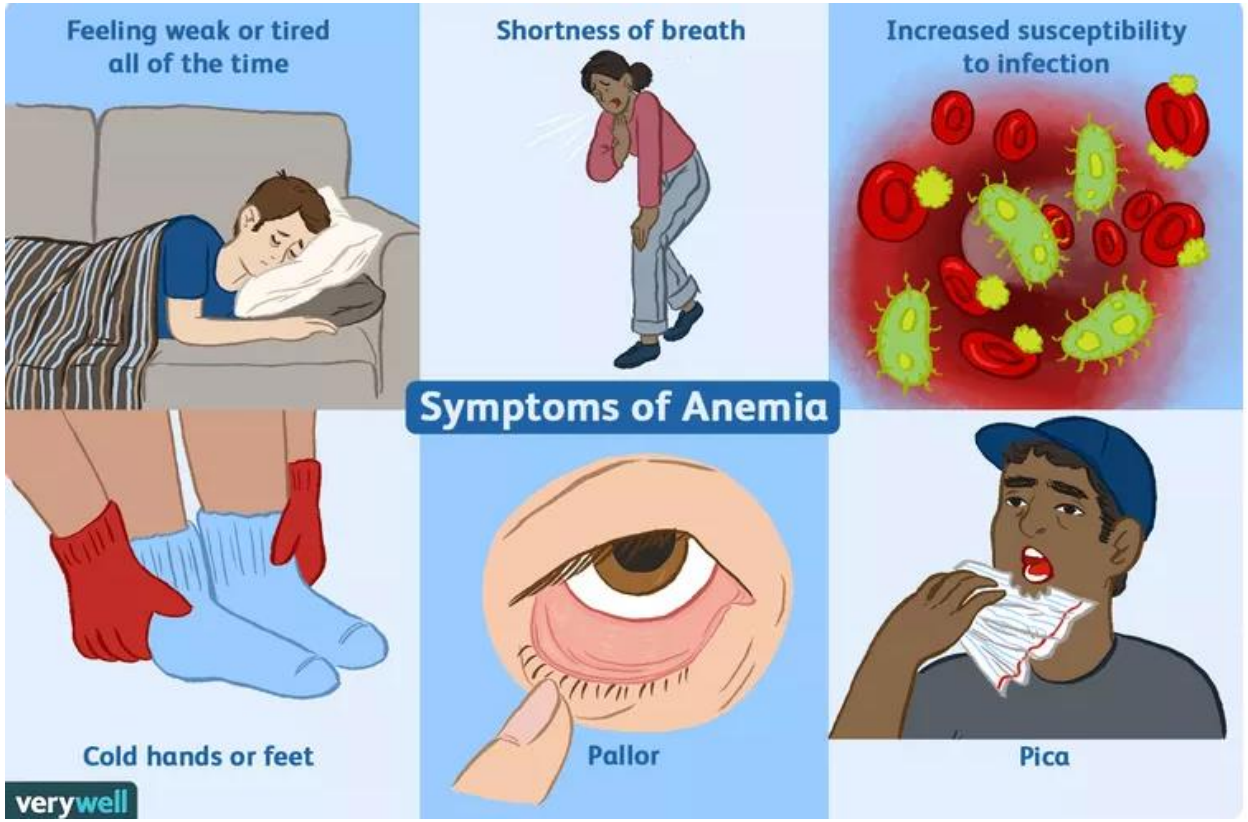
Drugs for Anemia

- Anemia is defined as a below-normal plasma hemoglobin concentration resulting from a decreased number of circulating red blood cells or an abnormally low total hemoglobin content per unit of blood volume

General signs and symptoms of anemia



Agents Used to Treat Anemias

- A. Iron

*Iron is stored in the intestinal mucosal cells, liver, spleen, and bone marrow as ferritin and delivered to the marrow for hemoglobin production

IRON FORMULATION	BRAND NAME(S)	ELEMENTAL IRON (%)	NOTES
Ferrous gluconate	Fergon, Ferro-Tab	12	• Less elemental iron, but similar tolerability to *ferrous sulfate*
Ferric ammonium citrate	Iron citrate	18	• Less bioavailable than ferrous salts • Must be reduced to ferrous form in the intestine
Ferrous sulfate	Fer-in-Sol, Feratab	20	• Most common oral iron supplement • Low cost with good effectiveness and tolerability
Ferrous sulfate, anhydrous	Slow-Fe	30	• Extended-release formulation of *ferrous sulfate* (once-daily dosing) • Higher cost than *ferrous sulfate*
Ferrous fumarate	Ferretts, Ferrimin, Hemocyte	33	• Similar effectiveness and tolerability to *ferrous sulfate* • Almost no taste compared to other iron salts
Carbonyl iron	Icar, Feosol	100	• Microparticles of purified iron • Dissolves in the stomach to form HCl salt to be absorbed • Less toxic than iron salts due to slower absorption rate (continued iron release for 1 to 2 days)
Polysaccharide-iron complex	Bifera, NovaFerrum, Nu-Iron 150	100	• Tasteless and odorless • Once-daily elemental iron dose similar to twice-daily *ferrous sulfate*

Adverse effects

- Gastrointestinal (GI) disturbances caused by local irritation (abdominal pain, constipation, nausea, diarrhea)
- Fatal hypersensitivity and anaphylactoid reactions can occur in patients receiving parenteral iron (mainly iron dextran formulations). A test dose should be administered prior to iron dextran

B. Folic acid (folate)

- The primary use of folic acid is in treating deficiency states
- Folate deficiency may be caused by

1) increased demand (for example, pregnancy and lactation)

2) poor absorption caused by pathology of the small intestine

3) alcoholism

4) treatment with drugs that are dihydrofolate reductase inhibitors (for example, methotrexate and trimethoprim)

C. Cyanocobalamin and hydroxocobalamin (vitamin B12)

- Deficiencies of vitamin B12 can result from either low dietary levels or, more commonly, poor absorption of the vitamin due to the failure of gastric parietal cells to produce intrinsic factor (as in pernicious anemia), or a loss of activity of the receptor needed for intestinal uptake of the vitamin.
- vitamin B12 deficiency anemia may cause tingling (pins and needles) in the hands and feet, difficulty walking, dementia, and, in extreme cases, hallucinations, paranoia, or schizophrenia.
- In patients with malabsorption, such as in bariatric surgery (surgical treatment for obesity), vitamin B12 supplementation as cyanocobalamin [sye-an-oh-koe BAL-a-min] is required daily in high oral doses or monthly by the parenteral route.

D. Erythropoietin and darbepoetin

- EPO regulates red blood cell proliferation and differentiation in bone marrow.
- Human erythropoietin (epoetin alfa), produced by recombinant DNA technology, is effective in the treatment of anemia caused by end-stage renal disease, human immunodeficiency virus infection, bone marrow disorders, prematurity, and malignancy.