I. INTRODUCTION
The ability to provide effective analgesia and sedation is paramount in optimizing patient care in the intensive care unit and is a primary goal for critical care practitioners. Pain refers to the adrenergic and emotional response to a noxious stimulus. Sources of pain in the surgical intensive care unit (SICU) include wound sites, line or drain insertion, endotracheal intubation, stiff joints, immobility, catheters, etc. Poorly managed pain contributes to insomnia, exhaustion, disorientation, agitation, and varying degrees of delirium. Consequently, pain must be assumed to be present unless the patient states otherwise. Patients in intensive care units also frequently display signs of apprehension, anxiety, cognitive dysfunction, delirium, distress and agitation. Sedation refers to the use of environmental and pharmacological interventions to control these symptoms. In addition, sedation may be required to facilitate patient safety, mechanical ventilation, wound care, during neuromuscular blockade, and to reduce energy requirements and oxygen consumption. Anxiety and sleep deprivation act synergistically to increase pain perception and analgesic requirements. The current approach to analgesia and sedation is to separate the component symptoms (pain, anxiety, insomnia, and delirium), assess them independently, and create an integrated plan of care.

II. PURPOSE
To provide improved quality of care for critical care patients through more effective management of pain, anxiety, delirium, and insomnia, and to control cost.

III. INTERVENTIONS
A. Pain
   i. Treat pain first. Analgesia requirements are determined by the magnitude of tissue injury, subjective and objective assessment of symptoms, allergy history and history of chronic use of pain medications.
   ii. The plan and goals for effective analgesia should be designed and communicated to critical care team members. This includes physicians, nurses, nurse practitioners, respiratory therapists and pharmacists.
   iii. The Visual Analog Scale for Pain is used in cooperative patients. This ensures consistency, accountability and reproducibility.
   iv. Patients who cannot verbalize pain should be assessed with objective findings, such as facial expressions, posturing and restlessness, as well as physiological findings, such as tachycardia, hypertension, tachypnea and diaphoresis.
v. If unable to ascertain if behavior is pain related and patient is intubated, bolus with 100–200 μg fentanyl IV or 2-5 mg morphine IV.

vi. If the patient is not intubated, bolus with 50-100 μg fentanyl IV or 1-2 mg morphine IV. Monitor behavioral and physiologic response.

vii. Morphine is the first line agent for pain, unless patient has hemodynamic instability or renal failure, in which case hydromorphone or fentanyl is used.

viii. In intubated patients, analgesics can be administered on a continuous or scheduled basis, with supplemental doses administered as needed.

ix. In an awake cooperative patient assess if patient is a candidate for patient controlled analgesia (PCA).

x. Consider adjuncts such as NSAIDS, acetaminophen, or regional blocks.

xi. Refer to pain table for selection of appropriate agent based on hemodynamic stability and comorbidities.

xii. If escalating doses of opioids are needed, reassess pain and consider an alternative opioid.

xiii. When converting from one opioid to another, begin new drug at 75% of the calculated equianalgesic dose.

xiv. Assess for anxiety, insomnia, or delirium. Refer to appropriate algorithm.

xv. Consider adding clonidine when morphine exceeds a rate of 15 mg/hr or hydromorphone exceeds 2 mg/hr. Clonidine is used to reduce the adrenergic response to noxious stimuli. Titrate clonidine dose to patient’s baseline blood pressure.

xvi. Consider consulting the Pain service for alternative treatments, such as regional nerve blockade.

xvii. After 24 hours at effective dose at which pain is well controlled, begin tapering the analgesia dose by 10-20%/day.

xviii. For patients with a baseline opioid requirement, resume home regimen when possible in addition to treating the acute pain syndrome.

xix. Patients receiving narcotics should be on a bowel regimen of docusate sodium 100 mg BID and bisacodyl suppository every day as needed. Monitor for diarrhea.

xx.

