
Screening for and Managing Anemia

Prevalence of Anemia

Anemia is a global epidemic associated with adverse outcomes including developmental delay in infants; cognitive disability in children; and increased mortality in healthy women, patients with congestive heart failure, and the elderly. An estimated 25% of the world's population is anemic from nutrition deficiencies, infectious, malignancy, and genetic causes (Table 3). Iron deficiency is the most common type of anemia and accounts for approximately 50% of all cases globally, affecting a high proportion of school-aged children and women.⁴⁻⁶

Risk of Anemia

Anemia has been characterized as an independent risk factor for increased major morbidity and mortality in perioperative patients. Preoperative anemia is present in a high proportion of patients presenting for elective surgery.⁷⁻⁹ The impact of anemia on important perioperative outcomes and serious adverse events continues to be defined.^{10,11} Preoperative anemia is associated with adverse outcomes including increased organ injury (eg, brain, heart, kidney) and mortality.^{8,9,12-16} The high prevalence of preoperative anemia results in postoperative anemia in up to 90% of patients following surgery.^{7,10,17,18} Recent retrospective data have demonstrated that there is a reduction in adverse outcomes including infection rate, length of hospital stay (LOS), serious adverse events, and mortality in centers that have adopted a multimodal and multidisciplinary approach to blood conservation.^{1-3,18} In one such program (ONTraC), implementation of a blood conservation program resulted in a ~50% reduction in Red Blood Cell (RBC) transfusions in patients undergoing knee arthroplasty and coronary artery bypass surgery (CABG) over 10 years.² This was associated with a significant reduction in infections and LOS over the same period.² In

another report, a blood conservation program reduced RBC transfusion, mortality, and the incidence of major adverse events following cardiac surgery when outcomes were compared with other comparable centers without blood conservation programs.³ Despite these positive reports, prospective data from adequately powered randomized trials are not yet available to guide management of anemia.

Causes of Anemia

Iron deficiency anemia (IDA) and anemia of chronic disease (ACD) are prevalent among the causes of preoperative anemia (Table 3).¹⁹⁻²⁴ This suggests that effective treatment strategies can be employed to reduce the incidence of preoperative anemia. Chronic preoperative anemia is a risk factor for acute intraoperative anemia, which frequently results from acute blood loss and fluid resuscitation.^{15,25} Adverse outcomes associated with acute reduction in intraoperative anemia have been best characterized in cardiac surgical patients in whom a low nadir hematocrit on cardiopulmonary bypass (CPB) is associated with increased incidence of adverse outcomes including acute renal failure, stroke, and mortality.^{15,25-29} A low preoperative hemoglobin concentration is associated with low intraoperative hemoglobin levels in these patients; both of these markers increase the risk for adverse perioperative outcomes including stroke, acute renal failure, and death.¹⁰

History and Physical Examination

The physiological consequences of acute and chronic reduction in hemoglobin include symptoms of easy fatigability, tachycardia, and hypotension. These symptoms might be more pronounced in patients suffering from acute anemia or in older patients with cardiovascular disease. Indeed, in a recent randomized clinical trial of transfusion in older patients with hip fractures, the incidence of RBC transfusion due to symptoms (tachycardia or hypotension) was three times higher in the lower transfusion threshold group (12.2% vs 4.2%).³⁰

Table 3. Causes of Anemia

1. Decreased or impaired red cell production
 - Nutrition deficiencies (iron, folate, vitamin B12)
 - Reduced erythropoietin (EPO) production caused by renal failure
 - Marrow causes: aplastic anemia, myelodysplasia/cancer, or fibrosis
 - Chronic inflammation (also known as anemia of chronic disease)
 - Medications with myelotoxic potential: immunosuppressive (eg, imuran), chemotherapy (eg, cyclophosphamide), anticonvulsants, etc.
 2. Increased red cell destruction (hemolysis)
 - Intrinsic to red cells: membrane disorders, hemoglobinopathies (sickle cell disease, thalassemia, enzyme deficiencies)
 - Extrinsic to red cells: immune (allo- or autoantibody mediated), microangiopathy (DIC, TTP), macroangiopathy (leaky valve), infections (malaria), other (burns)
 3. Red cell loss
 - Bleeding (gastrointestinal bleeding, menorrhagia, surgery, etc)
 4. Red cell sequestration
 - Related to splenomegaly
 5. Dilution
 - iatrogenic (ie, blood loss and fluid resuscitation with crystalloid), pregnancy
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DIC = disseminated intravascular coagulation; TTP = thrombotic thrombocytopenic purpura.

Frequently, the patient's history will point toward the presence of significant medical conditions that may predispose the patient to transfusion. Foremost among these would be diagnoses of renal or hepatic failure. Ultimately, laboratory testing is required to make the diagnosis. The following list identifies signs and symptoms that may help guide the clinician in early assessment of anemia.