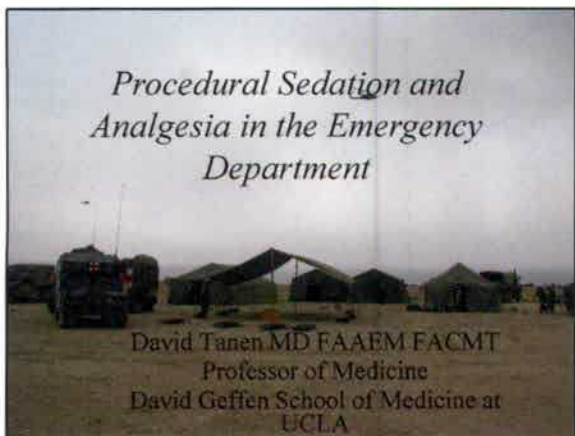


Procedural Sedation and Analgesia in the Emergency Department



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Cases to Consider

- 17 yo M soccer player who suffers an ankle fx dislocation with no PMH and no allergies
- 4 yo F with a both bone forearm fracture that needs to be reduced
- 18 mo M with a laceration under his chin
- 2 yo F needing sedation for a CT/MRI

Learning Objectives

- Integrate knowledge of physiology and pharmacology into your approach of dealing with procedural sedation and analgesia (PSA)
- Be aware of and ready to deal with consequences of administering sedatives

History of Procedural Sedation

- Ancient Greek and Roman surgeons utilized a wide range of painkillers and sedatives to help in surgery, including extracts of opium poppies (morphine) and henbane seeds (scopolamine).
- At the same time in China (~ 100 AD) Hua Toa made a concoction of similar herbs called ma-fei-san for the same purpose

PSA Definition

A technique of administering sedatives or dissociative agents with or without analgesics to induce a state that allows the patient to tolerate unpleasant procedures while maintaining cardio respiratory function.

Continuum that extends from minimal to moderate to deep to general anesthesia

	Anxiolysis/ Min Sedation	Moderate Sedation	Deep Sedation	General Anesthesia
Responsiveness	Normal response to verbal stimulation	Purposetul to verbal/ light tactile stimulation	Purposetul to repeated / deep stimulation	No response to painful stimulation
Airway	Maintained	Maintained	May need intervention	Usually needs intervention
Ventilation	Normal	Adequate	May need assistance	Usually needs assistance
Cardio-vascular Function	Normal	Maintained	Usually Maintained	May be impaired



Preparation


- Adequate Monitoring/Equipment
 - Cardiac Monitor
 - Pulse Oximetry
 - Capnography
 - EtCO₂ > 50 or an increase of 10 predict cases of respiratory depression
 - Oxygen
 - Airway adjuncts
 - Suction, BVM, Nasal Trumpets, Intubation Equipment

Patient Screening

- Pre-sedation Assessment
 - ASA I – Normal healthy patient
 - ASA II – Mild systemic disease
 - ASA III – Severe systemic disease
 - ASA IV – Severe disease / constant life threat
 - ASA V – Moribund, not expected to survive
- ASA I and II - good candidates
- ASA IV and V – not worth the risk

Patient Screening

- Other considerations
 - Drug allergies
 - Meds: B-blockers
 - Airway physiology – Mallampati



- Recent food intake is not a contraindication
 - Food intake should be weighed against urgency of the need for sedation

Types of Procedures

- Painful procedures – LP, laceration repair, joint reduction, difficult IVs
- Distressful procedures – foreign body removal, urethral catheter placement
- Non-painful procedures – imaging studies CT, MRIs, etc



Classes of Medications for PSA

- Analgesics – treat pain
 - Fentanyl, Morphine
- Anxiolytics – reduce anxiety
 - Midazolam
- Hypnotics – induce a sleep-like state
 - Propofol, Etomidate
- Dissociatives – block consciousness
 - Ketamine

Choosing the right sedative

- Type of procedure
- Duration
- Patient characteristics
- Pharmacology of the sedative
 - Advantages
 - Disadvantages
 - Potential adverse effects

