REVIEW ARTICLE

Medical Management of Anemia in the Surgical Patient

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Anemia is defined as a medical condition in which the body does not have enough healthy red blood cells in order to provide oxygen to the body tissue. This article serves to review the clinical presentation, work-up and management of anemia, specifically anemia that is seen in pre/postoperative patients. Similar to hypertension, anemia can often go unnoticed if mild and if severe can cause irreversible damage, including death. An efficient, simple way to evaluate for anemia in a patient is to obtain a Complete Blood Count (CBC). There are endless etiologies that may cause anemia including but not limited to medications, chronic disease, cancers, pregnancy, malnutrition and trauma. In surgical patients, anemia has been linked to increased postoperative morbidity and mortality despite being a medical condition that can be treated. Primary care physicians can become a crucial component in the preoperative preparation and postoperative treatment of anemia in their surgical patients. In order to efficiently achieve maximum surgical success, patients must be educated about the common symptoms seen with anemia in addition to regular primary care physician visits. With the proper treatment of anemia, patients will have a decreased risk of postoperative complications including a decreased cost of care, infections and length of hospital stay.

INTRODUCTION

The major contributor to red blood cell production in the human body is the bone marrow. Healthy red blood cells last between 90 and 120 days.[1] When old red blood cells are removed from the body, a hormone called erythropoietin, which is made in your kidneys, signals your bone marrow to make more red blood cells.[1] When the body does not have the necessary building blocks to make more red blood cells, anemia ensues. It is estimated that one-third to one-half of surgical patients may be anemic preoperatively secondary to the conditions for which they require surgery. After surgery, anemia is even more common, found to affect nearly 90% of the patients.[2] Anemia should be viewed as a significant clinical condition, rather than simply an abnormal laboratory value.[3] Whether to transfuse the patient or administer iron supplementation with or without erythropoietin remains controversial to this day. Research on universal treatment guidelines for pre/postoperative patients has largely been ignored. A more efficient and agreeable approach to treating perioperative anemia has the potential to reduce medical costs and possible complications that anemic patients may experience.

METHODS

The National Center for Biotechnology Information PubMed database was used as the primary source of references used to complete this review. Keywords and phrases searched include pre/postoperative anemia, causes of anemia, anemia treatment, transfusion complications, iron supplementation, erythropoietin and anemia guidelines. Medscape and Google were also used to access reference information. Material published with an emphasis on pre/postoperative patients was included in the compilation of this review.

PATHOPHYSIOLOGY OF ANEMIA & RISK FACTORS

Inflammatory cytokines after surgery and trauma invoke a response characterized by, among other effects, decreased iron uptake from the gastrointestinal tract and iron sequestration in macrophages, along with a diminished erythroid response to erythropoietin.[4] Other contributory causes to postoperative anemia include pre-existing preoperative anemia and trauma/surgical blood loss. Added to these is an element of hemodilution occurring as a result of fluid replacement before, during, and after surgery.[4] Common causes of anemia not related to surgery that should be checked preoperatively include chronic diseases, cancers, malnutrition, thalassemia and certain medications. The body needs certain vitamins, minerals, and nutrients to make enough red blood cells. Iron, vitamin B12, and folic acid are three of the most important ones required for red blood cell production.[1] Several studies have shown that patients with preoperative anemia have a higher incidence of needing an allogeneic blood transfusion, compounding the problems from anemia which may include a longer hospital stay and an increased likelihood of death after surgery. Patients who are transfused after surgery as a result of anemia are more likely to develop postoperative infection, require longer periods of mechanical ventilation, and have a greater risk of mortality.[5]

CLINICAL PRESENTATION

Educating patients on the symptoms of anemia can help when obtaining the history of present illness and give a more definitive

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time of onset of symptoms. Depending on the severity of anemia, patients may either be asymptomatic or present with nonspecific complaints including feeling grumpy, generalized weakness, fatigue, headaches and problems concentrating initially.[1] It is important to take into consideration that feeling tired when recovering from surgery is very common as surgery puts an extreme stress on the body. If the anemia worsens, one could expect a patient to have pale skin, develop pica, dyspnea, develop brittle nails and complain of a sore tongue.[1] Some pertinent exam findings seen in an anemic patient include new onset heart murmur, low blood pressure (especially with standing), pallor and tachycardia.[1] If any of the above symptoms/findings are met and there is a clinical concern for anemia, baseline laboratory orders should include a CBC, vitamin B12/folate level and an iron/ferritin level.

