New York State Council on Human Blood and Transfusion Services

GUIDELINES FOR TRANSFUSION OF RED BLOOD CELLS - ADULTS

Second Edition
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New York State Council on Human Blood and Transfusion Services
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GUIDELINES FOR TRANSFUSION OF RED BLOOD CELLS - ADULTS

INTRODUCTION

Despite remarkable progress in the reduction of the risks of transmission of human immunodeficiency virus (HIV), hepatitis C virus (HCV) and hepatitis B virus (HBV), a progressively conservative approach has been applied to blood transfusion since the last publication in 1989 of the New York State Department of Health's *Guidelines for Transfusion of Red Blood Cells - Adults*. This restraint is due in part to concerns about transmission of new infectious agents either not previously present in this country, or not considered significant earlier, *e.g.*, West Nile virus, Chagas' disease, bacterial sepsis, parvovirus, variant Creutzfeldt-Jakob disease and babesiosis. The concept that immunomodulation from blood transfusion may lead to postoperative infections, increased mortality and multi-organ failure is now also gaining acceptance, and likely affects a large number of patients. Other non-infectious complications are being recognized more frequently as well. For example, transfusion-related acute lung injury is now a major cause of death due to transfusion. Moreover, fundamental questions are being raised about the efficacy of red blood cell function in acutely ill patients.

The risk/benefit ratio of transfusion has been studied in randomized trials in few clinical settings. A large randomized controlled trial (Hébert, 1999) and prospective observational studies (Vincent) have not only failed to show the benefits of a more liberal red blood cell transfusion policy in the peri-operative and critical care settings, but have also suggested an increased risk of death in certain subgroups of patients who have been liberally transfused Further studies are urgently needed, especially in individuals with underlying acute myocardial ischemia, in whom conflicting results have been reported (Bracey, Wu). Whenever the benefits of transfusion are not obvious based on hemoglobin concentration (Hgb of 7-10 g/dL) and the clinical picture alone, other data, if available, such as oxygen extraction ratio and P_vO_2 are useful adjuvants to determine the clinical necessity for blood transfusion.

Increasing use in recent years of blood products in a growing elderly population, combined with more restrictive donor criteria, have also resulted in reduced product availability. These complex factors have led many groups to encourage blood conservation by combining new techniques for minimizing blood loss with the optimal alternatives to allogeneic transfusion now available. The New York State Department of Health is updating its RBC transfusion guidelines with more conservative hemoglobin concentrations.

RBC transfusions are given to improve oxygen delivery. It is prudent to transfuse only in the presence of compelling clinical indications in individual patients. No universal trigger has been established for red cell transfusions that is deemed appropriate for all patients. In most healthy patients, oxygen delivery is thought to be adequate even at a hemoglobin of 7 g/dL. Many adaptive, physiological changes occur as a result of anemia, such as increase in cardiac output, and altered blood viscosity, and coronary and cerebral blood flow. Some patients, such as the elderly, those who are already anemic, and those with

underlying cardiac and pulmonary disease, may not be able to respond in this manner, and therefore tolerate anemia poorly; they may need to be transfused at higher hemoglobin concentrations.

Prior to elective transfusion, the ordering physician should discuss with the patient the indications for, risks and benefits of, and alternatives to transfusion, such as erythropoietin administration to produce a sustained hemoglobin increase in some cases. This discussion, as well as the consent and rationale for transfusion, should be documented in the patient's chart. Blood loss through phlebotomy is a frequent cause of anemia in the intensive care unit. Efforts should be made to minimize the frequency and volume of blood drawn by using pediatric-size tubes and microchemistry testing, and performing as many tests as possible on each sample.

I. ACUTE BLOOD LOSS (SURGERY, TRAUMA OR BLEEDING)

The effects of anemia must be considered separately from the reduction in blood volume alone. Maintenance of normovolemia is the single most important strategy for ensuring adequate tissue perfusion. Estimating the loss of circulating blood volume, by measurement and clinical signs and symptoms, is the standard approach to evaluating the patient's response to acute bleeding, and provides a useful guide for immediate patient management. However, it should be noted that such vital signs may be masked by anesthetic agents and other drugs.

A. A Blood Volume Loss Of:

1. 15 - 30 percent -- should be treated with crystalloids or colloids, not RBCs, in young, healthy patients;

2. 30 - 40 percent -- requires rapid volume replacement, and RBC transfusion is probably necessary;

3. >40 percent -- is life-threatening and volume replacement, including RBC transfusion, is required.

B. Hemoglobin Concentration

The accuracy of hemoglobin concentration measured after acute blood loss is influenced by intravenous fluid resuscitation and time needed for equilibration. Thus, hemoglobin alone is an imprecise measurement of oxygen delivery.

Elderly patients, or those with underlying anemia or other comorbid factors, may need to be transfused with RBCs following a blood loss of less than 30 percent. Blood loss and hemoglobin concentration must be evaluated, along with the risk of further bleeding, presence of coagulopathies, body temperature, and associated high-risk factors, all of which may affect the decision to transfuse.

The American Society of Anesthesiologists Task Force on Blood Component Therapy recommendations[1] based on hemoglobin concentration are:

Hemoglobin >10 g/dL -- transfusion is rarely indicated.

Hemoglobin 6-10 g/dL -- indications for transfusion should be based on the patient's risk of inadequate oxygenation from ongoing bleeding and/or high-risk factors.

Hemoglobin < 6 g/dL -- transfusion is almost always indicated.