Morphine

- Opiate – analgesia
- Morphine is the prototypical opioid analgesic agent to which all other opioids are compared
- Named after Morpheus – Greek god of dreams
- Extracted from opium from the seedpods of the Papaver somniferum poppy



Morphine

- Dose
 - IV/IM: 0.05 – 0.15 mg/kg
 - Titrate to effect (max 3 mg/kg)
 - Onset 5 – 10 minutes
 - Duration – 120 – 180 minutes



Morphine

- Advantages
 - Good pain relief
 - Long duration
 - Good for longer orthopedic procedures
 - Ubiquitous



Morphine

- Disadvantages
 - Hypotension – secondary to histamine release
 - Lasts a long time
 - Respiratory depression especially when combined with benzodiazepines
 - Nausea/Vomiting
 - Cardiovascular depression

Fentanyl

- Opiate – analgesic
- Synthetic opiate similar to morphine but has little to no effect on the release of histamine
- More potent than morphine
 - 100 mcg of fentanyl = 10 mg Morphine
- Shorter duration

Fentanyl

- Dosage
 - IV – 1 – 2 mcg/kg
 - Titrate 1 mcg/kg q 3 - 5 minutes
 - Onset – 1 – 5 minutes
 - Duration 30 – 60 minutes
 - IN – 2 mcg/kg



Intranasal

- Ideal volume for intranasal medication:
 - 0.3 mL per naris**
 - (max: 1 mL per naris)
 - Preload the syringe with 0.1 mL for dead space

Fentanyl

- Advantages
 - Rapid onset of analgesia
 - Minimal hypotension – of all the opiates, it induces the least amount of histamine release
 - Few cardiovascular effects

Fentanyl

- Disadvantages
 - Respiratory depression especially if used with benzodiazepines
 - Chest wall rigidity if given IVP especially in neonates

Midazolam

- Sedative - Anxiolytic
- Benzodiazepine potentiating GABA at the GABA_A receptor to open Chloride channels to hyperpolarize cells (neg inhibitory effect)



Midazolam dosage

- IV - 0.03 – 0.05 mg/kg
 - Onset 1 – 2 minutes with a duration 15 – 20 minutes
- IN - 0.3 mg/kg - 0.5 mg/kg
 - Onset 1 – 2 minutes with a duration 15 – 20 minutes
- IM 0.1 – 0.2 mg/kg
 - Onset 5 – 20 minutes with a duration 60 – 120 min
- PO/PR – 0.5 mg/kg
 - Onset 10 – 30 min with a duration of 60 – 120 min

Midazolam

- Advantages
 - Anxiolysis
 - Short acting
 - Reversible (Flumazenil)
 - Amnesia to the procedure

Midazolam

- Disadvantages
 - Hypotension (usually mild)
 - Respiratory depression when administered with opiates
 - Paradoxical agitation
 - Excessive sedation

Propofol

- Sedative Hypnotic
 - Similar to benzodiazepines, works through the GABA_A receptor
 - Dissolved in soybean oil
 - No analgesic effects



Propofol

- Dose
 - IV – 1 mg/kg
 - Titrate with additional 0.5 mg/kg aliquots
 - Onset – seconds (less than a minute)
 - Duration – 5 – 10 minutes
 - Infusion to maintain sleep
 - 100 – 150 mcg/kg/min

Propofol

- Advantages
 - Rapid onset
 - Short duration of action
 - Amnestic
 - Antiemetic
 - Great for procedures such as MRI or in combination with opiates for quick procedures

Propofol

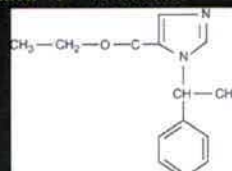
- Disadvantages
 - Hypotension
 - Bradycardia
 - Respiratory depression and apnea
 - Burns with infusion (can infuse lidocaine first)
 - Avoid in patients with egg/soy allergies

Etomidate

- Sedative/Hypnotic medication
- Imidazole derivative
- Similar to benzodiazepines, potentiates GABA effects at the GABA_A receptors leading to hyperpolarization and increased inhibitory neural tone

