Anemia or blood transfusions: There is no winner

Andra E. Duncan, MD, MS

From the Department of Cardiothoracic Anesthesia, The Cleveland Clinic, Cleveland, Ohio.

Disclosures: Author has nothing to disclose with regard to commercial support.

Received for publication July 1, 2016; accepted for publication July 6, 2016; available ahead of print Aug 18, 2016.

Address for reprints: Andra E. Duncan, MD, MS, Cleveland Clinic Foundation, 9500 Euclid Ave, J4-331, Cleveland, OH 44195 (E-mail: duncana@ccf.org).

J Thorac Cardiovasc Surg 2016;152:1421-2

0022-5223/\$36.00

Copyright © 2016 by The American Association for Thoracic Surgery

<http://dx.doi.org/10.1016/j.jtcvs.2016.07.034>

Anemia predicts early and late mortality after cardiac surgery. This is true whether anemia is diagnosed preoperatively¹⁻³ or whether it develops acutely in the intraoperative period.⁴ Ironically, the intraoperative treatment for anemia, namely blood transfusions, also increases risk for morbidity and mortality.^{5,6} Moreover, the risk of adverse outcome is magnified when patients have a combination of these factors.^{7,8} These data complicate the frequent clinical question of whether anemia during surgery should be tolerated or corrected—because neither approach improves outcomes. In other words, no one wins.

In this issue of the *Journal*, von Heymann and colleagues⁹ seek to answer the question of whether preoperative anemia, blood transfusion, or the combination of both is more strongly associated with adverse long-term outcomes. Using a retrospective observational cohort design, von Heymann and colleagues⁹ stratified patients by level of anemia (none, mild, or severe) with and without blood transfusions to investigate 3-year survival after cardiac surgery. An association between increasing severity of anemia and progressively worse survival is reported, and this risk is compounded by blood transfusions. Interestingly, patients without anemia who received perioperative blood transfusions also had worse survival, similar to the risk with mild anemia.

von Heymann and colleagues⁹ are to be commended for their approach in this investigation. Although many studies have examined the postoperative mortality risk associated with anemia, most have not categorized patients by severity of anemia and few have examined long-term mortality. In addition, the use of blood transfusion data provides a more in-depth understanding of the interaction between anemia and its treatment by documenting that patients who received blood transfusions had worse outcomes at every level of anemia.

There are, however, limitations to this analysis. First, a comparison of preoperative anemia with intraoperative transfusion may be akin to a comparison of patients with chronic illness (causing preoperative anemia) to those with intraoperative bleeding (requiring transfusion): both have increased risks of adverse outcomes, but for different reasons. Blood transfusion was considered a binary variable;

Andra E. Duncan, MD, MS

Central Message

Anemia and blood transfusions both increase risk of adverse outcomes. Continued efforts to minimize perioperative anemia are needed.

See Article page 1412.

thus this analysis did not discriminate between patients who required a single unit of blood and those requiring multiple blood transfusions. Use of the last available hemoglobin level before surgery to categorize preoperative anemia may have caused selection bias, because more patients with acute and emergency bleeding, hospitalized patients with hospital-acquired anemia, and those with chronic illness are included in this category. Certainly, residual confounding, which is inherent in all retrospective studies, is the most important limitation of this investigation because unmeasured variables may affect the outcome. Intraoperative nadir hematocrit and reoperative surgery are important variables that were missing in this analysis. Importantly, this report only proves association, not causation.

What can we learn from this investigation? Because decisions to treat or not treat anemia in patients undergoing cardiac surgery are made each day and significantly affect outcomes, it seems obvious that anemia should be avoided. Several approaches, including continued perioperative blood conservation measures, reducing hemodilutional effects, and preoperative optimization of hemoglobin level, can reduce anemia and its complications. Continued efforts are needed—because when we need to choose between anemia and blood transfusion, there is no winner.

References

1. Zindrou D, Taylor KM, Bagger JP. Preoperative haemoglobin concentration and mortality rate after coronary artery bypass surgery. *Lancet*. 2002;359:1747-8.

2. Karkouti K, Wijeyesundera DN, Beattie WS. Reducing Bleeding in Cardiac Surgery Investigators. Risk associated with preoperative anemia in cardiac surgery: a multicenter cohort study. *Circulation*. 2008;117:478-84.
3. van Straten AH, Hamad MA, van Zundert AJ, Martens EJ, Schönberger JP, de Wolf AM. Preoperative hemoglobin level as a predictor of survival after coronary artery bypass grafting: a comparison with the matched general population. *Circulation*. 2009;120:118-25.
4. Loor G, Li L, Sabik JF III, Rajeswaran J, Blackstone EH, Koch CG. Nadir hematocrit during cardiopulmonary bypass: end-organ dysfunction and mortality. *J Thorac Cardiovasc Surg*. 2012;144:654-62.e4.
5. Koch CG, Li L, Duncan AI, Mihaljevic T, Loop FD, Starr NJ, et al. Transfusion in coronary artery bypass grafting is associated with reduced long-term survival. *Ann Thorac Surg*. 2006;81:1650-7.
6. Koch CG, Li L, Duncan AI, Mihaljevic T, Cosgrove DM, Loop FD, et al. Morbidity and mortality risk associated with red blood cell and blood-component transfusion in isolated coronary artery bypass grafting. *Crit Care Med*. 2006;34:1608-16.
7. Engoren M, Schwann TA, Habib RH, Neill SN, Vance JL, Likosky DS. The independent effects of anemia and transfusion on mortality after coronary artery bypass. *Ann Thorac Surg*. 2014;97:514-20.
8. Karkouti K, Wijeyesundera DN, Yau TM, McCluskey SA, Chan CT, Wong PY, et al. Influence of erythrocyte transfusion on the risk of acute kidney injury after cardiac surgery differs in anemic and nonanemic patients. *Anesthesiology*. 2011;115:523-30.
9. von Heymann C, Kaufner L, Sander M, Spies C, Schmidt K, Gombotz H, et al. Does the severity of preoperative anemia or blood transfusion have a stronger impact on long-term survival after cardiac surgery? *J Thorac Cardiovasc Surg*. 2016;152:1412-20.