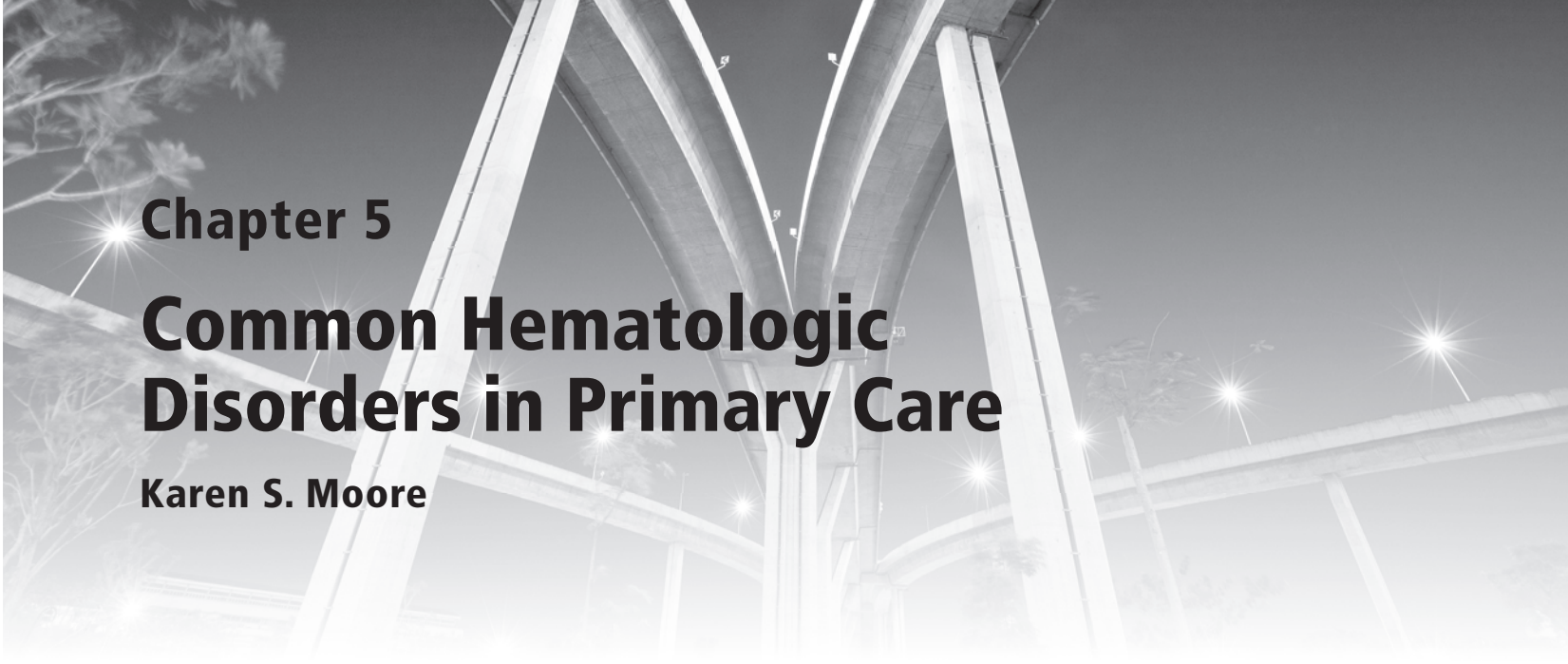

Chapter 5

Common Hematologic Disorders in Primary Care

Karen S. Moore

Chapter Outline

Case 1 - Anemia of Chronic Disease

- **A.** History and Physical Exam
- **B.** Recommended Labs/Diagnostics
- **C.** Pathophysiology
- **D.** Treatment Plan
- **E.** Guidelines to Direct Care:

  Kidney Disease: Improving Global Outcomes (KDIGO) Anemia Work Group. KDIGO clinical practice guideline for anemia in chronic kidney disease.

  KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease.

Case 2 - Anemia of B_{12} Deficiency

- **A.** History and Physical Exam
- **B.** Recommended Labs/Diagnostics
- **C.** Pathophysiology
- **D.** Treatment Plan

Case 3 - Anemia of Folate Deficiency

- **A.** History and Physical Exam
- **B.** Recommended Labs/Diagnostics
- **C.** Pathophysiology
- **D.** Treatment Plan
- **E.** Guidelines to Direct Care:

  American Red Cross Blood Donation Guidelines.

  National Institutes of Health. National Institute on Alcohol Abuse and Alcoholism. Alcohol use disorder guideline.

Case 4 - Iron Deficiency Anemia

- **A.** History and Physical Exam
- **B.** Recommended Labs/Diagnostics
- **C.** Pathophysiology
- **D.** Treatment Plan
- **E.** Guidelines to Direct Care:

  Treatment of Anemia in patients with heart disease: a clinical practice guideline from the American College of Physicians.

Case 5 - Alpha Thalassemia

- **A.** History and Physical Exam
- **B.** Recommended Labs/Diagnostics
- **C.** Pathophysiology
- **D.** Treatment Plan

Learning Objectives

Using a case-based approach, the learner will be able to:

1. Identify key history and physical examination parameters for common hematologic disorders seen in primary care, including anemia and thalassemia.
2. Summarize recommended laboratory and diagnostic studies indicated for the evaluation of common hematologic disorders seen in primary care.
3. State pathophysiology of common hematologic disorders.
4. Document a clear, concise SOAP note for patients with common hematologic disorders.
5. Identify relevant education and counseling strategies for patients with common hematologic disorders.
6. Develop a treatment plan for common hematologic disorders utilizing current evidence-based guidelines.

Case 1

Mr. Frederick is a 66-year-old African American male who presents with complaints of (c/o) fatigue, increased shortness of breath that worsens with walking or activity, and "just feeling bad." Mr. Frederick has not been to a primary care provider in "about 10 years." States he went to the emergency room (ER) "about a month ago" and was diagnosed with hypertension (HTN) and kidney disease. States he was started on medications to decrease fluid retention and treat his HTN and referred to your office for follow-up. Unsure of last tetanus vaccination date, does not get annual influenza vaccines. States he had "regular childhood" immunizations. Denies significant illness prior to recent diagnoses. Denies chest pain, coughing, dizziness, vomiting. When queried further, Mr. Frederick reports some nausea and itching skin that has gotten progressively worse over the last few months. Denies surgeries or prior hospitalizations. Denies alcohol use, illicit drug use, tobacco use. No known drug allergies (NKDA). Current medications: furosemide 10 mg QD and lisinopril 5 mg QD.

Physical Exam

Vital Signs: Blood pressure (BP) 168/94, heart rate (HR) 116, respiratory rate (RR) 20, temperature (T) 98.8, height (Ht) 6'2", weight (Wt) 325 lbs

General (GEN): Progressive fatigue. Denies fever, chills, or night sweats. No acute distress

Head, eyes, ears, nose, and throat (HEENT): Head normocephalic without evidence of masses or trauma. Pupils equal, round, react to light, accommodation (PERRLA), extraocular movements (EOMs) full to confrontation. Noninjected. Fundoscopic exam unremarkable with exception of pale retinal background. Palpebral conjunctiva pale. Ear canal without redness or irritation, tympanic membranes (TMs) clear, pearly, bony landmarks visible. No discharge, no pain noted. Pale nasal mucosa. Posterior pharynx pale. Neck: Supple without masses. No thyromegaly. No jugular vein distention (JVD) noted.

Skin: Dry skin with pruritus, no discoloration, no open areas noted

Cardiovascular (CV): S_1 and S_2 regular rate and rhythm (RRR), no murmurs, no rubs. 2+ edema noted to bilateral midpretibial region of lower extremities

Lungs: Clear to auscultation

Abdomen: Soft, nontender, nondistended, bowel sounds present × 4 quadrants, no organomegaly, no bruits

Rectal: Normal vault, good tone, heme-negative stool

Neuro: Cranial nerves (CN) II–XII intact. Rhine/Weber normal, Romberg negative. Sensation intact, deep tendon reflexes (DTR) 2+

What additional assessments do you need?

What is the differential diagnoses list?

What is your working diagnosis?

Additional Assessments/Diagnostics Needed

Mr. Frederick presents with symptoms of anemia and chronic kidney disease.[1–8] Anemia is characterized by decreased hemoglobin and hematocrit identified on lab testing but may have multiple causes requiring different interventions to correct underlying disease pathology. It is important to identify the underlying cause of Mr. Frederick's anemia.

His diagnosis of HTN and his fluid retention dictate that a more careful evaluation be completed to evaluate for cardiovascular disease. It is important to remember that HTN can be a complication of kidney disease, or it may have been a causative factor. Because Mr. Frederick has not been evaluated in 10 years, it is difficult to determine whether his HTN preceded the kidney failure or the elevated blood pressure is a result of worsening kidney function. Regardless, evaluation of complications of HTN and kidney disease should be undertaken as well as identification of the cause of his anemia.

