Detection, Evaluation, and Management of Anemia in the Elective Surgical Patient

Lawrence T. Goodnough, MD, Aryeh Shander, MD, Jerry L. Spivak, MD, Jonathan H. Waters, MD, Arnold J. Friedman, MD, Jeffrey L. Carson, MD, E. Michael Keating, MD, Thomas Maddox, MD, and Richard Spence, MD

Departments of Pathology and Medicine, Stanford University, Stanford, California; Department of Anesthesiology, Critical Care Medicine, Pain Management and Hyperbaric Medicine, Englewood Hospital and Medical Center, Englewood, New Jersey; Mount Sinai School of Medicine, Mount Sinai Hospital; Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland; Department of Anesthesiology, Magee Women's Hospital, University of Pittsburgh, Pittsburgh, Pennsylvania; Department of Obstetrics and Gynecology, Beth Israel Medical Center, New York, New York; Division of General Internal Medicine, University of Medicine and Dentistry of New Jersey, Robert Wood Johnson Medical School, New Brunswick, New Jersey; Center for Hip and Knee Surgery, St. Francis Hospital, Mooresville, Indiana; Department of Family Practice, St. Luke's Hospital of Kansas City, Kansas City, Missouri; Department of Surgery, St. Agnes HealthCare, Baltimore, Maryland

The prevalence of anemia in elective surgical patients may be as frequent as 75% in certain populations. A national audit demonstrated that 35% of patients scheduled for joint replacement therapy have a hemoglobin <13 g/dL on preadmission testing. Standard practice currently consists of preadmission testing 3 to 7 days before an elective operative procedure, precluding the opportunity to effectively evaluate and manage a patient with unexpected anemia. Therefore, a standardized approach for the detection, evaluation, and management of anemia in the preoperative surgical setting was identified as an unmet medical need. To address this knowledge gap, we convened a panel of physicians to develop a clinical care pathway for anemia management in this setting. Elective surgery patients should receive a hemoglobin (Hgb) determination a minimum of 30 days before the scheduled surgical procedure. Because the identification and evaluation of anemia in this setting will assist in expedited diagnosis and treatment of underlying comorbidities and will improve patient outcomes, unexplained anemia (Hgb <12g/dL for females and <13g/dL for males) should cause elective surgery to be deferred until an evaluation can be performed.

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Previously undiagnosed anemia is identified in 5% to 75% of elective surgical patients (1), depending on the associated comorbidity. In a national audit of elective orthopedic surgery (2), 35% of patients were found to have hemoglobin <13 g/dL at preadmission testing. Other studies have indicated that the large majority of such patients are women and that approximately one third of these are the result of iron deficiency (3). The remainder of anemias, although poorly characterized, is usually attributed to anemia of chronic disease.

Preoperative anemia has been associated with increased morbidity after surgery (4), most commonly related to blood transfusion therapy (2), including increased rates of postoperative infection (5–7) and mortality (8). Gruson et al. (4) assessed the relationship between admission hemoglobin levels and long-term postoperative morbidity, mortality, and functional recovery in an elderly population with hip fractures. This study found that patients at risk for poor outcomes could be identified by measuring hemoglobin levels at hospital admission. Dunne et al. (9) found a frequent incidence of preoperative anemia in surgical patients and that blood transfusion in the first 24 h after trauma was associated with increased risk for systemic inflammatory response syndrome, intensive care admission, and death. Halm et al. (10) recommended the diagnosis and correction of

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Address correspondence to Lawrence T. Goodnough, MD, Stanford University Medical Center, 300 Pasteur Drive H-1402, Stanford, CA 94305–5626. Address e-mail to ltgoodnough@stanford.edu. Address reprint requests to the Society for the Advancement of Blood Management, 555 East Wells Street, Suite 1100, Milwaukee, Wisconsin 53202–3823.

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nutritional anemia with iron, vitamin B_{12}, folate supplementation, or administration of recombinant human erythropoietin (rHuEPO). Shorter length of stay and decreased odds of death were associated with higher preoperative hemoglobin levels.