Visual Analog Scale for Pain

<table>
<thead>
<tr>
<th>No Pain</th>
<th>Mild Pain</th>
<th>Moderate Pain</th>
<th>Severe Pain</th>
<th>Worst</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
B. Sedation
   i. Sedation should be started only after ensuring adequate analgesia and treating reversible causes.
   ii. The Richmond Agitation Sedation Scale (RASS) is used to determine the level of sedation, anxiety, or agitation in a patient.
      1. The target level of sedation is a calm patient who is easily aroused and has a normal sleep-wake cycle (RASS 0–2).
      2. Some patients may require deeper levels of sedation, i.e. traumatic brain injury (TBI), open (“damage control”) abdomen, neuromuscular blockade, severe hypoxic respiratory failure (RASS –3–5).
   iii. Sedatives should be administered as needed to determine dose required to attain therapeutic goal.
      1. A typical RASS goal for an intubated patient is –3 (Refer to Table 1).
      2. A typical RASS goal for a non-intubated patient is 0 (Refer to Table 1).
   iv. For acutely agitated patients administer midazolam 2 mg IV every 5 minutes x 3 or until sedated.
   v. Once stabilized, change agent to lorazepam IV boluses at scheduled intervals and as needed for breakthrough.
   vi. If patient is requiring doses of lorazepam IV more frequently than every 2 hours, begin a lorazepam drip at lowest effective dose. Titrate to RASS score.
   vii. Propofol is indicated for patient’s requiring frequent neurological assessments as indicated in the Severe Head Injury (SHI) protocol (see Management of Severe Head Injury CPG) and for patient’s experiencing a paradoxical response to benzodiazepines. Propofol may not be used in the pediatric patient population (age < 18). Critical care attending physician approval is required for its use. Maximal propofol dose is 80 mg/hr.
   viii. Hold lorazepam and propofol infusions daily at 6 am until patient’s RASS is –2 unless contraindicated by one of the criteria listed above in “ii”.
      1. Restart infusion only if needed.
      3. If mechanically ventilated, assess for ability to extubate as appropriate.
   ix. After 24 hours at effective dose taper infusions by 10-20 % daily.
   x. Under certain circumstances, neuromuscular blockade may be necessary. It is imperative that the patient is deeply sedated when chemically paralyzed. Refer to the policy on “Nondepolarizing Neuromuscular Blocking Agents in the Adult ICU” Practice Manual.
C. Insomnia
   i. Assess based on patient report or observation.
   ii. Consider as differential if patient is becoming progressively clinically agitated.
   iii. Control environment.
       1. Lights and televisions turned off at night
       2. Minimize background noise
       3. Maintenance of day-night cycle
   iv. The agents of choice for sleep are as follows:
       1. First, chloral hydrate 500-1000 mg po at bedtime
       2. Second, temazepam 15-30 mg po at bedtime
       3. Third, if necessary, diphenhydramine 25-50 mg IV at bedtime
   v. Consider consulting PMR for complex cases or when insomnia is contributing to delirium.

D. Agitation / Delirium
   i. Delirium may or may not be accompanied by agitation.
   ii. Assess for agitation using the RASS scale.
   iii. Signs of delirium include the following:
CLINICAL PRACTICE GUIDELINE MANUAL

UNIVERSITY OF PENNSYLVANIA MEDICAL CENTER
HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA
Surgical Critical Care
Department of Surgery
Department of Anesthesia and Critical Care

ADMINISTRATIVE
SUBJECT:
ANALGESIA & SEDATION IN THE SICU
NUMBER CC.05

X CLINICAL
Reference: Surgical Critical Care Policy Manual
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1. Disorganized thinking
2. Altered level of consciousness
3. Inattention

iv. Identify and treat reversible causes.
   1. Metabolic derangements (hypoxia, shock, ischemia, sepsis, electrolyte imbalances)
   2. Pharmacological interactions/side effects

v. Control environment (refer to C iii above).

vi. The agent of choice for non-substance (ETOH) withdraw delirium is Haloperidol every 30 minutes. Once controlled a standing dose of Haloperidol, at 25% of loading dose, is administered every 6 hours. Maximum dose to be administered over a 24 hour period is 40 mg.
   1. Add something about scheduled benzo dosing for prophylaxis of DT’s??

vii. Consider consulting PM&R for complex patients.

IV. BIBLIOGRAPHY


Clinical Practice Guidelines (CPG) are meant to standardize and optimize care and decrease variability in practice. They are intended to be used as framework for the delivery of patient care in the surgical critical care units. CPG’s are a combination of evidence-based medicine and accepted practices in critical care medicine. CPG’s are intended to provide decision support for the management of the majority of patients, and are not proposed as directives, rules, or policies. They are not substitutes for clinical judgement. Deviations from the CPG’s are expected when deemed medically necessary; all exceptions should be documented in the medical record and require discussion between the Surgical Critical Care attending and the attending of the primary or consulting service.
CLINICAL PRACTICE GUIDELINE MANUAL

UNIVERSITY OF PENNSYLVANIA MEDICAL CENTER
HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA
Surgical Critical Care
Department of Surgery
Department of Anesthesia and Critical Care

ADMINISTRATIVE SUBJECT: ANALGESIA & SEDATION IN THE SICU NUMBER CC.05

X CLINICAL Reference: Surgical Critical Care Policy Manual Page 7 of 16

Approved by:

__________________________       __________________
Vicente H. Gracias, MD                      Date
Co-Medical Director, Surgical Critical Care
Division of Traumatology & Surgical Critical Care
Department of Surgery

__________________________       __________________
C. William Hanson, MD                      Date
Co-Medical Director, Surgical Critical Care
Department of Anesthesia
### Pharmacologic Tables