Evaluation for patients with suspected anemia should include:

- Risk factors for anemia:
  - Anemia risk increases with age. Although the exact etiology of anemia in elderly persons may be multifactorial, advancing age is a known risk factor for anemia.
  - A diet that is deficient in quality protein sources and B vitamins is a known risk factor for anemia. Hematopoiesis requires healthy levels of macronutrients and micronutrients to carry out cell production and maturation.
  - Intestinal disorders such as malabsorptive disorders, parasitism, lack of intrinsic factor, gastric bypass surgery, Crohn's disease, and ulcerative colitis increase the risk of anemia.
  - Chronic diseases such as thyroid, liver, kidney, or autoimmune diseases as well as HIV/AIDS and cancer increase the risk of anemia. Mr. Frederick has a recent diagnosis of chronic kidney disease, so you need to investigate whether his kidney disease is the cause of his anemia.
  - Pregnancy, childbirth, and dysfunctional uterine bleeding predispose women to anemia.
  - Inherited diseases such as sickle cell disease or trait as well as the thalassemias can interfere with production and maturation of red blood cells.
  - Bone marrow dysfunction such as myelodysplastic syndrome, blood or bone cancers, and marrow suppression by medications, toxins, or disease increase the risk of anemia.
- Identifiable causes of anemia:
  - *Bleeding:* Either chronic or acute blood loss can be the cause of anemia. In the case of Mr. Frederick, he denies any signs or symptoms of upper gastrointestinal blood loss, he is male, which precludes menstrual abnormalities as the cause of his anemia, and his stool was negative for blood during exam, which lessens the likelihood that his anemia is related to lower gastrointestinal loss. Depending on his laboratory testing, this cause of anemia may need to be explored in addition to other more likely causes.
  - *Diminished red blood cell (RBC) production:* For Mr. Frederick, his diagnosis of kidney disease should increase suspicion of the potential cause of his anemia. Chronic kidney disease is associated with a decreased level of erythropoietin, which is a hormone secreted by the kidneys that is necessary for RBC production. This probable etiology for Mr. Frederick's anemia should be further explored with laboratory testing.
  - *Rapid rates of red blood cell destruction:* Inherited or acquired diseases that cause an increased rate of RBC destruction can lead to anemia. Mr. Frederick's medical history does not suggest any of these potential causes nor does his physical examination reveal enlargement or abnormality of his spleen. If suspected, laboratory studies to rule out sickle cell disease and thalassemia should be performed. If other causes are ruled out, further studies for causative agents of hemolytic anemia may be undertaken.
- Presence or absence of complications of anemia:
  - Arrhythmia
  - Congestive heart failure
  - End organ damage such as liver and kidney failure

ROS

Focus additional questions on assessment of the impact that his anemia symptoms are having on his activities of daily living as well as potential clues to the cause of his anemia, including:

- Fatigue (Mr. Frederick reports fatigue)
- Chest pain (denies)
- Palpitations (denies)
- Shortness of breath (SOB) (Mr. Frederick reports SOB)
- Dyspnea on exertion (DOE) (Mr. Frederick reports DOE)
- Dizziness (denies)
- Headache (denies)
- Coolness in hands and feet or paresthesias (denies)
- Nausea/vomiting—patients with chronic kidney disease often report nausea (Mr. Frederick reports nausea)
- Worsening of these symptoms with activity can provide an estimate of the severity of anemia

Further discussion of cardiovascular risk factors should also be explored, including:

- HTN—Mr. Frederick has been diagnosed with HTN
- Cigarette smoking—Mr. Frederick is a nonsmoker
- Obesity—Mr. Frederick has a body mass index of 41.7
- Physical inactivity—Mr. Frederick does not exercise
- Dyslipidemia—you will need to order labs
- Diabetes mellitus—you will need to order labs
- Microalbuminuria or estimated glomerular filtration rate (GFR)—you will need to order urine analysis and labs. This will be in addition to other kidney-related evaluations
- Age—Mr. Frederick is 66 years old
- Family history—when queried further, he reports his mother and father both had HTN, diabetes mellitus (DM), and chronic kidney disease (CKD). These are significant risk factors

Physical Exam

The physical examination for this patient should include:

- A thorough assessment of the heart and lungs for signs and symptoms (s/s) of cardiac complications of anemia and kidney disease (arrhythmias, extracardiac sounds, murmurs or rubs, auscultation of lungs)
- Evaluation for fluid overload (peripheral edema, JVD, cardiac and lung evaluation)

- Appropriate measurement of blood pressure with verification in the contralateral arm
- Palpation of the lower extremities for edema and peripheral pulses
- Examination of the abdomen for enlarged spleen, liver, changes in kidneys (either enlarged or smaller than anticipated), masses, and abnormal aortic pulsations
- Examination of the skin and nails for complications of anemia and kidney disease (pruritus, spoon nails [koilonychias])
- Examination of the mucous membranes for s/s of anemia (pallor, glossitis of the tongue, angular cheilitis of the mouth)

Routine Labs

Routine labs for Mr. Frederick should include those directed at assessing his kidney function as well as his anemia and end organ function.

Baseline studies:

- Comprehensive metabolic panel, including:
  - Albumin (normal)
  - Alkaline phosphatase (normal)
  - ALT (alanine aminotransferase) (normal)
  - AST (aspartate aminotransferase) (normal)
  - Blood urea nitrogen (BUN) (elevated)
  - Creatinine (elevated)
  - Calcium (normal)
  - Chloride (normal)
  - Carbon dioxide (normal)
  - Glucose (normal)
  - Potassium (high normal range)
  - Sodium (normal)
  - Total bilirubin (normal)
  - Total protein (normal)
- Complete blood count, including:
  - RBC (low)
  - Hemoglobin (Hgb) 11% (low)
  - Hematocrit (Hct) 33% (low)
  - MCV mean corpuscular volume (normal)
  - MCH mean corpuscular hemoglobin (normal)
  - MCHC mean corpuscular hemoglobin concentration (normal)
  - Platelets (normal)
  - White blood cells (WBCs) (basophils, eosinophils, lymphocytes, monocytes, neutrophils) (normal)

Additional kidney function studies:

- Urinalysis (UA) (protein ++)
- 24-hour urine (A 24-hour urine is completed to assess for sedimentation and creatinine clearance to provide information on kidney function)
- Glomerular filtration rate (GFR) 40 (mL/min per 1.73 m^2)—GFR of 30–59 is considered Stage 3 CKD[7]

Additional anemia studies:

- Serum iron (low)
- Serum ferritin (low)
- Total iron-binding capacity (TIBC) (low)
- Vitamin B_{12} (may be abnormal in some anemias, but in the case of Mr. Frederick it is normal)
- Folate (may be abnormal in some anemias, but in the case of Mr. Frederick it is normal)
- Reticulocyte count (low)
- Red cell distribution width (RDW) (variable but within normal range)
- Peripheral blood smear (poikilocytosis)

Additional labs:

- *Liver function tests:* Done as baseline study related to possible causes of anemia and potential for cholesterol management (normal)
- *Cholesterol panel:* Advised to assess for cardiovascular disease (CVD). Done as baseline study related to Mr. Frederick's age and years since last primary care evaluation (Mr. Frederick's cholesterol and low-density lipoprotein [LDL]/high-density lipoprotein [HDL] ratio results suggest the need for further intervention)
- *Thyroid studies:* If thyroid disease is suspected (not done for Mr. Frederick)
- *EPO:* Erythropoietin (EPO) studies may be ordered to determine whether CKD and resultant erythropoietin deficiency is the cause of anemia (Mr. Frederick's EPO is low)

Potential diagnostic studies:

- Renal ultrasound—to determine size, shape, and density of kidneys
- Renal biopsy—to determine precise etiology of kidney disease

Differential Diagnoses List

Chronic kidney disease
Anemia of chronic disease
Anemia of B_{12} deficiency
Anemia of folate deficiency
Hypertension
Cardiovascular disease
Congestive heart failure
Diabetes mellitus
Obesity

Working Diagnoses

Chronic kidney disease—Stage 3
Anemia of chronic disease

Hypertension

Obesity

Pathophysiology

Anemia is defined as a hemoglobin level of less than 12.0 mg/dL in adult females and less than 13.5 mg/dL in adult males.[1–8] Anemia is the most common blood disorder in the United States and affects nearly 3 million persons annually. Anemia of chronic disease (ACD), as in the case of chronic kidney disease, is caused primarily by decreased erythropoietin leading to a decreased reticulocyte count. ACD is diagnosed by careful observation of the lab values. ACD is referred to as a normocytic, normochromic anemia. This means that the MCV is normal, and MCHC is normal. The reticulocyte count is low, with variability in the size of the RBCs, but the RDW is still within normal limits. The RBCs may demonstrate abnormal shapes on the smear, known as poikilocytosis. The serum iron and TIBC will be low.

Although other forms of anemia may also be present and coexist in a patient with chronic kidney disease or other chronic illnesses, Mr. Frederick's lab results suggest an anemia caused by erythropoietin insufficiency leading to lowered RBC production by the bone marrow.

What Is Your Treatment Plan?

Pharmacologic

Continue Mr. Frederick on his current dosage of furosemide and lisinopril.[1–8] This medication regimen may need to be adjusted once evaluated by a renal specialist, but at the current dosage it should be well tolerated by Mr. Frederick. Remember that anemia is treated by identifying the root cause and then treating that disease process. In the case of chronic kidney disease, erythropoietin deficiency is the cause of the anemia so that is where you should focus your treatment. Erythropoietin-stimulating agents (ESAs) are given via injection and could be a consideration for Mr. Frederick. ESAs should be initiated and managed by the renal specialist because this medication is not without risk. Mr. Frederick's Hgb is 11%, which is the target Hgb for persons with chronic kidney disease. For that reason, it is unlikely that ESAs would be initiated. Iron supplementation will generally be initiated whether or not ESAs are included in Mr. Frederick's treatment plan. Oral iron may not be effective in patients with CKD related to decreased absorption of iron from the gastrointestinal (GI) tract. Intravenous (IV) iron may be an acceptable alternative if iron stores do not improve with oral iron dosing regimens but should be managed by the renal specialist.

