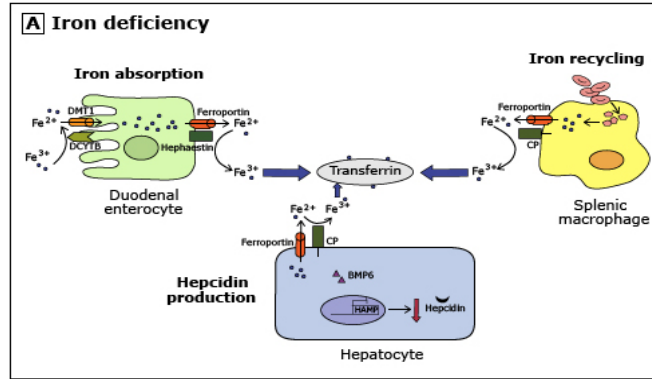
Daily low-dose aspirin (July 2023)

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- Randomized trial in older adults assigned to daily low-dose aspirin or placebo
 - Small but statistically significant increase in the rate of anemia.
 - 51 per 1000 person-years in the aspirin group versus 43 per 1000 person-years with placebo (13 % with aspirin vs 10 % with placebo)
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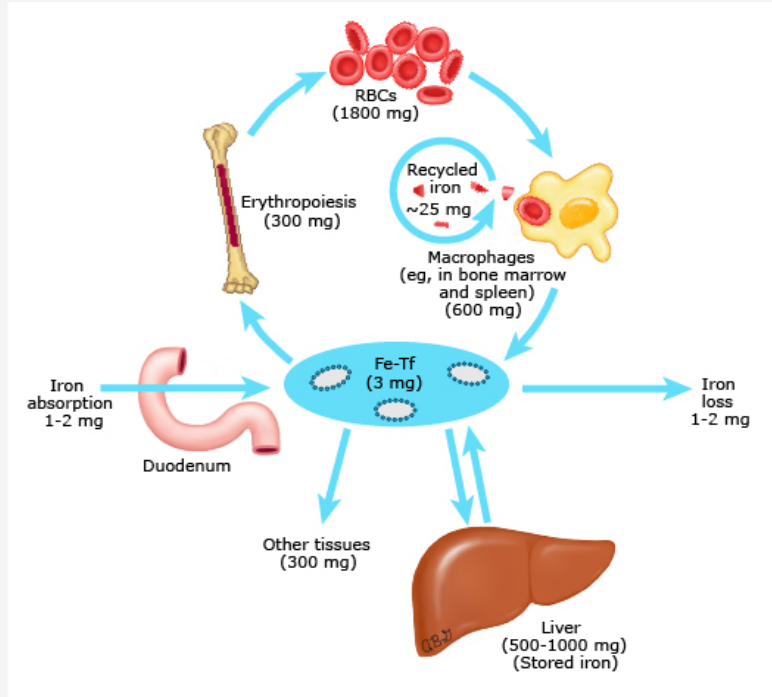
Distribution

	70 kg man	60 kg woman
Iron stores - transferrin, ferritin, hemosiderin	0.7 g	0.3 g*
Hemoglobin	2.5 g	1.9 g
Myoglobin	0.14 g	0.13 g
Heme enzymes	0.01 g	0.01 g
TOTAL	3.35 g	2.34 g