RESULTS

When a CBC is drawn post operatively and the patient's hemoglobin is found to be low, there are generally two treatment options: a transfusion or iron supplementation. Many patients that are placed on iron supplementation only have a hemoglobin level checked and are not further evaluated to see if they are actually iron deficient. Several studies have been performed evaluating the effectiveness of administering oral iron supplementation versus not supplementing iron in postoperative patients. In a recent study published, focusing specifically on anemia in elderly patients who had undergone hip surgery, the population of patients was divided into an experimental group, receiving ferrous sulfate orally four times a day for the duration of their hospitalization and a control group, which did not receive any supplementation.[6] After analysis, there was no significant difference in mean hemoglobin levels between the treatment and control groups (95% confidence interval [CI]) and a conclusion was subsequently made that the administration of oral iron supplements to elderly, healthy orthopedic patients postoperatively did not hasten the recovery of hemoglobin levels, provided adequate tissue iron stores were present.[6]

Furthermore, there was an additional study published that was conducted to determine if early recovery from severe post-operative anemia is accelerated by intravenous (IV) iron therapy alone or in combination with recombinant erythropoietin (EPO).[7] In this double-blinded, placebo controlled randomized study, there was no clinical significant difference between the treatment and control groups and a conclusion was subsequently made that early postoperative treatment with IV iron alone or in combination with EPO does not appear to accelerate early recovery from postoperative anemia.[7] The majority of the literature searched showed similar conclusions on postoperative anemia treatment leading to the conclusion that the prescription of iron to all anemic patients immediately post-operatively should be avoided and only used if the patient is found to be truly iron deficient.[4]

MANAGEMENT

The overall prevalence of anemia in the general population increases with age, so that in the elderly (>65 yr old), the prevalence of anemia as defined by the World Health Organization (WHO) is 11% and 10.2% for men and women, respectively.[8] According to current guidelines from the American Society of Anesthesiologists, RBC transfusion is recommended if the hemoglobin concentration drops below 6–10 g/dl. Transfusions over 10 g/dl are rarely indicated, and transfusions are generally indicated if hemoglobin falls below 6 g/dl.[9] Allogeneic transfusion is a common treatment for perioperative blood loss resulting in low postoperative hemoglobin, but it has a number of well-recognized risks, complications *(Table 1, page 30)*, and costs.[9] Iron supplementation is another common treatment for anemia, however, this really only has an effect if the patient is truly iron deficient, which a large portion of postoperative patients are not.[4]

The most effective strategy to avoid postoperative anemia and transfusion therapy is to identify and correct preoperative anemia whenever possible.[4] While hemoglobin screening is included in standard pre-admission testing, it usually occurs only 3-7 days prior to surgery.[5] This does not provide enough time to effectively evaluate and manage a patient who is found to be anemic. Whenever clinically feasible, elective surgical patients should have their hemoglobin level tested a minimum of 30 days before the scheduled surgical procedure. This allows for adequate evaluation and treatment if a patient is found to be anemic preoperatively.[5]

