Transfusion Stewardship Reference List

Clinical Practice Guidelines

1. Carson JL, Guyatt G, Heddle NM, et al. Clinical Practice Guidelines From the AABB: Red Blood Cell Transfusion Thresholds and Storage. *Jama.* 2016;316(19):2025-2035.

A summary of recommendations presented by the American Association of Blood Banks after conducting a literature review of 31 randomized clinical trials (RCTs), including 12,587 patients. Restrictive and liberal transfusion thresholds were compared and found that restrictive thresholds were not associated with higher rates of 30-day mortality, myocardial infarction, cerebrovascular accident, rebleeding, pneumonia, or thromboembolism. Thirteen RCTs were reviewed, including 5515 patients, and found that patients receiving fresher blood did not improve clinical outcomes. Recommendation 1: a restrictive transfusion threshold (hgb: 7 g/dL) is recommended for hospitalized adult patients who are hemodynamically stable, including critically ill patients rather than liberal transfusion (hgb: 10 g/dL). A restrictive transfusion threshold of 8 g/dL is recommended for patients undergoing orthopedic or cardiac surgery, and for patients with preexisting cardiovascular disease. This recommendation is not applicable to patients with acute coronary artery syndrome, severe thrombocytopenia, and chronic transfusion-dependent anemia. Recommendation 2: Patients, including neonates, should receive RBC units selected at any point within their licensed dating period rather than limiting patients to tranfusion of only fresh (storage length <10 days) RBC units.

2. Practice guidelines for perioperative blood management: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Blood Management*. *Anesthesiology.* 2015;122(2):241-275.

A summary of recommendations provided by the American Society of Anesthesiologists Task Force on Perioperative Blood Management. The Task Force acknowledges the complexity of certain clinical presentations or surgical situations and recognizes that these Guidelines may not apply. These Guidelines are based upon scientific evidence from the literature and opinion-based evidence from membership and expert opinion surveys. Preoperatively, the recommendations outline the importance of patient evalution and preadmission patient prepartion to determine the risk for bleeding and reduce the likelihood for transfusion. Specifically, the Guidelines outline considerations in the treatment of anemia, discontinution of anticoagulants and antiplatelet agents, and preadmission autologous blood donation. Further, strategies are proposed for reducing transfusion through implementation of blood management protocols. In general, a restrictive transfusion strategy may be used to reduce transfusion requirements. The Task Force define restrictive transfusion criteria as transfusing only when the hemoglobin is less than 8 g/dL or hematocrit is less than 25%. The need to transfuse should be based upon hemoglobin or hematocrit values but also on the assessment of the patients actual or potential for ongoing bleeding, intravascular volume status, signs of organ ischemia, and adequacy of cardiopulmonary reserve. The Guidelines also specify that red blood cells should be administered unit-by-unit, when possible, with interval reevaluation. Finally, the Task Force reviewed the literature and provided recommendations in the areas of anticoagulant reversal, treatment of excessive blood loss, age of stored blood, and reinfusion of recovered red blood cells. These Guidelines were published as an update to the 'Practice Guidelines for Perioperative Blood Transfusion and Adjuvant Therapies' that was published in 2006.

Orthopedic Surgery

3. Carson JL, Terrin ML, Noveck H, et al. Liberal or restrictive transfusion in high-risk patients after hip surgery. *The New England journal of medicine.* 2011;365(26):2453-2462.

A randomized trial performing the Transfusion Trigger Trial for Functional Outcomes in Cardiovascular Patients Undergoing Surgical Hip Fracture Repair (FOCUS) to determine whether a higher threshold for blood transfusion would improve recovery in hip fracture patients. A total of 2016 patients aged 50 years or older with a history or risk factors for cardiovascular disease and whose hemoglobin (Hgb) level was below 10g/dL after hip-fracture surgery were included. Patients were randomly assigned to a liberal transfusion strategy (Hgb < 10g/dL) or a restrictive transfusion strategy (Hgb < 8g/dL). Primary outcomes observed were death and an ability to walk across the room without human assistance. During a 60-day follow up, primary outcomes were similar in both groups (35.2% liberal vs. 34.7% restrictive). Furthermore, the frequencies of in hopsital clinical events and serious adverse events did not differ significantly between groups. Patients in the restrictive group received 65% fewer units of blood than those in the liberal group. In conclusion, no significant evidence was found that maintaining the hemoglobin level above 10g/dL was superior to transfusion for symptoms or maintaining a hemoglobin level of less than 8g/dL with respect to the primary outcomes.