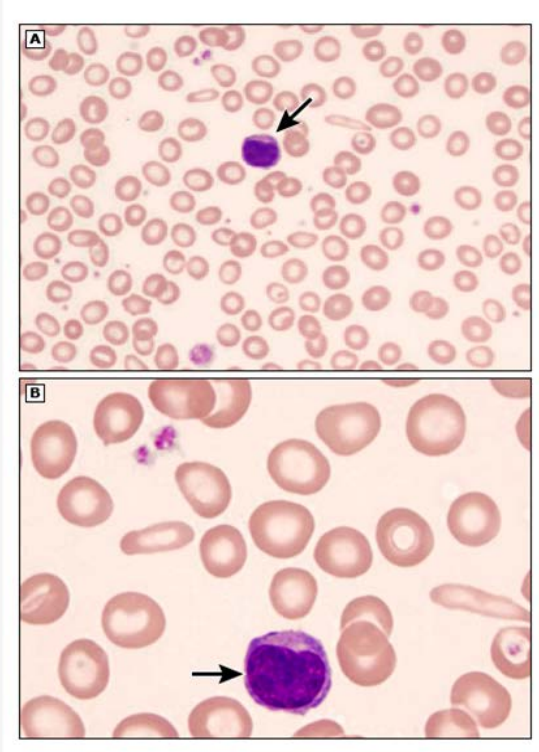
Regulation of Iron Balance



Regulation of iron absorption, transport, and homeostasis



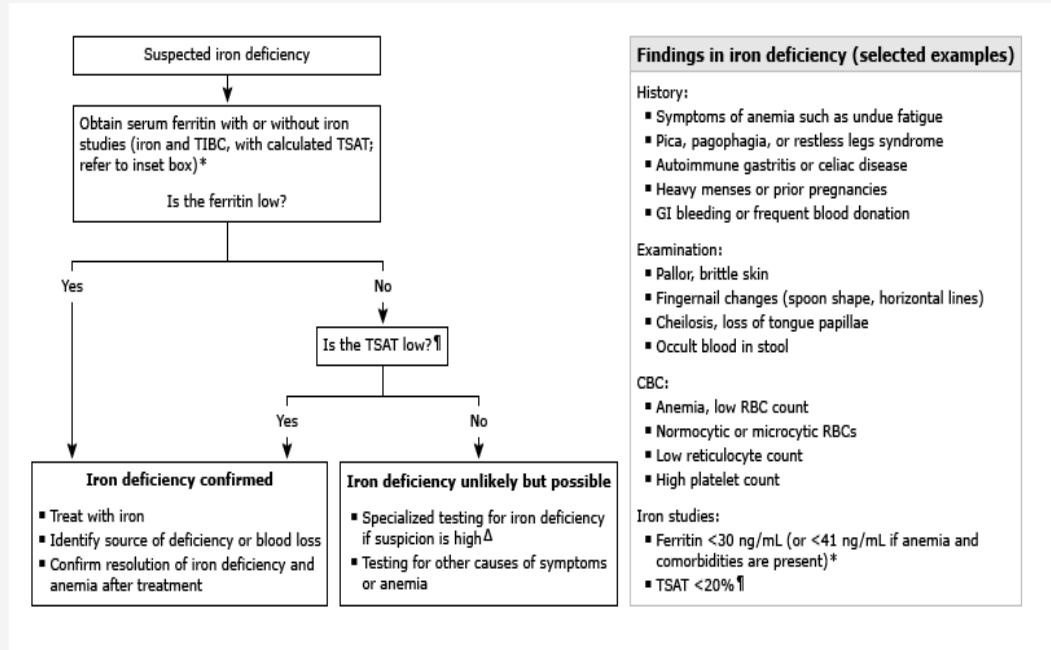
Peripheral Blood Smear



Laboratory findings

	Normal	Iron deficiency without anemia	Iron deficiency with mild anemia	Iron deficiency with severe anemia
Hemoglobin	Normal range*	Normal range*	9 to 12 g/dL (90 to 120 g/L)	6 to 7 g/dL (60 to 70 g/L)
Red blood cell size and appearance	Normal	Normal	Normal or slight hypochromia (slight decrease in MCHC)	Microcytosis (decrease in MCV) and hypochromia (decrease in MCHC)
Serum ferritin	40 to 200 ng/mL (40 to 200 mcg/L; 89.9 to 449 picoM/L)	<40 ng/mL[†] (<40 mcg/L; <89.9 picoM/L)	<20 ng/mL (<20 mcg/L; <45 picoM/L)	<10 ng/mL (<10 mcg/L; <22.5 picoM/L)
Serum iron	60 to 150 mcg/dL (10.7 to 26.7 microM/L)	60 to 150 mcg/dL (10.7 to 26.7 microM/L)	<60 mcg/dL (<10.7 microM/L)	<40 mcg/dL (<7.1 microM/L)
Total iron-binding capacity (TIBC; transferrin)	300 to 360 mcg/dL (53.7 to 64.4 microM/L)	300 to 390 mcg/dL (53.7 to 69.8 microM/L)	350 to 400 mcg/dL (62.6 to 71.6 microM/L)	>410 mcg/dL (>73.4 microM/L)
Transferrin saturation (serum iron/TIBC)	20 to 50%	20%	<15%	<10%
Reticulocyte hemoglobin^[1]	30.6 to 35.4 pg	22.3 to 34.7 pg	14.8 to 34.0 pg	Data not available
Bone marrow iron stain	Adequate iron present	Iron absent	Iron absent	Iron absent
Erythrocyte zinc protoporphyrin, ng/mL RBC	30 to 70	30 to 70	100 to 200	100 to 200

Diagnosis



CLINICAL PRESENTATION

Iron-deficiency anemia can cause:

- Brittle nails
- Cracks in the side of the mouth
- Extreme fatigue (tiredness)
- Chest pain
- Pale skin
- Dizziness or light headedness
- Fast heart rate
- Headache
- an enlarged spleen
- Cold hands and feet
- frequent infections.
- Irritability
- shortness of breath
- swelling or soreness of the tongue
- Pica
- Restless leg syndrome (RLS)



Angular cheilitis in a patient with iron deficiency



Koilonychia (spoon nail) associated with iron deficiency



Koilonychia (spoon nail) associated with iron deficiency



TREATMENT

- Iron supplements



Causes of lack of response

A coexisting condition is interfering with bone marrow response to iron repletion