*Etomidate*

- Dose
 - IV - 0.15 mg/kg (half the induction dose)
 - Onset – seconds (less than a minute)
 - Duration - 5 – 15 minutes

*Etomidate*

- Advantages
 - Rapid onset
 - Brief duration
 - No histamine release
 - Stable hemodynamic profile
 - Minimal change in heart rate/blood pressure/respirations

Etomidate

- Disadvantages
 - Myoclonus – in up to 20% of patients
 - Usually brief but can be dramatic
 - Adrenal suppression
 - inhibits adrenal steroid synthesis primarily by blocking the activity of 11 β -hydroxylase
 - Questionable in the septic patient
 - Emesis

Ketamine

- **Dissociative Sedative**
 - NMDA receptor antagonist
 - Prevents higher centers from perceiving visual and auditory stimulation
 - Muscle tone (thus airway reflexes) maintained
 - Eyes open – nystagmus
 - Mu-receptor agonist (similar to opiates)
 - Provides analgesia

Ketamine Dosage

- **IV: 1 – 2 mg/kg**
 - May redose every 10 minutes with 1 mg/kg
 - Onset – 1 minute
 - Duration – 15 – 30 minutes
- **IM: 3 – 4 mg/kg**
 - Onset – 2 – 5 minutes
 - Duration – 15 – 30 minutes



Ketamine

- **Advantages**
 - Dissociative and analgesic
 - Wide therapeutic window
 - Bronchodilation
 - Increase BP and HR
 - May be neuro protective
 - Airway and respirations maintained

Ketamine

- **Disadvantages**
 - Hypersalivation
 - Emesis when waking up
 - Emergence Syndrome
 - Laryngospasm (0.4% incidence)
 - Possible increase in ICP and IOP
 - Hypertension and tachycardia



Rescue Agents

- **Atropine**
 - Hypersalivation with Ketamine
 - Bradycardia with Propofol
- **Flumazenil**
 - Benzodiazepine reversal
- **Naloxone**
 - Opioid reversal for respiratory depression



Atropine

- IV: 0.02 mg/kg
 - (min dose 0.1 mg, max 0.5 – 1 mg)
 - Onset – less than a minute
 - Duration 5 – 10 minutes

Flumazenil

- Competitive antagonist at the benzodiazepine receptor
- IV – 0.2 mg over 15 seconds
 - Onset – 1 – 2 minutes
 - Duration – 30 – 60 minutes
 - May repeat up to 1 mg
 - Don't use in patients with seizure disorder or chronic Benzo users because of potential of intractable seizures

Naloxone

- Naloxone, an opioid antagonist, has affinity for all three of the opioid receptors.
- IV 0.04 mg dose up to 2 mg
 - Onset 1 – 2 minutes
 - Duration – 20 – 40 minutes
- IM – 0.4 mg dose up to 2 mg
 - Onset - 2 - 10 minutes
 - Duration – 30 – 60 minutes



Cases

- 17 yo M soccer player who suffers an ankle fx dislocation with no PMH and no allergies

Case 1

- 17 yo M soccer player who suffers an ankle fx dislocation with no PMH and no allergies

Fentanyl/Propofol
Fentanyl/Midazolam

Case 2

- 4 yo F with a both bone forearm fracture that needs to be reduced

Case 2

- 4 yo F with a both bone forearm fracture that needs to be reduced

Ketamine
(IM first then place an IV)

Case 4

- 18 mo M with a laceration under his chin

Case 4

- 18 mo M with a laceration under his chin
 - Intranasal Midazolam
 - Ketamine for longer/complicated repair

Case 4

- 2 yo F needing sedation for a CT/MRI

Case 4

- 2 yo F needing sedation for a CT/MRI

Propofol

Summary

- There is no correct drug to use, only viable options.
- Need to consider the possible side-effects of the drug in relation to the procedure being performed.
- Separate provider for the sedation and the procedure
- Optimize Patient selection (ASA, Mallampati, last meal)

Experiences?



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