Lessons Learned about Human Fallibility, System Design, and Justice in the Aftermath of a Fatal Medication Error:
Opportunities for Improvement

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ISMP National Medication Errors Reporting Program

- National Medication Error Reporting Program
- National Vaccine Error Reporting Program
- Consumer Error Reporting Program

June 16, 2016 ▪ Volume 21 Issue 12

ISMP

Acute Care ISMP Medication Safety Alert!®

Educating the Healthcare Community About Safe Medication Practices

Paralyzed by mistakes

Reassess the safety of neuromuscular blockers in your facility

HIGH-ALERT

PROBLEM: Neuromuscular blocking agents are high-alert medications because of their well-documented history of causing catastrophic injuries or death when used in error. These drugs are used during tracheal intubation, during surgery of intubated patients, and to facilitate mechanical ventilation of critically ill patients. However, neuromuscular blockers have been inadvertently administered to both adult and pediatric patients who were not receiving proper ventilatory assistance. Because neuromuscular blockers paralyze the muscles that are necessary for breathing, some patients have died or sustained serious, permanent injuries if the paralysis was not witnessed by a practitioner who could intervene.

After a patient receives a neuromuscular blocker, progressive paralysis develops, initially affecting the small muscle groups such as the face and hands, then moving to larger muscle groups in the extremities and torso until all muscle groups are paralyzed and respiration ceases. However, full consciousness remains intact, and patients can experience intense fear when they can no longer breathe. They can also sense pain. The experience can be horrific for patients and can lead to psychological trauma, including post-traumatic stress disorder.[1]

The ISMP National Medication Errors Reporting Program (MERP) has received well over 100 reports of errors involving neuromuscular blockers. However, the true incidence of injuries from erroneous administration of neuromuscular blockers is much higher than reflected in our error-reporting program. While some errors have occurred during anesthesia in the operating room (OR), many have taken place outside this setting, in emergency departments (EDs), interventional radiology departments, intensive care units (ICUs), and other medical, surgical, and psychiatric units.

The most common type of error with neuromuscular blockers appears to be administration of the wrong drug. A 2009 analysis of 154 events over a 5 year period showed that a neuromuscular blocker was not the intended drug in approximately half of all wrong drug errors.[2] Practitioners thought they were administering a different drug, so patients may not have been supported with mechanical ventilation. More than 80% of these wrong-drug errors reached the patient, and approximately a quarter resulted in patient harm—a rate significantly higher when compared to less than 1% of events causing harm with all other wrong-drug errors during the same study period.[2]

Errors with neuromuscular blockers can be attributed to one or more common causes. The following provides a sampling of the causes of errors with examples.

Look-alike packaging and labeling

An ED nurse administered pancuronium instead of influenza vaccine to several patients. The vials were the same size, and the labels were quite similar. The look-alike vials had been stored next to each other in the refrigerator. The patients experienced dyspnea and respiratory depression but, fortunately, sustained no permanent injuries.

continued on page 2—Neuromuscular blockers >

SAFETY briefs

A liquid dose cup you can read. Comar has begun distribution of mL-only liquid dose cups with an easy-to-read, printed scale. These are being distributed by Medi-Dose (www.ismp.org/sc?id=1749) and are available in three capacities: 20, 30, and 60 mL. Previous dosage cups we have seen have had embossed scales that were difficult to read or displayed both mL and teaspoonful amounts. We

Figure 1. A mL-only dosage cup with printed scale.

continued on page 3—SAFETY briefs >

20-year anniversary of this newsletter. The *ISMP Medication Safety Alert!* began publication on January 15, 1996. Now in its 20th year, we are highlighting some of the significant ISMP patient safety milestones—small snippets of articles or safety briefs we wrote so many years ago that are memorable, humorous, or still newsworthy.

A glimpse down memory lane

April 24, 1996 newsletter:

Be ready for accidental IV potassium overdoses

By 1996, ISMP was aware of multiple deaths and patient injuries that had been associated with accidental intravenous administration of concentrated potassium chloride injection prior to dilution. The drug was inadvertently given as a direct intravenous (IV) push injection or erroneously used as a diluent to prepare sterile antibiotic powders, then injected by direct IV

continued on page 2—memory lane >

https://www.ismp.org/resources/paralyzed-mistakes-reassess-safety-neuromuscular-blockers-your-facility

January 17, 2019 ▪ Volume 24 Issue 1

ISMP 25 ADVANCING MEDICATION SAFETY

Acute Care ISMP Medication Safety Alert!®

Educating the Healthcare Community About Safe Medication Practices

Safety enhancements every hospital must consider in wake of another tragic neuromuscular blocker event

PROBLEM: National news recently exposed details about a 2017 fatal medication error that happened at a large, prestigious hospital after the Centers for Medicare & Medicaid Services (CMS) briefly placed its Medicare reimbursement status in jeopardy. The hospital's status was quickly restored following submission of a plan of correction to CMS. Upon ISMP's awareness of the event, it became imperative to share the lessons learned from the fatal event so other healthcare providers can avoid a similar tragedy.

