Clinical Practice Guideline: Red Blood Cell Transfusion in Adult Trauma and Critical Care

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STATEMENT OF THE PROBLEM

Red blood cell (RBC) transfusion is common in critically ill and injured patients. Many studies1–6 have documented the widespread use of RBC transfusion in critically ill patients and the data from these studies from diverse locations in Western Europe, Canada, the United Kingdom, and the United States reveal remarkably similar findings, with approximately 40% of patients receiving RBC transfusions, with a mean of five RBC units transfused per patient, and approximately 40% of patients receiving RBC transfusions.

RBC transfusions are used for the treatment of hemorrhage and anemia as well as to improve oxygen delivery to tissues. Blood transfusion is clearly indicated for the treatment of hemorrhagic shock, particularly in patients who have reached critical oxygen delivery. Independent of the mechanism of injury, hemorrhagic shock consistently represents the second leading cause of early deaths among the injured, with only the central nervous system injury consistently more lethal.

However, most RBC transfusions in the intensive care unit (90% in the CRIT trial in the United States) are used for the treatment of anemia (Anemia and Blood Transfusion in Critical Care1 and Anemia and Blood Transfusion in the Critically Ill [CRIT2] trials). The efficacy of RBC transfusion in hemodynamically stable trauma and critically ill patients with anemia has not been demonstrated in most clinical settings. Historically, the decision to transfuse has been guided by a Hb concentration, “transfusion trigger.” A reevaluation of this practice has been prompted by the growing recognition of transfusion-related complications such as transfusion-related infections and immunosuppression, studies that demonstrate RBC transfusion may be associated with worse clinical outcomes, and lack of evidence documenting efficacy.

Although recent data suggest that critically ill patients in general can tolerate anemia to a Hb level of 7 g/dL, concerns have been raised that this level of anemia may not be well tolerated by certain critically ill or injured patients, such as those with preexisting coronary, cerebrovascular, and pulmonary disease. Finally, some clinicians retain the belief that certain conditions may require higher Hb concentrations, such as acute respiratory distress syndrome (ARDS), sepsis and multiple organ failure, traumatic brain injury, and cerebrovascular diseases.

A number of previous guidelines regarding the indications for RBC transfusion have been published,7–15 but none have specifically addressed the issue of RBC transfusion in critically ill and injured adult patients. This guideline reviews the evidence regarding RBC transfusion in adult trauma and critical illness. It will not address issues related to neonates and children.

GOALS OF THE GUIDELINE

1. To review the evidence regarding efficacy of RBC transfusion in trauma and critical care.
2. To review the evidence regarding risks of RBC transfusion in trauma and critical care.
3. To review indications for RBC transfusion in critically ill and injured patients.
4. To review possible alternatives to RBC transfusions.
5. To review practices that have been associated with decreased need for RBC transfusion.

**PROCESS**

The joint planning group (Eastern Association for the Surgery of Trauma and Society of Critical Care Medicine [SCCM]) conducted a computerized search of the National Library of Medicine (MEDLINE, EMBASE, and Cochrane Databases). Peer-reviewed English language citations during the period of 1980 through July 2008 using the words transfusion, blood transfusion, and RBC transfusion were identified from the database of journal articles. Additional references were identified by review of bibliographies of relevant published articles. Of the articles identified, those dealing with either prospective or retrospective series were selected. The following groups of articles were eliminated from analysis: (1) literature review articles; (2) wartime experiences; and (3) articles from institutions, which were duplicative. The articles were reviewed, and this practice management guideline was developed by a joint taskforce of the Eastern Association for the Surgery of Trauma and SCCM.

**Assessment (Grading) of Scientific Evidence**

All relevant empirical data were evaluated for clinical benefits and harms of the various interventions. Attempts were made to collect as much quality scientific data as possible. This included using previously published national consensus-based guidelines. Proper methods, including a variety of databases and cross-checking of citations, were used to ensure that these standards were met and biases avoided. Reference sections of the articles identified were also used to gather additional articles, and the Cochrane database was used to assure that all prospective randomized controlled trials were identified and collected for review. The scientific evidence assessment methods used by the Canadian and US Preventative Task Force were applied when classifying the articles identified for review.

**RECOMMENDATIONS SUMMARY**

**Recommendations Regarding Indications for RBC Transfusion in the General Critically Ill Patient**

**Level 1**

1. RBC transfusion is indicated for patients with evidence of hemorrhagic shock.
2. RBC transfusion may be indicated for patients with evidence of acute hemorrhage and hemodynamic instability or inadequate oxygen delivery.
3. A “restrictive” strategy of RBC transfusion (transfuse when Hb <7 g/dL) is as effective as a “liberal” transfusion strategy (transfusion when Hb <10 g/dL) in critically ill patients with hemodynamically stable anemia, except possibly in patients with acute myocardial ischemia.