Cardiac Surgery

4. Carson JL, Brooks MM, Abbott JD, et al. Liberal versus restrictive transfusion thresholds for patients with symptomatic coronary artery disease. *American heart journal.* 2013;165(6):964-971.e961.

Pilot trial on 110 patients with acute coronary syndrome or stable angina undergoing cardiac catheterization to observe if such patients may benefit from transfusion triggers higher than 7-8g/dL. Patients were assigned to either a liberal transfusion strategy group (transfused at Hgb <10g/dL) or restrictive group (transfused at Hgb <8g/dL). Patients with coronary artery disease frequently become anemic and receive transfusion because they have pre-existing anemia. On average, the patients in the liberal arm received 3 times as many transfusions as those in the restrictive group. The mean Hgb concentration at time of transfusion was 1.4g/dL higher in the liberal group and 72.7% of patients in the restrictive group did not receive a blood transfusion. Primary outcomes included all-cause mortality, myocardial infarction or unscheduled coronary revascularization up to 30 days after randomization. Death at 30 days was less frequent among liberal transfusion patients compared to restrictive. Overall the liberal transfusion strategy was associated with a trend for fewer major cardiac events than a more restrictive trigger in patients with acute coronary syndrome.

Outcomes

5. Glance LG, Dick AW, Mukamel DB, et al. Association between intraoperative blood transfusion and mortality and morbidity in patients undergoing noncardiac surgery. *Anesthesiology.* 2011;114(2):283-292.

A retrospective analysis of 30-day mortality and morbidity on 10,100 patients receiving a blood transfusion during general, vascular or orthopedic surgery. Anemia increases perioperative morbidity and mortality, but whether intraoperative blood transfusion reduces such adverse events is unknown. The purpose of this study was to determine whether non-cardiac surgical patients with a baseline hematocrit (Hct) less than 30% who received 1-2 units of packed red blood cells (PRBCs) intraoperatively were less likely to survive and more likely to experience major complications when compared to patients who did not receive a transfusion. Data was obtained from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database. Overall, 21.4% of patients were transfused and the rate of transfusion varied as a function of the baseline Hct: 34% of patients with a baseline Hct between 15-23.9% received a transfusion compared with 18% of patients with a baseline Hct between 27-30%. The 30-day mortality rate for patients who were transfused was 6.44% versus 4.26% for patients who were not transfused. Patients who received one or two units of PRBCs had a 29% increased odds of death and a 40-90% increased odds of pulmonary, sepsis, wound or thromboembolic complication. In conclusion, intraoperative blood transfusion is associated with a higher risk of mortality and morbidity in surgical patients with severe anemia. However, it is still unknown whether this association is due to the adverse effects of blood transfusion or rather the result of increased blood loss in those patients receiving blood.

Economic Impact

6. Ejaz A, Frank SM, Spolverato G, Kim Y, Pawlik TM. Potential Economic Impact of Using a Restrictive Transfusion Trigger Among Patients Undergoing Major Abdominal Surgery. *JAMA surgery.* 2015;150(7):625-630.

An economic analysis of the impact of liberal blood transfusions based on hemaglobin (Hgb) triggers of 10g/dL (liberal) and 8g/dL (restrictive). Data on Hgb levels that triggered a transfusion were obtained from 3027 patients who underwent pancreas, liver or colorectal surgery at Johns Hopkins Hospital. The majority of transfusions occurred postoperatively (60.5%) while 39.5% of transfusions were given intraoperatively. Of the 942 patients who received a transfusion based on liberal triggers, 112 received PRBCs intraoperatively and 79 patients received PRBCs postoperatively. This resulted in 456 units of PRBCs that were potentially transfused unncessarily. This liberal use of blood products led to an excess transfusion cost ranging from $100,320 to $346,560 during the 44-month study period based on an institutional acquisition cost of $220/unit and activity based cost of $760/unit. Furthermore, patients who received PRBCs had a higher incidence of perioperative morbidity (33.3%) as well as a longer hospital length of stay than those who did not receive transfussion ($P < .001$). Patient blood management programs should aim to identify and reduce liberal transfusion practice in the surgical patient.