Pain Management in the Emergency Department

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Outline

• Pathophysiology and Psychology of Pain
• Assessing Pain
• Managing Pain
  – Systemic, Regional, Local
  – Special Situations
• Procedural Sedation
• Summary
Pathophysiology

Nociceptors

- First-order sensory neurons
- Cell bodies are located in dorsal root ganglia or trigeminal ganglia.
- Axons distributed throughout the body
- Concentrated in skin, periosteum, arterial walls, teeth, joint surfaces, and the dura
# Pathophysiology

Nociceptors: Two types of axons

<table>
<thead>
<tr>
<th>Axon</th>
<th>$A\delta$</th>
<th>$C$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Pain</td>
<td>Sharp, fast, somatic</td>
<td>Dull, slow, visceral</td>
</tr>
<tr>
<td>Prevalence</td>
<td>20%</td>
<td>80%</td>
</tr>
<tr>
<td>Conduction speed</td>
<td>5 to 30 m/s</td>
<td>0.5 to 2 m/s</td>
</tr>
<tr>
<td>Stimulus response</td>
<td>Thermal, mechanical</td>
<td>Chemical, thermal, and mechanical</td>
</tr>
</tbody>
</table>
Pathophysiology

Pathways

- Afferent axons transmit painful stimuli from the periphery to the central nervous system.
- Afferent axons synapse with second-order neurons in the dorsal horn above, below, or at the same level of entry.
- Second-order neurons cross the anterior commissure at several levels above to ascend the anterior spinothalamic tract to the brainstem and thalamus.
- The thalamus interprets the signals and sends them to the somatosensory cortex.
Pathophysiology

Modulation of Pain Signals

• Locations
  – Periaqueductal gray area
  – raphe magnus nucleus in the pons
  – pain inhibitory complex in the anterior horn

• Mechanisms
  – Inhibition by adjacent sensory neurons
  – Endogenous opioids
  – Neurotransmitters (norepinephrine, oxytocin, GABA)
Pathopsychology

Limbic lobe

- Emotional experience of pain
- subcallosal, cingulate, dentate, and parahippocampal gyri, and hippocampus
- Lobectomy eliminates the unpleasantness of pain but not the pain signal.
The Limbic System

- Septum pellucidum
- Indusium griseum
- Corpus callosum
- Anterior commissure
- Subcallosal area
- Paraterminal gyrus
- Amygdala
- Parahippocampal gyrus
- Cingulate gyrus
- Fornix
- Mamillary body
- Fimbria
- Hippocampus

Legend:
- **Limbic Gyrus**
- **Intralimbic Gyrus**
- **Fornix & Inner Arc**
Pathopsychology

Psychological Factors which Increase Pain

• Fearing pain
• Focusing on the pain
• Remembering pain
• Learning pain
• Expecting pain
• Capitulating to pain
• Somatiform pain disorders
Assessing Pain

• Pain is the most common chief complaint of patients presenting to the ED.

• Pain measurement is subjective and complex.

• Pain measurement is required at triage.
Assessing Pain

Numerical Rating Scale (NRS)

Visual Analog Scale (VAS)
Assessing Pain

• ED patients expect most of their pain to be relieved. About one-fifth of ED patients expect all of their pain to be relieved.

• On average, ED patients expect to receive pain medicine within 23 minutes of arrival but actually receive pain medicine within 78 minutes of arrival.

• Most patients who report adequate pain relief are satisfied with their care whereas only half of those who did not have their pain needs met were satisfied. Staff attitudes towards patient pain had similar affects.
Assessing Pain

Challenges

• Provider beliefs about pain in general

• Provider bias toward different types of patients

• Emergency department environment and culture
Managing Pain: Systemic Analgesia

- Multimodal
- Patient-specific
Managing Pain: Systemic Analgesia

Acetaminophen

• mild to moderate pain
• Analgesic: inhibits prostaglandin synthetase
• Antipyretic: hypothalamic thermal regulator
• Not anti-inflammatory
• Alone or in combination with other agents for headache, earache, back pain, dysmenorrhea, and musculoskeletal pain (considered drug of choice for osteoarthritis pain).
• Adverse reactions: hepatotoxicity with chronic use in patients with liver disease.
• Safest analgesic
Managing Pain: Systemic Analgesia