Nonpharmacologic

- Referral to a renal specialist.
- Consider RBC transfusion if Hgb is below target based upon patient's s/s and comorbid conditions. This is not indicated in Mr. Frederick
- Renal ultrasound—to be ordered by renal specialist
- Renal biopsy—to be ordered by renal specialist
- Lifestyle modifications to decrease CVD risk
  - Dietary modifications for weight loss, chronic kidney disease, CVD
  - Increase activity
- Dietary consultation
- Electrocardiogram (ECG) in office
- Consider cardiology consultation for further evaluation of CVD with exercise tolerance test (ETT)

Education/Counseling

- Lifestyle modifications
  - Dietary modifications
  - Sodium restriction
  - Weight loss
- Dietary consultation
- Signs and symptoms of worsening anemia/CKD
- Living well with CKD

SOAP Note

S: Mr. Frederick is a 66-year-old African American male who presents with c/o fatigue, DOE, and malaise as well as nausea and itching. Mr. Frederick has not been to a primary care provider in "about 10 years." Mr. Frederick was diagnosed with HTN and renal disease at the emergency room one month ago, started on medications for treatment, and referred for primary care follow-up. Unsure of last tetanus vaccination date, does not get annual influenza vaccines. States he had "regular childhood" immunizations. Denies significant illness prior to recent diagnoses. Denies chest pain, coughing, dizziness, vomiting. Denies surgeries or prior hospitalizations. Denies alcohol use, illicit drug use, tobacco use. NKDA. Current medications: furosemide 10 mg QD and lisinopril 5 mg QD.

O: *Vital Signs:* BP 168/94, P 116, RR 20, T 98.8, Ht 6'2", Wt 325 lbs

GEN: Progressive fatigue. Denies fever, chills, or night sweats. No acute distress

HEENT: Head normocephalic without evidence of masses or trauma. PERRLA, EOMs full to confrontation. Noninjected. Fundoscopic exam unremarkable with exception of pale retinal background. Palpebral conjunctiva pale. Ear canal without redness or irritation, TM clear, pearly, bony landmarks visible. No discharge, no pain noted. Pale nasal mucosa. Posterior pharynx pale. Neck supple without masses. No thyromegaly. No JVD noted

Skin: Dry skin with pruritus, no discoloration, no open areas noted

CV: S_1 and S_2 RRR, no murmurs, no rubs. 2+ edema noted to bilateral mid-pretibial region of lower extremities

Lungs: Clear to auscultation

Abdomen: Soft, nontender, nondistended, bowel sounds present × 4 quadrants, no organomegaly, no bruits

Rectal: Normal vault, good tone, heme-negative stool

Neuro: CN II–XII intact. Rhine/Weber normal, Romberg negative. Sensation intact, DTR 2+.

Lab Results: RBC, Hgb, Hct, retic, serum Fe, TIBC decreased, RDW, MCV, MCHC normal

A: Chronic kidney disease—Stage 3

Anemia of chronic disease

Hypertension

Obesity

P: Refer to renal specialist for further evaluation and management of renal disease and recommendations for anemia of chronic disease. Recommend lifestyle and dietary modifications for renal, CVD, and weight loss. Refer to dietitian. Continue lisinopril and furosemide. Vaccinations recommended: hepatitis A, hepatitis B, pneumonia, shingles, and annual influenza. Schedule colonoscopy. Follow-up in 2 weeks to assess medication tolerance, verify referral appointments, and review plan of care.

Health Promotion Issues[7–8]

- Vaccinations: Hepatitis A, hepatitis B, pneumonia, shingles, annual influenza
- Schedule colonoscopy

Guidelines to Direct Care

Centers for Disease Control and Prevention. Recommended adult immunization schedule, by vaccine and age group. 2015. http://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html. Accessed September 16, 2015.

Kidney Disease: Improving Global Outcomes (KDIGO) Anemia Work Group. KDIGO clinical practice guideline for anemia in chronic kidney disease. *Kidney Int Suppl*. 2012; 2(4):279–335. http://www.kdigo.org/clinical_practice_guidelines/pdf/KDIGO-Anemia%20GL.pdf. Accessed September 16, 2015.

Kidney Disease: Improving Global Outcomes (KDIGO) Anemia Work Group. KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. *Kidney Int Suppl*. 2013(3):1. http://www.kdigo.org/clinical_practice_guidelines/pdf/CKD/KDIGO_2012_CKD_GL.pdf. Accessed September 16, 2015.

US Preventive Services Task Force. Published recommendations. http://www.uspreventiveservicestaskforce.org/BrowseRec/Index/browse-recommendations. Accessed September 16, 2015.

World Health Organization. *Haemogolobin concentrations for the diagnosis of anaemia and assessment of severity*. Vitamin and Mineral Nutrition Information System. Geneva: World Health Organization; 2011. http://www.who.int/vmnis/indicators/haemoglobin.pdf. Accessed September 16, 2015.

Case 2

Mrs. Williams is a 68-year-old white female who presents with a complaint of fatigue that has gradually worsened over the last 6 months. The fatigue is not associated with chest pain, SOB, diaphoresis, or palpitations. She also recently noticed coldness as well as numbness and tingling in her lower extremities and intermittent dizziness when moving quickly from a seated to a standing position. Denies changes in bowel/bladder habits, denies appetite changes. Past medical history (PMH) of measles, mumps, rubella, and chickenpox in childhood. Denies significant medical conditions. Uses occasional ibuprofen as needed for arthralgia. No surgeries or hospitalization. NKDA. Reports immunizations up-to-date, tetanus booster vaccination 3 years ago, shingles and pneumonia vaccination 2 years ago, influenza vaccination annually. Mrs. Williams's last mammogram and well-woman exam were 3 years ago, and both were normal. Natural menopause and last menstrual period 15 years ago. Denies tobacco use, alcohol consumption, illicit drug use.

Physical Exam

Vital Signs: BP 126/80 supine, 118/76 sitting, 110/68 standing with reported mild dizziness, HR 82 regular, RR 14, T 98.7, Ht 5'5", Wt 135 lbs

GEN: Progressive fatigue that is causing her to cut down on her normal activities. Denies fever, chills, or night sweats. No acute distress

HEENT: Head normocephalic without evidence of masses or trauma. PERRLA, EOMs full to confrontation. Noninjected. Fundoscopic exam unremarkable with exception of pale retinal background. Palpebral conjunctiva pale. Ear canal without redness or irritation, TM clear, pearly, bony landmarks visible. No discharge, no pain noted. Pale nasal mucosa. Posterior pharynx pale with beefy red tongue. Neck: Supple without masses. No thyromegaly. No JVD

CV: S_1 and S_2 RRR, no murmurs, no gallops, no rubs

Lungs: Clear to auscultation

Abdomen: Soft, nontender, nondistended, bowel sounds present × 4 quadrants, no organomegaly, no bruits

Back: Nontender to palpation. No pain with forward flexion of low back but reports some mild dizziness with touching toes. No costovertebral angle (CVA) tenderness

GU: Normal pelvic exam

Rectal: Normal vault, good tone, heme-negative stool

Neuro: CN II–XII intact. Rhine/Weber normal, Romberg positive. Some difficulty with tandem walking. Paresthesias noted with monofilament testing of bilateral feet, DTR 1+

What additional assessments/diagnostics do you need?

What is the differential diagnoses list?

What is your working diagnosis?

Additional Assessments/Diagnostics Needed

Mrs. Williams presents with symptoms of anemia that are suspicious for a vitamin-deficient cause.[1–4,7–10] Further exploration of her medical history, including family history, as well as laboratory and diagnostic studies will be important to help narrow the potential cause. Her symptoms of coolness, numbness, and tingling in her extremities as well as dizziness and swelling of her tongue need to be evaluated further to determine whether these could be attributed to her anemia or another cause.

Evaluation for Mrs. Williams's suspected anemia should include:

- Risk factors for anemia:
  - Anemia risk increases with age. Although the exact etiology of anemia in elderly persons may be multifactorial, advancing age is a known risk factor for anemia.
  - A diet that is deficient in quality protein sources and B vitamins is a known risk factor for anemia. Because you suspect a vitamin-deficient cause in the case of Mrs. Williams, a careful dietary assessment should be conducted.
  - Intestinal disorders such as malabsorptive disorders, parasitism, lack of intrinsic factor, gastric bypass surgery, Crohn's disease, and ulcerative colitis increase the risk of anemia. Mrs. Williams denies a personal history of intestinal disorders but does report a family history of pernicious anemia in her mother.
  - Chronic diseases such as thyroid, liver, kidney, or autoimmune diseases as well as HIV/AIDS and cancer increase the risk of anemia. Mrs. Williams denies personal history of chronic disease, reports history of autoimmune disorder in her mother.
  - Pregnancy, childbirth, and dysfunctional uterine bleeding predispose women to anemia. Mrs. Williams is postmenopausal and denies any abnormal bleeding.
  - Inherited diseases such as sickle cell disease or trait as well as the thalassemias can interfere with production and maturation of red blood cells. Mrs. Williams has no history of inherited blood disorders.
  - Bone marrow dysfunction such as myelodysplastic syndrome, blood or bone cancers, and marrow suppression by medications, toxins, or disease increase the risk of anemia. Mrs. Williams denies history of these diseases.
- Identifiable causes of anemia:
  - *Bleeding:* Either chronic or acute blood loss can be the cause of anemia. In the case of Mrs. Williams, she denies any signs or symptoms of upper gastrointestinal blood loss, she denies any postmenopausal bleeding, and her stool was negative for blood during exam, which lessens the likelihood that her anemia is related to lower gastrointestinal loss. Depending on her laboratory testing, this cause of anemia may need to be explored in addition to other more likely causes.
  - *Diminished red blood cell (RBC) production:* Laboratory testing will determine whether a vitamin deficiency is the cause for Mrs. Williams's diminished blood counts.
  - *Rapid rates of red blood cell destruction:* Inherited or acquired diseases that cause an increased rate of RBC destruction can lead to anemia. Mrs. Williams's medical history does not suggest any of these potential causes nor does her physical examination reveal enlargement or abnormality of the spleen. If other causes are ruled out, further studies for causative agents of hemolytic anemia may be undertaken.
- Presence or absence of complications of anemia:
  - Arrhythmia
  - Congestive heart failure
  - End organ damage such as liver and kidney failure

ROS

Focus additional questions on assessment of the impact that her anemia symptoms are having on her activities of daily living as well as potential clues to the cause of her anemia, including:

- Fatigue (Mrs. Williams reports fatigue)
- Chest pain (denies)
- Palpitations (denies)
- Shortness of breath (SOB) (denies)
- Dyspnea on exertion (DOE) (denies)
- Dizziness (Mrs. Williams reports dizziness)
- Headache (denies)
- Coolness in hands and feet or paresthesias (Mrs. Williams reports this symptom)
- Worsening of these symptoms with activity can provide an estimate of the severity of the anemia (Mrs. Williams reports worsening with activity)

Explore her health history further, making note of hints to what the vitamin deficiency may be:

- Alcohol (ETOH) use (denies)
- Medications that may interfere with absorption such as hormones, anticonvulsants, antineoplastic agents (denies)
- Diet recall (vegetarian, low intake of B vitamins)

- Additional risk factors: Women of northern European ancestry who are prematurely gray with blue eyes, living in a northern cold climate, have an increased risk of pernicious anemia

Physical Exam

The physical examination for this patient should include:

- A thorough assessment of the heart and lungs for s/s of cardiac complications of anemia (arrhythmias, extracardiac sounds, murmurs or rubs, auscultation of lungs)
- Evaluation for fluid overload (peripheral edema, JVD, cardiac and lung evaluation)
- Appropriate measurement of blood pressure with verification in the contralateral arm and in various positions (orthostatic)
- Palpation of the lower extremities for edema and peripheral pulses
- Examination of the abdomen for enlarged spleen, liver, changes in kidneys, masses, and abnormal aortic pulsations
- Examination of the skin and nails for complications of anemia (spoon nails [koilonychias])
- Examination of the mucous membranes for s/s of anemia (pallor, glossitis of the tongue, angular cheilitis of the mouth)

Routine Labs

Routine labs for Mrs. Williams should include those directed at assessing her anemia.

Baseline studies:

- Comprehensive metabolic panel, including:
  - Albumin (normal)
  - Alkaline phosphatase (normal)
  - ALT (alanine aminotransferase) (elevated)
  - AST (aspartate aminotransferase) (normal)
  - BUN (normal)
  - Creatinine (normal)
  - Calcium (normal)
  - Chloride (normal)
  - Carbon dioxide (normal)
  - Glucose (normal)
  - Potassium (normal)
  - Sodium (normal)
  - Total bilirubin (normal)
  - Total protein (normal)
- Complete blood count, including:
  - RBC (low)
  - Hgb (low)
  - Hct (low)
  - MCV (elevated)
  - MCH (normal)
  - MCHC (normal)
  - Platelets (low)
  - WBCs (basophils, eosinophils, lymphocytes, monocytes, neutrophils) (low)
- Urinalysis (normal)

Additional anemia studies:

- Serum iron (normal)
- Serum ferritin (normal)
- Total iron-binding capacity (TIBC) (normal)
- B_{12} (low)
- Folate (normal)
- Reticulocyte count (normal)
- RDW (elevated)
- Peripheral blood smear (macrocytosis, hyperpigmented neutrophils, and giant platelets)
- Schilling's test (positive)

Additional Labs and Diagnostic Testing

- *Liver function tests:* Done as baseline study related to possible causes of anemia and potential for cholesterol management. Lactate dehydrogenase (LDH) is elevated.
- *Cholesterol panel:* Advised to assess for CVD. Done as baseline study related to Mrs. Williams's age and years since last primary care evaluation. Mrs. Williams's cholesterol panel is normal.
- *Thyroid studies:* If thyroid disease is suspected. This was completed and was normal for Mrs. Williams.
- *EPO:* Erythropoietin studies may be ordered to determine whether erythropoietin deficiency is the cause of anemia. Not done in this case.
- *KOH test:* Potassium hydroxide (KOH) test on scraping from tongue to determine whether fungal infection is responsible for the glossitis observed on Mrs. Williams's examination. The test was negative for fungal infection.
- *Schilling's test:* The Schilling's test is helpful in differentiating vitamin B_{12}–deficiency anemia from folic acid–deficiency anemia. Mrs. Williams's Schilling's test is positive, which is diagnostic for vitamin B_{12} deficiency.

Potential Diagnostic Studies

- Colonoscopy for wellness and to rule out (r/o) occult GI bleed

Differential Diagnoses

Anemia of vitamin B_{12} deficiency

Anemia of folate deficiency

Iron-deficiency anemia—related to (r/t) malignancy, GI blood loss

Postural hypotension

Glossitis—can be r/t B_{12} or folate deficiency

Peripheral vascular disease (PVD)

Working Diagnosis

Hypoproliferative macrocytic anemia secondary to vitamin B_{12} deficiency

Peripheral neuropathy related to vitamin B_{12} deficiency

Leukopenia secondary to vitamin B_{12} deficiency

Thrombocytopenia secondary to vitamin B_{12} deficiency

Elevated LDH and ALT secondary to vitamin B_{12} deficiency

Glossitis due to vitamin B_{12} deficiency

Pathophysiology

Vitamin B_{12} deficiency leads to decreased production of RBC and resultant anemia.[9] This deficiency can be caused by a lack of intrinsic factor and is commonly known as pernicious anemia. Pernicious anemia occurs when cells in the stomach that synthesize intrinsic factor are damaged by disease or surgical disruption, as with gastric bypass. Pernicious anemia occurs more often in women than in men, especially those of northern European descent with fair skin and blue eyes who reside in cool northern regions. Another cause of vitamin B_{12} deficiency is damage to the intestine leading to an inability of the GI track to absorb vitamin B_{12}. This occurs in disease processes such as celiac disease, Crohn's disease, or parasitism. Vitamin B_{12} deficiency may occur simultaneously with other forms of anemia such as folate-deficiency and iron-deficiency anemia.

What Is Your Treatment Plan?

Mrs. Williams is not acutely ill and has had progressive generalized fatigue for 6 months.[9] Her lab work clearly demonstrates vitamin B_{12} deficiency, and she is complaining of neurologic problems (coolness in extremities, gait disorder, dizziness) consistent with her vitamin B_{12}–deficiency anemia.

Her BP is stable, but she does have BP changes with position. She is not tachycardic, not febrile, and not actively bleeding. She needs treatment for her vitamin deficiency and a colonoscopy screening to rule out any GI blood loss and as a general health maintenance recommendation.

Pharmacologic

- Start on 1,000 mcg of vitamin B_{12} daily for 14 days and then every week for 12 weeks. Then titrate down to monthly. This monthly regimen will probably be required for life. Nasal vitamin B_{12} is fairly expensive. Patients can use oral vitamin B_{12} as long as absorption is not the issue causing the deficiency, but many patients still come in monthly for a vitamin B_{12} injection.

Nonpharmacologic

- Transfusion is not necessary for this patient. With supplementation, her anemia should improve.
- Plan a colonoscopy within the next day or so. She may also need an upper GI work-up. Her results of the colonoscopy will dictate how soon a follow-up colonoscopy is needed. If polyps are found, she will need screening every 3 years.

Education/Counseling

- Review diet with Mrs. Williams to identify areas of concern.
- Schedule a formal dietary consultation to educate Mrs. Williams about ways to increase foods rich in vitamin B_{12}.
- Encourage this patient to increase her fluids. This should help with the orthostatic hypotension she is experiencing.

SOAP Note

S: Mrs. Williams is a 68-year-old postmenopausal white female who presents with a complaint of fatigue, dizziness with position changes, and coolness and numbness in extremities that has gradually worsened over the last 6 months. She denies chest pain, SOB, diaphoresis, or palpitations, changes in bowel/bladder habits, appetite changes. PMH of measles, mumps, rubella, and chickenpox in childhood. Uses occasional ibuprofen as needed for arthralgia. NKDA. She reports her immunizations are up-to-date. Mrs. Williams's last mammogram and well-woman exam were 3 years ago, and both were normal. No tobacco use, alcohol consumption, illicit drug use.

O: *Vital Signs:* BP 126/80 supine, 118/76 sitting, 110/68 standing with reported mild dizziness, HR 82 regular, RR 14, T 98.7, Ht 5'5", Wt 135 lbs

GEN: Progressive fatigue that is causing her to cut down on her normal activities. Denies fever, chills, or night sweats. No acute distress

HEENT: Head normocephalic without evidence of masses or trauma. PERRLA, EOMs full to confrontation. Noninjected. Fundoscopic exam unremarkable with exception of pale retinal background. Palpebral conjunctiva pale. Ear canal without redness or irritation, TM clear, pearly, bony landmarks visible. No discharge, no pain noted. Pale nasal mucosa. Posterior pharynx pale with beefy red tongue. Neck supple without masses. No thyromegaly. No JVD

CV: S_1 and S_2 RRR, no murmurs, no gallops, no rubs

Lungs: Clear to auscultation

Abdomen: Soft, nontender, nondistended, bowel sounds present × 4 quadrants, no organomegaly, no bruits

Back: Nontender to palpation. No pain with forward flexion of low back but reports some mild dizziness with touching toes. No CVA tenderness

GU: Normal pelvic exam

Rectal: Normal vault, good tone, heme-negative stool

Neuro: CN II–XII intact. Rhine/Weber normal, Romberg positive. Some difficulty with tandem walking. Paresthesias noted with monofilament testing of bilateral feet, DTR 1+

Lab results:

- RBC, Hgb, Hct, WBC, B_{12} decreased
- LDH, ALT, MCV, RDW elevated
- Peripheral blood smear (macrocytosis, hyperpigmented neutrophils, and giant platelets)
- Schilling's test (positive)

A: Hypoproliferative macrocytic anemia secondary to vitamin B_{12} deficiency

Peripheral neuropathy related to vitamin B_{12} deficiency

Leukopenia secondary to vitamin B_{12} deficiency

Thrombocytopenia secondary to vitamin B_{12} deficiency

Elevated LDH and ALT secondary to vitamin B_{12} deficiency

Glossitis due to vitamin B_{12} deficiency

P: Begin vitamin B_{12} supplementation. Refer for dietary consultation to increase vitamin B_{12}–rich foods. Schedule colonoscopy, mammogram, and well-woman exam. Recheck in 1 month.

