Learning From Others:

A Case Report From the Anesthesia Incident Reporting System

Anesthesia Quality Institute
ANESTHESIA INCIDENT REPORTING SYSTEM (AIRS)

Detailed review of unusual cases is a cornerstone of anesthesiology education. Each month, the AQI-AIRS Steering Committee will abstract a case and provide a detailed discussion based on a submission to the national Anesthesia Incident Reporting System. Feedback regarding this item can be sent by email to **r.dutton@asahq.org**. *Report incidents to* **www.aqiairs.org**.

Case 2013-7: Hexed

One: *A 72-year-old, ASA Physical Status III man presented for cataract excision and intraocular lens implantation. Past history was significant for coronary artery disease, hypertension, insulin-dependent diabetes and obesity. The case was performed in a freestanding ambulatory surgery center (ASC), and the plan was for intravenous sedation to facilitate peribulbar local anesthetic injection by the surgeon, followed by sedation as needed for the remainder of the procedure. Due to a medication shortage, propofol was not available in the ASC and methohexital was substituted. During the injections, the patient developed laryngospasm and oxygen desaturation, leading to a run of ventricular tachycardia. The procedure was halted, intravenous lidocaine was administered, and ventilation was assisted with positive pressure via a facemask. The patient recovered uneventfully and the procedure was postponed.*

Two: *A 40-year-old, ASA Physical Status II man presented for tympanoplasty at an ASC that was unable to obtain propofol. The plan was for general anesthesia with a supraglottic airway (SGA). General anesthesia was induced with 100 mcg of fentanyl, 50 mg of lidocaine and 1.5 mg/kg of methohexital. Unconsciousness was confirmed, but during SGA placement the patient vomited. The oropharynx was suctioned, further medications were given, and the trachea was intubated. The remainder of the procedure was uneventful, and the patient recovered without sequelae. The provider noted "In 11 years of practice I have never had a patient vomit during SGA placement after induction with propofol."*

Discussion

Medication shortages have become a fact of life in anesthesia practice, with everything from pressors to propofol in short supply.[1] Some substitutions are straightforward and easily managed. There are risks brought on by lack of experience and by differences in packaging (see AIRS case 2012-1), but the medications are similar enough to allow easy change. Other substitutions are harder, either because recommended dosages differ – like hydromorphone for fentanyl – or because the substituted medication is not a perfect analogue of the desired one. Methohexital for propofol is an example of this issue.

While both methohexital and propofol are induction agents, they are profoundly different in chemical structure and ease of titration. Even when propofol was substantially more expensive, its obvious advantages led to rapid adoption for short general anesthetics and titrated sedation cases over barbiturates such as thiopental and methohexital. Propofol is more predictable from patient to patient, more readily tolerated over longer cases, and associated with a substantial improvement in the speed and crispness of emergence, due to its much shorter elimination half-life. When it became available, propofol rapidly became the preferred choice for facilitating moderate or deep sedation.

The supply of propofol in the United States has been problematic for the past several years. Manufacturing issues have disrupted production, as vendors have had to rebuild and recertify factories. Efforts by ASA and the Food and Drug Administration (FDA) to "fast track" new companies into the U.S. market have not kept up with demand, while hoarding and gray market profiteering have led to anomalies in local distribution. Hospitals and anesthesia departments have reacted by restricting the use of propofol to certain populations and procedures, repackaging existing supplies into smaller unit doses, and promoting the use of alternatives. Cancelling surgery is rarely considered an acceptable option.[2] Instead, anesthesiologists are expected

to substitute other agents. This may be both more costly – as when dexmedetomidine is substituted for propofol as an ICU sedative – or more dangerous, as in the cases presented.

Some practitioners have reverted to volatile anesthetic inductions in adult patients, typically using a sevoflurane breathe-down technique. This approach is slower and less controlled than intravenous induction with propofol, and may increase the risk for laryngospasm, bronchospasm and aspiration even in healthy patients managed by experienced providers. While specific safety data is lacking, there is also an element of patient experience involved. This is another area in which the market has spoken: intravenous induction is overwhelmingly preferred. When propofol is unavailable for this purpose, another option is methohexital, currently the only short-acting barbiturate available in intravenous form. (Sodium thiopental was a mainstay of anesthesia practice for decades, but is unavailable in the United States. Withdrawal from the U.S. market is due in part to its history of use for judicial executions; foreign manufacturers and governments are unwilling to export it here.[3]) As noted above, however, and illustrated in the cases from AIRS, methohexital as a short-acting sedative leaves something to be desired. The provider who sent the second case report noted after the fact that "I should have just cancelled the case."

These events fit James Reason's model of "violations" within his popular error taxonomy[4] as a necessary violation: deviation from best practice because it is impossible to complete the task otherwise. Other types of violation include: routine violation – everyone exceeds the speed limit by 5 mph; optimizing violation – it is better for everyone if I do it this way (e.g. splitting propofol vials to maximize their reach during a shortage, violating the single-use standard but serving more patients); and reckless violation – I just feel like doing this and don't care about the best practice or consequences. "Necessary violations" require system and institutional fixes, rather than personal motivation.

It is possible that results will improve with more provider experience, but at the same time frustrating that patient care might suffer while anesthesiologists "re-calibrate" to the available medications. Providers must take greater care when working with unfamiliar agents and insist on more time for careful titration of less-familiar sedatives. Provider education will help reduce complications. Simulator exercises created specifically to train providers on unfamiliar medications would be one way to achieve this. Another would be more time and institutional commitment to training or "in-servicing" on new drugs and devices.[5] A final, more controversial option would be an individual commitment on the part of anesthesiologists to vary their practice on a daily basis, to remain current with a wider "palette" of medication options. While this would increase our capability to react to changing external circumstances (such as medication supply), it raises an ethical question of when it is acceptable to substitute a less-effective medication purely for learning purposes. Most providers are comfortable switching from a Macintosh to Miller blade on occasion, but might object to using a medication viewed as less effective.

ASA will continue efforts to encourage new sources of propofol, facilitate fair and even distribution of existing stocks, and streamline FDA approval of factories and supply chains.[6] It is likely that market demand will eventually result in increased supply, although likely at an increased cost. ASA's efforts in this area will be facilitated by clinical examples that illustrate the risks created by medication shortages.

The AQI has created a module in AIRS specifically for capturing adverse events and near misses related to drug shortages. Understanding the potential consequences of forced drug substitution and other work-arounds is important, even when presented in anecdotes. This information can be set in context by comparison to multi-center utilization data. The National Anesthesia Clinical Outcomes Registry (NACOR) is now broad enough to provide utilization rates for most common anesthesia medications. Through AIRS and NACOR, the AQI is prepared to provide information to ASA leaders to facilitate advocacy efforts in defense of good patient care. All anesthesiologists are invited to submit their cases and observations at **www.aqiairs.org**.

References:

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