PSA: Taking the Torture out of Procedures

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Objectives

• List three medical procedures that can be enhanced when performed utilizing procedural sedation.
• Identify at least three steps that must be taken prior to performing procedural sedation.
• Recall at least four different medications and their pharmacodynamics as it pertains to procedural sedation.

Goals of PSA

• To reduce patient anxiety and awareness
• Provide sedation and pain control
• To facilitate a medical procedure
• Patient maintains their airway & breathing

Uses and Indications

• Cardiac procedures
• Complex laceration repair and I&D
• Foreign Body Removal
• Dislocation and fracture reductions
• Chest Tube Placement
• Burn and wound care
• Facilitate diagnostics

What is Procedural Sedation and Analgesia?

Procedural sedation refers to a technique of administering sedatives or dissociative agents with or without analgesics. This provides a controlled state of depressed consciousness which allows reflex ability to maintain a patent airway, and permits appropriate neurological responses to verbal stimuli.

Sedation vs. Brutane

• Less stressful and fearful for patient
• Less stressful for staff
• Improved outcomes
Risks of Procedural Sedation

- Hypoventilation
- Hypoxia
- Hypotension
- Vomiting and aspiration
- Allergic reaction
- Death

- Monitored closely by Joint Commission & CMS

Continuum of Consciousness

Awake, baseline
Procedural (Conscious or Moderate) Sedation
General Anesthesia

Minimal Sedation or Analgesia “Drowsy”
Deep Sedation

Levels of Sedation

- Sedation Score 0 = Fully awake
- Sedation Score 1 = Light sedation, largely aware of self/surroundings. Mildly sleepy.
- Sedation Score 2 = Moderate sedation, slightly aware of self/surroundings; somnolent but easily aroused with stimulation.
- Sedation Score 3 = Deeply sedated; unaware of self/surroundings.
- Sedation Score 4 = General anesthesia; patient is unconscious.

Pre-sedation Assessment

- Medical History
  - Previous sedation complications?
- Family History
- Medications and Allergies
- Social History
- Baseline V/S
- Physical Exam
- Available diagnostics

LEMON

- Look at face and neck anatomy, is it normal?
- Evaluate the 3-3-2 rule
- Mallampati
- Obstruction, is there one present?
- Neck mobility

Mallampati

- Class 1
- Class 2
- Class 3
- Class 4
**MOANS**

- Patients who are Difficult to Mask Ventilate
  - Mask seal: beard, distorted lower facial contour
  - Obese/Obstruction
  - Age > 55 years
  - No teeth
  - Stiff or noncompliant lungs

**ASA Physical Status**

Class I: Healthy patient
Class II: Mild systemic disease that does not limit daily activity
Class III: Severe systemic disease that limits daily activity
Class IV: Incapacitating systemic disease that is a constant threat to life
Class V: Dying (Moribund) & not expected to survive without treatment
Class VI: Declared brain dead
E: added if an emergency procedure

**Preparation**

- Informed Consent
  - Risks and Benefits
- NPO status
  - ASA recommendations
  - 2hr for liquids
  - 6hr for solids
  - ACEP: Risk and Benefit
- IV access
- Emergency Equipment
  - Crash Cart – emergency medications
  - Reversal agents

**Needed Equipment**

- SOAP ME
  - Suction
  - Oxygen
  - Airway equipment
    - Intubation setup
  - Pharmacological agents
  - Monitors
    - ECG
    - NIBP
    - SaO₂
    - ETCO₂

**Preparation**

- Typically at least 3 staff members in addition to the provider(s) performing the procedure
  - Procedure Assistant – tech or RN
  - Patient Monitor – RN
    - ACLS, PALS
  - Respiratory Therapist
  - Time Out

**During Sedation**

- Continuous Assessment
  - Mental Status
  - V/S including ETCO₂
    - Every 5 mins
  - Bispectral Index (BIS)
What It Is Not!