Health Promotion Issues[7–8]

- Schedule for a mammogram once her anemia is stable.
- Vaccinations are up-to-date.
- Schedule well-woman exam
- Schedule colonoscopy.

Remember that anemia is never normal, and the history and physical exam are key in narrowing down the diagnosis. Be certain to carefully review medications for a cause of anemia. Vitamin B_{12} deficiency usually occurs over 3 or more years, and by the time you make the diagnosis, neurologic manifestations may be present. Also, iron-deficiency anemia (IDA) occurs in about a third of patients with pernicious anemia, which may be a cause for incomplete response to therapy.

Guidelines to Direct Care

Centers for Disease Control and Prevention. Recommended adult immunization schedule, by vaccine and age group. 2015. http://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html. Accessed September 16, 2015.

US Preventive Services Task Force: Published recommendations. http://www.uspreventiveservicestaskforce.org/BrowseRec/Index/browse-recommendations. Accessed September 16, 2015.

World Health Organization. Haemogolobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System. Geneva: World Health Organization; 2011. http://www.who.int/vmnis/indicators/haemoglobin.pdf. Accessed September 16, 2015.

Case 3

Mrs. Smith is a 63-year-old African American female who recently had a blood count done at her local health fair. She was told to see her healthcare provider because she had a "low blood count." Mrs. Smith is in generally good health with a history of degenerative joint disease (DJD) of the hips, which necessitated right hip replacement 2 years ago. She takes no daily medications, uses aspirin (ASA) occasionally for "aches and pains," and has NKDA. She donates blood about every 6 months and has never been told she has anemia. Mrs. Smith has been married for the past 43 years and has three grown children who are alive and well. She and her husband are retired and live in an isolated area about 90 miles from the health clinic. Vaccinations up-to-date, including tetanus, Pneumovax, shingles, and an annual flu shot. Well-woman exam and mammogram completed last year and all normal. Feels well and denies fatigue, weight loss, or easy bruising. Denies chest pain, SOB, palpitations, lightheadedness, orthopnea, or paroxysmal nocturnal dyspnea (PND). Denies recent upper respiratory infections. No chronic cough or sputum production. No abdominal pain, weight loss, nausea, vomiting, or diarrhea. Denies bloody stools or mucus in stools. Denies illicit drug use, denies tobacco use, reports drinks approximately four cocktails per night.

Physical Exam

Vital Signs: BP 138/88, P 96 regular, RR 16, T 97.6, Ht 5'6", Wt 150 lbs

GEN: Healthy-appearing, enthusiastic woman, very cooperative

Skin: Several scattered seborrheic keratoses

HEENT: PERRLA, EOMs full to confrontation. Normal pharynx without exudates. No JVD or thyromegaly

CV: S_1 and S_2 RRR, no murmurs, gallops, or rubs

Resp: Clear to auscultation

Breasts: No masses

Abdomen: Soft, nontender, nondistended. Bowel sounds present × 4 quadrants. No masses or organomegaly

Rectal: Normal vault, good tone. No hemorrhoids. Fecal occult blood testing negative

Neuro: Normal cerebral functioning. Cranial nerves II–XII intact. Normal sensory and motor exam, Romberg-normal

What additional assessments/diagnostics do you need?

What is the differential diagnoses list?

What is your working diagnosis?

Additional Assessments/Diagnostics Needed

Mrs. Smith presents without symptoms of anemia but with suspicion that anemia may be present.[1–4,7–8,10–13] Detailed exploration of her medical history, including family history, and laboratory and diagnostic studies will be important to help narrow the potential cause. She is asymptomatic at this time, which would suggest that the anemia is not severe and has not been a longstanding issue.

Evaluation for Mrs. Smith's suspected anemia should include:

- Risk factors for anemia:
  - *Age*
  - *Diet:* Exploration of Mrs. Smith's diet would be necessary to determine dietary intake of vitamin B_{12}, folate, and iron
  - *Intestinal disorders:* Mrs. Smith denies a history of intestinal disorders.
  - *Chronic diseases:* Mrs. Smith denies personal history of chronic disease.
  - *Females:* Pregnancy, childbirth, and dysfunctional uterine bleeding predispose women to anemia. Mrs. Smith is postmenopausal and denies any abnormal bleeding.
  - *Inherited:* Mrs. Smith has no history of inherited blood disorders.
  - *Bone marrow dysfunction such as myelodysplastic syndrome, blood or bone cancers, and marrow suppression by medications, toxins, or disease:* Drugs that can decrease folic acid measurements include alcohol, aminosalicylic acid (ASA), birth control pills, estrogens, tetracyclines, ampicillin, chloramphenicol, erythromycin, methotrexate, penicillin, aminopterin, phenobarbital, phenytoin, and drugs to treat malaria.
- Identifiable causes of anemia:
  - *Bleeding:* Either chronic or acute blood loss can be the cause of anemia. In the case of Mrs. Smith, she denies any signs or symptoms of upper gastrointestinal blood loss, she denies any postmenopausal bleeding, and her stool was negative for blood during exam, which lessens the likelihood that her anemia is related to lower gastrointestinal loss. Depending on her laboratory testing, this cause of anemia may need to be explored in addition to other more likely causes.
  - *Diminished red blood cell (RBC) production:* Laboratory testing will determine whether a vitamin deficiency is the cause for Mrs. Smith's diminished blood counts.
  - *Rapid rates of red blood cell destruction:* Inherited or acquired diseases that cause an increased rate of RBC destruction can lead to anemia. Mrs. Smith's medical history does not suggest any of these potential causes nor does her physical examination reveal enlargement or abnormality of the spleen. If other causes are ruled out, further studies for causative agents of hemolytic anemia may be undertaken.
- Presence or absence of complications of anemia:
  - Arrhythmia (not present)
  - Congestive heart failure (not present)
  - End organ damage such as liver and kidney failure (not present)

ROS

Focus additional questions on assessment of the impact that her anemia symptoms are having on her activities of daily living as well as potential clues to the cause of her anemia, including:

- Fatigue (denies)
- Chest pain (denies)
- Palpitations (denies)
- Shortness of breath (SOB) (denies)
- Dyspnea on exertion (DOE) (denies)
- Dizziness (denies)
- Headache (denies)
- Coolness in hands and feet or paresthesias (denies)
- Worsening of these symptoms with activity can provide an estimate of the severity of her anemia (denies)

Explore her health history further, making note of hints to what the cause of anemia may be:

- ETOH use. Administer CAGE questionnaire (Mrs. Smith reports drinking 4 cocktails per night)
- Medications that may interfere with absorption such as hormones, anticonvulsants, antineoplastic agents (Mrs. Smith reports using ASA for her DJD)
- Diet recall (vegetarian, low intake of B vitamins) (denies)

Physical Exam

The physical examination for this patient should include:

- A thorough assessment of the heart and lungs for s/s of cardiac complications of anemia (arrhythmias, extracardiac sounds, murmurs or rubs, auscultation of lungs)
- Evaluation for fluid overload (peripheral edema, JVD, cardiac and lung evaluation)
- Appropriate measurement of blood pressure with verification in the contralateral arm
- Palpation of the lower extremities for edema and peripheral pulses
- Examination of the abdomen for enlarged spleen, liver, changes in kidneys, masses, and abnormal aortic pulsations
- Examination of the skin and nails for complications of anemia (spoon nails [koilonychias])
- Examination of the mucous membranes for s/s of anemia (pallor, glossitis of the tongue, angular cheilitis of the mouth)

Routine Labs

Routine labs for Mrs. Smith should include those directed at assessing her anemia.

Baseline studies:

- Comprehensive metabolic panel, including:
  - Albumin (normal)
  - Alkaline phosphatase (normal)

- ALT (alanine aminotransferase) (elevated)
- AST (aspartate aminotransferase) (elevated)
- BUN (normal)
- Creatinine (normal)
- Calcium (normal)
- Chloride (normal)
- Carbon dioxide (normal)
- Glucose (normal)
- Potassium (normal)
- Sodium (normal)
- Total bilirubin (normal)
- Total protein (normal)

- Complete blood count, including:
  - RBC (low)
  - Hgb (low)
  - Hct (low)
  - MCV (elevated)
  - MCH (normal)
  - MCHC (normal)
  - Platelets (low)
  - WBC (basophils, eosinophils, lymphocytes, monocytes, neutrophils) (low)
- Urinalysis (normal)

Additional anemia studies:

- Serum iron (normal)
- Serum ferritin (normal)
- Total iron-binding capacity (TIBC) (normal)
- Vitamin B_{12} (normal)
- Folate (low)
- Reticulocyte count (normal)
- RDW (elevated)
- Peripheral blood smear (abnormally large RBC—megaloblasts)
- Schilling's test (negative)

Additional Labs and Diagnostic Testing

- *Liver function tests:* Done as baseline study related to possible causes of anemia and potential for alcohol-related changes (elevated)
- *Cholesterol panel:* Advised to assess for CVD. Done as baseline study related to Mrs. Smith's age (normal)
- *Thyroid studies:* If thyroid disease is suspected. Not done in this case
- *EPO:* Erythropoietin studies may be ordered to determine whether erythropoietin deficiency is the cause of anemia. Not done in this case
- *Schilling's test:* The Schilling's test is helpful in differentiating vitamin B_{12}–deficiency anemia from folic acid–deficiency anemia. Mrs. Smith's Schilling's test is negative.

