Fast facts

- Anemia affects 1.62 billion people worldwide. According to the WHO, worldwide prevalence is highest among preschool aged children (47%). Prevalence among school aged children worldwide is estimated at 25%.
- Iron deficiency anemia is the most common type of anemia, estimated to make up about 50% of cases.

Background

Anemia refers to a hemoglobin (Hgb) that is lower than normal for age and leads to decreased ability to deliver adequate oxygen to the body. Anemia in pediatrics is generally defined as a hemoglobin or hematocrit level lower than the age-adjusted reference range for healthy children. This leads to diminished oxygen-carrying capacity that does not optimally meet the metabolic demands of the body. Long-standing anemia can lead to problems with growth and development. There are many causes of anemia, and these causes vary based age at presentation, family history, socioeconomic factors, medications, genetics, diet, and comorbidities. In neonates and young infants, immune hemolytic disease, infection, and hereditary disorders are most common causes, while in older children, acquired causes related to diet or blood loss are more likely. The most common cause of anemia worldwide is iron deficiency.

Assessment:

Risk factors and clinical history should be assessed as appropriate on routine visits.

- Clinical history:
  - Signs/symptoms of anemia
  - Any bleeding history
  - Diet and growth history
- Family history:
  - Ethnicity, any other family members with anemia
- Medications that may contribute to anemia

Labs will inform management/treatment. If anemia is suspected based on assessment/risk factors or Hgb <10 on 12 month screen, obtain CBC with differential, reticulocyte count, iron studies including total iron, ferritin, and transferrin. If macrocytic, get B12 and folate levels.

Of note, if there is concern for abnormal newborn screen, please call CHoR 1PAL line for a doc to doc consult with CHoR Hematology.

Management/Treatment in the PCP office:

If Red Flags present, consider ED:
- Hgb <5 g/dL (indicates need for blood transfusion)
- Concern for severe symptoms of anemia (hypoxia, dyspnea on exertion, syncopal episodes)
- Abnormalities in all 3 cell lines

Refer to CHoR Hematology urgently (visit within 24-28 hours) or consider ED if:
- More than one cell line abnormality (i.e. neutropenia or thrombocytopenia in addition to anemia) Note: thrombocytosis is common in iron deficiency anemia

If Hgb is below lower limit for age (see table in algorithm), microcytic anemia (MCV < 80) and no other cell lines involved, treatment for suspected iron deficiency anemia can begin in the PCP office.
- If there is additional concern for failure to thrive, pica, or tachycardia syncopal episodes which may indicate severe or long-standing anemia, consider non-urgent referral to CHoR Pediatric Hematology in addition to beginning steps below.

1. Obtain baseline iron studies (as above, CBC, retic, total iron, ferritin, and transferrin)
2. Iron supplementation: 3 mg/kg/day of elemental iron given once daily (ferrous sulfate or iron polysaccharide if better tolerated)
3. Increase dietary intake of iron: provide hand-out on iron rich foods

All children are different. It is often appropriate to adapt these recommendations to the special needs of each child. These guidelines are not a substitute for thoughtful clinical judgment.
4. If >12 months of age, decrease cow’s milk intake to <18 oz (2 cups) per day.

5. Advise taking iron with vitamin C and to avoid milk within 2 hours of taking supplement to optimize absorption.

6. Recheck labs after 1 month of adherence to iron supplementation. If there is a significant increase in reticulocytes or increase in hemoglobin by at least 1 g/dL, recheck CBC and iron studies after 3 months. Iron can be discontinued when ferritin is normalized (generally after 3-6 months).

If no increase in hemoglobin or reticulocytes after 1 month on consistent iron supplementation, non-urgent referral to CHoR Hematology with the following:

- Send iron studies (ferritin, transferrin, iron) before starting treatment and after 1 month of treatment.
  A. Assess for any symptoms of malabsorption, i.e. blood in stools, poor growth, or diarrhea. Consider need for Pediatric Gastroenterology referral as well.
  B. Ensure patients are compliant with medications – prescription has been picked up, being taken as instructed, milk intake has decreased, etc.
- If applicable, also send any abnormal hemoglobin variants on newborn screen.