II. PERI-OPERATIVE TRANSFUSION

Prior to surgery, the aim should be to manage the patient so as to avoid transfusion by treating pre-existing anemia, discontinuing anti-platelet drugs, reversing anticoagulation, and considering various strategies for autogeneic transfusion. Pharmacological agents to raise hemoglobin and reduce surgical bleeding should also be used as appropriate.

Patients with asymptomatic anemia and hemoglobin ≤ 7 g/dL may need to be transfused if:

A. scheduled surgery is expected to produce significant blood loss; and

B. the risks associated with general anesthesia are high.

III. CHRONIC ANEMIA

Patients presenting with a chronic anemia will have developed compensatory mechanisms, such as increased blood flow due to lowered viscosity and increased release of oxygen due to higher levels of 2,3-DPG. This may allow time for careful observation and a trial of erythropoietin or other therapy. In patients who do not respond, transfusion may be necessary.

A. The cause of the anemia should be established. RBC transfusion is contraindicated if specific replacement therapy is possible (*e.g.*, iron, vitamin B12, folic acid). Transfusion should only be used under these conditions if the situation is life-threatening, such as in case of emergency surgery, acute blood loss, or trauma.

B. Anemia secondary to aplasia or bone marrow suppression. In patients with no symptoms of anemia and:

   1. no high risk factors -- a hemoglobin of 6-7 g/dL may be sufficient;

   2. evidence of cardiovascular, pulmonary or cerebrovascular disease -- may need to be transfused with a hemoglobin of ≥7 g/dL. The exact therapeutic concentration needs to be individualized for each patient.

   Patients with symptoms of anemia should be transfused to alleviate symptoms.

IV. SPECIAL SITUATIONS

A. Severe Thalassemia Or Other Congenital Anemia

The aim of transfusion in thalassemia cases is to prevent symptoms and suppress endogeneous erythropoiesis by maintaining hemoglobin at a minimum of 9-11 g/dL.

B. Sickle Cell Disease

Sickle cell disease patients with a history of or at high risk for stroke or other severe complications, who are on a chronic transfusion protocol or who require acute RBC exchange, may be transfused to reduce hemoglobin S to below 30 to 50 percent.

C. Burn Patients

A survey of RBC transfusion policies at several U.S. burn units found that hemoglobins as low as 6 g/dL and hematocrits as low as 15 percent were acceptable for healthy patients needing limited surgery. The highest hemoglobin considered as a transfusion trigger for critically ill patients with extensive burns and/or cardiopulmonary problems was 10 g/dL.

The following criteria are recommended for RBC transfusion of stable burn patients without active bleeding:

1. For patients not critically ill and without cardiopulmonary problems, RBCs may be transfused for a hemoglobin of 8 g/dL or lower.

2. For critically ill patients and/or those with cardiopulmonary problems, RBCs may be transfused for a hemoglobin of 10 g/dL or lower.

D. Additional Therapeutic Considerations

Some patients may benefit from specially prepared RBC components, such as CMV-safe, leukoreduced, HbS-negative, washed, and/or irradiated RBCs.

REFERENCES

1. Practice guidelines for blood component therapy: a report by the American Society of Anesthesiologists Task Force on Blood Component Therapy. Anesthesiology 1996; 84:732-47.

PERTINENT LITERATURE

Blumberg N, Heal JM. Transfusion immunomodulation. In: Anderson KC, Ness PM, eds. Scientific basis of transfusion medicine: implications for clinical practice. 2nd ed. Philadelphia: WB Saunders, 2000:580-97.

Bracey AW, Radovancevic R, Riggs SA, et al. Lowering the hemoglobin threshold for transfusion in coronary artery bypass procedures: effect on patient outcomes. Transfusion 1999;39:1070-7.

British Committee for Standards in Haematology, Blood Transfusion Task Force. Guidelines for the clinical use of red cell transfusions. Br J Haematol 2001;113:24-31.

Carson JL, Duff A, Poses RM, et al. Effect of anaemia and cardiovascular disease on surgical mortality and morbidity. Lancet 1996;348:1055-60.

Hébert PC. Red cell transfusion strategies in the ICU. Vox Sang 2000;78(Suppl 2):167-77.

Hébert PC, Fergusson DA. Red blood cell transfusions in critically ill patients (editorial). JAMA 2002;288:1525-6.

Hébert PC, Wells G, Blajchman MA, et al. A multicenter, randomized, controlled clinical trial of transfusion requirements in critical care. N Eng J Med 1999;340:409-17.

Marik PE, Sibbald WJ. Effect of stored-blood transfusion on oxygen delivery in patients with sepsis. JAMA 1993;269:3024-9.

New York State Council on Human Blood and Transfusion Services. Guidelines for physician options for blood conservation. Albany, NY: New York State Department of Health, 2002.

Simon TL, Alverson DC, AuBuchon J, et al. Practice parameter for the use of red blood cell transfusions: developed by the Red Blood Cell Administration Practice Guideline Development Task Force of the College of American Pathologists. Arch Pathol Lab Med 1998;122: 130-8.

Stainsby D, Maclennan S, Hamilton PJ. Management of massive blood loss: a template guideline. British Journal of Anaesth 2000;85:487-91.

Vincent JL, Baron JF, Reinhart K, et al. Anemia and blood transfusion in critically ill patients. JAMA 2002;288:1499-507.

Wu WC, Rathore SS, Wang Y, et al. Blood transfusion in elderly patients with acute myocardial infarction. N Eng J Med 2001;345:1230-6.