The details of the error that follow are from a CMS report. As the story unfolds, we hope you will see that this type of error could happen anywhere given current system vulnerabilities frequently found in hospitals, particularly when using automated dispensing cabinets (ADCs). In fact, ISMP has observed many of the same system vulnerabilities in other hospitals, and they are frequently at the root of a variety of medication errors reported to the ISMP National Medication Errors Reporting Program (ISMP MERP). Make no mistake—this type of error could happen in your hospital, and it is crucial to take steps now to reduce the risk of a similarly tragic event.

continued on page 2—Neuromuscular blocker event >

Table 1. ADC safety features to reduce the risk of errors when removing medications from cabinets*

General Safety Features	Description
Optimize profiled ADCs	Optimize the use of profiled ADCs that allows drug selection after pharmacy verification of orders in inpatient and outpatient settings (e.g., emergency department [ED], pre- and post-procedural locations)
Manage override lists	Limit the variety of medications that can be removed from an ADC via override for defined urgent/emergent situations
Block staff from loading inappropriate medications	Activate ADC software that prevents clinically inappropriate medications from being loaded into specific cabinets without prior approval
Utilize warnings during medication removal	Configure interactive alerts that require users to enter or select clinically relevant information (e.g., purpose for drug removal, whether the patient is ventilated [for neuromuscular blockers]) prior to removal
Witness override medication removal	Require a second individual to verify the correct patient, medication, strength, route, and indication upon override removal of a select list of medications or from certain ADCs; document the verification process
Allow simultaneous searching by brand and generic names	Configure ADCs to search simultaneously by brand and generic names; if searches are limited to either brand or generic names, educate staff how to toggle between these two functions
Support distraction-free ADC medication removal	Avoid distractions and talking at the ADC while searching for and removing medications
Neuromuscular Blocker Safety Features	**Description**
Limit access	Strictly limit availability in ADCs to perioperative, labor and delivery, critical care, and ED settings; in these areas, store in a sealed box, rapid sequence intubation (RSI) kit, or locked-lidded ADC pockets
Affix warnings to ADC pockets	Place auxiliary labels on ADC pockets/drawers/lids that clearly state, "**WARNING: CAUSES RESPIRATORY ARREST—PATIENT MUST BE VENTILATED;**" the warning should be visible when ADC pockets/drawers/lids are open

Assistance with implementing these recommendations is welcomed by vendors.

Finalized guidelines for electronic communication

ISMP has finalized a set of ***Guidelines for Safe Electronic Communication of Medication Information*** (see **pages 7-14**), which are now posted on our website at: www.ismp.org/node/1322. We published the first draft of these guidelines in our February 20, 2003 newsletter, when implementation of electronic health records (EHRs), electronic prescribing (e-prescribing), and other health information technology (HIT)-related tools began to evolve in both inpatient and outpatient settings. These technologies are now a mainstay in healthcare, and their introduction has brought about significant changes in how medications are prescribed, dispensed, and administered. If the conventions used to communicate medication information electronically are not carefully considered, these technologies may contribute to medication errors rather than mitigate risks.

In 2015, we again examined the literature and other credible sources to identify potential confusion that is unique to electronic communication or that affects both paper and electronic records. We then updated the draft guidelines, which were published in our August 27, 2015 newsletter (www.ismp.org/node/384). We solicited and received detailed comments about the updated draft guidelines from dozens of clinicians and more than 50 large groups, including federal and state government agencies; electronic pharmacy information, health information, and prescribing system vendors; and standards-setting, professional, and international organizations. Those who submitted comments were widely supportive; however, before we could publish the finalized guidelines, changes were made in the standards associated with the e-prescribing drug name (EPN) field in e-prescribing systems, and the ISMP guidelines con-

continued on page 2— Guidelines >

https://www.ismp.org/resources/safety-enhancements-every-hospital-must-consider-wake-another-tragic-neuromuscular

NDC 72611-**756**-01

Rocuronium Bromide Injection

50 mg/5 mL

(10 mg/mL)

WARNING: Paralyzing Agent

For Intravenous Use Only

5 mL Multiple-Dose Vial

Almaject® **Rx only**

WARNING: Paralyzing Agent. Causes Respiratory Arrest. Facilities must be immediately available for artificial respiration.

