

# IRONOVERLOAD WITH ANEMIA

## Clinical Evaluation & Management Protocol

### Tests: to help determine iron overload

Fasting serum iron → Serum iron/TIBC  
Total iron binding capacity X 100%= TS% (Normal 25-35%)

Serum ferritin: See ranges below

Liver biopsy with quantitative iron measurement (used in some cases; especially those with normal TS% with elevated serum ferritin)

Hepatic Iron Content (HIC): 4500 mcg (80 mcmmol) per gram of dry weight or 3-4+ iron stain

TS%= transferrin-iron saturation percentage

### Mean Corpuscular Volume (MCV) Reference Ranges

Newborn: 95 to 121 fl  
Ages 6 months to 2 years: 70 to 86 fl  
Ages 12 to 18 years  
Boys: 78 - 98  
Girls: 78 - 102  
Age over 18 years: 78 to 98 fl

### hemoglobin Adult Males Adult Females

Normal Range 13.5-17.5 g/dL 12.0-16.0 g/dL

### Adolescents, Juveniles, Infants & Newborns of normal height and weight for their age and gender

Age 6-18 years 10.0-15.5 g/dL	Age 2-6 mos 10.0-17.0 g/dL
Age 1-6 years 9.5-14.0 g/dL	Age 0-2 weeks 12.0-20.0 g/dL
Age 6 mos-1year 9.5-14.0 g/dL	Newborn 14.0-24.0 g/dL

### ferritin Adult Males Adult Females

Ideal Range	50-150 ng/mL	50-150 ng/mL
Induction Phase*	25-75 ng/mL	25-75 ng/mL

Serum ferritin decreases ~30 ng/mL per 500cc phlebotomy

### Adolescents, Juveniles, Infants & Newborns of normal height and weight for weight and gender

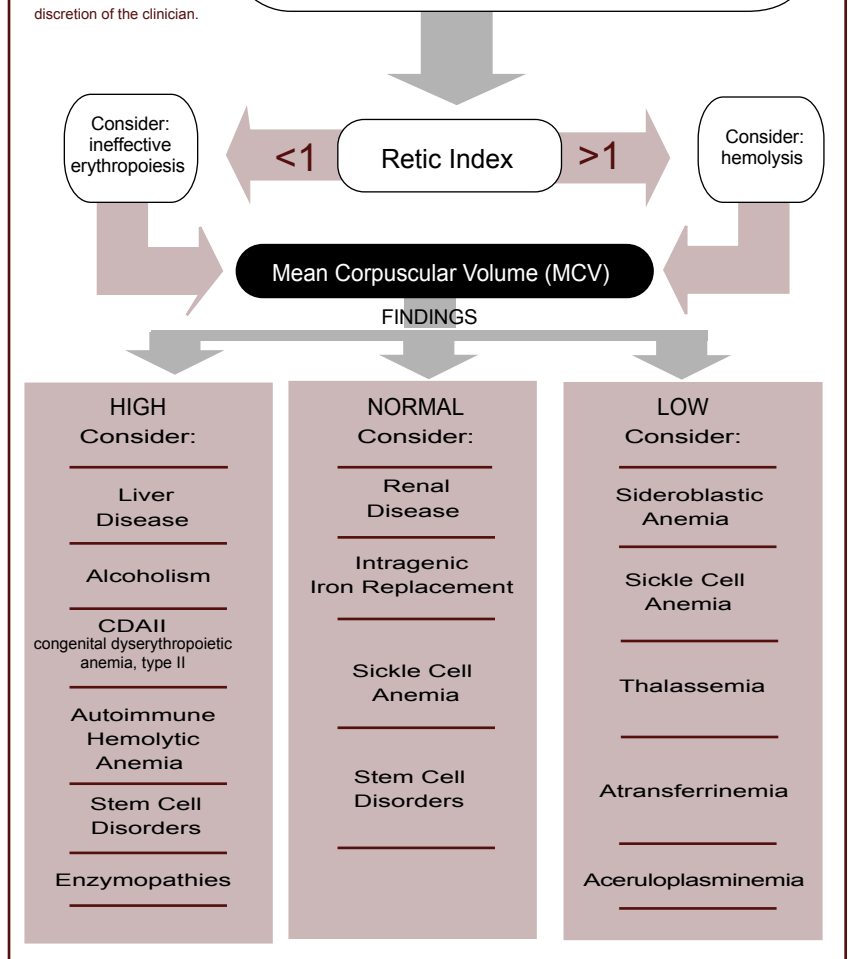
Male ages 10-19 years 23-70 ng/mL	Infants 7-12 months 60-80 ng/mL
Female ages 10-19 years 6-40 ng/mL	Newborn 1-6 months 6-410 ng/mL
Children ages 6-9 years 10-55 ng/mL	Newborn 1-30 days 6-400 ng/mL
Children ages 1-5 years 10-55 ng/mL	

\*iron reduction for iron overload patients who are not anemic e.g., hereditary hemochromatosis

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This algorithm is designed to be a general guideline only. Specific clinical circumstances may require modifications at the discretion of the clinician.

