Development of a Sedation Protocol for Mechanically Ventilated Patients in the Pediatric Intensive Care Unit at a University Hospital

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BACKGROUND:

•Sedation of pediatric patients to assist mechanical ventilation is a common practice in the intensive care setting.
•Large variance in the selection of drug therapies and assessment scales among institutions exists.
•Due to the lack of evidence to guide in the proper sedative selection, inconsistencies exist in the practice of sedation for mechanical ventilation in the pediatric patient.

OBJECTIVES:

•To develop, propose and implement a sedation protocol for use in ventilated patients in the pediatric intensive care unit at The University of Kansas Hospital.
•To evaluate the appropriateness of The University of Kansas Hospital's current sedation assessment scale, the Motor Activity Assessment Scale, in pediatric ventilated patients.

METHODOLOGY:

Current sedation practices and monitoring scale in pediatric intensive care unit (PICU) as reported by PICU attending physicians were reviewed

A query on the UHC list-serve was conducted to compare other institution's current practices to practices at The University of Kansas Hospital

Limited info obtained from survey & literature search

A retrospective literature review via PubMed and the references of Micromedex and the Pediatric Dosage Handbook (16th ed) were evaluated to establish approprate dosing ranges and monitoring parameters for the drug therapies of lorazepam, midazolam, fentanyl, morphine, dexmedetomidine, and propofol

The current sedation monitoring scale (Motor Activity Assessment Scale; MAAS) was compared to the COMFORT scale used in the pediatric population

Initial doses and absolute max dose determined by MD comfort and literature

A draft of the proposed protocol was created and modified based upon input from nursing and physician staff

RESULTS:

Table 1. KUMC Drug Dosage Ranges

Drug	Current Dose	# of Patients*
Fentanyl	0.17 – 4.25 mcg/kg/hr	6
Morphine	0.005 – 0.12 mg/kg/hr	1
Midazolam	0.03 – 0.22 mg/kg/hr	5
Lorazepam	0.01 – 0.15 mg/kg/hr	1
Propofol	5 – 100 mcg/kg/min	4

**Patients received a combination of drugs throughout their course of therapy*

Table 2. Literature Established Dosage Range

Drug	Lexi- Peds	Micromedex	KUMC MD Preferred Range
Fentanyl	Initial: 0.5-1 mcg/kg/hr Usual: 1-3 mcg/kg/hr	0.5-3 mcg/kg/hr	Initial: 0.5 mcg/kg/hr Max: 3 mcg/kg/hr
Morphine	Initial: 0.02 mg/kg/hr	0.01 – 0.03 mg/kg/hr	Initial: 0.02 mg/kg/hr Max: 0.2 mg/kg/hr
Midazolam	Initial: 0.06-0.12 mg/kg/hr Usual: 0.024 – 0.36 mg/kg/hr	Initial: 0.06 – 0.12 mg/kg/hr	Initial: 0.025 mg/kg/hr Max: 0.25 mg/kg/hr
Lorazepam (adults)	Initial: 0.01 – 0.1 mg/kg/hr	0.01 – 0.1 mg/kg/hr	Initial: 0.025 mg/kg/hr Max: 0.25 mg/kg/hr

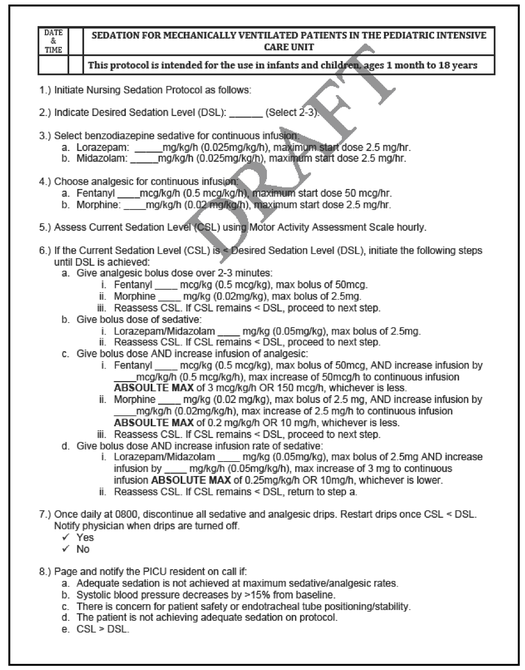
Table 3. Motor Activity Assessment Scale

SCORE	DESCRIPTION	DEFINITION
0	Unresponsive	Does not move with noxious stimulus*
1	Responsive only to noxious stimuli	Opens eyes OR raises eyebrows OR turns head toward stimulus OR moves limbs with noxious stimulus*
2	Responsive to touch or name	Opens eyes OR raises eyebrows OR turns head toward stimulus OR moves limbs with when touched or name is loudly spoken
3	Calm and cooperative	No external stimulus is required to elicit movement AND patient is adjusting sheets or clothes purposefully and follows commands
4	Restless and cooperative	No external stimulus is required to elicit movement AND patient is picking at sheets or tubes OR uncovering self and follows commands
5	Agitated	No external stimulus is required to elicit movement AND attempting to sit up OR moves limbs out of bed AND does not consistently follow commands (e.g., will lie down when asked but soon reverts back to attempts to sit up or move limb out of bed)
6	Dangerously agitated, uncooperative	No external stimulus is required to elicit movement AND patient is pulling at tubes or catheters OR thrashing side to side OR striking at staff OR trying to climb out of bed AND does not calm down when asked

