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Error in LASA medication administration during anesthesia. Case report

Error en la administración de medicamentos LASA durante la anestesia. Reporte de caso

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Abstract

Anesthetic practice involves the use of multiple drugs administered via various routes. Medication administration errors are frequent and represent one of the leading causes of adverse events. The incidence of errors in anesthesia is estimated to range between 0.02% and 1.12%. This case is particularly relevant as it illustrates how the similarity in ampoule appearance can lead to errors, emphasizing the potential risks in anesthetic practice and the need for vigilance.

The article discusses the case of a 45-year-old male undergoing elective cholecystectomy. Due to the similarity of ampoule appearances, the anesthesiologist mistakenly administered the wrong medication, fortunately without clinical consequences. Neuromuscular monitoring confirmed the absence of residual effects.

Look-Alike Sound-Alike (LASA) medications increase the risk of errors. Factors such as inexperience and time pressure significantly contribute to these events. Implementing preventive measures and strict regulations is essential to mitigate risks.

This case highlights the impact of LASA medications in anesthesia and the importance of implementing preventive measures and stringent regulations to minimize such errors. Likewise, it emphasizes the need to adopt enhanced safety protocols and to standardize the ampoules according to international standards. Contributing to improving patient safety during anesthesia requires a systematic approach to identify risks and mitigate the consequences of LASA medications-associated errors.

Key words: Medication errors, Patient Safety, Anesthesia, LASA medications, Safety Standards.

Resumen

La práctica anestésica implica el uso de múltiples medicamentos administrados por diversas vías. Los errores en la administración de medicamentos son frecuentes y representan una de las principales causas de eventos adversos. Se estima que la incidencia de errores en anestesia varía entre el 0,02 % y el 1,12 %. Este caso es particularmente relevante, ya que ilustra cómo la similitud en la apariencia de las ampollas puede llevar a errores, enfatizando los riesgos potenciales en la práctica anestésica y la necesidad de vigilancia. En el artículo se discute el caso de un hombre de 45 años de edad sometido a una colecistectomía electiva. Debido a la similitud en la apariencia de las ampollas, el anestesiólogo administró por error el medicamento equivocado; afortunadamente, sin consecuencias clínicas. El monitoreo neuromuscular confirmó la ausencia de efectos residuales. Los medicamentos de apariencia y sonido similar (LASA, por las iniciales en inglés de look alike, sound alike) aumentan el riesgo de errores. Factores como la inexperiencia y la presión de tiempo contribuyen significativamente a estos eventos. Este caso destaca el impacto de los medicamentos LASA en la anestesia y la importancia de implementar medidas preventivas y regulaciones estrictas para minimizar tales errores. Asimismo, enfatiza la necesidad de adoptar protocolos de seguridad mejorados y estandarizar las ampollas según normas internacionales. Contribuir a mejorar la seguridad del paciente durante la anestesia requiere un enfoque sistemático para identificar riesgos y mitigar las consecuencias de los errores asociados a medicamentos LASA.

Palabras clave: Errores de medicación; Seguridad del paciente; Anestesia; Medicamentos LASA; Normas de seguridad.

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INTRODUCTION

In anesthetic practice, administering multiple medications in a fast-paced and often high-pressure environment is a routine yet challenging task. An anesthesiologist may administer as many as 250,000 medications over the course of their career, which naturally increases the risk of errors. Studies repeatedly highlight medication errors as a significant cause of adverse events in the practice of anesthesiology.⁽¹⁻⁴⁾

Globally, the World Health Organization (WHO) has identified medication errors as one of the leading causes of preventable harm in healthcare, estimating an economic impact at a staggering \$42 billion annually. These errors not only prolong hospital stays and delay surgical procedures but also amplify their overall impact on healthcare systems.⁽⁵⁾

Broadly speaking, medication errors refer to preventable incidents that can harm patients or lead to inappropriate use of drugs. In anesthesia, the incidence of such errors has been reported to range between 0.02% and 1.12% of cases, depending on the study. Among the most common mistakes are drug substitutions and incorrect dosing, often influenced by human factors such as workload, lack of experience, distractions, time pressures, and communication breakdowns.⁽⁶⁻⁷⁾ These challenges are further intensified when dealing with Look-Alike-Sound-Alike (LASA) medications.