Potential diagnostic studies:

- Colonoscopy for wellness and to r/o occult GI bleed

Differential Diagnoses List

Folic acid deficiency
Vitamin B_{12} deficiency
Iron-deficiency anemia
Anemia of blood loss
Alcohol abuse

Working Diagnoses

Anemia due to frequent blood donations
Occult GI malignancy (ruled out by colonoscopy)
Alcohol abuse
Folate deficiency

Pathophysiology[12,13,20]

Folate deficiency leads to decreased production of RBCs and resultant anemia. This deficiency can be caused by a diet lacking in folic acid, alcoholism, use of certain medications, and pregnancy. Mrs. Smith's alcohol consumption would be defined as heavy drinking and would be a substantial risk factor for folic acid deficiency. Folate deficiency may occur simultaneously with other forms of anemia such as vitamin B_{12}–deficiency and iron-deficiency anemia.

What Is Your Treatment Plan?

Pharmacologic

- Begin oral iron therapy. FeSO4 325mg QD. Include client education about the drug
- Discuss proper administration (on empty stomach), possibility of constipation, dark-colored stools.
- Start folic acid 0.4 mg PO QD.

Nonpharmacologic

- Discuss diet to increase foods with iron and folic acid.
- Follow-up in 3 months to check complete blood count (CBC), folic acid, and BP. Don't expect return to normal folic acid for 2–3 months.

Education/Counseling[12,13,19,20]

- Encourage no more than two blood donations per year (three blood donations per year is roughly equivalent to the blood loss of normal menses in one year). The American Red Cross suggests waiting about 56 days between donations.
- Review other healthy lifestyle issues with her: exercise, stress management, diet
- Discuss ETOH use. According to the American Heart Association (AHA), women should drink no more than 4 oz of wine, 12 oz of beer, or 1 oz of hard liquor daily. Discuss risk of falls with Mrs. Smith related to ETOH use. When considering referral for ETOH-related issues, consider that the primary care provider (PCP) is likely to have the best working and trusting relationship with the patient. Discuss the ETOH issue and the impact ETOH is having on her health. Refer only when the patient is in agreement with the need for this. Without buy-in from the patient, she may not follow through or may be reluctant to share other concerns with you.

SOAP Note

S: Mrs. Smith is a 63-year-old African American female who reports a low blood count was identified at a local health fair. She reports a history of degenerative joint disease in her hips that necessitated a right hip replacement 2 years ago. She takes no daily medications currently, but she uses aspirin as needed for joint pain. NKDA. She donates blood about every 6 months and has never been told she has anemia. Mrs. Smith is retired, has been married for the past 43 years, and has three grown children who are alive and well. Vaccinations up-to-date; well-woman exam and mammogram completed last year were normal. Feels well and denies fatigue, weight loss, or easy bruising. Denies chest pain, SOB, palpitations, lightheadedness, orthopnea, or PND. No abdominal pain, weight loss, nausea, vomiting, diarrhea, bloody stools, or mucus in stools. Reports she drinks approximately four cocktails per night, but denies tobacco use or illicit drug use.

O: *Vital Signs:* BP 138/88, P 96 regular, RR 16, T 97.6, Ht 5'6", Wt 150 lbs

GEN: Healthy-appearing, enthusiastic woman, very cooperative

Skin: Several scattered seborrheic keratoses

HEENT: PERRLA, EOMs full to confrontation. Normal pharynx without exudates. No JVD or thyromegaly

CV: S_1 and S_2 RRR, no murmurs, gallops, or rubs

Resp: Clear to auscultation

Breasts: No masses

Abdomen: Soft, nontender, nondistended. Bowel sounds present × 4 quadrants. No masses or organomegaly

Rectal: Normal vault, good tone. No hemorrhoids. Fecal occult blood testing negative

Neuro: Normal cerebral functioning. Cranial nerves II–XII intact. Normal sensory and motor exam, Romberg-normal

A: Anemia due to frequent blood donations

Occult GI malignancy (ruled out by colonoscopy)

Alcohol abuse

Folate deficiency

P: Colonoscopy to r/o GI malignancy. Begin folate 0.4 mg PO QD and iron 325 mg PO QD. Encourage reevaluation of alcohol consumption and referral to appropriate support/treatment as she is willing. Encourage diet rich in folic acid.

Health Promotion Issues[7–8]

- Colonoscopy
- Vaccinations are up-to-date

Guidelines to Direct Care

American Heart Association. Alcohol and heart health. http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyEating/Alcohol-and-Heart-Health_UCM_305173_Article.jsp. Accessed September 16, 2015.

American Red Cross. Donating blood: eligibility guidelines. http://www.redcrossblood.org/donating-blood/eligibility-requirements. Accessed September 16, 2015.

Centers for Disease Control and Prevention. Recommended adult immunization schedule, by vaccine and age group. 2015. http://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html. Accessed September 16, 2015.

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US Dept of Agriculture, US Dept of Health and Human Services. *Dietary Guidelines for Americans, 2010.* 7th ed. Washington, DC: US Government Printing Office; December 2010. http://health.gov/dietaryguidelines/dga2010/dietaryguidelines2010.pdf. Accessed September 16, 2015.

US Preventive Services Task Force. Published recommendations. http://www.uspreventiveservicestaskforce.org/BrowseRec/Index/browse-recommendations. Accessed September 16, 2015.

Case 4

Mr. Snow is a 65-year-old male with progressively increasing SOB over the last 2 months. His SOB sometimes occurs at rest and often prevents him from shopping and walking up an incline. Admitted to the hospital 6 months ago with an episode of unstable angina that did not progress to acute myocardial infarction (AMI). Takes 325 mg ASA, 50 mg atenolol, and 40 mg simvastatin since his recent admission. Denies any other chronic medical problems or surgeries. NKDA. Smoked 20 cigarettes daily × 30 years. Stopped "cold turkey" after recent hospital admission. Rarely sees a healthcare provider. Does not believe in immunizations. Denies fever or rashes. No pruritus or skin color changes. Denies chest pain (CP), palpitations, or dizziness. Reports progressively increasing SOB both at rest and with exertion. Denies cough, sputum production, wheezing, orthopnea, or PND. Denies weight change. No abdominal pain, nausea, or vomiting. Denies bloody or mucous stools.

Physical Exam

Vital Signs: BP 120/70, HR 56 regular, RR 14, T 98.5, Ht 6'0", Wt 165 lbs

GEN: Alert and cooperative. In no apparent distress.

HEENT: Head normocephalic without evidence of masses or trauma. PERRLA, EOMs full to confrontation. Noninjected. Fundoscopic exam unremarkable with exception of pale retinal background. Palpebral conjunctiva pale. Ear canal without redness or irritation, TM clear, pearly, bony landmarks visible. No discharge, no pain noted. Pale nasal mucosa. Posterior pharynx pale. Neck: Supple without masses. No thyromegaly. No JVD noted

Skin: No discoloration, no open areas or abnormalities noted

CV: S_1 and S_2 regular with a soft aortic ejection murmur in the aortic area. No radiation to carotids or axilla. No JVD. No peripheral edema

Lungs: Minimal scattered rhonchi that resolve with coughing

Abdomen: Bowel sounds present in all quads. Abdomen soft with no organomegaly

Rectal: Normal vault, good tone, heme-positive stool

Neuro: Normal cerebral functioning. CN II–XII intact. Normal sensory and motor exam, Romberg negative

What additional assessments/diagnostics do you need?

What is the differential diagnoses list?

What is your working diagnosis?

Additional Assessments/Diagnostics Needed

Mr. Snow presents with symptoms that are troubling and may be attributable to respiratory disease, cardiac causes, or anemia.[1–4,7–8,10,14–18] Mr. Snow's history suggests that any of the aforementioned causes are plausible. Further exploration, laboratory testing, and diagnostics will need to be completed to provide clarity and direct treatment.

ROS

Focus additional questions on assessment of the impact that his anemia symptoms are having on his activities of daily living as well as potential clues to the cause of his anemia, including:

- Chest pain (denies)
- Palpitations (denies)
- Shortness of breath (SOB) (Mr. Snow reports SOB)
- Dyspnea on exertion (DOE) (Mr. Snow reports DOE)
- Dizziness (denies)
- Headache (denies)
- Coolness in hands and feet or paresthesias (denies)
- Nausea/vomiting (denies)
- Worsening of these symptoms with activity can provide an estimate of the severity of his anemia

Further discussion of cardiovascular risk factors should also be explored, including:

- *HTN:* None noted
- *Cigarette smoking:* Mr. Snow is a former smoker but is not currently
- *Obesity:* Mr. Snow has a normal body mass index
- *Physical inactivity:* Mr. Snow does not exercise
- *Dyslipidemia:* Present but under treatment by cardiologist
- *Diabetes mellitus:* You will need to order labs
- *Age:* Mr. Snow is 65 years old
- *Family history:* When queried further he reports his mother and father both had HTN and CVD. This is a significant risk factor

Evaluation for Suspected Anemia

- Risk factors for anemia:
  - Anemia risk increases with age. Although the exact etiology of anemia in elderly persons may be multifactorial, advancing age is a known risk factor for anemia.
  - A diet that is deficient in quality protein sources and B vitamins is a known risk factor for anemia. Hematopoiesis requires healthy levels of macronutrients and micronutrients in order to carry out cell production and maturation.
  - Intestinal disorders such as malabsorptive disorders, parasitism, lack of intrinsic factor, gastric bypass surgery, Crohn's disease, and ulcerative colitis increase the risk of anemia.

- Chronic diseases such as thyroid, liver, kidney, or autoimmune diseases as well as HIV/AIDS and cancer increase the risk of anemia.
- Pregnancy, childbirth, and dysfunctional uterine bleeding predispose women to anemia.
- Inherited diseases such as sickle cell disease or trait as well as the thalassemias can interfere with production and maturation of red blood cells.
- Bone marrow dysfunction such as myelodysplastic syndrome, blood or bone cancers, and marrow suppression by medications, toxins, or disease increase the risk for anemia.

