

Look-alike Vials – A Continuing Threat to Patient Safety

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Medication errors cost society \$42 billion annually. The World Health Organization (WHO) aims to reduce preventable medication-related harm by 50% by the end of this year (asamonitor.pub/3oeEbhD). While no large epidemiological studies of perioperative medication errors exist, small prospective studies and self-reported data indicate that errors are common (*Br J Anaesth* 2021;127:346-9). In a single-center observational study, one in 20 perioperative medication administrations resulted in a medication error or adverse drug event, a majority of which were preventable (*Anesthesiology* 2016;124:25-34). A recent analysis of self-reported events to Australia and New Zealand's WebAIRS system found that, in the first 4,000 reports, 462 were related to medication errors (*Anaesth Intensive Care* 2022;50:204-19). Other studies of self-reported data have found the incidence of medication error to range from 0.37%, or one in 274 anesthetics, to 0.75%, or one in 133 anesthetics, with the most common being incorrect doses and substitutions (*Anaesth Intensive Care* 2009;37:93-8; *Anaesth Intensive Care* 2001;29:494-500). Medication errors are the most frequently cited critical incident in anesthesiology, and 4% of claims in the Anesthesia Closed Claims Project database are due to medication error (*BMJ* 2011;343:d5543; asamonitor.pub/3cjQLy6). A more recent analysis of the database cites medication events as "important causes of patient injury" (*Int Anesthesiol Clin* 2020;58:7-12).



Figure 1: From left to right: ondansetron, phenylephrine, famotidine, metoclopramide, and oxytocin.

Types of medication errors

Medication errors can be categorized into several types (Table). Incorrect drug is one of the most common error types (*Br J Anaesth* 2021;127:346-9; *Anaesth Intensive Care* 2022;50:204-19). Substitution errors occur when one drug is intended but another is administered, such as in a drug vial or syringe swap. In one study, substitution errors constituted 28.1% of all medication errors, the most common being substituting a neuromuscular blocking agent for a benzodiazepine (*Anaesth Intensive Care* 2022;50:204-19).

Causes of substitution errors among health care professionals are multifactorial, including production pressure, distractions and interruptions, urgency of the procedure, need to multitask, morbidity of patient, reliance on color coding, incorrect stocking, lack of verification or double check, and a large number of medications that need to be administered within a short period of time (e.g., induction and emergence). Look-alike vial swaps have led to catastrophic harm (*Br J Anaesth* 2018;120:438-40). A recent analysis of medication errors reported to the Institute for Safe Medication Practices (ISMP) found that one-third of errors related to oxytocin were due to look-alike vials (asamonitor.pub/3IPStyP). Oxytocin is often presented in a 1 mL vial with a green top, very similar to other medications in 1 mL and 2 mL vials (Figure 1).

Root causes and potential solutions

The OR is a functionally chaotic environment where multiple disciplines with different priorities work synchronously to provide care for a vulnerable patient.



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against the risk of medication error, ensuring that labels are checked; visual reminders, cognitive aids, and checklists may be helpful nudges to verify medications. When there is a potential concern for patient safety, anesthesiologists must be able to "stop the line" and speak up. Algorithms to train "speaking up" behaviors are easy to remember and widely available, such as PACE (probe-alert-challenge-emergency), CUS (concerned-uncomfortable-(un)safe), and the two-challenge rule (*ASA Monitor* 2021;85:41).

Regardless of the clinician's vigilance, medication errors will still occur. As the late Ron Litman, DO, former director of the Institute for Safe Medication Practices, has written: "If operating theaters have not been equipped with the means to avoid these errors, patients have no choice but to rely solely on the anesthesiologist's mental focus and vigilance to get it right, each and every time. Of course, that is impossible because human errors are inevitable and arguably normal" (*Br J Anaesth* 2018;120:438-40). Look-alike vials pose a systematic threat to patient safety and have been highlighted by the Anesthesia Patient Safety Foundation (APSF) as an area for particular improvement (asamonitor.pub/3RBIO2X). Procurement of medications from infrequently used suppliers and constant drug presentation changes contribute to the presence of look-alike vials in the OR, and the scope of the problem has been exacerbated by supply chain issues from the COVID-19 pandemic. Anesthesiology departments should work closely with institutional medication safety officers and OR pharmacists to evaluate all medications prior to procurement to ensure they do not appear similar to medications currently in distribution (Figure 2). In addition, efforts should be made to avoid multiple presentations of the same medication