References:


Assessment:
All patients screened at 12 months.
Risk factors and clinical history assessed as appropriate on routine visits

Risk factors for anemia:
- Family history of anemia
- Ethnicity- African ancestry in sickle cell disease; Mediterranean, Asian, or African ancestry in thalassemia; Sephardic Jewish, Filipino, Greek, Sardinian, or Kurdish ancestry in G6PD deficiency
- Bleeding history (ie blood in stools, heavy period)
- Recent illness or chronic illness
- Vegan diet or other restrictive diet
- Toddlers and children with milk intake >24 oz a day
- Currently taking medications which can cause anemia (ie sulfa drugs, nitrofurantoin)

Clinical signs/symptoms of anemia:
- Fatigue
- Lightheadedness
- Exercise intolerance
- Syncopal episodes
- Pallitations
- Pallor
- Pica

Are Red Flags Present?
Hgb <5 g/dL (indicates need for blood transfusion)
Concern for severe symptoms of anemia (hypoxia, dyspnea on exertion, syncopal episodes)
Abnormalities in all 3 cell lines

Consider ED

Labs
- CBC with differential
- Reticulocyte count
- Iron studies including total iron, ferritin, and transferrin
- If macrocytic, get B12 and folate levels

Are there other cell line abnormalities besides Hgb?

Yes
- Refer to CHoR Hematology

No
- Recheck CBC and iron studies after 3 months. Can discontinue iron when ferritin normalized – generally after 3-6 months

Suspect possible anemia based on risk factors, symptoms or Hgb/Hct flagging low on screening lab?

No
- Continue to screen for signs/symptoms as appropriate on follow-up visits

Yes
- Yes
- Labs
- CBC with differential
- Reticulocyte count
- Iron studies including total iron, ferritin, and transferrin

Yes
- If macrocytic, get B12 and folate levels

Consider ED

Is Hgb below the lower limit of normal for age? (See table page 2)

No
- Continue to screen for signs/symptoms as appropriate on follow-up visits

Yes
- Recheck labs (CBC and reticulocytes) after one month on consistent iron supplementation

Are Red Flags Present?
Hgb <5 g/dL (indicates need for blood transfusion)
Concern for severe symptoms of anemia (hypoxia, dyspnea on exertion, syncopal episodes)
Abnormalities in all 3 cell lines

Consider ED

Labs
- CBC with differential
- Reticulocyte count
- Iron studies including total iron, ferritin, and transferrin
- If macrocytic, get B12 and folate levels

Yes
- Refer to CHoR Hematology

No
- Recheck CBC and iron studies after 3 months. Can discontinue iron when ferritin normalized – generally after 3-6 months

For doc to doc consult with a CHoR Heme-Onc doc or to schedule an urgent visit call CHoR’s 1PAL line 804-628-1PAL (1725)

Increase dietary intake of iron- educate on iron rich foods
- Children >1 year should drink no more than 18oz (~2 cups) cow’s milk per day.
- Iron Supplementation: 3mg/kg/day of elemental iron given once daily – Max dose of 200mg elemental iron
- Take iron with vitamin C and avoid milk within 2 hours of taking supplement to maximize absorption
- Adherence to iron supplementation can be an issue, collaborate with families to ensure adherence

Recheck labs (CBC and reticulocytes) after one month on consistent iron supplementation

PO Iron Formulations:
- Ferrous Sulfate - 325mg contains 62mg elemental iron
- Iron Polysaccharide - 150mg contains 150mg elemental iron

First Approved May 2022, Created by CHoR division of Heme-Onc, with input from Virginia Children’s Care Network Community PCPs
<table>
<thead>
<tr>
<th>Age</th>
<th>Hemoglobin (g/dl)</th>
<th>Hematocrit (%)</th>
<th>Red cell count (10^{12}/l)</th>
<th>MCV (fl)</th>
<th>MCH (pg)</th>
<th>MCHC (g/dl)</th>
<th>Reticulocytes</th>
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<td>Birth (cord blood)</td>
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<td>4.7</td>
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<td>1–3 days (capillary)</td>
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<td>1 week</td>
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<td>2 weeks</td>
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<td>1 month</td>
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<td>2 months</td>
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*These data have been compiled from several sources. Emphasis is given to studies employing electronic counters and to the selection of populations that are likely to exclude individuals with iron deficiency. The mean ± 2 SD can be expected to include 95% of the observations in a normal population.