Patient has Iron Overload and is also anemic.  
Do physical exam, note ethnicity and family history; complete blood count with differential, blood smear\*\* and retic index



\*\* For blood cell images visit The American Society of Hematology website: [www.hematology.org](http://www.hematology.org)

For books and articles about types of iron disorders visit our website: [www.irondisorders.org](http://www.irondisorders.org)

### Iron Profile in Selected Conditions

iron panel	IRON PANEL TESTS					
	Serum Iron	Serum Ferritin	Transferrin Iron Saturation Percentage	Total Iron Binding Capacity (TIBC)	Transferrin	Hemoglobin
Hemochromatosis	↑	↑	↑	↓	↓	NORMAL
Iron Deficiency Anemia	↓	↓	↓	↑	↑	↓
Sideroblastic Anemia	↑	↑	↑	↓	↓	↓
Thalassemia	↑	↑	↑	↓	↓	↓
Porphyria Cutanea Tarda (PCT)	↑	↑	↑	↓	↓	NORMAL
Anemia of Chronic Disease (ACD)	↓	↑ OR NORMAL	↓	↓	↓	↓
African Siderosis (AS)	↑	↑	↑	↓	↓	NORMAL
Vitamin B12 Deficiency (pernicious anemia)	↑ OR NORMAL	↑ OR NORMAL	↑ OR NORMAL	↓ OR NORMAL	↓ OR NORMAL	↓

NOTE: Many of these conditions occur concomitantly with other illnesses confounding the findings.

Anemias associated with ineffective erythropoiesis are more prone to be associated with de novo iron overload. Conditions with associated iron overload are in the table below.

Condition	Cause/Mechanism	Management of Iron Overload
Sideroblastic Anemia	Inherited: Mutations of the X chromosome, autosomes, mitochondrial chromosomes Iron overload due to ineffective erythropoiesis Acquired: exposure to toxins, medications, nutritional deficiencies, alcoholism, MDS. Iron overload due to chronic hemolysis	EPO with phlebotomy if hemoglobin is sufficient; if not, chelation therapy with desferioxamine or deferasirox. See product notes** below.  Beneficial supplements include B6, folic acid and antioxidants.
Thalassemia	Inherited: Iron overload due to ineffective hemoglobin production and repeated blood transfusion	Chelation therapy with desferioxamine or deferasirox. See product notes** below. Bone marrow transplantation may be useful. Beneficial supplements include folic acid and diets rich in antioxidants.
CDA II Congenital dyserythropoietic anemia	Inherited: Iron overload due to chronic hemolysis and ineffective erythropoiesis	May require splenectomy to control hemolysis. EPO with phlebotomy if hemoglobin is sufficient; if not, chelation therapy with desferioxamine or deferasirox. See product notes** below.
Red Cell Enzymopathies such as: Glucose-6 Phosphate Dehydrogenase deficiency (G6PD) or Pyruvate kinase deficiency (PKD)	Inherited: G6PD: Iron overload is due to chronic hemolysis triggered by specific drugs, especially anti-malarials or by foods especially Fava beans. In PKD, iron overload is due to chronic hemolysis or repeated blood transfusion.	Avoidance of drugs, foods or conditions that precipitate hemolysis. EPO with phlebotomy if hemoglobin is sufficient; if not, chelation therapy with desferioxamine or deferasirox. See product notes** below.
Sickle Cell Disease	Inherited: Iron Overload due to repeated blood transfusion	Chelation therapy with desferioxamine or deferasirox. See product notes** below. Beneficial supplements include folic acid and antioxidants.
Autoimmune Hemolytic Anemia	Acquired: autoimmune response to drugs, systemic autoimmune diseases or idiopathic. Iron overload due to chronic hemolysis	Steroids or other immunosuppressive treatments. EPO with phlebotomy if hemoglobin is sufficient. If not, chelation therapy with desferioxamine or deferasirox. See product notes** below.
Myelodysplastic Syndromes Aplastic Anemia	Acquired: stem cell disorder  Iron overload due to repeated blood transfusion	EPO with phlebotomy if hemoglobin is sufficient. If not, chelation therapy with desferioxamine or deferasirox. See product notes** below. Treatment to correct bone marrow dysfunction. Bone marrow transplantation may be necessary in some cases.
Atransferrinemia or hypotransferrinemia Aceruloplasminemia or hypoceruloplasminemia	Inherited: Iron transport protein deficiencies Iron overload due to absent or low transferrin  Iron overload due to absent or low ceruloplasmin	Chelation therapy with desferioxamine or deferasirox. See product notes** below. Beneficial supplements include folic acid and antioxidants.

**\*\*Product Notes**

**E  
P  
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Recombinant human erythropoiesis-stimulating products available as epoetin-alpha brand names  
Epoetin® (Amgen);  
Procrit® (Ortho Biotech)  
darbepoetin alfa, brand name Aranesp® (Amgen)  
For more information about these products:  
Ortho Biotech [www.orthobiotech.com](http://www.orthobiotech.com)  
Amgen: [www.amgen.com](http://www.amgen.com)

**\*\*EXJADE® is the Novartis Pharmaceuticals brand for deferasirox. Desferal® is the Novartis Pharmaceuticals brand for desferioxamine.  
EXJADE® is approved by the FDA for use in treating transfusional iron overload. Recommendations in this chart to consider removal of iron with deferasirox may be off-label use.**