Continuous Assessment

- Continuous Capnography
  - Excellent correlation between ETCO$_2$ and PaCO$_2$ unless there is a shunt
  - ETCO$_2$ increases before SaO$_2$ decreases
- Red Flags
  - ETCO$_2$ > 50 mm Hg or 10% above baseline

Capnography

Causes of Altered ETCO$_2$

- Increased
  - Decreased respiratory rate
  - Decreased minute ventilation
  - Hyperthermia
  - Increased perfusion
  - Partial airway obstruction
- Decreased
  - Increased respiratory rate
  - Increased minute ventilation
  - Hypothermia
  - Decreased lung perfusion

Premedication

- Atropine
- Ondansetron (Zofran)
- Analgesia
**Dissociative Sedation**

- A trance-like cataleptic state in which the patient experiences profound analgesia and amnesia, but retains airway protective reflexes, spontaneous respirations, and cardiopulmonary stability.
- Tailor each PSA to the specific patient
  - Consider local or regional blocks
  - Distraction therapy

**Sedation**

- Benzodiazepines
- Others
  - Etomidate
  - Ketamine
  - Propofol
  - Nitrous Oxide

**Midazolam (Versed)**

- Mechanism of action: suppresses the limbic system, enhances GABA, occupies GABA receptors
- Causes sedation, amnesia, anxiolysis
- Dose: 0.05 – 0.1 mg/kg IV/IM  
  – 0.3 mg/kg IN
- Onset: 1-5 mins depending on route
- Duration: 30-60 mins depending on route and dose
- Adverse Effects: respiratory depression, hypotension

**Etomidate**

- Mechanism of action: depresses brain stem reticular activity through GABA receptors, enhances GABA
- Causes sedation, anxiolysis, amnesia
- Dose: 0.03-0.1 mg/kg IV
- Onset: < 1 minute
- Duration: 3 – 5 mins depending on dose
- Indications: induction for intubation, short acting sedation for procedures
- Very Safe medication, little to no respiratory or BP effects
- May cause myoclonic contractions, nausea, and pain at the injection site
- Not intended for repeated use, causes adrenal suppression

**Ketamine**

- Mechanism of action: suppresses the cortical and limbic systems: dissociative anesthetic
- Causes sedation, amnesia, and analgesia
- Catecholamine stimulation
- Dose: 1-2 mg/kg IV or 2-4 mg/kg IM  
  –0.1-0.3 mg/kg for analgesia
Ketamine

- Duration: 5 – 30 mins depending on route and dose
- Contraindications: ischemic events, hypertension
  – Head injuries, increased ICP
- Adverse Effects: increase in salivation, laryngospasms, emergence nightmares

Propofol (Diprivan)

- Mechanism of action: interacts with GABA receptors, enhances GABA
- Causes sedation, amnesia, and hypnosis
- Sedation Dose: 0.5–1 mg/kg IV
  – Infusion 1.5-4.5 mg/kg/hr
  – Always use aseptic technique
- Onset: 30-60 seconds, very short duration
- Adverse Effects: respiratory depression, hypotension, pain at the injection site
- Caution in patients with an egg or soy allergy and with active liver disease

Ketofol

- Provides sedation and analgesia
- Less effect on respiratory and cardiovascular systems
- 1:1 mixture of 10mg/ml of each
- Dose: 0.75 mg/kg of each
- When combined
  – Less risk of hypoxia, nausea, delirium
  – More hemodynamically stable
  – Quicker onset of sedation
  – Provides sedation and analgesia

Comparisons

- Kennedy et al. (1998)
  – Prospective, single-blinded, randomized controlled trial
  – 260 pediatric patients
  – Fentanyl + sedation agent
  – Hypoxia
    • Ketamine 6%
    • Midazolam 20%
  – p=.001

- Havel et al. (1999)
  – Prospective, randomized, blinded, comparison trial
  – 89 patients
  – Morphine + sedation
  – Recovery time
    • Propofol 14.9 +/- 11.1 mins
    • Midazolam 76.4 +/- 47.5 mins
  – p <0.001
Comparisons