- Infection
- Inflammatory disorder (eg, rheumatoid arthritis)
- Concomitant malignancy
- Coexisting folate and/or vitamin B12 deficiency
- Bone marrow suppression from another cause

Patient is not iron deficient; possible correct diagnoses include

- Thalassemia
- Lead poisoning
- Anemia of chronic disease/anemia of inflammation
- Copper deficiency (zinc toxicity)
- Myelodysplastic syndrome/refractory sideroblastic anemia

Patient is not taking the medication

- Prescription has not been filled
- Prescription has been filled but patient is no longer taking the medication

Medication is being taken but is not being absorbed

- Rapid intestinal transport bypasses area of maximum absorption
- Enteric coated product: coating is not dissolving
- Patient has an acquired condition that causes malabsorption of iron (eg, sprue, atrophic or autoimmune gastritis, *Helicobacter pylori* infection)
- Patient is taking an agent that interferes with absorption (eg, antacids, tetracycline, tea)
- Patient has a congenital cause for iron malabsorption (eg, iron-resistant iron deficiency anemia [IRIDA])

Continued blood loss or need in excess of iron dose ingested

- Treatable cause of blood loss (eg, bleeding peptic ulcer)
- Cause of blood loss that is not treatable (eg, hereditary hemorrhagic telangiectasia [Osler-Weber-Rendu syndrome]) or need cannot be met by oral iron preparation (eg, kidney failure or a malignancy being treated with erythropoietin)

IV Iron products

Drug	Trade (brand) name	Concentration of elemental iron	Dosing (adults)	Test dose	Premedication
Ferric carboxymaltose (FCM)	Injectafer (United States), Ferinject (United Kingdom and other countries)	50 mg/mL	<ul style="list-style-type: none"> Weight ≥ 50 kg: 1 or 2 doses of 750 mg, given 7 or more days apart <p>-OR-</p> <ul style="list-style-type: none"> Weight < 50 kg: 1 or 2 doses of 15 mg/kg, given 7 or more days apart 	Not required	<ul style="list-style-type: none"> We do not routinely premedicate for any of the IV iron products. For patients with asthma, multiple drug allergies, or inflammatory arthritis, we often give methylprednisolone alone prior to the iron infusion. We do not give diphenhydramine.
Ferric derisomaltose (previously called iron isomaltoside)	Monoferic (United States, Canada), Monofer (United Kingdom, other countries)	100 mg/mL	<ul style="list-style-type: none"> Weight ≥ 50 kg: Single dose of 1000 mg <p>-OR-</p> <ul style="list-style-type: none"> Weight ≥ 50 kg: Up to 3 doses of 500 mg given over 7 days <p>-OR-</p> <ul style="list-style-type: none"> Weight < 50 kg: Single dose of 20 mg/kg 	Not required	
Ferric gluconate (FG)	Ferriect	12.5 mg/mL	<ul style="list-style-type: none"> Multiple doses of 125 to 250 mg 	Not required, but recommended if the patient has a history of multiple drug allergies	
Ferumoxyl*	Feraheme (United States), Ruenso (United Kingdom and other countries)	30 mg/mL	<ul style="list-style-type: none"> Single dose of 1020 mg <p>-OR-</p> <ul style="list-style-type: none"> 2 doses of 510 mg, given 3 to 8 days apart 	Not required	
Iron dextran, low molecular weight (LMW ID) [†]	INFeD (United States), Dexiron (Canada), CosmoFer (United Kingdom and other countries)	50 mg/mL	<ul style="list-style-type: none"> Single dose of 1000 mg (diluted in 250 mL normal saline) given over 1 hour <p>-OR-</p> <ul style="list-style-type: none"> Multiple doses of 100 mg 	Yes, 25 mg (0.5 mL) prior to the first dose	
Iron sucrose (IS)	Venofer	20 mg/mL	<ul style="list-style-type: none"> Multiple doses of 100 to 300 mg 	Not required, but recommended if the patient has a history of multiple drug allergies	

IV iron vs Oral

	Advantages	Disadvantages
Oral iron	<ul style="list-style-type: none">▪ Effective for most patients▪ Extremely low risk of serious adverse events▪ Initial costs very low	<ul style="list-style-type: none">▪ Gastrointestinal side effects are common▪ Adherence may be low▪ May be inadequate for severe or ongoing blood loss▪ May require administration for several months▪ Total costs may be higher
IV iron	<ul style="list-style-type: none">▪ Effective for most patients▪ More rapid correction of anemia and resolution of symptoms▪ Ability to administer large doses (up to 1000 mg elemental iron) in a single infusion▪ Adherence is assured▪ No gastrointestinal side effects	<ul style="list-style-type: none">▪ Requires monitored intravenous infusion▪ Rare cases of allergic or infusion reactions▪ Requires equipment and personnel to treat allergic or infusion reactions▪ Initial costs may be higher



THANKS

DO YOU HAVE ANY QUESTIONS?

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