JECT. 2015;47:242–244
The Journal of ExtraCorporeal Technology

Invited Commentary

Perfusion Electronic Record Documentation Using Epic Systems Software

Jeffrey B. Riley, MHPE, CCP; George A. Justison, BS, CCP

Mayo Clinic, Rochester, Minnesota; and University of Colorado Hospital, Aurora, Colorado

Abstract: The authors comment on Steffens and Gunser's article describing the University of Wisconsin adoption of the Epic anesthesia record to include perfusion information from the cardiopulmonary bypass patient experience. We highlight the current-day lessons and the valuable quality and safety principles the Wisconsin-Epic model anesthesia-perfusion record provides. **Keywords:** electronic medical record, EMR, Epic software, perfusion electronic record, integrated perfusion anesthesia patient record. *JECT. 2015;47:242–244*

Congratulations to Thomas Steffens and John Gunser at the University of Wisconsin (UW) Hospital and Clinics for the description of their adoption of the Epic Systems Corporation (EpicCare EMR, Verona, WI, www.epic.com) electronic anesthesia record to include perfusion activities. The authors describe their implementation experience using the Epic anesthesia module as a platform for perfusion documentation for cardiopulmonary bypass (CPB) while automatically collecting variables from the serial port on the Terumo Cardiovascular Group heart–lung machine (HLM) (Advanced System 1™, Terumo Cardiovascular Systems, Ann Arbor, MI, www.terumocvs.com). The Epic anesthesia record is not specifically designed with a perfusion module so the Wisconsin team designed an Epic interface to allow the entry of several variables from the HLM and perfusion in real time consistent with their standard practice and the American Society of ExtraCorporeal Technology Standards and Guidelines for Perfusion Practice (1).

The authors' willingness to communicate their invention makes this article a bellwether publication for several reasons. The authors share their successful collaboration between the anesthesia and perfusion teams. The UW perfusion documentation solution demonstrates a precedence to not use the perfusion electronic record provided by the HLM manufacturer. Now that the authors have a database of anesthesia and perfusion variables, the issues of quality monitoring, patient dashboards, more accurate participation in national registries, and patient outcomes analysis become more feasible (2,3).

Historically, there have been several unique start-ups to automatically and manually collect perfusion data (4–13). It is interesting that 35 years after the first publications, perfusion electronic record keeping is gaining acceptance while manual records scanned into Portable Document Formats (PDF, Adobe Acrobat, San Jose, CA, www.adobe.com) and added to the electronic record remain the standard of care. Other non-HLM manufacturing vendors have created pump-side computer-assisted perfusion records that manually generate a printout record, will they export perfusion information directly to the anesthesia and other hospital system records or suffer the same fate as the platform-specific electronic perfusion records (OnCloud, Perfusion.Com, Fort Meyers, FL, www.perfusion.com; Perfusion Pro EPR, West Terre Haute, IN www.perfusionpro.com; Viper Vision Data Management System, Medtronic, Minneapolis, MN, www.medtronic.com). The challenge of exporting automatically collected perfusion data and transferring it to a hospital-wide or healthcare system-wide electronic health record system has not yet been solved for widespread application. The UW offers a possible solution for widespread standardization.

Address correspondence to: Jeffrey B. Riley, MHPE, CCP, Mayo Clinic, Rochester, MN. E-mail: Riley.Jeffrey@mayo.edu
The senior author has stated that the authors have reported no material, financial, or other relationship with any healthcare-related business or other entity whose products or services are discussed in this paper.

Like a handful of U.S. cardiac surgery facilities, our centers (University of Colorado Hospital and Mayo Clinic Enterprise Hospitals in Minnesota, Wisconsin, Florida, and Arizona) are going through the identical challenge that the UW Hospital and Clinics is navigating: how do we best bring perioperative perfusion information into the Epic anesthesia record? Epic EMR software is pervasive and Epic, which currently doesn't have plans to build a perfusion module, recommends integrating key portions of charting with Epic. One such integration method is using the anesthesia module (personal communication, Alex Chang, Epic Systems, December 6, 2015). Our institutions are investing money and personnel time to solve this problem so the UW article is a guide for us. On the basis of our recent interviews of HLM manufacturers and perfusionists implementing electronic perfusion records, perhaps more U.S. centers have already adopted Epic systems software to the hourly documentation of mechanical circulatory support and extracorporeal life support (ECLS) in the intensive care unit rather than CPB in the operating room.