- McDowell et al. (1995)
  - Retrospective review of 971 patients, 279 anesthesia related occurrences
    - Vomiting
      - Etomidate 9.9%
      - Propofol 0.5% (p<0.005)
      - Ketamine 14.6%
    - Hypoxia
      - Etomidate 2%
      - Propofol 15.7%
      - Ketamine 1.1 (p<0.005)

Nitrous Oxide

- Laughing Gas
- Dissociative Anesthetic
- Can be self administered by Patient
- 50%-50% mixture O\(_2\) & N\(_2\)O
- Causes analgesia and euphoria
- Rapid Onset: <3 min
- Short Acting
  - Recover in < 5 mins

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Pain

- What is Pain?
  - Pain is an unpleasant sensation which may be associated with actual or potential tissue damage.
  - Pain is a subjective event and should be considered what the patient says it is.

ANALGESIA

Wong-Baker Faces Pain Scale

FLACC

<table>
<thead>
<tr>
<th>Category</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face</td>
<td>No pain or feelings</td>
<td>Occasional grimace or moans, or whimpering</td>
<td>Continuous or constant crying, whimpering, or yelling</td>
</tr>
<tr>
<td>Legs</td>
<td>Normal position or relaxed</td>
<td>Uncomfortable, tense</td>
<td>Arching, rigid, or jerking</td>
</tr>
<tr>
<td>Activity</td>
<td>Lying quietly, activity present, restless</td>
<td>Squirming, shifting back and forth, tense</td>
<td>Arching, rigid, or jerking</td>
</tr>
<tr>
<td>Crying</td>
<td>No crying or tears</td>
<td>Tears or whining, occasional complaint</td>
<td>Crying, continuous or constant, frequent complaints</td>
</tr>
<tr>
<td>Consolability</td>
<td>Content, relaxed</td>
<td>Restless by environmental stimuli, hugging, or being held to, discomfort</td>
<td>Difficult to console or comfort</td>
</tr>
</tbody>
</table>

ANALGESIA
Adult Nonverbal Pain Scale

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>No particular expression or change</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Occasional gaze, head movement, facial or voice expression</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Frequent gaze, head movement, vocalization or verbalization</td>
</tr>
</tbody>
</table>

**Behavioral Pain Scale**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facial expression</td>
<td>Relaxed</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Partially tightened (eyebrow lowering)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Fully tightened (eyebrow closing)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Grimacing</td>
<td>4</td>
</tr>
<tr>
<td>Upper limb movements</td>
<td>No movement</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Partially bent</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Fully bent with finger flexion</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Permanently retracted</td>
<td>4</td>
</tr>
<tr>
<td>Compliance with mechanical ventilation</td>
<td>Coughing but tolerating ventilation</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Unable to control ventilation</td>
<td>4</td>
</tr>
</tbody>
</table>

Morphine

- Strong μ agonist that produces analgesia, euphoria, and sedation
- **Dose**: 0.05-0.2 mg/kg IV/IM/SC every 2-6 hours
- **Onset**: Rapid minutes depending on route
- **Duration**: 5-6 hours depending on route and dose
- **Caution**: histamine release, hypotension

Meperidine (Demerol)

- Strong μ agonist that produces analgesia, euphoria, and sedation
- **Dose**: 0.5–1 mg/kg IV/IM/SC every 3-4 hours
- **Onset**: Rapid minutes depending on route
- **Duration**: 2-4 hours depending on route and dose
- **Caution**: prone to cause N/V, avoid prolonged use in geriatric and renal patients

