

**A** 76-year-old male was found to have multiple episodes of ventricular tachycardia at a community hospital. He was started on a lidocaine infusion and transferred to a tertiary care hospital for an emergent cardiac ablation.

Previous medical history included congestive heart failure secondary to non-ischemic cardiomyopathy with an ejection fraction of 20%, atrial fibrillation, and hypertension.

Preoperative medications included aspirin, sacubitril/valsartan (Entresto), and dapagliflozin (Farxiga).

Upon admission to the cardiac ICU and prior to the procedure, all his home medications were continued, and the patient was made NPO. The patient was evaluated by the on-call anesthesiologist and appeared to be ill, tachypneic, and complained of abdominal pain and nausea. The critical care team decided to delay the procedure until the following day.

In the EPS lab the next day, the patient again appeared ill and was still tachypneic, but cardiology determined that the procedure could no longer be delayed. The decision was made to proceed with the cardiac ablation.

Sedation was initiated by a different anesthesiologist. However, due to the tachypneic spontaneous ventilation that appeared to interfere with the cardiac ablation, the case was converted to a general anesthetic with endotracheal intubation and an arterial line was placed.

The results of an initial arterial blood gas analysis were consistent with severe metabolic acidosis with compensatory respiratory alkalosis. The base deficit was 12.8mEq/L and the serum glucose level was normal (88 mg/dL).

The astute anesthesiologist, upon further reflection on the patient's medical history and puzzling clinical presentation, determined that the metabolic acidosis was due to euglycemic diabetic ketoacidosis (EDKA) secondary to dapagliflozin, a sodium-glucose co-transporter-2 inhibitor (SGLT-2 inhibitor), administered in a stressed and fasting patient.

Intravenous dextrose, insulin, and fluids were administered, resulting in an improvement of the patient's acid/base status. Urinalysis concurrently demonstrated ketonuria and glucosuria consistent with the presumptive diagnosis of EDKA. The endocrinology service was consulted upon the patient's return to the ICU and the dapagliflozin was discontinued. The pa-



tient's condition improved rapidly, and the patient was discharged to home the following day.

The anesthesiologist attributed his recognition, diagnosis, and rapid treatment of this dire clinical picture to an educational clinical practice advisory disseminated and posted two days earlier by his anesthesiology group practice. The clinical practice advisory highlighted the unusual clinical presentation of EDKA in some patients taking SGLT-2 inhibitors used for the treatment of type 2 diabetes mellitus, congestive heart failure, and/or chronic kidney disease. Patients undergoing prolonged fasting (dehydration and reduced carbohydrate intake), surgical stress, and concurrent illness are known to have a higher risk for developing EDKA. This patient had not been evaluated at the presurgical testing clinic, and the ICU staff was not aware of the need to discontinue SGLT-2 inhibitors in fasting patients to avoid development of EDKA.

This case brings to light an important problem associated with the exponential growth of medical knowledge in the 21<sup>st</sup> century and the pressure on clinicians to keep up with this information explosion in order to practice evidence-based medicine. While this challenge affects all areas of medical practice, it has special relevance in our specialty. Anesthesia providers must be aware of new drugs, new indications for existing drugs, and the interactions between the medications we administer in the perioperative setting and the prescribed drugs or over-the-counter supplements taken by patients preoperatively.

New protocols for improved surgical outcomes are being published, new guidelines and protocols are being recommended, and patients and their families have also become more educated and medically savvy, and therefore have higher expectations regarding their medical care.

To deliver the best anesthesia care in the present environment, anesthesia providers need to stay well-informed about the latest advances in medical innovation. But in the era of routine staff shortages, how can an anesthesia clinician carry the burden of a busy clinical practice, while at the same time keep pace with current medical knowledge?

Dr. Peter Densen, in his opinion paper titled "Challenges and Opportunities Facing Medical Education," pointed out that if the estimated doubling of medical knowledge in 1950 took 50 years, this same process would take only 73 days in 2020 (*Trans Am Clin Climatol Assoc* 2011;122:48-58). Simply put, the amount of information is increasing faster than our ability to assimilate and apply it in our everyday practice.

