Back to the Basics: Preventing Administration of Neuromuscular Blocking Agents Unventilated Patients

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ISMP Institute for Safe Medication Practices | 25 YEARS ADVANCING MEDICATION SAFETY

Objectives

- Describe underlying causes of events associated with administering a NMB to an unventilated patient
- Examine best practices associated with neuromuscular blocking agents
- Reviewing events from a Just Culture perspective

Neuromuscular Blocking Agents (NMBs)

High-alert medications

- Fatalities if respiratory paralysis not witnessed and patient not ventilated
- If patient survives, experience can be horrific

Received more than 100 error reports

- Many outside the perioperative setting

In more than half, NMB not the intended medication

- Practitioners thought they were administering a different medication
- Patients not mechanically ventilated

More than a quarter have resulted in harm

- Mostly death or anoxic brain injury

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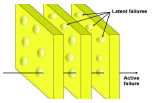
Active and Latent Failures

Active Failures

Specific actions of humans that contribute to an event

- Human error and behavioral choices



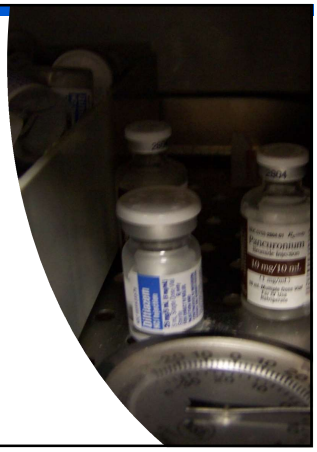
Latent Failures

Underlying organizational features and equipment/technology design that set people up to make mistakes

- Organizational influences
- Preconditions
- System design
- Technology or equipment design

Unsafe Storage

- Available in units where not needed or where patients cannot be ventilated and monitored by practitioners with competencies
  - Atracurium administered instead of hepatitis B vaccine
- Mix-ups with other medications in refrigerators, ADCs
  - Atracurium used as sterile water to prepare nebulizing treatment



Look-alike Packaging and Labeling

- Pancuronium and influenza vaccine
  - Look-alike vials stored next to each other in the refrigerator
- Vecuronium and flumazenil
  - Look similar after caps removed
  - Both stored in procedural areas
- Vecuronium and vancomycin
  - Look similar after caps removed
  - Both lyophilized powders that require reconstitution

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Drug Name Confusion

- **Narcan** (naloxone) and **Norcuron** (vecuronium)
- **Narcan** (naloxone) and **Nimbex** (cisatracurium)
- **Versed** (midazolam) and **vecuronium**

Unsafe Drug Searches Using Two or Three Letters

- "Cis" during order entry
  - Intended to find cisplatin
  - Selected cisatracurium
  - Label generation led to preparation and dispensing
- "Ve" during removal of medication from ADC
  - Intended to find Versed
  - Selected vecuronium
  - Administered wrong drug

Unlabeled and Mislabeled Syringes

Leftover syringe containing vecuronium mistaken as saline flush

Syringe swap between midazolam and rocuronium; fenta**NYL** and succinylcholine

Label swap for batches of pharmacy-prepared succinylcholine and e**PHED**rine syringes

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Unclear or Absent Warnings

- Ineffective manufacturer's warning on ferrule or cap
  - Nurses have repeatedly overlooked or misunderstood the warning
  - Warning does **NOT**:
    - Capture attention
    - Help user to understand the warning, believe it applies to them
    - Cause the user to understand the action they need to take
- Auxiliary warnings on vials absent, easily overlooked, misunderstood
  - "Neuromuscular agent" mistaken to mean that the drug was within a class of drugs to control seizures (fosphenytoin)
- No warnings on ADC screens, pockets, storage locations
  - Removed NMB by accident without notice

Drug Administration after Extubation

Continuing orders for NMB after the patient has been extubated

--Administration to an unventilated patient

Leaving a discontinued NMB infusion hanging at the bedside, which was mistaken as a different infusion and started