- Identifiable causes of anemia:
  - *Bleeding:* Either chronic or acute blood loss can be the cause of anemia. In the case of Mr. Snow, he does have symptoms of lower gastrointestinal blood loss because his stool was positive for blood during examination today. This potential cause of his anemia will need to be explored with further diagnostic studies.
  - *Diminished red blood cell (RBC) production:* Mr. Snow's history does not suggest this as a potential cause of his anemia. If other causes are ruled out, further studies may need to be completed.
  - *Rapid rates of red blood cell destruction:* Inherited or acquired diseases that cause an increased rate of RBC destruction can lead to anemia. Mr. Snow's medical history does not suggest any of these potential causes nor does his physical examination reveal enlargement or abnormality of his spleen. If suspected, laboratory studies to rule out sickle cell disease and thalassemia should be performed. If other causes are ruled out, further studies for causative agents of hemolytic anemia may be undertaken.
- Presence or absence of complications of anemia:
  - Arrhythmia
  - Congestive heart failure
  - End organ damage such as liver and kidney failure

Physical Exam

The physical examination for this patient should include:

- A thorough assessment of the heart and lungs for s/s of cardiac complications of anemia and kidney disease (arrhythmias, extracardiac sounds, murmurs or rubs, auscultation of lungs). Mr. Snow has an ejection murmur.
- Evaluation for fluid overload (peripheral edema, JVD, cardiac and lung evaluation). None noted.
- Appropriate measurement of blood pressure with verification in the contralateral arm. Mr. Snow has a normal BP bilaterally.
- Palpation of the lower extremities for edema and peripheral pulses. None noted.
- Examination of the abdomen for enlarged spleen, liver, changes in kidneys (either enlarged or smaller than anticipated), masses, and abnormal aortic pulsations. None noted.
- Examination of the skin and nails for complications of anemia and kidney disease (pruritus, spoon nails [koilonychias]). None noted.
- Examination of the mucous membranes for s/s of anemia (pallor, glossitis of the tongue, angular cheilitis of the mouth). Pallor noted.

Labs

Mr. Snow is under the care of a cardiologist since his hospital admission 6 months ago, when his cholesterol panels were completed and a medication regimen initiated. Laboratory evaluation at this visit should focus on those issues that may be contributing to his increasing SOB.

- *D-dimer:* D-dimer may be completed if a pulmonary embolism (PE) is suspected. Mr. Snow is not acutely SOB and is in no apparent distress, so this cause is unlikely. The D-dimer may be elevated with inflammation from a number of causes, so false positives are possible. This evaluation was not done for this patient at this visit.
- *WBC:* Will be completed as part of CBC to evaluate for potential of infection

Routine Labs

Routine labs for Mr. Snow should include those directed at assessing for anemia, infection, and end organ function.

Baseline studies:

- Comprehensive metabolic panel, including:
  - Albumin (normal)
  - Alkaline phosphatase (normal)
  - ALT (alanine aminotransferase) (normal)
  - AST (aspartate aminotransferase) (normal)
  - BUN (normal)
  - Creatinine (normal)
  - Calcium (normal)
  - Chloride (normal)
  - Carbon dioxide (normal)
  - Glucose (normal)
  - Potassium (normal)
  - Sodium (normal)
  - Total bilirubin (normal)
  - Total protein (normal)
- Complete blood count, including:
  - RBC (low)
  - Hgb 11.9% (low)
  - Hct 38% (low)

- MCV (low normal)
- MCH (normal)
- MCHC (normal)
- Platelets (normal)
- WBCs (basophils, eosinophils, lymphocytes, monocytes, neutrophils) (normal)

Additional kidney function studies:

- Urinalysis (UA) (normal)

Additional anemia studies:

- Serum iron (low)
- Serum ferritin (low)
- Total iron-binding capacity (TIBC) (high)
- Vitamin B_{12} (Not completed for Mr. Snow)
- Folate (Not completed for Mr. Snow)
- Reticulocyte count (elevated)
- RDW (elevated)
- Peripheral blood smear (variably sized with some abnormally shaped and some hypochromic RBC noted)

Additional Labs

- Cholesterol panel—completed at prior hospitalization. Medications managed by cardiologist
- Thyroid studies—not completed for Mr. Snow
- EPO—not completed for Mr. Snow

Diagnostics should include:

- In-office EKG—unchanged from prior studies
- Chest X-ray to rule out pneumonia and evaluate cardiac size and anatomical structures of lungs—negative for pneumonia, cardiac silhouette normal, lung with changes noted consistent with COPD
- Colonoscopy—Mr. Snow has blood in his stool per the test during the examination. Further evaluation is necessary to rule out malignancy, determine extent of ongoing blood loss.

Differential Diagnoses

Chronic obstructive pulmonary disease (COPD)—smoker, rhonchi

Cardiac failure—left sided, angina

Anemia—ASA, diet, pallor, ejection murmur

Poor physical conditioning

Asthma

Pneumonia

PE—may occur in the absence of coughing up blood

GI bleeding—subclinical bleeding, has been taking ASA for past 6 months

Ejection murmur

Working Diagnosis

Anemia related to subclinical bleeding due to ASA use

COPD

Hyperlipidemia

Ejection murmur

Pathophysiology

Iron-deficiency anemia can be caused by a low-iron diet, loss of blood, impaired iron absorption, or loss of body stores of iron that have been depleted by disease states.[18] Early iron-deficiency anemia (IDA) is characterized by a normocytic, possibly hypochromic anemia with progression to a microcytic hypochromic anemia in later phases. In the case of Mr. Snow, his anemia has been precipitated by ASA use and a subclinical GI bleed and is in an early phase, according to his lab values. With correction of the underlying disease process and iron supplementation, his anemia should correct.

What Is Your Treatment Plan?

Pharmacologic

- Begin iron supplementation with FeSO4 at 325 mg PO QD.
- Modify ASA regimen to 81 mg QD. ASA would be recommended in this patient r/t his murmur and for CVD, but if the bleeding continues, further consultation with the cardiologist would need to be initiated to determine risk/benefit of continued therapy. Simply reducing the ASA is the easiest and most cost-effective plan. Proton pump inhibitor therapy is not indicated because of lack of GI symptoms.[7–8,15,17–18]

Nonpharmacologic

- Consider pulmonary function testing to determine whether further treatment is indicated for his COPD.
- Keep normal follow-ups with cardiology.
- Congratulate him on decision to quit smoking and encourage him to stay the course.
- Continue follow-up (f/u) with cardiologist.

Education/Counseling[10,12,14–16]

- Diet education with an emphasis on iron-rich foods
- Education regarding s/s of worsening
- Medication education—when and how to take, side effects (constipation). Change in color of stool, nausea
- Educate patient on pursed-lip breathing and COPD management goals

SOAP Note

S: Mr. Snow is a 65-year-old male with a 2-month history of progressively increasing SOB at rest and worsening dyspnea on exertion. Mr. Snow was hospitalized for unstable angina without MI 6 months ago and was started on ASA

325 mg, atenolol 50 mg, and simvastatin 40 mg daily. NKDA. 30-pack-year history of tobacco use but stopped "cold turkey" after recent hospital admission. Rarely sees a healthcare provider. Does not believe in immunizations. Denies fever or rashes. No pruritus or skin color changes. Denies CP, palpitations, or dizziness. Denies cough, sputum production, wheezing, orthopnea, or PND. Denies weight change, abdominal pain, nausea, vomiting, or bloody or mucous stools.

O: *Vital Signs:* BP 120/70, P 56 regular, RR 14, T 98.5, Ht 6'0", Wt 165 lbs

GEN: Alert and cooperative. In NAD

HEENT: Head normocephalic without evidence of masses or trauma. PERRLA, EOMs full to confrontation. Noninjected. Fundoscopic exam unremarkable with exception of pale retinal background. Palpebral conjunctiva pale. Ear canal without redness or irritation, TM clear, pearly, bony landmarks visible. No discharge, no pain noted. Pale nasal mucosa. Posterior pharynx pale. Neck supple without masses. No thyromegaly. No JVD noted

Skin: No discoloration, no open areas or abnormalities noted

CV: S_1 and S_2 regular with a soft aortic ejection murmur in the aortic area. No radiation to carotids or axilla. No JVD. No peripheral edema

Lungs: Minimal scattered rhonchi that resolve with coughing

Abdomen: Bowel sounds present in all quads. Abdomen soft with no organomegaly

Rectal: Normal vault, good tone, heme-positive stool

Neuro: Normal cerebral functioning. CN II–XII intact. Normal sensory and motor exam, Romberg negative

ECG: Unchanged

Labs: Normocytic, hypochromic anemia consistent with IDA

A: Anemia related to subclinical bleeding due to ASA use

COPD

Hyperlipidemia

Ejection murmur

P: Mr. Snow presents today with subclinical lower GI bleeding secondary to ASA therapy resulting in IDA. Mr. Snow's history and physical examination are also significant for hyperlipidemia, ejection murmur, and COPD. Cardiology is already involved and following lipid management and ejection murmur. Will start Mr. Snow on FeSo4 325 mg PO QD today, continue on atenolol and simvastatin ordered by cardiologist. Education provided regarding COPD management, health management, and immunization recommendations today. Mr. Snow verbalized understanding of topics discussed but currently refuses vaccination for prevention of shingles, pneumonia, influenza, tetanus.

Health Promotion Issues[7–8,12]

- Encourage routine follow-ups for health maintenance.
- Encourage routine cardiology follow-up.
- Immunizations recommended: shingles, pneumonia, influenza, tetanus.

Guidelines to Direct Care

Centers for Disease Control and Prevention. Recommended adult immunization schedule, by vaccine and age group. 2015. http://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html. Accessed September 16, 2015.

Qaseem A, Humphrey LL, Fitterman N, et al. Treatment of anemia in patients with heart disease: a clinical practice guideline from the American College of Physicians. *Ann Intern Med*. December 3, 2013;159(11):770–779.

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World Health Organization. Haemogolobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System. Geneva: World Health Organization; 2011. http://www.who.int/vmnis/indicators/haemoglobin.pdf. Accessed September 16, 2015.