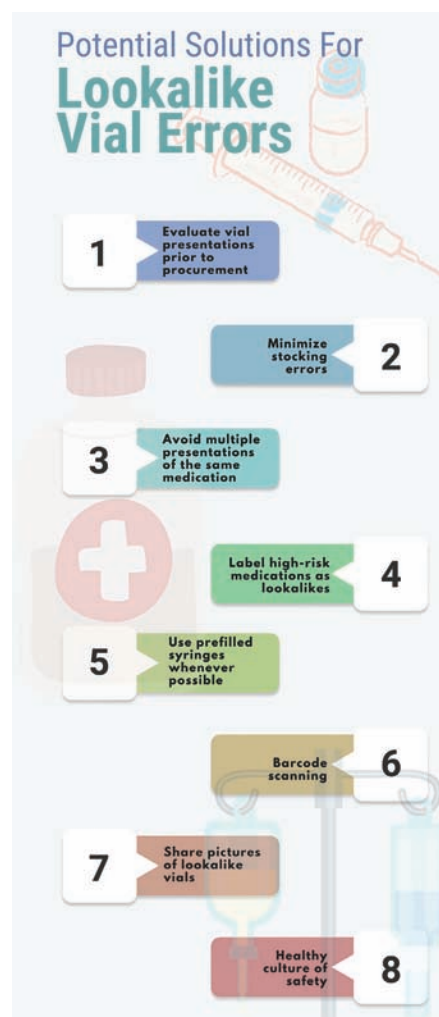


Figure 2: Steps to prevent look-alike vial errors.

Table: Types of Medication Errors

Incorrect medication prescribed
Substitution (vial or syringe swap)
Wrong dose or concentration
Omission
Repetition
Incorrect route
Incorrect timing
Incorrect rate

(Figure 3) and to prevent stocking errors, such as look-alike medications in the wrong bin (Figure 4).

Color coding of syringes has been supported by ASA (asamonitor.pub/3aMb-CFI). Indeed, color coding has been shown to decrease drug swaps between medication classes (*Anaesthesia* 2010;65:490-9). Nevertheless, there is continued debate regarding whether color coding encourages anesthesiologists to rely on the color of the syringe rather than reading the label (asamonitor.pub/3ob78v3). It is likely that this nearly subconscious reliance on color coding of syringes has extended to visual cognition of drug vials, resulting in look-alike medication errors. One potential solution would be to label high-risk look-alike vials, such as phenylephrine and ephedrine, with “look-alike medication” in bold letters. Another potential solution is to bypass drug vials completely and to use prefilled syringes whenever possible.

Barcode scanning of medications has been shown to decrease errors and has been encouraged by patient safety experts (*BMJ* 2011;343:d5543; *Br J Anaesth* 2017;118:32-43). Indeed, barcode scanning serves as a “double check” for anesthesiologists when preparing medications, especially when paired with auditory and visual feedback. In addition, scanning can help distinguish 1 mL and 2 mL vials with small print that may be difficult to see in an OR.

Anesthesiologists should disseminate pictures of look-alike vials within their departments to increase awareness of the risk, and all medication errors should be



Figure 3: More Look-alike vials in the perioperative setting. Two different presentations of ephedrine, which also happen to be look-alike medications with dexamethasone (left) and naloxone (right).

reported to departmental quality and safety committees in a timely fashion. Departments must encourage an environment where individuals are not blamed for adverse events that are the result of system design problems. Such an approach will help grow a robust culture of safety that invites individuals to report adverse events and to participate in systems improvement.

Errors related to look-alike vials can affect every single anesthesiology department, and thus interventions must occur at the local, regional, and national level. Drug manufacturers must be made aware and work with one another to reduce similar presentations of medications. Federal agencies should explore policies to reduce the similarity of drug vials as

well as investigate supply chain issues that lead to frequently changed drug presentations. The APSF is actively working on this and other medication safety issues with national leaders through the Medication Safety Patient Safety Priority Workgroup (asamonitor.pub/3BbyPf5).