**Level 2**

4. The use of only Hb level as a “trigger” for transfusion should be avoided. Decision for RBC transfusion should be based on individual patient’s intravascular volume status, evidence of shock, duration and extent of anemia, and cardiopulmonary physiologic parameters.
5. In the absence of acute hemorrhage, RBC transfusion should be given as single units.
6. Consider transfusion if Hb <7 g/dL in critically ill patients requiring mechanical ventilation. There is no benefit of a “liberal” transfusion strategy (transfusion when Hb <10 g/dL) in critically ill patients requiring mechanical ventilation.
7. Consider transfusion if Hb <7 g/dL in resuscitated critically ill trauma patients. There is no benefit of a “liberal” transfusion strategy (transfusion when Hb <10 g/dL) in resuscitated critically ill trauma patients.
8. Consider transfusion if Hb <7 g/dL in critically ill patients with stable cardiac disease. There is no benefit of a “liberal” transfusion strategy (transfusion when Hb <10 g/dL) in critically ill patients with stable cardiac disease.
9. RBC transfusion should not be considered as an absolute method to improve tissue oxygen consumption in critically ill patients.

**Level 3**

10. RBC transfusion may be beneficial in patients with acute coronary syndromes who are anemic (Hb ≤8 g/dL) on hospital admission.

**Recommendations Regarding RBC Transfusion in Sepsis**

**Level 1**

1. There are insufficient data to support level 1 recommendations on this topic.

**Level 2**

2. The transfusion needs for each septic patient must be assessed individually because optimal transfusion triggers in sepsis patients are not known and there is no clear evidence that blood transfusion increases tissue oxygenation.

**Recommendations Regarding RBC Transfusion in Patients at Risk for or With Acute Lung Injury and Acute Respiratory Distress Syndrome**

Acute lung injury (ALI) and ARDS are common clinical sequelae of massive transfusion. Previous studies have suggested that RBC transfusion is associated with respiratory complications, including ALI and ARDS, which remains even after adjusting for potential confounders.
Level 1
1. There are insufficient data to support level I recommendations on this topic.

Level 2
2. All efforts should be initiated to avoid RBC transfusion in patients at risk for ALI and ARDS after completion of resuscitation.
3. All efforts should be made to diagnose and report transfusion-related acute lung injury to the local blood bank because it has emerged as a leading cause of transfusion-associated morbidity and mortality, despite underdiagnosis and underreporting.
4. RBC transfusion should not be considered as a method to facilitate weaning from mechanical ventilation.

Recommendations Regarding RBC Transfusion in Patients With Neurologic Injury and Diseases
Level 1
1. There are insufficient data to support level I recommendations on this topic.

Level 2
2. There is no benefit of a “liberal” transfusion strategy (transfusion when Hb < 10 g/dL) in patients with moderate to severe traumatic brain injury.

Level 3
3. Decisions regarding blood transfusion in patients with subarachnoid hemorrhage must be assessed individually because optimal transfusion triggers are not known and there is no clear evidence that blood transfusion is associated with improved outcome.

Recommendations Regarding RBC Transfusion Risks
Level 1
1. There are insufficient data to support level I recommendations on this topic.

Level 2
2. RBC transfusion is associated with increased nosocomial infection (wound infection, pneumonia, and sepsis) rates independent of other factors.
3. RBC transfusion is an independent risk factor for multiple organ failure and systemic inflammatory response syndrome.
4. There is no definitive evidence that prestorage leukocyte depletion of RBC transfusion reduces overall complication rates, but some studies have shown a reduction in infectious complications.
5. RBC transfusions are independently associated with longer intensive care unit and hospital length of stay, increased complications, and increased mortality.

6. There is a direct relationship between transfusion ALI and ARDS.

Recommendations Regarding Alternatives to RBC Transfusion
Level 1
1. There are insufficient data to support level I recommendations on this topic.

Level 2
2. Recombinant human erythropoietin administration improves reticulocytosis and hematoctrit and may decrease overall transfusion requirements.
3. Hb-based oxygen carriers are undergoing investigation for use in critically ill and injured patients but are not yet approved for use in the United States.

Recommendations Regarding Strategies to Reduce RBC Transfusion
Level 1
1. There are insufficient data to support level I recommendations on this topic.

Level 2
2. The use of low-volume adult or pediatric blood sampling tubes is associated with a reduction in phlebotomy volumes and a reduction in blood transfusion.
3. The use of blood conservation devices for reinfusion of waste blood with diagnostic sampling is associated with a reduction in phlebotomy volume.
4. Intraoperative and postoperative blood salvage and alternative methods for decreasing transfusion may lead to a significant reduction in allogeneic blood usage.
5. Reduction in diagnostic laboratory testing is associated with a reduction in phlebotomy volumes and a reduction in blood transfusion.

SCCM Website
To view the tables and complete article, please visit the website of the Society of Critical Care Medicine at http://www.lernicu.org/Quick_Links/Pages/default.aspx.
The full guidelines are available at www.sccm.org and are also being copublished by the Society of Critical Care Medicine in the journal Critical Care Medicine 2009.

REFERENCES