Like the perfusion and anesthesia teams at UW, we are debating the issues of anesthesia-owned and perfusion-owned parameters to be collected in the anesthesia module. UW has taught us that it is not the anesthesia record or the perfusion record, it is the patient's record: a simple, yet profound concept that requires communication and trust. The Epic software tracks the provider who makes an entry in the patient anesthesia record.

In the medical-legal world during analysis of perfusion cases, there are undoubtedly discrepancies and errors between the time stamping and the accuracy of perfusion event entries in the separate anesthesia and perfusion records. The UW solution resolves these opportunities for error—both the anesthesia and perfusion providers view all the EMR entries in real time and can communicate immediately if an error is present.

Interestingly, Epic Systems is acting as the catalyst for integration of the perfusion information into the patient electronic health record via the anesthesia module. It is ironic in today's team training and team member safety environment that it is Epic who is helping to bring anesthesia and perfusion teams together to the patient's benefit.

Perfusionists are using the Epic solution to circumvent the HLM-specific electronic perfusion record. We have decided to operate the HLM online perfusion record while interfacing with the Epic anesthesia record because we do not want to lose the detailed perfusion information we have been collecting. The HLM manufacturers and independent electronic perfusion record companies will have to successfully interface with Epic Systems and Cerner® software solutions (North Kansas City, MO, www.cerner.com) in the future. Will Epic and Cerner systems be compatible if healthcare facilities and the government want to share patient information?

Steffens points out the research opportunities for an anesthesia–perfusion record. So many multidisciplinary cardiac patient standards and guidelines are being written that affect the working relationship between anesthesia and perfusion. Guidelines for blood management, temperature control, adequacy of perfusion, and team behaviors are published (14–19). The anesthesia–perfusion record can document compliance with the published evidence-based guidelines and monitor standardization of practice between providers and the team of teams who perform cardiac surgery.

Steffens' article reminds us that today the ideal perfusion data acquisition model is more than just collecting variables to populate a patient record. The model must populate a patient record and be widely available to the appropriate care providers in real time. The ideal record alerts the clinician to variation in optimal care paths (20). The ideal system should populate a database for quality monitoring and research that automatically updates dashboards that are available in real time and for researchers and managers who have approved access (21–24). The systems we build today should automatically upload patient health information–free procedure data to national registries where we can immediately benchmark local performance to results from other similar healthcare facilities (2,25,26). The systems for automatic perfusion data acquisition should begin with these end goals in mind. The UW model is an excellent first step to the ideal system.

REFERENCES

1. Standards and Guidelines for Perfusion Practice. American Society of Extracorporeal Technology. 2013. Available at: http://www.amsect.org/perfusion-safety/standards-and-guidelines/. Accessed December 6, 2015.
2. Baker RA, Newland RF, Fenton C, McDonald M, Willcox TW, Merry AF. Developing a benchmarking process in perfusion: A report of the perfusion downunder collaboration. J Extra Corpor Technol. 2012;44:26–33.
3. Groom RC. What does quality mean for perfusionists? J Extra Corpor Technol. 2015;47:73–4.
4. Hankins T. Computer assisted bypass management. J Extra Corpor Technol. 1980;12:95–102.
5. Riley J. A technique for computer-assisted monitoring in the management of total heart-lung bypass. J Extra Corpor Technol. 1981;13:171–6.
6. Riley J, Hurdle M, Winn B, Wagoner P. Automation of cardiopulmonary bypass data collection. J Extra Corpor Technol. 1985;17:35–9.
7. Cham B, Welch W, Janssens Willem E, Van Houwe R, Steemans M. Automatic data collection and feed-back processing during cardiopulmonary bypass: A more physiologic approach of a patient under artificial ventilation and circulation. Life Support Syst. 1985;3(Suppl 1):218–22.
8. Hayes R. Computerized data acquisition and data management for the open heart patient. J Extra Corpor Technol. 1987;19:287–9.
9. Hollenberg JP, Pirraglia PA, Williams-Russo P, et al. Computerized data collection in the operating room during coronary artery bypass surgery: A comparison to the hand-written anesthesia record. J Cardiothorac Vasc Anesth. 1997;11:545–51.
10. Cobb LA. Data collection and retrieval to document the outcomes of cardiopulmonary resuscitation. New Horiz. 1997;5:164–6.