Acetaminophen

- 325-1000 mg (10-15 mg/kg pediatrics) po Q4-6h PRN
- Maximum 4 g/day
- Advantages: inexpensive, OTC, safe throughout pregnancy and lactation
- Disadvantages: short duration, no anti-inflammatory effect
Nonsteroidal Anti-Inflammatories (NSAIDs)

- Mild to moderate pain
- Analgesic, anti-inflammatory, and antipyretic (inhibits cyclooxygenase)
- Alone or in combination with other agents for musculoskeletal pain, headache, renal colic, gout, and back pain.
- Adverse reactions: gastrointestinal bleeding, renal toxicity, myocardial infarction, tinnitus, peripheral edema, hepatotoxicity, rashes, hypersensitivity reactions
Managing Pain: Systemic Analgesia

Nonsteroidal Anti-Inflammatories (NSAIDs)

- **Ibuprofen**
  - 400-800 mg (4-10 mg/kg pediatrics) po Q6-8h PRN
  - Maximum 3200 mg/day
  - Advantages: inexpensive, OTC, safe in early pregnancy and lactation
  - Disadvantages: short duration

- **Naproxen**
  - 250-500 mg (5-10 mg/kg pediatrics) po Q8-12h PRN
  - Maximum 1500 mg/day
  - Advantages: longer duration
  - Disadvantages: more expensive, contraindicated in pregnancy and lactation
Managing Pain: Systemic Analgesia

Nonsteroidal Anti-Inflammatories (NSAIDs)

- **Indomethacin**
  - 25-50mg po q8-12h PRN, 75mg extended release Q24h PRN
  - Maximum 200 mg/day
  - Advantages: inexpensive, effective, once-a-day dosing for chronic arthritides, acute gout, tendinitis, and bursitis
  - Disadvantages: increased risk of NSAID adverse effects, limited use in pediatrics

- **Celecoxib**
  - 100-200 mg po Q12h PRN
  - Maximum 400 mg/day
  - Advantages: longer duration, COX-2 (less GI irritation)
  - Disadvantages: expensive, contraindicated in pregnancy and lactation, limited use in pediatrics
Managing Pain: Systemic Analgesia

Nonsteroidal Anti-Inflammatories (NSAIDs)

• Ketorolac
  – 30-60 mg IM Q6h PRN (< 65 y, > 50 kg), Maximum 120 mg/day
  – 15-30 mg IV Q6h PRN (> 65 y, < 50 kg), Maximum 60 mg/day
  – 10mg po Q 4-6h PRN
  – Maximum recommended duration of therapy 5 days.
  – 0.5 mg/kg IM/IV Q6h (pediatrics > 6 m), Maximum duration 3 days.
  – Advantages: enteral and parenteral dosing, opioid strength without opioid adverse effects
  – Disadvantages: increased risk of renal toxicity with mild renal insufficiency, limited duration
Managing Pain: Systemic Analgesia

Opioids

- Indicated for moderate to severe pain
- Bind to opioid receptors in the central nervous system to suppress pain signals and alter thalamocortical interpretation of pain signals
- Exist as pure agonists (recommended) and agonist-antagonists (not recommended because analgesic effect is limited)
- Titratable to achieve adequate analgesia without dose limit.
- Adverse effects: respiratory depression, urinary retention and decreased intestinal motility, nausea and vomiting, histamine release, and potential for abuse and addiction
Managing Pain: Systemic Analgesia

Opioids

• Short to intermediate-acting indicated for acute pain control.

• Time to maximum analgesia
  – Oral: 60 to 90 minutes, significant first-pass hepatic metabolism necessitates higher dosing than for parenteral routes
  – Intramuscular: 30 minutes
  – Intravenous: 6 minutes

• Maximum pain control for any dose is achieved after 5 half-lives of scheduled dosing every 4 hours instead of PRN dosing.