Studies on medication errors in Brazil, Colombia, and Argentina are limited, mostly focusing on nursing or outpatient dispensing rather than anesthetic practice. According to the Brazilian Institute for Safe Medication Practices (ISMP), medication administration errors in Brazil cause 8,000 deaths annually and account for 7% of hospitalizations, averaging 840,000 cases per year.⁽⁸⁾ The Colombian pharmacovigilance system only tracks adverse drug events, lacking programs and statistics on medication errors.⁽⁹⁾

Look-Alike-Sound-Alike (LASA) medications

refer to drugs with visual or phonetic similarities to others, sharing similar appearances or names. In daily practice, very similar ampoules in color and appearance may contain entirely different drugs. Issues with syringe labeling can also lead to medication errors. The similarity creates vulnerabilities in patient safety due to the high potential for confusion. LASA errors are particularly concerning in anesthesiology due to the high stakes and rapid decision-making involved.⁽¹⁰⁻¹²⁾

This report discusses a case where a LASA medication error occurred during routine conditions, influenced by human factors such as time pressure and cognitive biases. The case emphasizes the need for better ampoule design and labeling to minimize such errors. It also advocates for the implementation of international safety standards, such as ISO 26825, and more stringent regulations to address systemic vulnerabilities and improve patient safety in anesthetic practice.

Case presentation

A 45-year-old male patient was admitted to the hospital for an elective cholecystectomy due to a history of abdominal pain episodes, with ultrasound confirming cholelithiasis. The patient had no significant medical history except for active smoking (10 pack-years) with normal spirometry results. Preoperative studies and the pre-anesthesia assessment were unremarkable (the patient had no history of previous surgeries or exposure to general or regional anesthesia); no contraindications were identified for the procedure, and surgery was scheduled. Upon explaining the risks and benefits of the surgical procedure and anesthesia management, the patient submitted his Informed consent.

On the day of the procedure, the induction of anesthesia was performed using a continuous infusion of remifentanyl at 0.2 mcg/kg/min, 1.5 mg/kg of propofol, and 0.6 mg/kg of rocuronium for muscle relaxation. The patient was intubated

using a Macintosh laryngoscope with an 8.0 endotracheal tube, without airway complications. Proper endotracheal tube placement was confirmed, and the vaporizer was initiated to achieve a minimum alveolar concentration (MAC) of 0.8 to 1 with sevoflurane for maintaining hypnosis during surgery.

After induction, the surgery began. The attending anesthesiologist prepared medications for intraoperative analgesia. From the medication box, the anesthesiologist selected a vial of ketorolac 30 mg and another of dexamethasone 8 mg, drawing both into separate clean syringes for intravenous administration. Upon discarding the vials, the anesthesiologist realized that the ampoule presumed to contain ketorolac was actually a vial of succinylcholine 10 mg. The anesthesiologist immediately applied neuromuscular monitoring to assess and manage muscle relaxation. The patient's Train-of-Four (TOF) ratio was monitored throughout the procedure and confirmed to return to 100% at the end of the surgery, indicating full neuromuscular recovery without clinical consequences. The surgical team was informed of the incident, and a safety report was filed.

The surgery was completed uneventfully, lasting approximately 90 minutes. Postoperatively, the patient was transferred to the post-anesthesia care unit and monitored with pulse oximetry, noninvasive blood pressure measurements, and ECG. Finally, the patient was discharged with no complications but he was informed about the incident. He acknowledged the unintentional error and expressed gratitude that it was resolved smoothly and without complications.

DISCUSSION

Patient safety is a cornerstone of anesthesiology; however, medication errors pose an ongoing and significant threat. LASA medications, due to their visual and phonetic similarities, represent

a particularly concerning risk. Errors often arise during drug preparation and administration, as demonstrated in this case, where the similar appearance of ampoules led to an unintentional drug substitution. [Figure 1](#) displays examples of ampoules in Argentina that, despite looking similar, contain different drugs.

Medication errors are complex and multifactorial. Cognitive biases, fatigue, stress, and time pressure are some of the human factors that heavily influence the likelihood of errors. In this case, although the anesthesiologist worked under normal

conditions, the visual similarity of the ampoules contributed to the mistake. The poor labeling and lack of standardized packaging made the situation even riskier. Effective communication and strict adherence to checklists could have significantly reduced these risks.

The impact of incorrect medication administration can range from mild to severe, but may even be life-threatening. While the patient in this case did not experience any harm, the administration of succinylcholine could have led to serious complications, including prolonged apnea

or cardiovascular issues. The absence of adverse effects highlights the importance of early detection and prompt intervention to prevent harm.

