

Anemia In Athletes

See also Anemia

Background

1. Anemia = hemoglobin (Hgb) or hematocrit (Hct) < 2 SD below mean
 - Normal values vary w/age, sex, altitude
 - Normal Hgb for males: 14-16 gm/dL
 - Normal Hgb for females: 12-15.5 gm/dL
 - "Sports anemia": anemia in an athlete
2. General information:
 - Anemia in athletes should be worked up & tx as in non-athletes:
 - Iron studies
 - Vit B12 & Folate
 - GI evaluation
 - Referral as indicated

Pathophysiology

1. Anemia is a lack of RBCs due to a number of causes:
 - Vitamin deficiencies
 - Iron deficiency
 - Hemoglobinopathies
 - Bone marrow failure or dysfunction
2. Symptoms of anemia related to relative tissue hypoxia due to low oxygen carrying capacity of blood
3. Sports anemia is a dilutional pseudoanemia
 - Research indicates it may be a beneficial adaptation
 - Plasma vol incr 10-20% as a response to endurance training
 - Incr plasma vol causes Hgb levels to decr while incr blood fluidity
 - Not felt to be pathologic
 - Usually returns to normal within 3-5 days of activity cessation
4. Footstrike hemolysis or Exertional hemolysis, also "heel strike hemolysis" and "march hemoglobinuria"
 - Result of intravascular hemolysis d/t RBC trauma at sole of foot on impact
 - Primarily seen in long distance runners d/t repeated forceful, high impact heel strikes
 - Can also occur when recreational runner incr distance
 - "March hemoglobinuria" described in 1861 in military personnel after strenuous field marches
 - Affected men had dark urine that cleared w/rest
 - Can also be seen in swimming, wt lifting, and rowing
 - Thought to be d/t RBC exposure to continuous high oxygen-flux causing oxidative damage
 - Which may lead to a shorter life-span of RBC
 - Normal life-span: 120 days
5. Iron deficiency in athletes
 - Long-distance endurance sports
 - GI loss of heme due to reversible bowel ischemia, GI bleeding, gastric ulcers
 - Poor dietary intake of iron

- Menstruation
 - Ferritin can be decreased in training athletes
 - Loss in sweat
 - Rapid turnover of iron in aerobic oxidative muscle metabolism
 - Iron shift from tissue storage to RBCs
6. Incidence/ prevalence
- Athletes are no more likely to develop anemia than non-athletes
 - Footstrike hemolysis found in up to 20% of long-distance endurance runners
 - Occurs equally in male and female runners
 - Iron deficiency anemia is more common in female athletes and young athletes
 - Insufficient dietary intake of iron
 - Higher iron demands during growth
 - Menstruation
 - Low iron stores in ~18% of strenuously trained adolescent athletes

Diagnostics

1. History:

- Often no or mild symptoms
- General fatigue
- Weakness
- Dyspnea w/long, strenuous exertion
- Decr in exercise performance
 - Most common reason for athlete to seek care
- Hx should incl
 - Dietary intake
 - Possible hemoglobinopathies
 - Sickle cell anemia/ trait
 - Thalassemias
 - Occult malignancy
 - GI or GU pathology
 - Hx of blood transfusions
 - Oral supplements
 - Prescription meds
 - Recent training hx
 - If incr mileage eval for footstrike hemolysis

2. Physical examination:

- See: Anemia
- Often mild or no findings
- May see glossitis, angular stomatitis, spooning of nails

3. Diagnostic testing

- Sports anemia
 - Mild decr in Hgb in euvoletic pt
 - Orthostatic VS normal
 - Normal
 - MCV
 - Iron studies
 - Vit B12 level
 - Folate

- Footstrike hemolysis
 - Incr reticulocyte count
 - Echinocytes/ reticulocytes on peripheral smear
 - UA for hemoglobin, hemoglobin casts, hemosiderin
 - CBC w/mild decr in Hgb, mild incr in MCV
 - Iron studies normal w/ferritin normal or slightly low
- Iron deficiency anemia
 - Normal to low Hgb
 - Low serum ferritin
 - Decr MCV
 - Soluble transferrin receptor (sTfR)
 - Incr sTfR: upregulation of receptor indicates iron deficiency
 - Not standard testing at this time, may be helpful
 - Consider GI workup
 - Occult blood loss in stool incr w/long duration athletic events
 - Usually minimal loss
 - If anemic, work-up
 - Iron malabsorption
 - Check serum iron before and 2 hrs after oral iron supplementation
 - If no serum iron rise, malabsorption syndrome likely
 - Parenteral iron tx

Differential Diagnosis

1. Rule out other causes of anemia/ symptoms mimicking anemia
 - Acute infectious illness
 - Life threatening cardiac abnormalities
 - Congenital heart defects
 - HCM/ IHSS
 - If acute SOB
 - Pulmonary embolism (PE)
 - Asthma exacerbations
2. Decr exercise performance may be d/t deconditioning and overtraining w/o anemia
3. Supplements, herbal therapies, prescription drugs can cause bone marrow suppression
4. HIV may present w/anemia

Therapeutics

1. Sports anemia
 - Pseudoanemia
 - No tx required
2. Footstrike/ Exertional hemolysis
 - Temporary
 - Will improve w/decr training vol and/or runner adaptation
 - Biomechanical eval to change stride
 - Soft, padded shoe inserts
 - Training on soft surfaces
 - Appropriate hydration to prevent secondary renal insufficiency from hemolysis

3. Iron deficiency anemia

- Iron supplementation
 - 200 mg of elemental iron per day
 - Vit C incr bioavailability of oral iron
 - Severe iron deficiency requires further eval
 - May require parenteral therapy w/ IV iron supplementation and transfusion
 - IV iron max 100 mg of elemental iron per day once weekly for 4 wks
 - Followed by monthly therapy if required
 - IV iron dextran may cause anaphylaxis during tx
 - Less chance of reaction w/IV iron sucrose products
- Gastric ulcers
 - Tx w/histamine H2 antagonists

Follow-Up

1. For iron deficiency
 - Repeat CBC, serum iron and ferritin to eval response to oral iron
 - Severe iron deficiency requires GI eval
 - Occult GI malignancy
 - Hemorrhagic ulceration
 - Arteriovenous malformation
 - Other GI sources of blood loss
 - Iron malabsorption
2. Women w/severe menorrhagia
 - Need eval and referral to gynecology when appropriate

Prevention/ Screening

1. Screening for anemia in athlete is controversial
 - Consider in
 - Menstruating, tired female athletes
 - Elite male athletes
2. CBC and iron studies:
 - Iron
 - Ferritin
 - TIBC
 - Transferrin saturation
3. Consider soluble transferrin receptor assay if previous iron studies are indeterminant
4. If iron supplementation results in incr Hgb concentration, exercise performance improves

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