Because preoperative anemia is associated with perioperative risks of blood transfusion, as well as increased perioperative morbidity and mortality, a standardized approach for the detection, evaluation, and management of anemia in this setting was identified as an unmet medical need.

Methods

A panel of multidisciplinary physicians was convened by the Society for Blood Management (www.sabm.org) to develop a clinical care pathway for anemia management in the elective surgical patient for whom blood transfusion is a probability (defined as any procedure for which a preoperative blood type and crossmatch is requested) (11). A list of potential physicians with knowledge, experience, and expertise with this topic was generated. The specific specialties were also considered as well as some geographic location (West coast, East coast) and institution (community and academic centers) diversity. From that list the panelists were chosen by availability and response of the candidate (i.e., the candidate felt it was important enough to do the work required). The panel selected represented the specialties of anesthesiology ($n = 2$), hematology/transfusion medicine ($n = 2$), internal medicine ($n = 1$), orthopedic surgery ($n = 1$), general surgery ($n = 1$), family practice ($n = 1$), and obstetrics and gynecology ($n = 1$).

The panel evaluated the current best practices with regard to screening for preoperative anemia, anemia evaluation, and anemia therapy. A large institutional preoperative anemia optimization plan was presented by one panel member, and nine institutional preadmission testing policies were reviewed. The goal of this forum was to develop a clinical care pathway for the detection, evaluation, and management of anemia in the elective surgery patient.

Results

Recommendation 1

Whenever clinically feasible, elective surgical patients should have a hemoglobin level tested a minimum of 30 days before the scheduled surgical procedure (Fig. 1).

Rationale 1

The Circular of Information (12) for blood and blood products has recommended that iron, vitamin B12, folic acid, and erythropoietin be used "instead of blood transfusion" if the clinical condition of the patient permits sufficient time for these agents to promote erythropoiesis, with the key phrase relevant to this recommendation being "sufficient time . . . to promote erythropoiesis."

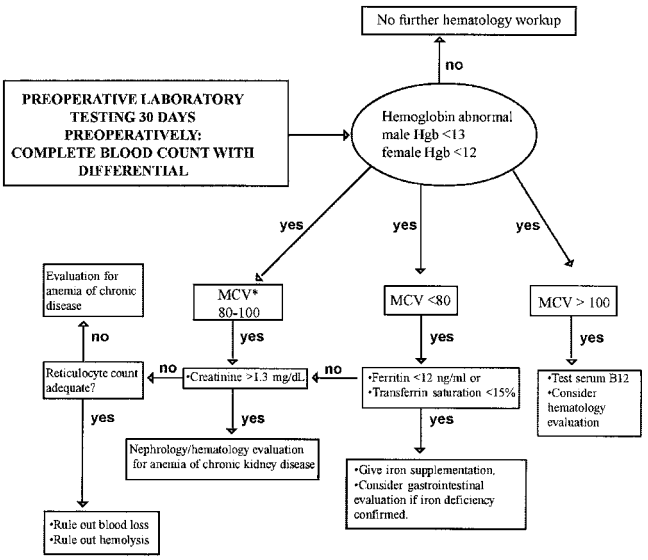

Figure 1. Clinical care pathway for identification and evaluation of anemia in elective surgical patients. MCV, mean corpuscular volume.

In this regard, we undertook a survey of institutions with which the panelists were associated. A review of 9 institutional preoperative admission testing policies indicated that complete blood counts were valid for the following time periods: 6 institutions stated laboratory testing was valid up to 30 days before the procedure; 1 required a complete blood count on the chart no more than 7 days before surgery; 1 stated laboratory testing was valid up to 3 mo before surgery; and 1 confirmed data as valid up to 1 yr before the surgical procedure. All institutional preadmission testing policies contained qualifiers stating additional testing was at the discretion of the anesthesiologist based on the presence or absence of patient comorbidity and the clinical situation; however, none of the preadmission testing policies included guidelines for evaluation of anemia in the elective surgical patient.

A thorough history and physical examination are also essential for identifying any comorbidities that are potential causes of anemia. When recording the history and physical examination, the health professional should inquire about new symptoms or signs related to anemia, as well as nutritional intake, herbal remedies, medical history, family history, alcohol intake, and current medications, in particular salicylates, nonsteroidal antiinflammatory drugs, and Coumadin. In addition, a stool specimen for occult blood should be obtained.

