Pain Management in Critical Care

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Dr. Ratliff and Dr. Young do not have any items to disclose

Objectives

- Identify appropriate pain management regimens for the intubated patient
- Describe methods to maintain adequate pain management when weaning patients off the ventilator
- Identify non-opioid/novel pain management strategies (ketamine, epidurals, blocks) in the critically ill patient
- Recognize the challenges associated with acute pain management for patients taking buprenorphine, methadone or naltrexone

Background of Pain in the ICU

- Prevalence in the ICU
- Long-term physical and psychological effects
- Acute and acute on chronic pain
  - Opioid tolerance
- Analgosedation
- Assessment of pain in an intubated patient
  - Critical Care Pain Observation Test (CPOT)
  - Behavioral Pain Scale (BPS)

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Critical Care Pain Observation Tool

Facial Expression	No muscular tension observed	Relaxed, neutral	0
	Presence of frowning, brow lowering, orbit tightening, levator contraction	Tense	1
	All of the above facial movements plus eyelid tightly closed	Grimacing	2
Body Movements	Does not move at all (does not necessarily mean absence of pain)	Absence of movements	0
	Slow, cautious movements, touching or rubbing the pain site, seeking attention through movements	Protection	1
	Pulling tube, attempting to sit up, moving limbs/thrashing, not following commands, striking at staff, trying to climb out of bed	Restlessness	2
Muscle tension	No resistance to passive movements	Relaxed	0
	Resistance to passive movements	Tense, rigid	1
	Strong resistance to passive movements, inability to complete them	Very tense or rigid	2
Compliance with the ventilator (intubated patients) **OR**	Alarms not activated, easy ventilation	Tolerating ventilator or movement	0
	Alarms stop spontaneously	Coughing but tolerating	1
	Asynchrony: blocking ventilation, alarms frequently activated	Fighting ventilator	2
Vocalization (extubated patients)	Talking in normal tone or no sound	Talking in normal tone or no sound	0
	Sighing, moaning	Sighing, moaning	1
	Crying out, sobbing	Crying out, sobbing	2
Total, range			**0-8**

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Behavioral Pain Scale (BPS)

Item	Description	Score
Facial Expression	Relax	1
	Partially tightened (brow lowering)	2
	Fully tightening (eyelid closing)	3
	Grimacing	4
Upper Limb Movements	No movement	1
	Partially bent	2
	Fully bent with finger flexion	3
	Permanently retracted	4
Compliance with Mechanical Ventilation	Tolerating movement	1
	Coughing but tolerating ventilation for most of the time	2
	Fighting ventilator	3
	Unable to control ventilation	4

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Designing a Pain Management Regimen

- Preventative pain management vs. treatment of pain
- Procedural pain vs. pain at rest
  - Preemptive analgesia for chest tube removal: strong recommendation for pain control
  - All other procedures that may cause pain: consider
- Non-neuropathic pain vs. neuropathic pain
  - Neuropathic pain assessment in a sedated patient
    - IV vs. oral therapy

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First Line: Opioids

- Morphine
- Hydromorphone
- Fentanyl
- Remifentanyl

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Intravenous Opioids

Opioid	Initial Dose	Onset	$T_{1/2}$	Drug Accumulation Factors	Active Metabolites	Context Sensitive Half Time
Fentanyl	50 - 100mcg	1-2 min	2-4 h	Hepatic failure	No	200 min (6hr) - 300 min (12hr)
Morphine	1-4mg OR 1-4mg/hr	5-10 min	3-4 hr	Renal/hepatic failure	Yes	—
Hydromorphone	0.5-1mg	5-15 min	2-3 hr	Hepatic failure	No	—
Remifentanyl	0.5mcg/kg/hr	1-3 min	3-4 min		No	3-4 min

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Intermittent vs. Continuous Therapy

- Patient specific factors:
  - Severity of pain
  - Mental status
  - Hemodynamic status
  - History of opioid tolerance
  - Anticipated duration of therapy
  - Anticipated pain during ICU stay
- Intermittent: less accumulation
- Considerations for continuous therapy
  - Persistent or uncontrolled pain
  - Hemodynamic instability
  - Deeper level of sedation
  - Longer duration of mechanical ventilation, longer ICU LOS, longer hospital LOS

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Considerations in Pain Management

- Shock → decreased hepatic and renal blood flow
- Therapeutic hypothermia → decreased volume of distribution of drug
- Patient specific considerations
  - Obesity
  - Genetic variations
- Context-sensitive half-time

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Context Sensitive Half-Time

- Time required for the concentration of a drug to decrease by 50% following discontinuation of a continuous infusion
- Context = duration of infusion
- Fentanyl
  - 200 min after 6 hour infusion
  - 300 min after 12 hour infusion
  - Exponential increase after infusion > 12 hours
- Implications
  - Weaning
  - Discontinuation
  - Planned length of therapy

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Pain Management in Ventilator Weaning

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Pain and Mechanical Ventilation

- Extended mechanical ventilation (MV) independently associated with moderate to severe pain
  - Measured pain prior to and after extubation
  - Using Visual Analog Scale (VAS)
  - Laryngeal edema, cuff pressure, cause of intubation
- Patients assessed for pain on Day 2 of MV
  - Shorter duration of MV (8 vs. 11 days, P< 0.01)
  - Shorter ICU LOS (13 vs. 18 days, P < 0.01)

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Ventilator Weaning

Performed daily, sequentially
Minimizing sedation to prepare for breathing trial
—>Does not apply to analgesia
Pain may preclude patients from participating in SBT

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Assessment Questions

- True/False: Visual Analogue Scale (VAS) is an appropriate scale to assess pain in an intubated patient.
- True/False: During a Spontaneous Awakening Trial (SAT), all analgesia should be held to prepare for the Spontaneous Breathing Trial (SBT).