11. Frank D, Williams TE, Hankins T, Chudik J. Evolution of a cardiovascular information system. J Extra Corpor Technol. 1998;30: 42–5.
12. Ottens J, Baker RA, Newland RF, Mazzone A. The future of the perfusion record: Automated data collection vs. manual recording. J Extra Corpor Technol. 2005;37:355–9.
13. Stammers AH, Trowbridge CC, Pezzuto J, Casale A. Perfusion quality improvement and the reduction of clinical variability. J Extra Corpor Technol. 2009;41:48–58.
14. Baker RA, Bronson SL, Dickinson TA, et al. Report from AmSECT's International Consortium for evidence-based perfusion: American Society of Extracorporeal Technology Standards and Guidelines for Perfusion Practice: 2013. J Extra Corpor Technol. 2013;45:156–66.
15. Likosky DS. Integrating evidence-based perfusion into practices: The International Consortium for evidence-based perfusion. J Extra Corpor Technol. 2006;38:297–301.
16. Engelman R, Baker RA, Likosky DS, et al. The Society of Thoracic Surgeons, The Society of Cardiovascular Anesthesiologists, and The American Society of ExtraCorporeal Technology: Clinical Practice Guidelines for Cardiopulmonary Bypass–temperature management during cardiopulmonary bypass. Ann Thorac Surg. 2015;100:748–57.
17. Ferraris VA, Brown JR, Despotis GJ, 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.
18. Likosky DS, Baker RA, Dickinson TA, et al. Report from AmSECT's International Consortium for Evidence-Based Perfusion Consensus Statement: Minimal criteria for reporting cardiopulmonary bypass-related contributions to red blood cell transfusions associated with adult cardiac surgery. J Extra Corpor Technol. 2015;47: 83–9.
19. Hammon JW, Shore-Lesserson L, Dickinson TA. Temperature management guidelines. Ann Thorac Surg. 2015;100:385.
20. Fung K, Beck JR, Lopez HC 2nd, Mongero LB. Case report: Remote monitoring using Spectrum Medical LIve Vue allows improved response time and improved quality of care for patients on cardiopulmonary support. Perfusion. 2013;28:561–4.
21. Svenmarker S, Haggmark S, Jansson E, Lindholm R, Appelblad M, Aberg T. Quality assurance in clinical perfusion. Eur J Cardiothorac Surg. 1998;14:409–14.
22. Groom R, Likosky DS, Rutberg H. Understanding variation in cardiopulmonary bypass: Statistical Process Control Theory. J Extra Corpor Technol. 2004;36:224–30.
23. Newland RF, Baker RA, Stanley R. Electronic data processing: The pathway to automated quality control of cardiopulmonary bypass. J Extra Corpor Technol. 2006;38:139–43.
24. Baker RA, Newland RF. Continous quality improvement of perfusion practice: The role of electronic data collection and statistical control charts. Perfusion. 2008;23:7–16.
25. Riley JB, Kavanaugh TA. Perfusion services national process improvement benchmarking. J Extra Corpor Technol. 1998;30:25–9.
26. Paugh TA, Dickinson TA, Theurer PF, et al. Validation of a perfusion registry: Methodological approach and initial findings. J Extra Corpor Technol. 2012;44:104–15.