Sterile, Nonpyrogenic.

Storage: Store in a refrigerator, 2° to 8°C (36° to 46°F). **DO NOT FREEZE.** Upon removal from refrigeration to room temperature storage conditions (25°C/77°F), use within 60 days. Use opened vials within 30 days.

The packaging of this product is not made with natural rubber latex.

Mfg. Lic. No.: 103/AP/RR/97/F/R

Distributed by: Almaject, Inc.
Morristown, NJ 07960 USA

Made in India LAB-020677-00

756-01-00 Rev. 05/2019

(01)00372611756011

Lot :

Exp. : Un varnish area for Batch details 20 x 13 mm

NDC 72611-**756**-01

Rocuronium Bromide Injection

50 mg/5 mL

(10 mg/mL)

WARNING: Paralyzing Agent

For Intravenous Use Only

5 mL Multiple-Dose Vial

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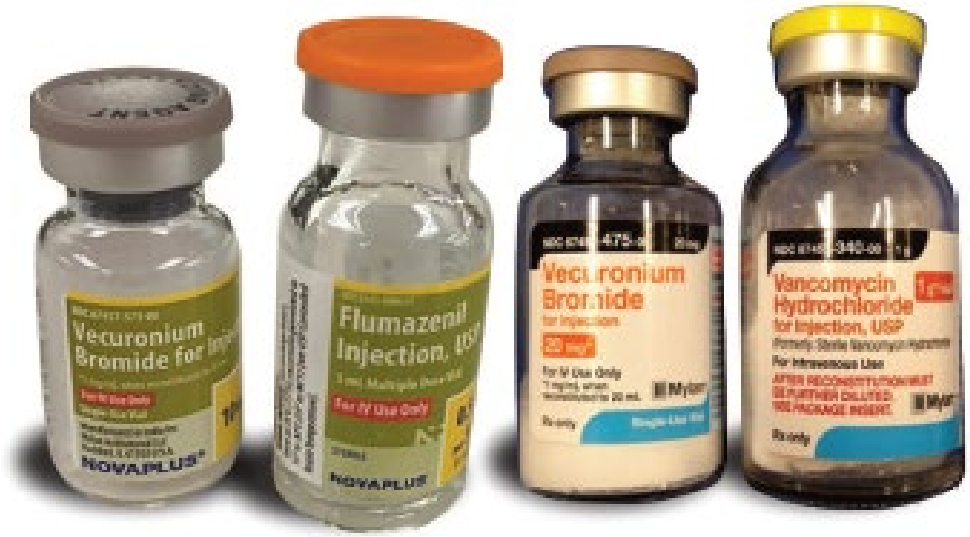
Lot :

Exp. : Un varnish area for Batch details 20 x 13 mm

Contributing factors

- Look-alike packaging and labeling



- Look-alike drug names
  - **Examples:** ***NARCAN*** *(naloxone) and* ***NORCURON*** *(vecuronium)*

Contributing factors

- Drug administration after extubation, such as failure to rewrite orders upon discharge from critical care (“continue previous meds”)
- Orders typed into wrong patient’s medical record
- Unlabeled and mislabeled syringes
- Syringe swaps
- Reversal agent not available
- Drug storage issues
- Residual drug flushed via still connected IV tubing after medication discontinued