Preventive measures are essential for minimizing LASA medication errors. Standardizing labeling and packaging, including the use of distinct colors, shapes, and barcode scanning([13](#)), has proven effective in reducing these risks. Countries such as the United States and Australia have already implemented ISO 26825([14](#)) standards, which should serve as an example for other regions, including Argentina([15](#)).

Figure 1. Examples of ampoules in Argentina that, despite looking similar, contain different drugs.



LASA Ampoules: 1) Ketorolac – Dipyrrone, 2) Neostigmine (4 different labs), 3) Flumazenil – Protamin, 4) Clindamycin – Atracurium – Diclofenac, 5) Hyoscine Butylbromide – Diclofenac, 6) Etomidate – Calcium Chloride, 7) Lidocaine – Hyperbaric Bupivacaine, 8) Clonidine – Succinylcholine, 9) Ketorolac (lab 1)–Succinylcholine–Ketorolac (lab 2), 10) Diclofenac, 11) Clonidine – Ketorolac, 12) Diclofenac – Rocuronium, 13) Tranexamic Acid–Lidocaine–Hyperbaric Bupivacaine, 14) Midazolam – Ranitidine, 15) Lidocaine – Fentanyl – Clindamycin – Tranexamic Acid, 16) Distilled Water– Flumazenil, 17) Gentamicin – 3% Polidocanol.

Source: Authors.

Table 1. Overview of LASA Medication Safety Regulations in Latin America.

Country	Current Regulation	LASA Regulations
Colombia	Resolution 2200 of 2005 Good Manufacturing Practices (GMP) – INVIMA	Use of high-contrast labels for LASA medications Requires ampoules and vials to have clear and differentiated labels, but does not specify color requirements.
Argentina	ANMAT-MED-BPF-001-16	Syringes: Color coding for high-risk medications
Brasil	RDC 36/2013 (ANVISA) RDC 63/2011 (ANVISA) RDC 2.095/2013 (ANVISA) RDC 222/2006 (ANVISA)	Protocol for the Safety of Prescription, Use, and Administration of Medications. Mandatory double-check requirement during administration. Regulates labeling requiring clear identification.
Chile	Decree 3/2010	Differentiated labeling medications.

Source: Authors.

Table 1 shows the different regulations and their respective recommendations across Latin American countries. The following guidelines or resolutions usually focus on anesthesia syringes rather than ampoules and may or may not be fully followed by pharmaceutical manufacturers:

As shown in **Figure 1**, if pharmaceutical companies fail to fulfill their responsibility to adequately differentiate ampoules, medication errors will remain a common issue.

Automated medication dispensing systems and barcode scanning technology are promising tools for minimizing human error. These systems ensure that the correct drug is selected and administered, yet their implementation requires significant investment and proper training.

Furthermore, hospitals must establish robust medication safety protocols. Adherence to checklists and regular training for healthcare staff is crucial. Regulatory bodies should enforce standardized ampoule designs and labeling practices to address the systemic vulnerabilities that contribute to errors.

Further studies should focus on evaluating the effectiveness of interventions such as automated dispensing systems, enhanced staff training, and stronger regulatory enforcement. The

development of new technologies aimed at reducing human error, as well as their cost-effectiveness across diverse healthcare settings, are key areas for future research.

It's also important to acknowledge the challenges of universal implementation of these solutions, especially considering financial constraints, regional differences in infrastructure, and variations in hospital policies with regards to automated medication systems and barcode scanning.

In conclusion, medication errors, especially those involving LASA drugs, pose a serious threat to patient safety in anesthesiology. Tackling these issues requires more than individual efforts. A comprehensive approach—incorporating institutional protocols, regulatory mandates, and technological advancements—is essential. Manufacturers need to prioritize safety in ampoule design by adopting international standards and innovative packaging solutions. Healthcare providers must reinforce safety practices and make the most of available technology to minimize the occurrence of errors. This case is a reminder of the ongoing need for vigilance and systemic improvements to safeguard patient safety in anesthetic practice. This case report was prepared with the written consent of the patient. No external funding

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ETHICAL DISCLOSURES

Ethics committee approval

This study was approved by the institutional Research Ethics Committee “Comite de Docencia e Investigacion Hospital Britanico Buenos Aires”, at a meeting held on 4-12-2024.

Protection of human and animal subjects

The authors declare that no experiments were performed on humans or animals for this study. The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Confidentiality of data

The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent

The authors declare that no patient data have been disclosed in this article.

The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

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Authors' contributions

HES Study planning, data collection, interpretation of results, and writing of the manuscript.

CM, GS and DT: writing and review of manuscript.

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