

Indications for Blood Transfusions

Goal of transfusing: Preserve oxygen delivery to tissues and avoid myocardial ischemia. One can do this by increasing the oxygen-carrying capacity of blood by raising the Hgb concentration of patients with acute/chronic anemia. Each unit will raise the Hct by 3 to 4 percent unless there is continued bleeding.

Background: Transfusion trigger based on the 10/30 rule, give 2 units. However, with the discovery of transfusion-related HIV and other viral diseases, the safety of blood and the risks associated with transfusions led to a more conservative approach.

- “The 1988 NIH Consensus Conference on Perioperative Red Blood Cell Transfusions suggested that no single criterion should be used as an indication for red cell component therapy and that multiple factors related to the patient’s clinical status and oxygen delivery needs should be considered.”

Transfusion Triggers/Indications

• Acute Blood Loss:

- Crystalloids should be used to fluid resuscitate hypovolemic patients along with inotropic agents to maintain blood pressure and cardiac output.
- Oxygen delivery adequate because greater cardiac output, rightward shift of the oxygen-hemoglobin dissociation curve, and increased oxygen extraction can compensate for the decrease in arterial oxygen content.
- Need for transfusion based on rate of blood loss. >40% blood volume loss has been shown to require rapid transfusion as well as 30-40% loss after initial replacement with crystalloids.

• Hemoglobin Concentration:

- Hgb around 10 previously used as a trigger. Studies reviewing Jehovah’s Witnesses postop outcomes have shown that lower Hgb concentrations did not increase mortality.
- Animal models and retrospective studies have shown increased mortality at Hgb levels of 3.5-4.0 g/dl. Notably, increase in the Lactate levels and the oxygen extraction ratio >50% were observed.
- However in animal models with cardiac disease, the increase in mortality was observed around Hgb levels of 6-7.5 g/dl.
- Canadian Critical Care Trial Group: study compared “restrictive” (Hgb<7) to “liberal” (Hgb<10) transfusion strategies among critically ill patients. The “restrictive” strategy was as effective and superior to the “liberal” transfusion strategy among patients less than 55 and without cardiac disease. Patients had an overall greater decrease in mortality and less complications. They concluded that a transfusion threshold of 7 g/dl is safe in critically ill patients, including those with minimal cardiopulmonary disease.
- Recent recommendations suggest RBC transfusion only in cases with <Hgb and known clinical symptoms.

Guidelines for Red Cell Transfusions and Volume Replacement in Adults†

Need based on estimation of lost blood volume:

>40 percent loss (>2000 mL): Rapid volume replacement, including RBC transfusion, is required

30 to 40 percent loss (1500 to 2000 mL): Rapid volume replacement with crystalloids or synthetic colloids is required; RBC transfusion will probably also be required

15 to 30 percent loss (800 to 1500 mL): Need to transfuse crystalloids or synthetic colloids; need for RBC transfusion is unlikely unless the patient has pre-existing anemia, continuing blood loss, or reduced cardiovascular reserve

Less than 15 percent blood loss (≤750 mL): No need for transfusion unless volume loss is superimposed on preexisting anemia, or when patient is unable to compensate due to severe cardiac or respiratory disease

Need based on hemoglobin concentration:

Hgb <7 g/dL: RBC transfusion indicated. If the patient is otherwise stable, the patient should receive 2 units of packed RBC, following which the patient’s clinical status and circulating Hgb should be reassessed

Hgb 7 to 10 g/dL: Correct strategy is unclear

Hgb >10 g/dL: RBC transfusion not indicated

High risk patients: Patients >65 and/or those with cardiovascular or respiratory disease may tolerate anemia poorly. Such patients may be transfused when Hgb < 8 g/dL.

† Adapted from Murphy, MF, et al. British Committee for Standards in Haematology, Blood Transfusion Task Force. Br J Haematol 2001; 113:24.

Postoperative Outcomes of Anemic Jehovah’s Witnesses†

Preoperative hemoglobin level	Mortality (percent)
< 6 g/dL	61.5 percent
6.1 to 8 g/dL	33 percent
8.1 to 10 g/dL	0 percent
> 10 g/dL	7.1 percent

†Data from: Carson, JL, Noveck, H, Berlin, JA, Gould, SA. Mortality and morbidity in patients with very low postoperative Hb levels who decline blood transfusion. Transfusion 2002; 42:812.

- **Clinical Signs:** fatigue, dyspnea, tachycardia, change in mental status, decreased UOP, hypotension, PaO₂/FiO₂<200.
 - One study showed that in individuals with Hgb<6: 54% tachy, 32% hypotensive, 35% altered mental status, 27% dyspnea were symptomatic.
 - Few trials have been done in this area in regards to transfusion. Useful in deciding when to transfuse patients with chronic anemia and with acute blood loss. Transfusions are recommended at given intervals to maintain the Hgb above a symptomatic level usually seen around 8g/dl. However, some studies suggest to treat underlying cause and give Epo first.
 - Overall, difficult to assess and the symptomatic Hgb level varies with age and underlying disease.

Restrictive Triggers

- >65y, cardiovascular and pulmonary disease

Guidelines

- In general, one needs to evaluate the risk-benefit ratio of transfusion. There are no reliable parameters to decide on when to transfuse, especially when Hgb 7-10g/dl. One needs to use their clinical judgment and consider the following along with the above indications:
 - Ability to compensate for anemia
 - Rate of ongoing blood loss
 - Likelihood of further blood loss
 - Evidence of end-organ compromise
 - Risk of CAD
 - Balance of risks vs. benefits of transfusion
- Perioperative patients: patient should be managed with the goal of not needing a transfusion, ie treat anemia, reverse anticoagulation, consider autologous transfusion. The same guidelines as when to transfuse for acute blood loss should be applied.
- Consider other management options: 100 percent oxygen, hyperbaric oxygen therapy, autologous transfusion, Epo. Methods such as sedation, mechanical ventilation, and induction of mild hypothermia have been shown to decrease oxygen demand.
- Remember potential risks: transmission of viral infections (HIV 1:2,100,000, HCV 1:1,900,000, HBV 1:60,000-270,000, CMV), bacterial contamination of blood components with *Yersinia*, hemolytic reactions, transfusion-related acute lung injury leading to ARDS, and transfusion-mediated immunomodulation.