#### Opioid Analgesics for Continuous Infusion

<table>
<thead>
<tr>
<th>Drug</th>
<th>Onset (minutes)</th>
<th>Half-life (hours)</th>
<th>Usual Dosing Range</th>
<th>Adverse effects</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fentanyl</td>
<td>1.5 minutes</td>
<td>2-7</td>
<td>25-500 mcg / hr</td>
<td>Rigidity with high doses</td>
<td>Hepatic metabolism; no active metabolites</td>
</tr>
<tr>
<td>Hydromorphone</td>
<td>15-20 minutes</td>
<td>2-3</td>
<td>0.1-2 mg / hr</td>
<td>Greater risk of respiratory depression than other opioids</td>
<td>Hepatic metabolism; active metabolite; renally excreted</td>
</tr>
<tr>
<td>Morphine</td>
<td>&lt; 5 minutes</td>
<td>1-4</td>
<td>1-15 mg / hr</td>
<td>May cause hypotension and bronchospasm secondary to histamine release; Prolonged sedation and respiratory depression in renal failure</td>
<td>Hepatic metabolism; active metabolite; renally excreted-acumulates in renal failure</td>
</tr>
</tbody>
</table>

All opioid infusions should be titrated to appropriate pain score on the visual analog scale
(0= no pain to 10= worst pain possible)

Doses recommended are for opioid naïve patients. Patients chronically receiving opioids require higher doses for pain relief. All opioids can cause respiratory depression, gastrointestinal hypoactivity, sedation, constipation, nausea and vomiting, urinary retention, and cough suppression.

**Intravenous Equianalgesic Dose Comparison:**

- Fentanyl 40 mcg = Hydromorphone 0.15 mg = Morphine 1 mg

Because of incomplete cross-tolerance among opioids, begin the new opioid drug at 2/3 of the calculated equianalgesic dose.
Nonopioid Analgesics:

Nonsteroidal anti-inflammatory:

<table>
<thead>
<tr>
<th>Drug</th>
<th>Onset</th>
<th>Dosing</th>
<th>Adverse effects</th>
<th>Considerations</th>
</tr>
</thead>
</table>
| Ketorolac | 10 minutes | Age < 65 years: 30 mg IV q6 hr  
              Age ≥ 65 years, renal insufficiency, or < 50 kg: 15 mg IV q6 hr | Gastrointestinal bleeding, platelet inhibition, renal insufficiency/failure | ↑ incidence of GI bleeding, renal failure, and operative site bleeding when used > 5 days |

NSAIDS are useful in reducing inflammation associated with pain. Other NSAIDS may be used in appropriate patients if enteral administration is feasible.

Miscellaneous agents

<table>
<thead>
<tr>
<th>Drug</th>
<th>Onset</th>
<th>Dosing</th>
<th>Adverse effects</th>
<th>Considerations</th>
</tr>
</thead>
</table>
| Acetaminophen | 10 minutes | 1000 mg q 12hr | Hepatotoxicity; Rare hematologic complications | Maximum of 2 gm /day in patients with poor nutrition, alcohol abuse, preexisting hepatic disease or use of anticonvulsant medications  
In patients without the above preexisting conditions, maximum dose is 4 gm/ day. |

Acetaminophen is used to treat mild to moderate pain. Provides opioid sparing effects when used in combination with opioids.

Hepatotoxicity has been reported with large doses and long term administration in patients receiving the following medications due to hepatic microsomal enzyme induction: Barbiturates, Carbamazepine, Phenytoin, Isoniazid, Rifampin.
### Miscellaneous Agents (cont.)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Onset</th>
<th>Dosing</th>
<th>Adverse effects</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clonidine</td>
<td>30-60 minutes (oral)</td>
<td>0.1-0.3 mg po bid-tid 0.1-0.3 transdermal patch q 7 days</td>
<td>Sedation, dizziness, hypotension, dry mouth, constipation, rebound hypertension</td>
<td>Antihypertensive effects of the transdermal patch take 48 hours</td>
</tr>
</tbody>
</table>

Clonidine is used to treat the hyperadrenergic response to systemic inflammation. Typically clonidine reduces heart rate, blood pressure, opioid requirements and induces mild sedation.

