Paralyzed by Errors:

Implementation of a Neuromuscular Blocker Infusion Order Set

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Disclosure Statement

The speaker has nothing to disclose in relation to this presentation.

Objective

- Describe the importance of care coordination among the interprofessional team to ensure patient safety for those receiving neuromuscular blocker infusions.

Abbreviations

- NMBA = Neuromuscular Blocking Agent
- ARDS = Acute Respiratory Distress Syndrome
- ICP = Intracranial pressure
- TTM = Targeted Temperature Management
- TOF = Train of Four
- BIS = Bispectral Index
- ICU = Intensive Care Unit
- CHNw = Community Health Network

Overview of NMBA Infusions

- NMBAs paralyze skeletal muscles by blocking transmission of nerve impulses at the myoneural junction

Agents	Cisatracurium, atracurium, rocuronium, vecuronium, pancuronium
Indications	ARDS, elevated ICP, TTM Reserved for when conventional sedation and analgesia strategies have failed
Monitoring	Depth of blockade: TOF + clinical assessment Depth of sedation: BIS

Risks of NMBA Infusions

High alert medications

- ICU staff must be trained in administration and monitoring
- Appropriate equipment for assessing degree of paralysis
- NMBA packaging and labeling should clearly differentiate from other drugs
- Special safeguards for storage, labeling, ordering, and administering

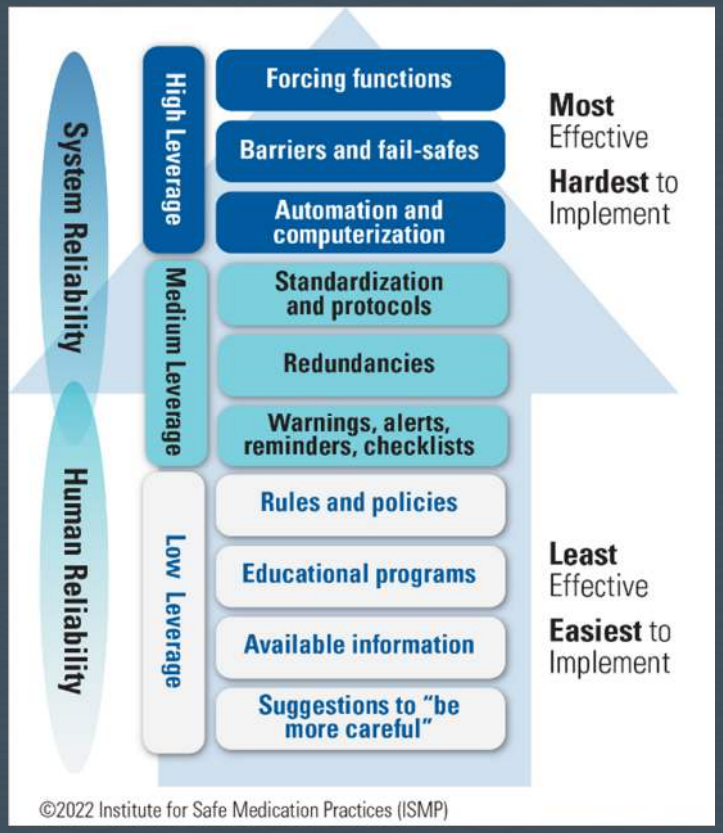
Awareness during paralysis	• Deep sedation with appropriate agent (NOT dexmedetomidine) • Titrate to deep sedation prior to initiation • BIS Monitoring
Corneal abrasions	• Scheduled eye care that includes lubricating drops or ointment and eye closure
Prolonged paralysis	• Daily NMBA interruption • Least effective dose to achieve clinical goal
ICU-acquired muscle weakness	• Limit use to < 48 hours • Mobility protocols

Examples of Reported Errors at CHNw

- Inappropriate sedative infusion
- Pain infusion omission
- Sedative infusion stopped
- Sedative infusion reduced
- Lack of monitoring