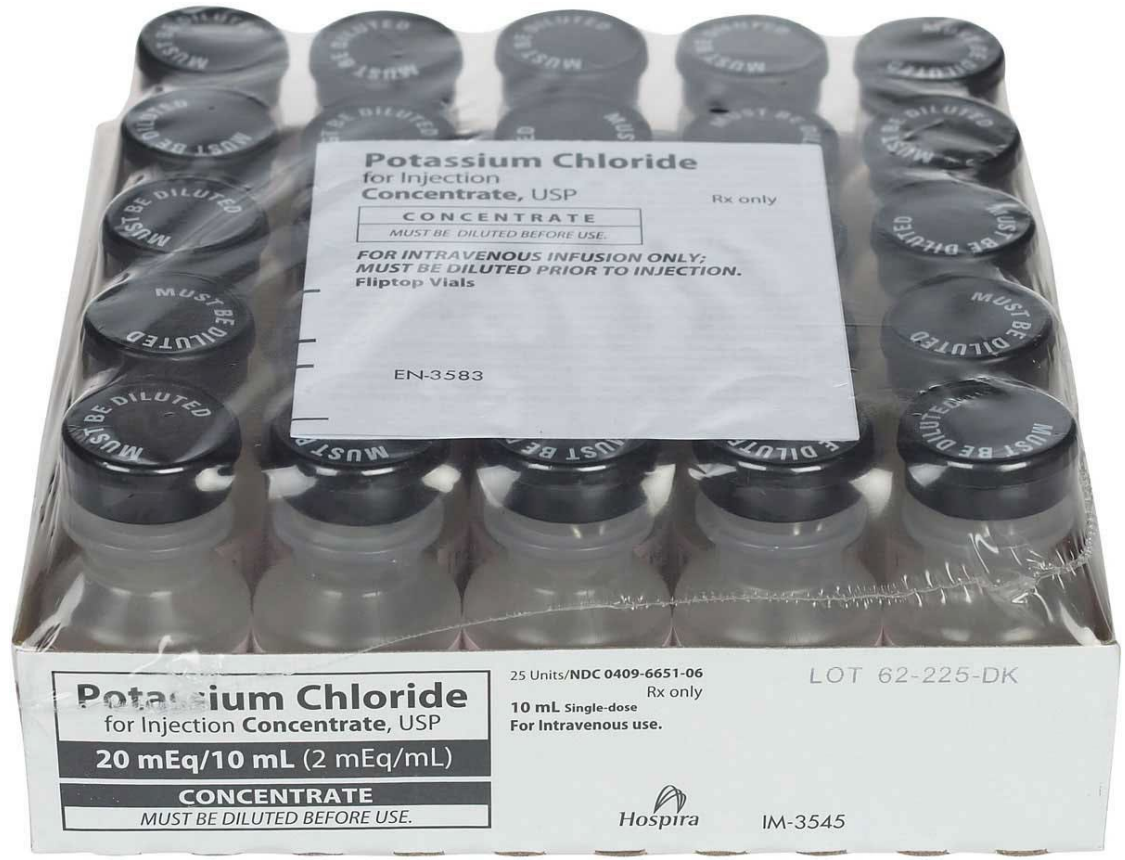
2022-2023

ISMP Targeted Medication Safety Best Practices for Hospitals

ISMP
Institute for Safe Medication Practices
An ECRI Affiliate

www.ismp.org


20 mEq
Potassium Chloride
for Inj. Concentrate, USP (2 mEq/mL)
CONCENTRATE
MUST BE DILUTED BEFORE USE


Potassium Chloride
for Injection
Concentrate, USP
Rx only
CONCENTRATE
MUST BE DILUTED BEFORE USE.
FOR INTRAVENOUS INFUSION ONLY:
MUST BE DILUTED PRIOR TO INJECTION.
Fliptop Vials
EN-3583
MUST BE DILUTED
Potassium Chloride
for Injection Concentrate, USP
20 mEq/10 mL (2 mEq/mL)
CONCENTRATE
MUST BE DILUTED BEFORE USE.
25 Units/NDC 0409-6651-06
Rx only
10 mL Single-dose
For Intravenous use.
LOT 62-225-DK
Hospira
IM-3545

BEST PRACTICE 7:

- BEST PRACTICE 7: Segregate, sequester, and differentiate all neuromuscular blocking agents (NMBs) from other medications, wherever they are stored in the organization.
  - Eliminate the storage of NMBs in areas of the hospital where they are not routinely needed.
    - Limiting neuromuscular blockers can also help reduce mix-ups with other drugs due to similar appearance
    - Outside ICU, ER and perioperative settings, provide in sealed box, clear plastic zip bags, or rapid sequence intubation (RSI) kit.
  - Segregate NMBs from all other medications in the pharmacy by placing them in separate lidded containers in the refrigerator or other secure, isolated storage area.

BEST PRACTICE 7:

- Place auxiliary labels on all storage bins and/or ADC pockets and drawers that contain NMBs as well as all final medication containers of NMBs (e.g., syringes, intravenous (IV) bags) that state: “WARNING: CAUSES RESPIRATORY ARREST – PATIENT MUST BE VENTILATED” or “WARNING: PARALYZING AGENT – CAUSES RESPIRATORY ARREST” or “WARNING: CAUSES RESPIRATORY PARALYSIS – PATIENT MUST BE VENTILATED” to clearly communicate that respiratory paralysis will occur and ventilation is required.
  - Exception: The auxiliary label practice excludes anesthesia-prepared syringes of NMBs.