Fentanyl

- Strong μ agonist that produces analgesia, euphoria, and sedation
- **Dose**: 1–5 mcg/kg IM/IV every 1-2 hours
  - SL, buccal and transdermal
  - 2 mcg/kg IN
- **Onset**: Rapid minutes depending on route
- **Duration**: 1-2 hours depending on route and dose
- **Caution**: chest wall muscle rigidity with rapid administration
- **Less likely to cause respiratory depression or hypotension**
- Sufentanil, alfentanil, remifentanil
Hydromorphone (Dilaudid)
• Strong \( \mu \) agonist that produces analgesia, euphoria, and sedation
• Dose: 0.015 mg/kg IV/IM/SC every 3-6 hours
• Onset: Rapid – minutes depending on route
• Duration: 2-4 hours depending on route and dose

Partial Agonists
• Partial \( \mu \) agonist that produces analgesia and sedation, PO only
• Often combined with acetaminophen, ibuprofen, or aspirin
• Codeine 15-60 mg every 4-6 hrs
• Hydrocodone 5-10 mg every 4-6 hrs
• Oxycodone 5-30 mg every 4-6 hrs

Codeine
• Naturally occurring opioid
• Metabolized to morphine
• CYP2D6 polymorphisms – Increased risk of toxicity or
  – No longer recommended in peds
• No Analgesic effect at all
• Weak analgesic and antitussive
• Oxycodone and hydrocodone are synthetic analogues of codeine

Tramadol (Ultram)
• Centrally acting weak \( \mu \) agonist that also blocks serotonin and norepinephrine reuptake
• Synthetic analogue of codeine
• Dose: 50-100 mg PO q 4-6hrs
• Not recommended in pediatrics or pregnancy
• Cautions: narcotic dependent patients, can cause drowsiness, rare to cause respiratory depression, caution with patients on antidepressants and with a history of seizures

Buprenorphine (Buprenex)
• Partial \( \mu \) agonist and \( \kappa \) antagonist
• IV for acute moderate-severe pain
• Dose: 300 mcg IV/IM every 6-8 hrs PRN
• Buprenorphine/naloxone (Suboxone) SL – Used in drug treatment programs
  – Requires special training and endorsements
  – Bunavil – new buccal film formulation
• Butrans (transdermal) – chronic pain only

Mixed Agonist – Antagonist
• Strong \( \kappa \) agonist and weak \( \mu \) antagonist
• Butorphanol (Stadol)
• Pentazocine (Talwin)
• Nalbuphine (Nubain)
Reversal

• Narcotics
  – Airway Management
  – Naloxone (Narcan)
    • Adults 0.4–2 mg IV/IM/SC/ET
      – 1 mg IN
    • Peds: 0.1 mg/kg IV/IM/SC/ET/IN
      – Remember the half life of Naloxone is less than that of the opioid
      – Evzio – naloxone auto injector

• Benzodiazepines
  – Airway Management
  – Circulation Management
  – Flumazenil (Romazicon)
    • Adult: 0.2 mg slow IV PRN x1-5 doses, max of 3mg/hr
    • Peds: 0.01 mg/kg slow IV PRN x1-5 doses, max of 0.2 mg/dose; max total dose of 1 mg
    – The use of flumazenil is controversial R/T risks
    – Consider airway management as priority

Topicals

• Mixture of the “caines”
• Onset varies, 20-60 mins depending on mixture
• Consider risks of “caines”

Infants

• 25% sucrose buccaly
• Provides mild analgesia
• Stimulates the release of endogenous opioids
• Onset: 2-5 mins
• Duration: 5-8 mins

Discharge Criteria

• Stable V/S
• Return to neurological baseline
• Able to be mobile at baseline
• Tolerate PO
• If reversal agents were used, it’s been > 2-4 hours
• Discharged home with responsible adult

Post-Anesthesia Recovery (PAR) Score

• Motor
• Respiratory Effort and Cough
• BP
• Mental Status
• SaO₂
• Each scored 0-2
• Score > 8 needed to discharge or stop monitoring
Discharge Instructions

- What was done and used
- What to expect, any potential problems
- What to do if something changes
- Where to follow up, if indicated
- When to return to normal activities
  - When can they drive, return to work

Questions

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References


References


References