Case 5

Latisha is a 38-year-old African American woman who presents to the clinic for a new patient physical examination. Latisha is concerned about persistent mild fatigue, which she reports has been gradually worsening for the last 6 months. She has noted a gradual decrease in her work tolerance and feels "washed out" at the end of the workday. She reports no changes in her diet. She denies nausea, vomiting, or diarrhea. She has not noted any dark stools or blood in her stools but admits to an occasional mild nosebleed. She also mentions that her menstrual flow has been a little heavier than usual for the past several months. She denies

cold intolerance, muscle weakness, fever, chills, or joint pain. She began to take over-the-counter vitamins, one tablet a day, 2 weeks ago. She reports feeling a bit better since she started her vitamins.

Past Medical History

Allergies: NKDA

Medical illnesses: HTN, hx of depression treated 5 years ago with no reoccurrences

Hospitalizations: Normal vaginal delivery 10 years ago

S/P laparoscopic tubal ligation at the age of 33

Medications: Vasotec 10 mg daily

Multivitamin with iron daily

ASA 1 tablet 325 mg daily

Family History

Latisha was born in the United States. Her parents are natives of Algeria. No family history of sickle cell disease, diabetes, kidney disease, HTN, cancer, or thyroid disease.

Social History

Her parents are college professors. Latisha has one brother who is alive and well and attends a local high school. Latisha is employed at a local insurance company. She denies any changes in her work, home, or social life. She is a nonsmoker and a nondrinker. She denies illicit drug use.

Health Promotion History

Latisha's immunizations are up-to-date, including tetanus. She has never had a mammogram. She does SBE occasionally. She only sees her healthcare provider when she has a problem.

Focused ROS

General: Denies weight loss, night sweats, muscle aches, joint pain, lymphadenopathy, or fever

HEENT: Occasional mild nosebleed

CV: Denies chest pain, leg swelling, and palpitations

Resp: Denies SOB, DOE, or orthopnea. No cough or recent respiratory tract infections

GI: Denies nausea, vomiting, diarrhea, melena, or blood in her stools

GU: Denies polydipsia, polyuria, or polyphagia. Increase in menstrual flow for the past several months

Physical Exam

Vital Signs: BP 110/88, P 82 (regular), RR 14, T 99, Ht 5'2", Wt 135 lbs

GEN: Alert, oriented × 3, well nourished, in no acute distress

Skin: Normal distribution, normal skin turgor, no rashes

HEENT: Palpebral conjunctivae are pale bilaterally. No lymphadenopathy

CV: S_1 and S_2 RRR, no murmurs, gallops, or rubs

Lungs: Clear to auscultation

Breasts: No masses or tenderness

Abdomen: Soft, nontender, no organomegaly

Neuro: Unremarkable

Extremities: Unremarkable

Pelvic: Normal

Rectal: Normal vault, no hemorrhoids, stool negative for occult blood

What additional assessments/diagnostics do you need?

What is the differential diagnoses list?

What is your working diagnosis?

Additional Assessments/Diagnostics Needed

Further exploration of Latisha's history should include exploration of the following:[1–4,7,8,18,19]

- What is the reason for taking ASA (Latisha reports she takes ASA for "heart health," but it was not ordered by another healthcare provider.)
- More info regarding her nosebleeds, diet, menstrual flow, headache, palpitations, fever, or sore throat (Latisha denies headache, palpitations, fever, or sore throat)

The following lab studies should be completed:

Baseline studies:

- Comprehensive metabolic panel, including:
  - Albumin (normal)
  - Alkaline phosphatase (normal)
  - ALT (alanine aminotransferase) (normal)
  - AST (aspartate aminotransferase) (normal)
  - BUN (normal)
  - Creatinine (normal)
  - Calcium (normal)
  - Chloride (normal)
  - Carbon dioxide (normal)
  - Glucose (normal)
  - Potassium (normal)
  - Sodium (normal)
  - Total bilirubin (normal)
  - Total protein (normal)
- Complete blood count, including:
  - RBC (normal)
  - Hgb (low)

- Hct (low)
- MCV (low)
- MCH (low)
- MCHC (low)
- Platelets (normal)
- WBC (basophils, eosinophils, lymphocytes, monocytes, neutrophils) (normal)

Additional kidney function studies:

- Urinalysis (UA) (normal)

Additional anemia studies:

- Serum iron (normal)
- Serum ferritin (normal)
- Total iron-binding capacity (TIBC) (normal)
- Reticulocyte count (normal)
- RDW (normal)
- Peripheral blood smear (nucleated target cells, poikilocytosis, microcytic, hypochromic RBC)

Additional labs:

- Thyroid studies—if thyroid disease is suspected. Not done for Latisha
- Hemoglobin electrophoresis—this test will determine whether thalassemia is present. Latisha's results were elevated A2 level and increased levels of Hgb F consistent with alpha thalassemia

Differential Diagnoses

Iron-deficiency anemia—Latisha is of reproductive age with monthly blood loss, making iron-deficiency anemia the most likely cause. Because of the microcytic hypochromic indices, the megaloblastic anemias can be ruled out.

Thalassemia—Latisha's parents are from the "thalassemia belt," so this diagnosis needs to be considered during the evaluation process.

Lead exposure—there are no apparent risk factors, but with the information you currently have from your evaluation it is a possibility.

Anemia of chronic disease—not likely based upon current information.

Hypertension—well controlled on current regimen.

Working Diagnoses

Alpha thalassemia

Hypertension

Pathophysiology

Thalassemia is a group of hereditary anemias caused by abnormalities on the protein chains that make up hemoglobin.[19] Symptoms range from asymptomatic carrier states to fatal illness. Adult hemoglobin is made up primarily of alpha and beta chains. Thalassemia is most often seen in persons of African, Asian, Mediterranean, or Middle Eastern descent. The thalassemias are among the most common inherited disorders. Problems result from ineffective erythropoiesis. Thalassemia minor usually goes unrecognized until adulthood and is found on routine lab evaluation. It is a hypochromic and microcytic anemia and is most easily confirmed by hemoglobin electrophoresis, which would demonstrate an elevated A2 level, increased levels of hemoglobin F, or both. In some patients, the diagnosis can be confirmed by a family tree showing the presence of anemia, microcytosis, or splenomegaly.

What Is Your Treatment Plan?

Pharmacologic

- Discontinue the multivitamin (MVI). MVI with iron is not indicated for Latisha's alpha thalassemia.
- Continue vasotec.
- Discontinue ASA. Not indicated for this patient.[1–4,7–8,19]

Nonpharmacologic

- Refer to hematology. Latisha should be referred to hematology for development of a monitoring plan and possible genetic counseling. Thalassemia is dependent on the ethnic origins of the client. B-thalassemia is seen in clients of Greek and Italian descent most commonly, and A-thalassemia is seen most commonly in African Americans, American Indians, and Asians.

Education/Counseling

The importance of diagnosing thalassemia minor lies in the genetic information obtained because it does not require therapy. Sometimes lab data may indicate IDA, but iron is not needed unless there is excessive blood loss. In fact, iron therapy is harmful because iron overload may cause organ damage. It is very important that this patient is educated to avoid all iron (FE) supplements and foods high in FE.

SOAP Note

S: Latisha is a 38-year-old African American woman of Algerian descent who presents to the clinic for a new patient physical examination. Latisha is concerned about persistent worsening fatigue. Latisha denies nausea, vomiting, diarrhea, dark stools, or blood in her stools but admits to an occasional mild nosebleed and heavier than usual menstrual periods. She denies cold intolerance, muscle weakness, fever, chills, or joint pain. She began to take an over-the-counter MVI, one tablet a day, 2 weeks ago. She reports feeling a bit better since she started taking the MVI.

O: *Vital Signs:* BP 110/88, P 82 (regular), RR 14, T 99, Ht 5'2", Wt 135 lbs

GEN: Alert, oriented × 3, well nourished, in no acute distress

Skin: Normal distribution, normal skin turgor, no rashes

HEENT: Palpebral conjunctivae are pale bilaterally. No lymphadenopathy

CV: S_1 and S_2 RRR, no murmurs, gallops, or rubs

Lungs: LCTA

Breasts: No masses or tenderness

Abdomen: Soft, nontender, no organomegaly

Neuro: Unremarkable

Extremities: Unremarkable

Pelvic: Normal

Rectal: Normal vault, no hemorrhoids, stool negative for occult blood

Labs: Nucleated target cells, poikilocytosis on smear. Microcytic, hypochromic anemia. Hgb electrophoresis consistent with alpha thalassemia

A: Alpha thalassemia

Hypertension

P: Patient presents with alpha thalassemia. Refer to hematology for further evaluation. Continue vasotec. Discontinue ASA and MVI. Follow up in 6 months to reevaluate HTN and discuss results and understanding of information from hematology consultation.

Health Promotion Issues

- Emphasize importance of health maintenance and routine follow-up.
- Discuss alpha thalassemia and provide basic education prior to hematology consultation.

Guidelines to Direct Care

Centers for Disease Control and Prevention. Recommended adult immunization schedule, by vaccine and age group. 2015. http://www.cdc.gov/vaccines/schedules/hcp/imz/adult.html. Accessed September 16, 2015.

US Preventive Services Task Force. Published recommendations. http://www.uspreventiveservicestaskforce.org/BrowseRec/Index/browse-recommendations. Accessed September 16, 2015.

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Conclusion

Keep in mind that the signs and symptoms of anemia are caused by decreased delivery of oxygen to peripheral tissues. Anemia is a common problem in primary care with dietary issues as a frequent causation. The leading cause of anemia in the United States is iron deficiency, followed by folate deficiency and vitamin B_{12} deficiency. You should suspect anemia if your patient complains of dizziness, exertional dyspnea, fatigue, headaches, loss of libido, mood changes, sleep problems, tinnitus, weakness, glossitis, jaundice, neuropathy, pallor, peripheral edema, splenomegaly, tachycardia, hemic murmur, or pica.

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