• Longer acting, slow-release preparations indicated for prolonged treatment of chronic severe pain.
Managing Pain: Systemic Analgesia

Opioids

• Codeine
  – Mild to moderate pain
  – 15-60 mg po Q4-6h PRN (acetaminophen, caffeine)
  – Advantages: inexpensive, oral dosing, improved efficacy in combination with acetaminophen
  – Disadvantages: potent gastrointestinal adverse effects, drowsiness, and dizziness at subtherapeutic doses, requires metabolism to morphine for analgesic effect. 10% of the population cannot metabolize codeine to morphine well and experience only adverse effects.
Managing Pain: Systemic Analgesia

Opioids

• Hydrocodone
  – Moderate pain
  – 5-20 mg po Q4-6h PRN (acetaminophen or ibuprofen)
  – Metabolized to hydromorphone
  – Advantages: inexpensive, oral dosing, improved efficacy in combination with acetaminophen or ibuprofen, low gastrointestinal adverse effects
  – Disadvantages: causes more drowsiness and dizziness
Managing Pain: Systemic Analgesia

Opioids

• Oxycodone
  – Moderate to severe pain
  – Oral: 5-30 mg po Q4h PRN
  – Oral extended release: 10-160 mg po Q12h PRN
  – Advantages: inexpensive, oral dosing, strong opioid agonist, improved efficacy in combination with acetaminophen or aspirin, low gastrointestinal adverse effects
  – Disadvantages: causes more drowsiness, dizziness, headache, and nausea
Managing Pain: Systemic Analgesia

Opioids

• Morphine
  – Moderate to severe pain
  – 2.5-5 mg (0.05 mg/kg) IV Q 5-10 minutes. Titrate to effect. Repeat dosing every 2-4h PRN
  – 10 mg (0.15 mg/kg pediatrics) IM Q3-4h PRN
  – 10-30 mg po Q4h PRN
  – Advantages: first line opioid for acute severe pain in the ED, inexpensive, parenteral and enteral formulations, low toxicity, longer duration of action (4 hours)
  – Disadvantages: CNS toxicity with prolonged administration particularly in older patients, greater histamine release resulting in urticaria and hypotension
Managing Pain: Systemic Analgesia

Opioids

• Hydromorphone
  – Moderate to severe pain
  – 1 mg IV Q10 min. Titrate to effect.
  – 1-2 mg IM Q 3-4 h PRN
  – 2-8mg po Q3-4h PRN
  – Advantages: inexpensive, enteral and parenteral formulations, low gastrointestinal adverse effects, less drowsiness and delirium in older patients
  – Disadvantages: higher potential for abuse
Managing Pain: Systemic Analgesia

Opioids

• **Meperidine**
  – Not recommended for acute pain in the ED.
  – Poor bioavailability
  – Short duration of analgesia (2-3 hours)
  – Strong anticholinergic effects
  – Produces as much smooth muscle contraction as other opioids.
  – Normeperidine metabolite is highly toxic.
    • Half life of 24-48 hours
    • Blocks serotonin and norepinephrine reuptake
    • Stimulates CNS to cause delirium, hyperreflexia, and seizures
Managing Pain: Systemic Analgesia

Opioids

- Fentanyl
  - Preprocedural analgesia
  - 1 μg/kg IV Q3-5 minutes. Titrate to effect.
  - Oral Transmucosal 200 μg over 15 minutes.
  - Transdermal patch 12-100 μg/h
  - Advantages: less histamine release and hypotension, rapid onset (2-3 min) and short duration (30 min) well-suited for procedural analgesia,
  - Disadvantages: short duration requires continuous infusion in monitored setting for prolonged analgesia
Managing Pain: Regional Anesthesia

Peripheral Nerve Blocks

• **Advantages**
  – Require less local anesthetic thereby decreasing risk of systemic toxicity
  – Less painful to patient
  – Avoids tissue distortion produced by local anesthetic infiltration thereby facilitating cosmetic repair.