When a patient is found to have unexplained anemia, a secondary cause should be evaluated because treatment of this problem may resolve the anemia. When a hemoglobin returns low, laboratory testing must be performed to further evaluate if the anemia is from nutritional deficiencies, chronic renal insufficiency, and/or chronic inflammatory disease.[10] If a screening CBC detects anemia, evaluation should begin with an assessment of iron status. The assessment of iron-restricted erythropoiesis needs to distinguish between absolute iron deficiency, iron sequestration due to inflammation, and/or functional iron deficiency due to erythropoietin stimulation.[11] The accurate differentiation of these is difficult using traditional biochemical markers of iron status, such as serum iron, percentage saturation of transferrin, and serum ferritin.[12] As ferritin is an acute-phase reactant, traditional laboratory thresholds of <12 µg/L (1 ug/L = 1 ng/ml) may be suitable for identifying absolute iron deficiency in normal individuals, but not in patients with any evidence of an inflammatory process.[13] For patients without chronic renal disease, ferritin levels >100 µg/L confirm the presence of stored iron.[10]

When absolute iron deficiency is detected, consideration to pursue a work-up to rule out a gastrointestinal malignancy as a source of chronic blood loss is indicated.[14] If laboratory evaluation or a diagnostic trial of iron therapy rules out absolute iron deficiency, measurement of serum creatinine and glomerular filtration rate (GFR) may indicate CKD with further management directed by the level of renal disease.[14] If ferritin, iron saturation values, and/or other markers of iron-restricted erythropoiesis are inconclusive, further evaluation to rule out iron deficiency or iron sequestration due to inflammation/chronic disease is necessary. A therapeutic trial of oral iron therapy would confirm absolute iron deficiency .[10] If there is no response to iron therapy, one cannot rule out absolute iron deficiency as this may possibly be caused by patient non-compliance[11] ongoing blood (iron) losses in excess of oral iron absorption[15] and/or diminished gastrointestinal absorption of iron due to inflammation.[12] Using the above mentioned recommendations preoperatively will significantly decrease the patient's postoperative morbidity and mortality risk. Furthermore, if preoperative anemia is treated, there is less of a chance that the patient will need a transfusion or iron supplementation (if found to be iron deficient) after surgery.

TABLE 1:

Incidences of potential risks associated with allogeneic blood transfusions

	Risks Associated	Incidence
Volume Overload	Hypertension, pulmonary edema	1:100 – 1:1,000
Mistransfusion	Acute hemolytic reaction Delayed hemolytic reaction	1:6,000 – 1:33,000 1:2,000 – 1:11,000
Bacterial Contamination	Sepsis	1:10,000 – 1:100,000
Viral Contamination	HIV Hepatitis C Hepatitis B Hepatitis A Cytomegalovirus Epstein–Barr virus West–Nile virus	1:2,300,000 1:1,800,000 1:350,000 1:1,000,000 1:10–1:30 1:200 1:3,000–1:5,000
Prion Contamination	Creutzfeldt–Jakob Disease	Unknown
Transfusion-related acute lung injury	Immune Nonimmune	1:625 1:2,800
Allergic transfusion reaction		1:100–1:2,000
Immunosuppression		1:1
Alloimmunization		1:16,000

CONCLUSION/DISCUSSION:

Anemia often presents with vague and nonspecific symptoms, however, if left untreated especially in preoperative patients, anemic patients are at an increased risk of mortality and morbidity. A proper history and physical is imperative in the management of anemia. Despite being a treatable medical condition, anemia is often just looked at as simply an abnormal laboratory value. One of the best ways to increase a patient's surgical success is to prevent the need for a transfusion and/or prescribing unnecessary iron/EPO supplements as both these medical treatments can cause unwanted complications. Primary care physicians can become a crucial component in the preoperative preparation and postoperative treatment surrounding their patient's surgery. As mentioned previously, the recommendations that a primary care physician can partake in preoperatively include: elective surgical patients having a hemoglobin level determination 28 days before the scheduled surgical procedure and the patient's target hemoglobin before elective surgery must be within the normal range. If anemic, further laboratory testing to evaluate if the anemia is caused from nutritional deficiencies, chronic renal insufficiency, and/or chronic inflammatory disease is necessary. Lastly, treat those deficiencies prior to surgery and provide supplementation if warranted.[13] A more efficient and agreeable approach to treating pre/postoperative anemia has the potential to reduce medical cost and possible complications that our patients may experience added on to the already stressful time in their life surrounding their operation.

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