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Multimodal Pain Management

May lead to:	Earlier mobilization
	Decreased length of hospital stay
	Reduced hospital costs
	Increased patient satisfaction
	Decreased post-operative complications
	Decreased opioid requirements
	Reduced opioid use post discharge

Pain therapy should be tailored to the individual patient

Kodali B, Oberoi J. Management of postoperative pain. UpToDate. Available at: http://www.uptodate.com/contents/management-of-postoperative-pain?source=search_result&search=management of postoperative pain&selectedTitle=1~150. Accessed July 3, 2014.

Non-Opioid Pain Management

- Ketamine
- Epidurals
- Blocks

Ketamine

- NMDA receptor antagonist
- Rapid acting general anesthetic
- Produces potent analgesia at sub-anesthetic therapeutic concentrations
  - Anesthetic and analgesic actions are thought to be from different mechanisms
- Unknown how much it works on opioid receptors

Micromedex. Ketamine. Accessed 8/15/16.

Ketamine

Produces:

- Analgesia
- Normal pharyngeal-laryngeal reflexes
- Skeletal muscle tone
- CV and respiratory stimulation
- Transient respiratory depression

Who can benefit from low dose ketamine?	Opioid dependent/tolerant
	Patients who failed all other methods of pain control
	Major abdominal surgery where epidural is not possible
	Upper abdominal, thoracic, and major orthopedic surgery
	Trauma patients whose pain cannot be controlled by other means

Usage Restrictions

Contraindications:

- Conditions where significant elevations in blood pressure would be a serious hazard
- Hypersensitivity to ketamine or any component of the medication

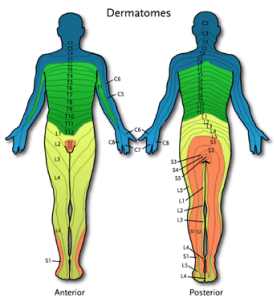
Precautions:

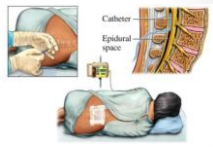
- Alcohol intoxication/abuse
- Hypertension or cardiac decompensation
- Elevated CSF pressure
- History of psychiatric disorder
- History of seizures

ANMC Dosing

- Ketamine should be prescribed as: 500mg (10mL) ketamine 50mg/mL in 500mL 0.9% normal saline for a final concentration of 1mg/mL
- Usual starting rate of 10 mg/hour; may increase by 5 mg every 2 hours to a maximum dose of 40 mg/hour
- Provider bolus: 10 mg every 2 hours as needed for adequate pain relief
- Ketamine infusions are required to be infused via a locked infusion pump

Epidural Pain Control





Desired pain relief in the appropriate dermatome

Nutritional Health Now. Dermatomes. Spiritual Birth. Epidural.

Epidural Pain Control

Candidates

- Surgical procedures that are expected to cause high pain
  - Thoracotomy
  - Large open abdominal surgery
  - Lower extremity revision/arthroplasty
- Poly-trauma
  - Rib fractures/plating
- Opioid tolerant patients (methadone, buprenorphine, or chronic long acting opioids)
- Patients requiring large doses of sedation and pain medications while intubated

Epidural Contraindications

Absolute
- Patient refusal, unable to consent
- Coagulopathy
- Active infection at epidural site or bacteremia
- Immunocompromised

Relative
- Intoxicated
- Unstable C-spine
- Personality disorder/behavior health issues

Epidural Pain Control

Common Medications
- Local anesthetics (bupivacaine, ropivacaine)
- Opioids (fentanyl, morphine, hydromorphone)
- Clonidine

ANMC Formulations
- **Bupivacaine 0.2% solution**
- Ropivacaine 0.2%/fentanyl 2mcg/mL solution (labor & delivery only)

Blocks

Transversus Abdominus Plane (TAP) Block
- Local anesthetic
- Provides anesthesia from the parietal peritoneum and superficial area
- Can be performed on an anesthetized patient, if the case goes open, or on a patient with coagulopathy

Continuous infiltration into surgical wounds
- Local anesthetic

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3270549/

Acute Pain Management in the Opioid Tolerant Patient

Challenging Concurrent Medications

Buprenorphine
- Mixed agonist/antagonist
  - Partial agonist at the mu-opioid receptor
  - Antagonist at the kappa-opioid receptor

Methadone
- Mu-opioid receptor agonist

Naltrexone
- Pure opioid antagonist

Acute Pain Management in the Opioid Tolerant Patient

- Buprenorphine or buprenorphine/naloxone
  - Two strategies/theories
    - Continue buprenorphine – extremely high doses of opioids will be required
    - Discontinue buprenorphine – high doses of opioids will be needed to start until the buprenorphine has been fully metabolized
- Methadone
- Naltrexone
  - Depends upon the route of administration (PO vs. IM)

http://paindr.com/wp-content/uploads/2015/09/2015-01-04-FINAL_UPDATE_BUPRENORPHINE-CHAPTER_WM.pdf

Acute Pain Management in the Opioid Tolerant Patient

Adjuvants	Ketamine
	Epidurals
	Local Anesthetics/blocks
	Ketorolac/NSAIDs
	Acetaminophen
	Neuropathic pain medications (gabapentin, pregabalin, TCAs, venlafaxine etc)

Assessment

- True/False: Low dose ketamine infusions can be administered to a patient on opioid and/or benzodiazepine continuous infusions?
- Which of the following is not an absolute contraindication to an epidural?
  A. Acute intoxication
  B. Patient refuses
  C. Active infection
  D. Immunocompromised