#### Sedatives

<table>
<thead>
<tr>
<th>Drug</th>
<th>Onset (minutes)</th>
<th>Half-life</th>
<th>Usual Dosing Range</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lorazepam</td>
<td>5-20 minutes</td>
<td>10-20 hours</td>
<td>0.5- 10 mg/hr</td>
<td>Metabolized in the liver</td>
</tr>
<tr>
<td>Midazolam</td>
<td>2-5 minutes</td>
<td>1.5-3.5 hours single dose 3-11 hours infusion</td>
<td>2-5 mg IV q 5-15 minutes until acute agitation controlled</td>
<td>Metabolized in the liver; Multiple drug interactions; Prolonged infusion results in increased half-life and duration of sedative effect</td>
</tr>
<tr>
<td>Propofol</td>
<td>1-2 minutes</td>
<td>184-834 minutes terminal half-life</td>
<td>Initial 5 mcg/kg/min, Titrate to minimal effective dose; Maintenance dose 5-50 mcg/kg/min.</td>
<td>Adverse effects include infection, pain at the injection site, hypotension, apnea, hypertriglyceridemia, pancreatitis, and cardiac arrhythmias</td>
</tr>
</tbody>
</table>
### Delirium

<table>
<thead>
<tr>
<th>Drug</th>
<th>Onset (minutes)</th>
<th>Half-life</th>
<th>Usual Dosing Range</th>
<th>Considerations</th>
</tr>
</thead>
</table>
| Haloperidol    | 10-30 minutes   | 18-54 hours| ≥ 65 years old: 0.5-2 mg IV q 20-30 minutes  
< 65 years old: 2.5-5 mg IV q 20-30 minutes  
Give 25% of the loading dose q 6 hours | Metabolized in the liver;  
Minimal anticholinergic and alpha blocking effects;  
No depression of respiratory drive;  
Little sedative effect;  
QT interval prolongation;  
EPS effects include dystonia, pseudoparkinsonism, and akithisia |

If a dystonic reaction occurs, IM/IV benztropine 1-2 mg or IM/IV diphenhydramine 50 mg should be administered.

### Agents for Sleep

<table>
<thead>
<tr>
<th>Drug</th>
<th>Half-life</th>
<th>Usual Dosing Range</th>
<th>Adverse effects</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlora hydrate</td>
<td>7-10 hours</td>
<td>500-1000mg 15-30 minutes prior to bedtime</td>
<td>Somnolence, hangover, paranoid behavior, delirium</td>
<td>Little effect on respirations or blood pressure</td>
</tr>
</tbody>
</table>
| Temazepam     | 3.5-18.4 hours | 15-30 mg before bedtime  
Elderly: initial dose of 15 mg | Amnesia, excitement, agitation, hallucinations | Metabolized in the liver |
| Diphenhydramine | 2-8 hours | 25-50 mg before bedtime | Sedation, urinary retention, ↑ intraocular pressure, confusion, paradoxical excitation | ↑ sedative effects in elderly; anticholinergic properties; central nervous system effects |

These medications should not be used on a daily basis for > 2 weeks.
Algorithms

The Analgesia-Sedation Paradigm

Patient in distress in ICU

Pain

Anxiety

Insomnia

Delirium
Pain Algorithm

Assess Pain using Visual Analog Scale and/or clinical S/S

Establish goals and administer opioids
*Refer to Opioid Table in CPG*
Consider anxiety component

Co-operative Patient?

Yes

No

PCA

Scheduled doses or continuous infusion of opioids

Pain well controlled

Yes

No

Taper dosage by 10-20% daily until discontinued

Escalating doses of opioids:
1. Change opioid
2. Add Clonidine
3. Consider adjuncts

Continuing Pain?

Yes

No

Refer to Sedation, Insomnia, or Delirium Algorithms

Assess for:
- Anxiety
- Insomnia
- Delirium

Consult acute pain service

↑ Infusion
Sedation Algorithm

Agitated?

Yes

Go to Pain Algorithm

No

Assess for pain

Is patient acutely distressed?

No

Lorazepam IV-intermittent bolus

Yes

Continue prn regimen

No

>2h prn boluses required

Yes

Lorazepam Infusion to RASS goal

RASS –3 (intubated)

Yes

↑ infusion until goal RASS is met

No

Hold sedation QD at 0600 until neuro exam obtained

Yes

Taper dose by 10-20% daily until discontinued

No

RASS 0 (non-intubated)

Stable?

No

Midazolam bolus

Yes

Agitated?
Insomnia Algorithm

↑ Agitation
Report of insomnia

Environmental factors:
- Day / night cycle
- Noise
- Light
- Location

Suspect agitation from source other than insomnia

1st line = Chloral hydrate 500-1000mg po at night
2nd line = Temazepam 15 – 30 mg po at night
3rd line = Diphenhydramine 25-50 mg IV at night

Reassess daily
Agitation Algorithm

Agitated or Delirious patient (RASS +2-+5)

- Disorganized thinking
- Acute onset of changes
- Change in mental status
- Inattention
- Altered level of consciousness

Delirium

- Are the causes reversible?
  - Yes
    - Reorient / Symptom management / Treat cause
  - No
    - Haloperidol bolus q 30 minutes until controlled (Max dose 40 mg / 24 hours)

- Start haldol at 25% of loading dose q 6 hours
- Taper dose by 10-20% daily
  - Reassess need daily