

New York State Council on Human Blood and Transfusion Services

***GUIDELINES FOR TRANSFUSION OF
RED BLOOD CELLS – ADULTS***

**Third Edition
2012**

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

I. 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 publication of the 2004 edition of this guideline. This restraint is due in part to concerns about transmission of new infectious agents/diseases 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 has been reported in the literature and may affect a large number of patients. Other non-infectious complications are being recognized more frequently as well. For example, transfusion-related acute lung injury (TRALI) is now the major cause of death due to transfusion reported to the FDA. Moreover, fundamental questions are being raised about the efficacy of red blood cell (RBC) function and adverse effects related to the age of stored blood used for transfusion in acutely ill patients and cardiac surgery patients, based on retrospective studies. These questions need to be answered by good prospective randomized trials. Development of better additive solutions may mitigate red cell storage lesions.

The risk/benefit ratio of transfusion has been studied in randomized trials in few clinical settings. The results of the Transfusion Trigger Trial for Functional Outcomes in Cardiovascular Patients Undergoing Surgical Hip Fracture Repair (FOCUS) were recently published.¹ This large randomized trial found no benefit from liberal transfusion in either survival rates or in the ability to walk independently 60 days postoperatively. A large randomized controlled trial² and prospective observational studies³ have not only failed to show the benefits of a more liberal red blood cell transfusion policy in the perioperative 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.^{4,5} 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.

RBC transfusions are given to improve oxygen delivery. It is prudent to transfuse only in the presence of compelling clinical indications in individual patients. Patients should be assessed for further blood need after each unit transfused. 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, 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 or 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 that may 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. Exacerbation of blood loss through phlebotomy frequently contributes to 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 performing as many tests as possible on each sample. In recognition of the benefits of combining techniques for minimizing blood loss with alternatives to allogeneic transfusion, in 2010, the Society for the Advancement of Blood Management (SABM) established Administrative and Clinical Standards for Patient Blood Management Programs.⁶

II. 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:

- 15 - 30% – should be treated with crystalloids or colloids, not RBCs, in young, healthy patients;
- 30 - 40% – requires rapid volume replacement, and RBC transfusion is probably necessary;
- > 40% – is life threatening and rapid 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 < 30%. 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 recommendations⁷ 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.

III. PERIOPERATIVE 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:

- scheduled surgery is expected to produce significant blood loss; and
- the potential adverse effects associated with general anesthesia are significant.

IV. 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 prior to transfusion.

A. Anemia Treatable by Non-transfusion Therapy

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 the case of emergency surgery, trauma, or other acute blood loss.

B. Anemia Secondary to Aplasia or Bone Marrow Suppression

In patients with no symptoms of anemia and:

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

V. SPECIAL SITUATIONS

A. Congenital Anemias

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.

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 require acute RBC exchange and may be transfused to reduce hemoglobin S to $< 30 - 50\%$. Transfusion of red cells partially matched for Rh and Kell phenotypes has been shown to reduce the high rate of alloimmunization in the subset of patients requiring transfusion.

B. 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% 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 burns with cardiopulmonary compromise was 10 g/dL.^{8,9}

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

1. For patients not critically ill and without cardiopulmonary compromise, RBCs may be transfused for a hemoglobin of ≤ 8 g/dL.
2. For critically ill patients and/or those with cardiopulmonary compromise, RBCs may be transfused for a hemoglobin of ≤ 10 g/dL.

C. Additional Therapeutic Considerations

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

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