* Noxious stimulus, suctioning OR 5 secs. of vigorous orbital, sternal, or nail bed pressure

RESULTS:

Figure 1. Protocol



DRAFT

DATE & TIME		SEDATION FOR MECHANICALLY VENTILATED PATIENTS IN THE PEDIATRIC INTENSIVE CARE UNIT
		This protocol is intended for the use in infants and children ages 1 month to 18 years

1.) Initiate Nursing Sedation Protocol as follows:

2.) Indicate Desired Sedation Level (DSL): _____ (Select 2-3):

3.) Select benzodiazepine sedative for continuous infusion:
a. Lorazepam: _____mg/kg/h (0.025mg/kg/h), maximum start dose 2.5 mg/hr.
b. Midazolam: _____mg/kg/h (0.025mg/kg/h), maximum start dose 2.5 mg/hr.

4.) Choose analgesic for continuous infusion:
a. Fentanyl ____mcg/kg/h (0.5 mcg/kg/h), maximum start dose 50 mcg/hr.
b. Morphine: ____mg/kg/h (0.02 mg/kg/h), maximum start dose 2.5 mg/hr.

5.) Assess Current Sedation Level (CSL) using Motor Activity Assessment Scale hourly.

6.) If the Current Sedation Level (CSL) is > Desired Sedation Level (DSL), initiate the following steps until DSL is achieved:
a. Give analgesic bolus dose over 2-3 minutes:
i. Fentanyl ____ mcg/kg (0.5 mcg/kg), max bolus of 50mcg.
ii. Morphine ____ mg/kg (0.02mg/kg), max bolus of 2.5mg.
iii. Reassess CSL. If CSL remains < DSL, proceed to next step.
b. Give bolus dose of sedative:
i. Lorazepam/Midazolam ____ mg/kg (0.05mg/kg), max bolus of 2.5mg.
ii. Reassess CSL. If CSL remains < DSL, proceed to next step.
c. Give bolus dose AND increase infusion of analgesic:
i. Fentanyl ____ mcg/kg (0.5 mcg/kg), max bolus of 50mcg, AND increase infusion by ____mcg/kg/h (0.5 mcg/kg/h), max increase of 50mcg/h to continuous infusion **ABSOULTE MAX** of 3 mcg/kg/h OR 150 mcg/h, whichever is less.
ii. Morphine ____ mg/kg (0.02 mg/kg), max bolus of 2.5 mg, AND increase infusion by ____mg/kg/h (0.02mg/kg/h), max increase of 2.5 mg/h to continuous infusion **ABSOULTE MAX** of 0.2 mg/kg/h OR 10 mg/h, whichever is less.
iii. Reassess CSL. If CSL remains < DSL, proceed to next step.
d. Give bolus dose AND increase infusion rate of sedative:
i. Lorazepam/Midazolam ____ mg/kg (0.05mg/kg), max bolus of 2.5mg AND increase infusion by ____ mg/kg/h (0.05mg/kg/h), max increase of 3 mg to continuous infusion **ABSOLUTE MAX** of 0.25mg/kg/h OR 10mg/h, whichever is lower.
ii. Reassess CSL. If CSL remains < DSL, return to step a.

7.) Once daily at 0800, discontinue all sedative and analgesic drips. Restart drips once CSL < DSL. Notify physician when drips are turned off.
✓ Yes
✓ No

8.) Page and notify the PICU resident on call if:
a. Adequate sedation is not achieved at maximum sedative/analgesic rates.
b. Systolic blood pressure decreases by >15% from baseline.
c. There is concern for patient safety or endotracheal tube positioning/stability.
d. The patient is not achieving adequate sedation on protocol.
e. CSL > DSL.

CONCLUSIONS:

•Standardized protocols for PICU ventilator patients are not widely available or utilized.
•Current practice at KUMC is also not standardized and dependent upon the physician and their comfort level.

Sedation Scale Assessment:
•The COMFORT Scale is the only scale proven valid in pediatric population.
•After assessment by PICU nursing and physicians, it was decided that this scale is too cumbersome to use clinically as an hourly assessment tool.
•The PICU staff agreed that continuing the use of the MAAS Scale is the best option at this time. Both physicians and nursing are comfortable with the use of this assessment scale.

FUTURE DIRECTION:

▪After approval of the protocol by The University of Kansas Hospital Pharmacy & Therapeutics Committee, the protocol will be implemented in the PICU at KUMC.
▪Nursing staff and residents in the PICU will be educated on the use of this protocol.

Disclosure:
All authors of this presentation have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation.

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