Emergency Medicine Evaluation and Management of Anemia

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KEYWORDS

• Anemia • Red blood cells • Evaluation • Management • Microcytic • Normocytic • Macrocytic • Transfusion • Transfusion reaction

KEY POINTS

- Anemia is commonly found on laboratory evaluation and is due to decreased red blood cells or hemoglobin concentration. Definition varies based on age.
- Anemia can be broken into several types based on symptoms, time of onset, and red blood cell indices (using MCV with microcytic, normocytic, and macrocytic).
- Transfusion considerations include assessment of patient hemodynamics. Unstable patients with anemia require transfusion.
- A transfusion threshold of 7 g/dL is recommended for patients with sepsis, trauma, critical illness, and gastrointestinal bleeding.
- Iron is an alternative treatment for patients with microcytic anemia owing to iron deficiency, and hyperbaric oxygen therapy is another option if available.

INTRODUCTION

Anemia is common in the emergency department (ED), frequently diagnosed on laboratory evaluation. Emergency physicians play an integral role in the diagnosis and management of anemia. Patients may demonstrate a wide variety of symptoms, with many remaining relatively asymptomatic. Few patients require acute intervention in the ED; however, significant variation is present in the management of anemia.[1–6] Understanding the different types of anemia and treatment modalities may improve ED evaluation and management of this common condition.

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DEFINITION OF ANEMIA

Anemia is a condition in which the body has decreased erythrocytes, otherwise known as red blood cells (RBCs), which is measured as a decreased hemoglobin concentration.[2–5] Hemoglobin levels of less than 13 g/dL in adult males and 12 g/dL in adult females define anemia according to the World Health Organization.[2,4] The definition of anemia can also include the lowest 2.5% of hemoglobin levels in a healthy population.[5,6] Normal hemoglobin and hematocrit levels depend on several factors, especially age and gender (**Table 1**).

EPIDEMIOLOGY

Anemia affects approximately 25% of the world's population and is more commonly found in children, females, the elderly, and chronically ill patients.[2,7–9] Women and African Americans at baseline have lower hemoglobin levels.[6,10] In the United States, the prevalence decreases to less than 5%, although more than 30% of patients older than 85 years demonstrate anemia.[7–17] Anemia is not a normal component of aging, with risk factors including male gender, nutritional deficiencies, advancing age, and chronic disease.[16,17] Anemia occurs in one-half of pregnant patients in the world, although this is 20% in the United States.[2,18] The risk in the United States increases with lower socioeconomic status, nutritional issues, and chronic illness.[7–11] Anemia can affect quality of life and may contribute to all-cause mortality in elderly patients, as well as increase the risk of fall and functional impairment.[9,11,19–23] Chronic anemia may lead to congestive heart failure or cardiovascular disease if severe.[2,15,16] From a practical perspective, there are only three possible causes of anemia: decreased RBC production, blood loss, and increased RBC destruction.

ERYTHROPOIESIS

An RBC functions to transport oxygen from the lungs to the rest of the body and carbon dioxide to the lungs for removal. The bone marrow is the originator of several cell lines, including RBCs after several cell divisions. RBCs are discoid, pliable cells containing four hemoglobin molecules but no nucleus. Erythropoietin, a glycoprotein from renal peritubular cells, controls RBC production.[1–5] RBC production requires erythropoietin stimulus, precursor cells within the bone marrow, and nutrients for synthesis.[5,24–28] Normal formation of RBCs requires 3 to 7 days. A normoblast is the originator that extrudes a nucleus to form a reticulocyte. This reticulocyte matures into an RBC with loss of the ribosomal network. The normal lifespan of an RBC is 100 to 120 days before the cell is removed by macrophages.[5,24–28]

Abnormalities in the production of RBCs can result in anemia, and these abnormalities can be the result of vitamin deficiency (vitamin B_{12} or folate) or a genetic hemoglobinopathy or membranopathy. Hemoglobinopathies are the result of

Table 1
Normal hemoglobin and hematocrit levels by age and gender

Age	Hemoglobin (g/dL)	Hematocrit (mL/dL)
≤3 mo	10.4–12.2	30–36
3–7 y	11.7–13.5	34–40
Adult female	12.0–16.0	35–48
Adult male	14.0–18.0	40–52