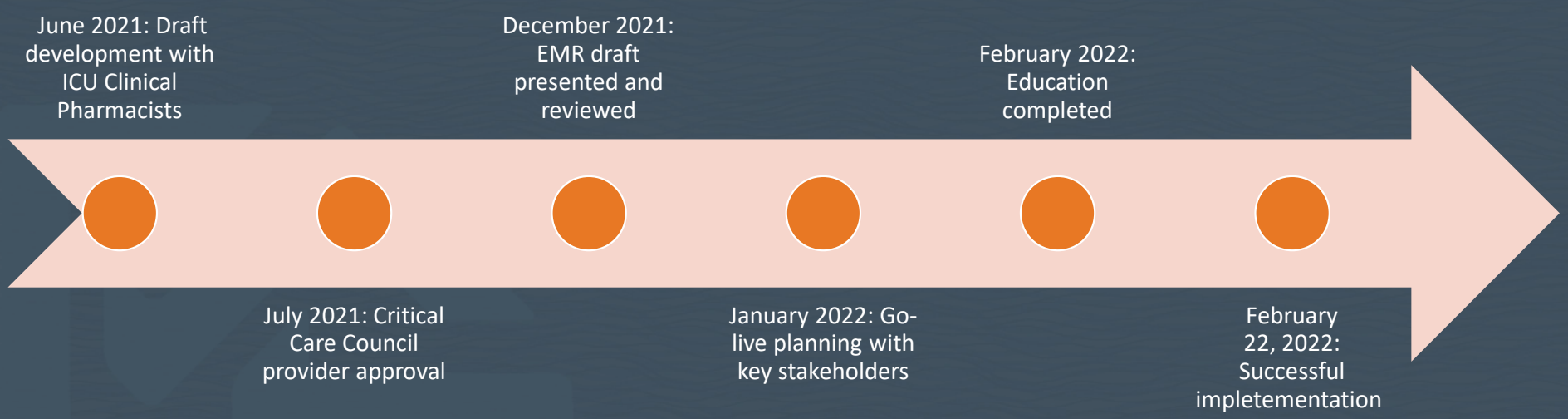
Initial Mitigation Strategies

- Nursing and pharmacy education
- Provider education
- Clinical pharmacist rounding
- Clinical monitoring tool alert
- Best practice alert (BPA)
- Pump warning



Key Stakeholders

Order Set Development



GEN.152 ICU Continuous Neuromuscular Blockade Focused Adult [2322]

Prior to paralytic initiation

Nursing Assessments

☑ Mechanical ventilation required prior to initiating paralytic	Routine, Until Discontinued, Starting today
☑ Continuous infusion of both analgesic and sedative (propofol or benzodiazepine) titrated to deep sedation required prior to initiating paralytic	Routine, Until Discontinued, Starting today
☑ A documented RASS of at least -4 is required prior to initiating paralytic to ensure adequate depth of sedation	Routine, Until Discontinued, Starting today
☑ BIS Monitor	Routine, Until Discontinued, Starting today, Goal less than 60 while paralytic infusing
☑ NMBA Therapy - Document Train of Four reading (Baseline)	Routine, Until Discontinued, Starting today, Obtain and document baseline TOF prior to initiation of paralytic.
☑ Notify Physician	Routine, Until Discontinued, Starting today, If RASS is not -4 or less despite maximum doses of analgesic and sedatives prior to initiation of paralytic infusion

Labs

☐ CPK	Now and every 72 hours, Routine

Pain Medication (Selection Required)

BOTH opioid continuous infusion and sedative (propofol or benzodiazepine) continuous infusion must be ordered in combination while on a continuous paralytic infusion

Discontinue all previously ordered opioid continuous infusions (due to different clinical goals)

☐ Fentanyl infusion + PRN bolus from bag dosing — **"And" Linked Panel**

☐ fentaNYL infusion	25-300 mcg/hr, Intravenous, Continuous, Continuous Initiate infusion at 25 mcg/hr. Titrate infusion by 25 mcg/hr every 20 minutes as needed to achieve goal: CPOT less than 3 and RASS -4 to -5 prior to initiating continuous paralytic infusion. If ordered, may use fentanyl IVP as needed for breakthrough pain. Refer to MAR. Maximum rate = 300 mcg/hr. Contact MD if rate is at maximum and goal has not been met.
☐ fentaNYL (SUBLIMAZE) 10 mcg/mL bolus from bag	50 mcg, Intravenous, Every 20 Minutes As Needed, for CPOT greater than 3., Every 20 Minutes As Needed

Sedation Medications (Selection Required)

BOTH opioid continuous infusion and sedative (propofol or benzodiazepine) continuous infusion must be ordered in combination while on a continuous paralytic infusion

Discontinue all previously ordered sedative continuous infusions (due to different clinical goals)

☐ Propofol drip orders — **"And" Linked Panel**

☐ propofol 10 mg/ml infusion	10-50 mcg/kg/min, Intravenous, Continuous, Continuous Initiate infusion at 10 mcg/kg/min or at previous dose if already receiving prior to initiation of paralytic. Titrate infusion by 10 mcg/kg/min every 10 minutes as needed to achieve goal RASS of -4 to -5 prior to initiating continuous paralytic infusion. Goal BIS less than 60 while paralytic infusing. Maximum rate 50 mcg/kg/min Contact MD if rate is at maximum and goal has not been met. Do not decrease sedatives or analgesic once desired RASS achieved while receiving continuous infusion paralytic. If sedative and/or analgesic needs interrupted for any emergent reason, also interrupt paralytic and notify provider.
☐ Triglycerides while on propofol	Now and every 72 hours, Starting today, STAT For propofol infusion

Neuromuscular Blocking Agent (Selection Required)

BOTH opioid continuous infusion and sedative (propofol or benzodiazepine) continuous infusion must be ordered in combination with continuous paralytic infusion.

