JECT. 2013;45:101–102
The Journal of ExtraCorporeal Technology

Letters to the Editor

Going Beyond Manufacturers' Limitations Is Not in the Best Interest of Our Patients

To the Editor,

In your last issue, the Technique Article entitled "Prescriptive Patient Extracorporeal Circuit and Oxygenator Sizing Reduces Hemodilution and Allogeneic Blood Product Transfusion during Adult Cardiac Surgery: by Bronson et al. (*JECT* 2013;45:167–72), the authors and their cardiac program are to be congratulated on their quality initiative to address intraoperative hemodilution and their reduction in allogeneic blood transfusions over a 2-year period.

However, I have several concerns about this retrospective observation study. To start, the authors' opening statement (also inferred in the title), "Decreased priming volumes led to increased hemoglobin nadir and decreases in allogeneic blood transfusion," concerns me the most because it gives the impression that decreased prime volumes of approximately 100–200 mLs of crystalloid were causally related to the programs' reduced transfusion statistics. Considering that only 30% of infused crystalloid contributes to intravascular hemodilution (1), the correlation between small decreases in prime volume and a programs' reduction in allogeneic blood transfusion is confusing at best. Smaller prime volumes will contribute to the overall goal of reducing hemodilution during bypass, but it is only one small part of an entire team's clinical practice that leads to reducing allogeneic blood transfusion statistics during cardiac surgery.

As the authors indicate in their conclusions, retrospective studies of this nature involve many confounders during the perioperative period (preoperative, intraoperative, postoperative), especially the fluid and pharmacological management practice of anesthesia, perfusion, and nursing, to name a few. Reinforcement of this fact is found in their methodology, where it is stated that "each perfusionist had the liberty to tailor their circuits to the patient needs" (arteriovenous loop reductions, antegrade and venous autologous prime [RAP, VAP], vacuum assist, 3/8" venous line, etc.), thereby stacking variable on variable in a broad retrospective analysis.

The authors did find statistical significance in nadir hemoglobin with a small mean increase of .38 g/dL over the 2-year period (8.76 vs. 8.38 g/dL, $p < .01$), but despite reaching good statistical validity, the poor internal validity relates to the many variables associated with perioperative transfusion and negates any direct relationship between their interpretation of "right size" circuits to the programs' transfusion statistics or cost savings (2). However, the authors did acknowledge their poor internal validity in the last paragraph of the article with their singular statement: "The results observed here were not singularly the result of prescriptive patient circuit sizing, but rather contributed to in part by many other blood conservation efforts and transfusion reduction working concurrently."

Another concern I have is in relation to the paper's "flow chart." This chart indicates that the authors would push a small adult oxygenator (FX15) beyond its manufacturer's maximum rated flow of 5 LPM. If this was so, the authors would be using this device in an off-label manner. Unfortunately, this is not an uncommon practice with pediatric and small adult oxygenators such as the Terumo FX15, Sorin D905-EOS, and Maquet Quadrox i-sa. The truth of the matter is that all manufacturers set their maximum rated oxygenator flows based on the results of many forms of in vitro testing, including the standards set by the International Standards Organization (ISO). Based on a combination of the patients' weight and height, and the target cardiac index of 2.4 L/min/m^2 as suggested by the authors, the 5-LPM oxygenator is qualified to handle patients with a body surface area <2.08 m^2 (3).

In the *Journal of Medical Device Regulation*, Klepinski (4) states that a physician's use of a medical device off-label is to be regulated by professional ethics, threat of a malpractice suit, Institutional Review Board or Ethics Committee policies, and insurance reimbursement rules. He also states that the manufacturer's dissemination of information about using their device off-label is regulated by the Federal Drug Administration (FDA) and reimbursement laws as well. Federal regulatory agencies like the FDA and the Canadian Medical Protective Association state: "off label use of a medical device means any use that is not included in the printed, cleared indications for use" (5) and "off label refers to using a licensed medical device outside of the indication for which the license was issued, therefore it is recommended that the physician obtain and document the appropriate informed consent before using a device off-label" (6).

In addition to federal regulatory issues around intentionally using medical devices off-label (7), there is the potential for increasing patient morbidity associated with gaseous microemboli (GME) when intentionally pushing oxygenators beyond their manufacturers' maximum rated flow. This morbidity can be associated with the increasing amounts of GME that are detected when pump flow rates approach or exceed the manufacturers' maximum rated flow (8–10).

Excessive hemodilution during cardiac surgery may be an independent risk factor for transfusion (11), but it can be a manageable risk factor if addressed by reliable staff education, common sense, team work, and the cooperation of all professions involved in cardiac surgery (3).

My final concern is with the author's use of the phrase "prescriptive" in this technique article. Considering the frequency of its use throughout the text and the devices the authors used, this phrase is too close to a manufacturer's marketing concept and not to an individual program's effort to reduce intraoperative hemodilution.

This article is a good indication of a department's teamwork and effort to improve quality control, but it "does not" associate small prime volume reductions with improvements in allogeneic blood transfusion statistics nor does it qualify or quantify the use of small adult oxygenators in an off-label manner.

Gerard J. Myers, RT, CP
Eastern Perfusion Consulting/Eastern
Perfusion International
Dartmouth, Nova Scotia Canada

REFERENCES

1. McIlroy DR, Kharasch ED. Acute intravascular volume expansion with rapidly administered crystalloid or colloid in the setting of moderate hypovolemia. Anesth Analg. 2003;96:1572–7.
2. Straub D, Boudreau MC, Gefen D. Validation guidelines for IS Positivist research. Comm Assn Info Syst. 2004;13:380–427.
3. Myers GJ. Predictive Hemodilution—The Principles and Practice of Hemodilution during Cardiac Surgery. Mirandola, Italy: Sorin Group Perfusion Books; 2013.
4. Klepinski R: Off-label use of medical devices in the USA. Journal Med Device Reg. 2009;6:8–19.
5. U.S. Department of Health and Human Services (FDA). Off-label and investigational use of marketed drugs, biologics, and medical devices. 2011. Available at: www.fda.gov/RegulatoryInformation/Guidances/ucm126486.htm.
6. Canadian Medical Protective Association. Risk management when using drugs or medical devices off-label. 2012. Available at: https://oplfrpd5.cmpa-acpm.ca/safety/-/asset_publisher/N6oEDMrzRbCC/content/risk-management-when-using-drugs-or-medical-devices-off label;jsessionid=B58C5E6D2B33B3452111CD59E85CC698.
7. Dresser R, Frader J. Off label prescribing: A call for heightened professional and government oversight. J Law Med Ethics. 2009;37:476–96.
8. Mathis RK, Lin J, Dogal NM, et al. Evaluation of four pediatric cardiopulmonary bypass circuits in terms of perfusion quality and capturing gaseous microemboli. Perfusion. 2012;27:470–9.
9. Melchior RW, Rosenthal T, Glatz A. An in vitro comparison of the ability of three commonly used pediatric cardiopulmonary bypass circuits to filter gaseous microemboli. Perfusion. 2010; 25:255–63.
10. Liu S, Newland R, Tully P, et al. In vitro evaluation of gaseous microemboli handling of cardiopulmonary bypass circuits with and without integrated arterial line filters. JECT. 2011; 43:107–14.
11. Society of Thoracic Surgeons Blood Conservation Guideline Task Force; Ferraris VA, Brown GR, et al. 2011 update to the Society of Thoracic Surgeons and the Society of Cardiovascular Anesthesiologists blood conservation clinical practice guidelines. Ann Thorac Surg. 2011;91:944–82.