--Similar event have happened with other medications such as oxytocin

Other Causal Factors

- Reversal agent not available
- Residual drug left in tubing
- Order entry errors
  - Entered into wrong patient's EHR
    - Often due to look-alike names
  - Mental slips
    - Entered rocuronium rather than fosphenytoin into IV admixture software

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Best Practices for Safeguarding Neuromuscular Blocking Agents

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Prescribing and Dispensing NMBs

- Prescribe NMB via a protocol or order set if used outside perioperative areas
- Do not allow orders for NMBs with directions to use for agitation
- Pharmacy verification of mechanical ventilation support if NMB ordered outside of critical care or ED

Percent Compliance from **2018 ISMP Medication Safety Self Assessment® for High-Alert Medications**

Item	Best Practice	None (%)	Partial (%)	Full (%)
1	Outside the operating room (OR) and post-anesthesia care unit (PACU), NMBs used for maintenance of paralysis in patients on a ventilator are **prescribed via a protocol or order set**.	21	29	51
2	Organizational policies **do not allow orders** for neuromuscular blocking agents with directions to **"use as needed for agitation**."	28	6	66
3	If a neuromuscular blocking agent (e.g., continuous infusion) is ordered for a patient located in a care environment that does not typically support mechanical ventilation, **pharmacy staff are required to verify that the patient is (or will be) supported by mechanical ventilation** before dispensing the product.	30	11	59

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Storage and Labeling

Store safely

- Limit availability in ADCs to perioperative, labor and delivery, critical care, and ED
- Segregate and sequester NMBs
  --Provide in sealed box, RSI kit
  --Keep in locked, lidded pockets in ADC
- Reversal agents available
  - Dantrolene available if succinylcholine stocked

Affix warnings

- Warning: Causes Respiratory Arrest—Patient Must Be Ventilated
- Storage locations, ADC drawers (visible when open), on vials and admixtures

Percent Compliance between 2016 and 2017 with the ISMP Targeted Medication Safety Best Practices for Hospitals

Best Practice	Level of Compliance	Feb 2016 (%)	Oct 2016 (%)	July 2017 (%)
Segregate, sequester, and differentiate all NMBs from other medications, wherever they are stored in the organization. --Eliminate storage where they are not routinely needed --Place in sealed box or RSI kit --If in ADC, keep in lock-lidded pockets --Place auxiliary labels on storage bins or ADC pockets	None	19	9	9
	Partial	54	34	21
	Full	27	57	70

Percent Compliance from 2018 ISMP Medication Safety Self Assessment® for High-Alert Medications

Item	Best Practice	None (%)	Partial (%)	Full (%)
4	NMBs are **only available** in RSI kits, surgical suites, PACU and anesthesia stock, ED, and/or critical care units **where patients can be ventilated and monitored by practitioners** with demonstrated competencies.	2	7	91
5	Refrigerated and non-refrigerated NMBs are **segregated from other medications** or sequestered in a RSI kit or lidded box/drawer wherever they are stored (including ADCs, pharmacy, anesthesia supplies).	4	31	65
6	**Storage bins and/or ADC pockets or drawers** containing NMBs include an auxiliary label to communicate that respiratory paralysis will occur and ventilation is required (e.g., **WARNING: CAUSES RESPIRATORY PARALYSIS—PATIENT MUST BE VENTILATED**). *Compliance can also be achieved by affixing an auxiliary warning label directly on vials or by displaying a warning on an ADC screen, which must be acknowledged prior to removal of an NMB.*	14	23	63

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Product Labeling—Manufacturers

Labeling changes

- Current warning ineffective, unheeded, misunderstood, missed altogether

ISMP suggestions for principle label

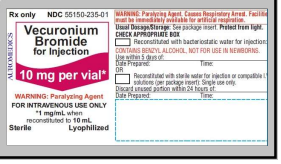
- Warning: Causes Respiratory Arrest—Patient Must Be Ventilated