Based on the time interval required for anemia evaluation and management, the panel considered a 30-day interval to be optimal in the elective surgical patient. The panel further recommended that the patient's target hemoglobin before elective surgery should be within the normal range (normal female ≥12 g/dL, normal male ≥13 g/dL).

Recommendation 2

Unexplained anemia should always be considered as secondary to some other process and, therefore, elective surgery should be deferred until an appropriate diagnosis is made.

Rationale 2

To serve the patient's best interests, efforts should be made to identify the underlying etiologic factor or factors causing anemia and correct or manage the condition appropriately. Clinical and functional outcomes improve with the recognition of anemia as a symptom of an underlying condition. To facilitate this, the panel recommended that an effort be made to identify the underlying disorder causing the anemia and to correct or manage the disorder.

In the event the hemoglobin level is less than normal, additional laboratory testing should take place on the basis of the following values: mean corpuscular volume (MCV) >100 fl requires blood to be drawn for the determination of serum B12 level (normal range, 200–900 pg/mL), MCV <80 fl requires measurement of the ferritin and transferrin saturation (ferritin <12 ng/mL and/or transferrin saturation <15% indicates iron deficiency), and a normal MCV requires measurement of the reticulocyte count and serum creatinine to evaluate for anemia of chronic disease.

Iron supplementation is indicated in the presence of confirmed iron deficiency anemia, as documented by the following laboratory values: hemoglobin <13 g/dL in a female or <14 g/dL in a male, MCV <80 fl, and ferritin <12 ng/mL or transferrin saturation <15% (Fig. 1). If iron deficiency is confirmed, gastrointestinal evaluation is recommended for any patient except menstruating women.

In the presence of a low hemoglobin and normal MCV, a reticulocyte count and serum creatinine level should be measured (Fig. 1). A hematology, gastroenterology, or nephrology consultation is appropriate if an abnormal reticulocyte count or creatinine level is present to evaluate for possible hemolysis, blood loss, or chronic kidney disease (Fig. 1).

Anemia of chronic disease is a diagnosis of exclusion (13). However, the following are considered evidence of anemia of chronic disease: unexpected anemia in the presence of an inadequate reticulocyte response, no evidence for iron deficiency or chronic kidney disease, and an associated chronic disease.

In the United States, epoietin alfa and darbepoietin alfa are approved for anemia associated with cancer treatment when the hematocrit level is 30% or less or when the patient is symptomatic (14). Epoetin alfa is also approved for the treatment of elective surgical patients who are anemic (hemoglobin <13 g/dL) and who are scheduled for major noncardiac, nonvascular surgery (14). The dose of erythropoietic drugs must follow the Food and Drug Administration labels for these indications.

The patient should receive iron supplementation throughout the course of erythropoietic therapy. There is a well-defined dose and response relationship for rHuEPO drugs and red blood cell production in the presurgical setting (14). Erythropoietic drugs with iron supplementation are effective in reducing subsequent need for allogeneic transfusion (15).

Discussion

This clinical care pathway was developed to provide guidance for preoperative evaluation in the elective surgical patient anticipated to have significant blood loss. Currently, limiting preadmission testing to within several days before the scheduled operative procedure precludes the opportunity to evaluate and manage the patient with unexplained anemia. The recommended timeframe of laboratory testing 30 days before the scheduled elective procedure ensures that anemia can be detected, evaluated, and managed appropriately before elective surgery.

The diagnosis of an unexplained anemia in patients scheduled for elective surgery in which significant blood loss is anticipated should be considered an indication for rescheduling surgery until the clinical care pathway is completed. Anemia should be viewed as a significant clinical condition, rather than simply an abnormal laboratory value (16). Morbidity and mortality after surgery is significantly associated with the presence of preoperative anemia (17), thus warranting this recommendation.

We conclude that the implementation of a clinical care pathway for anemia management in the elective surgical patient will improve patient outcomes through the identification and evaluation of unexpected anemia in this clinical setting.

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