Health care professionals are still far from the 50% reduction of medical errors sought by the WHO. Look-alike vials may cause catastrophic patient harm. While clinicians should always remain vigilant for medication error, there is no way to completely eliminate human factors when delivering health care. As such, systemic solutions for the look-alike vial problem, at both the institutional and national level, must be explored. ■

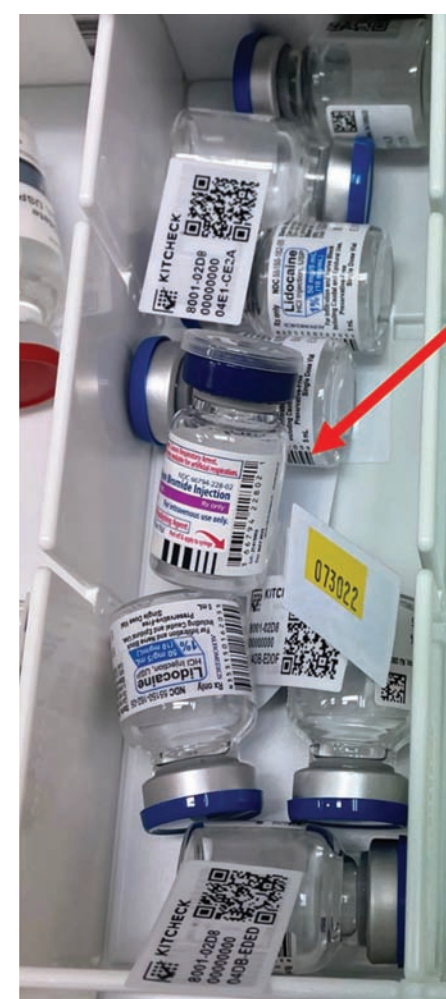


Figure 4: Loading error resulting in rocuronium being placed in lidocaine drug cart slot – rocuronium vial is located with lidocaine vials.

Disclosure: Dr. Methangkool is on the Speakers Bureau of Edwards Lifesciences and serves as a consultant for UpToDate.

22nd Annual FAER-Helrich Research Lecture

George A. Mashour, MD, PhD

It is my great pleasure to announce that the 22nd Annual FAER-Helrich Research Lecture will be presented by Michael Avidan, MBBCh, FCA (SA), at ANESTHESIOLOGY 2022 in New Orleans, Louisiana. The FAER-Helrich Research Lecture recognizes outstanding scholarship by a scientist and is part of FAER’s ongoing effort to encourage early-career anesthesiologists and trainees to consider careers in research and teaching. Dr. Avidan is currently the Dr. Seymour and Rose T. Brown Professor of Anesthesiology and Head of the Department of Anesthesiology at Washington University School of Medicine, as well as Anesthesiologist-in-Chief at Barnes-Jewish Hospital.

Dr. Avidan was born in South Africa, earned his medical doctorate in 1991 from the University of Witwatersrand in Johannesburg, then completed his residency in anesthesiology and intensive care at the South African



Michael Avidan, MBBCh, FCA (SA)

College of Medicine in 1996. Dr. Avidan thereafter served as a clinical lecturer from 1997 to 2000 in cardiothoracic anesthesiology and adult critical care at King’s College Hospital in London. Dr. Avidan was appointed to the faculty of the Washington University School of Medicine in 2001 and rose to the rank of Professor in 2011; he has served as head of the Department of Anesthesiology there since 2019.

Dr. Avidan is internationally renowned as an exceptional researcher who has led major clinical studies and published seminal articles in the *New England Journal of Medicine*, *The Lancet*, *JAMA*, and the top journals of anesthesiology; he has also authored important basic science articles in *Science* and

PNAS. His work has been funded by the National Institutes of Health, National Science Foundation, Gates Foundation, and James S. McDonnell Foundation. Dr. Avidan is a recognized leader in academic anesthesiology who serves as one of 12 trustees of the International Anesthesia Research Society; he also served as an editor of the *British Journal of Anaesthesia* and as President of the Association of University Anesthesiologists.

Dr. Avidan’s lecture will focus on decision-making in the context of anesthetic drugs. Currently, the choice of general anesthetic is made almost exclusively by anesthesiologists or other anesthesia clinicians. Dr. Avidan, along with Dr. Sachin Kheterpal from the University of Michigan, is leading a major multicenter study to explore shared decision-making regarding general anesthetic choices. This randomized controlled trial has been funded by the Patient-Centered Outcomes



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Research Institute through a \$30 million grant. Dr. Avidan’s lecture will explore this important topic and describe the groundbreaking study that will create a new foundation for patient-anesthesiologist partnerships in perioperative care.

Dr. Avidan is a brilliant academician and dynamic speaker; I would encourage you to attend the 22nd FAER-Helrich Research Lecture in New Orleans this October to learn about new directions in conscious choices for unconsciousness. ■

Disclosure: Dr. Mashour is a consultant for TRYP Therapeutics.