Recent FDA action

- WARNING: Paralyzing Agent to be added to the principle display panel on carton and label, directly below strength
- WARNING: Paralyzing Agent. Causes Respiratory Arrest. Facilities must be immediately available for artificial respiration to be added to the side panel
- In Prescribing Information

  --Warning in WARNINGS

  --Store with cap, ferrule intact in DOSAGE AND ADMINISTRATION



NMBs in ADCs

Build interactive warnings on screens

- Patient Must be Ventilated to Receive this Medication
- Require user to enter or select purpose and verify manual or mechanical ventilation

Require a witness upon removal

- Provide an automated prompt and require documentation of an independent double check at the ADC when removing facility-defined medications via override
- Require second individual to verify the correct patient, medication, strength, route, and indication (against electronic order if available)

ADC Vendor Requested Improvements

Safety Feature	Description
Increase the number of drug name letters required when searching for medications to a minimum of 5 letters	Allow a minimum of 5 letters (or a configurable number of letters) to narrow the choice, ideally to 1 drug/category; BD/Pyxis will consider, although search would likely not require a set number of letters to be typed, but instead be dynamic, allowing only the necessary letters to be typed to isolate a single medication
For witness upon removal, consider requiring biometrics	Require verification using fingerprints, voice, or other biometrics to improve the likelihood that required independent double checks will be carried out
Allow simultaneous (or alert users to) generic/brand name searches	Enable simultaneous searching by both brand and generic drug name; if brand and generic search capabilities are separate, the screen should clearly display which type of search is being conducted and make it easy to toggle between the two

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Syringe Labeling

- Provide anesthesia with labeled, prefilled syringes of NMBs
- Label all syringes (including anesthesia-prepared syringes)
  - Anesthesia color-coded drug class label not sufficient

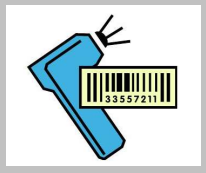
Percent Compliance from **2018 ISMP Medication Safety Self Assessment® for High-Alert Medications**

Item	Best Practice	None (%)	Partial (%)	Full (%)
9	**Anesthesia staff are provided with and use labeled, prefilled syringes** of neuromuscular blocking agents that are available from an outsourcer or prepared by pharmacy, rather than using self-prepared syringes.	47	38	16
8	Syringes of neuromuscular blocking agents prepared by **anesthesia** staff are **labeled** with the name and concentration/dose of the drug, and the expiration date and time. (An anesthesia color-coded drug class label alone is not sufficient.)	6	28	66

Bar-coding

Use bar-coding systems

- Prior to administration, verify each medication via barcode medication administration to ensure accuracy



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Post NMB Administration

Flush	Flush all of the drug out of the IV line (or change the line) prior to extubation
Remove	Remove all source containers as soon as the NMB is discontinued
Destroy or Discard	Destroy or discard an unused NMBs dispensed for the patient after extubation and/or upon discontinuation

Staff Education

- Drug action and need for ventilation
- Generic and brand names
- Special safeguards in place for NMBs
- Competency verification

June 16, 2016
ISMP Medication Safety Alert!

Paralyzed by mistakes

Reassess the safety of neuromuscular blockers in your facility

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

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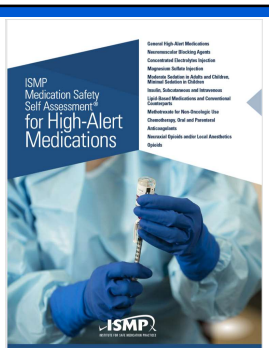

General High-Alert Medications

11 Medication Categories

Neuromuscular Blockers

https://www.ismp.org/sites/default/files/attachments/2018-01/EntireAssessmentWorkbook.pdf

Questions?

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