☐ cisatracurium (NIMBEX) 2 mg/mL in dextrose 5 % in water (D5W) 100 mL infusion	Intravenous, Continuous Initiate infusion at: 1 mcg/kg/min Titrate infusion by 0.5 mcg/kg/min q 30 minutes as needed to achieve goal (CHNW RX Cisatracurium Titration Parameters:23631) Maximum infusion rate: 10 mcg/kg/min If TOF >/= 2 and clinical goal achieved, no paralytic dose change needed If TOF 0 - 1 and clinical goal achieved, decrease paralytic dose per order to avoid over-paralysis and maintain clinical goal Upon discontinuation, stop infusion without taper. A documented RASS of at least -4 is required prior to initiating neuromuscular blockade to ensure adequate depth of sedation. Do not decrease sedatives or analgesic while receiving continuous paralytic infusion. If sedative and/or analgesic needs interrupted for any emergent reason, also interrupt paralytic and notify provider. Contact MD if rate is at maximum and goal is not met.

Supportive Care

☑ white petrolatum-mineral oil (LUBRIFRESH PM) ophthalmic ointment	Both Eyes, Every 6 Hours Scheduled

During paralytic infusion

Nursing Assessments

☑ Do not decrease sedatives or analgesic once RASS -4 or -5 achieved while receiving continuous infusion paralytic. If sedative and/or analgesic needs interrupted for any emergent reason, also interrupt paralytic and notify provider.	Routine, Until Discontinued, Starting today
☑ NMBA Therapy - Document Clinical Goal	Routine, Every 4 Hours (Specified), Assess and document clinical effect (ex: ventilator synchrony).
☑ NMBA Therapy - Document Train of Four reading (Maintenance)	Routine, Until Discontinued, Starting today, TOF every 30 minutes after each titration of paralytic to meet clinical goal. Once clinical goal achieved, obtain and document TOF every 4 hours. - If TOF greater than or equal to 2 and clinical goal achieved, no paralytic dose change needed - If TOF 0 - 1 and clinical goal achieved, decrease paralytic dose per order to avoid over-paralysis and maintain clinical goal
☑ NMBA Therapy - Document BIS reading (Maintenance)	Routine, Every 2 Hours, Document BIS reading in combination with SR and SQI every 2 hours and with each sedative infusion titration.
☑ NMBA Therapy - Discuss continued need for paralytic with medical attending daily.	Routine, Until Discontinued, Starting today, If paralytic interruption desired, enter order for 'Interruption of Paralytic Infusion'
☑ Notify Physician	Routine, Until Discontinued, Starting today, If BIS sustained greater than 60 despite maximum doses of analgesic and sedatives while paralytic infusing

After paralytic discontinuation

Nursing Assessments

☑ NMBA Therapy - Document Train of Four reading (Discontinuation)	Routine, Until Discontinued, Starting today, After discontinuation of paralytic, obtain and document TOF every 15 minutes until TOF 4/4 prior to weaning sedative or analgesic

Prior State vs Current State

Prior State	Current State
• NMBA infusions ordered 'a la carte', along with appropriate sedative and pain orders • Sedative infusions included incorrect titration parameters • No routine monitoring orders • Clinical pharmacist adding ancillary medication orders (ex: eye lubricant)	• NMBA infusion ordering restricted to order set ONLY • Sedative and opioid infusions included in order set contain specific titration parameters for NMBA infusions • Hard stop requiring selection of both opioid infusion and deep sedative • Pre-checked orders for monitoring (ex: TOF, BIS) and ancillary medications

Lessons Learned

- High level error-prevention strategies, such as forcing functions, are most effective
  - Hardest to develop --> require buy-in from several key stakeholders
  - Longest to implement --> time from draft to implementation was 8 months!
- Importance of buy-in from provider champions, bedside nurses, and frontline staff to drive change
- Continuous evaluation of process changes --> update and adjust as needed based on feedback or clinical scenarios

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- CHNw Critical Care Council
- CHNw Intensive Care Units

References

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