Coupled with an increasing demand for our services, this requirement to be well-informed is overwhelming and may contribute to burnout. The situation may be particularly difficult in the setting of private practice groups, where emphasis is centered on productivity and efficiency, as opposed to knowledge creation and dissemination.

Paradoxically, the vast amount of information and skills required to deliver the highest level of expert care in anesthesiology subspecialty areas, such as pediatric, cardiac, or pain management, can

also lead to knowledge gaps when these providers may be called upon to cover general call duties. This conundrum has been observed in other fields such as internal medicine, in which subspecialists practicing outside their own area of clinical expertise have been shown to deliver lower quality and less efficient care when compared to colleagues practicing within their subspecialty (*Arch Intern Med* 2002;162:527-32).

This challenge is not unique to medicine. Other professions have been facing the problem of processing new information as well. Lawyers, for example, employ paralegals and use automated systems to perform research for legal cases.

Large hospital organizations recognize that optimal medical care is an organizational responsibility and are working continuously to create new processes and decision support tools to facilitate care. Such tools can come in the form of decision aids, like those used to guide anticoagulation usage in neuraxial anesthesia or to guide preoperative cardiac evaluation for patients undergoing noncardiac surgery. Computer-based decision support tools, whether in electronic health records, mobile apps, or as part of our other existing technology (e.g., infusion pumps), can also be employed to help anesthesia clinicians synthesize and assimilate updated information into clinical care (*J Clin Monit Comput* 2017;31:885-94). Safer care can also be attained by collaborating with other health care providers, as demonstrated by a reduction in medication discrepancies achieved through pharmacy-led medication reconciliation on admission/discharge from the hospital (*Clin Pharm Ther* 2016;41:128-44). Another example of an organized "para-medical" support service is UpToDate®, which employs 63,000 physician authors and editors to create synopses of the most current evidence for practicing clinicians.

What about our professional society? Programs like ASA's SEE and ACE are intended to help us to stay informed without significant time commitment. MOCA Minute® questions and explanations are designed to guide us through the ever-changing landscape of medical knowledge. Infographics in Anesthesiology is another example of an effective educational tool developed by the editors of *Anesthesiology*. Multiple blogs and podcasts are also

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This entry was written by Dr. Brent Lee on behalf of the AIRS Committee, and special acknowledgement goes to Dr. Madina Gerasimov for her contributions in this report.

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available through various social media platforms.

In summary, there are several strategies that we can use to overcome the challenge of bringing the best current evidence into our everyday practice.

1. Our specialty is unique in that we often practice independently, whereas interacting with other anesthesia clinicians may require effort and a time commitment outside of the OR. Practicing in a private practice setting, where “grand rounds” or weekly educational conferences are not commonplace, may make one feel at a disadvantage. Nevertheless, talking to colleagues and developing mechanisms within the practice to keep current with the most recent literature are worthwhile strategies and represent opportunities to simultaneously stay informed, connect with colleagues, and reduce the stress of a busy day.
2. Reading journals can be viewed as a “gold standard,” either by picking up a hard copy or by scanning through a file on a digital device of your choice. In academic institutions, journal clubs are designed to teach physicians how to read and analyze a research article.
3. Creating bespoke tools such as educational flyers and/or adopting from other institutions’ decision support strategies are very effective ways of bringing innovation into clinical practice.
4. Participating in educational conferences, such as the ASA annual meeting, is a great opportunity to combine all of the above. Collaboration with other physicians and institutions can become an invaluable tool for quality improvement at one’s institution.

Being a good anesthesia clinician means becoming a lifelong learner. ■

Each month, the AQI-AIRS Steering Committee abstracts a patient history submitted to AIRS and authors a discussion of the safety and human factors challenges involved. Absence of commentary should not be construed as agreement with the clinical decisions described. Reader feedback can be sent to [airs@asahq.org](mailto:airs@asahq.org). Report incidents or download the AIRS mobile app at [www.aqiairs.org](http://www.aqiairs.org).