• **Disadvantages**
  – Require patient cooperation and participation.
  – Increased risk of toxicity from unintentional intravascular injection of local anesthetic or delayed absorption from interstitium.
  – Success is provider-dependent.
Managing Pain: Regional Anesthesia

Peripheral Nerve Blocks

Basic technique

• Perform in a monitored setting with resuscitative equipment readily available in the event systemic toxicity.

• Consider pre-medicating with a benzodiazepine or opioid to minimize anxiety or injection pain, respectively.

• Prepare the skin using antiseptic technique.
Managing Pain: Regional Anesthesia

Peripheral Nerve Blocks

Basic technique

• During needle insertion and localization, aspirate prior to injection of anesthetic to prevent intravascular infusion.

• Aim for perineural injection which produces mild, transient paresthesias and a successful peripheral nerve block.

• Avoid intraneuronal injection which produces intense, prolonged pain and ischemic nerve injury.
Managing Pain: Regional Anesthesia
Peripheral Nerve Blocks

- Radial Nerve
- Ulnar Nerve
- Median Nerve
- Digital Nerve
- Femoral Nerve
- Ankle Nerves (5)
- Intercostal Nerves
- Supraperiosteal dental
- Superior alveolar nerve
- Inferior alveolar nerve
- Infraorbital nerve
- Mental nerve
- Supraorbital nerve
Managing Pain: Local Anesthesia

Local Anesthetics

• Block sodium channels on nociceptor axons to prevent depolarization (transmission of pain signals)
• Weak bases (become less ionized as pH rises)
• Anesthetics which are more lipophilic, protein-binding, with a pKa closer to physiologic pH have faster penetration and potency.
• Alkaline environments favor rapid absorption.
Managing Pain: Local Anesthesia

Local Anesthetics

- Aromatic hydrocarbons bound to a tertiary amine by an amide or ester linkage.
- Esters are rapidly hydrolyzed in the plasma by pseudocholinesterase to para-aminobenzoic acid which can cause allergic reactions.
- Amides are slowly metabolized by the liver.

![Amide and Ester Structures](image-url)
Managing Pain: Local Anesthesia

**Topical Anesthetics**

- **Advantages**
  - Avoid pain of injection
  - Avoid tissue distortion of subcutaneous infiltration
  - Can be used on mucous membranes, non-intact skin, and intact skin

- **Disadvantages**
  - Limited anesthesia (3-5mm depth)
  - Delayed onset of action
Managing Pain: Local Anesthesia

Topical Anesthetics

• Mucous Membranes
  – Cocaine
    • 4% solution lasts 45 minutes
    • Maximum dose 3 mg/kg
    • Advantages: rapid onset, vasoconstrictor controls bleeding
    • Disadvantages: causes coronary artery vasospasm, hypertension, tachycardia, and has abuse potential
Managing Pain: Local Anesthesia

Topical Anesthetics

• Mucous Membranes
  – Lidocaine
    • 1% to 4% solution (epinephrine, phenylephrine)
    • 2% jelly
    • Maximum dose 5 mg/kg
    • Advantages: rapid onset, vasoconstrictor (epinephrine, phenylephrine) controls bleeding
Managing Pain: Local Anesthesia

Topical Anesthetics

• Intact Skin
  – EMLA (Eutectic Mixture of Local Anesthetics)
    • 2.5% lidocaine and 2.5% prilocaine in 1:1 ratio by weight
    • 2.5 g to 20-25 cm² skin, max 2g on 10 cm² skin
    • Advantages: painless application, safe, lasts 1-2 hours
    • Disadvantages: expensive, slow onset of action (1-2 hours), contact dermatitis, risk of methemoglobinemia in infants < 3 months of age
Topical Anesthetics

• Intact Skin
  – ELA-Max
    • 4% lidocaine cream in a liposomal matrix
    • 2.5 g to 20-25 cm² skin, max 2g on 10 cm² skin
    • Advantages: painless application, faster onset of action (30 minutes), safe for all ages,
    • Disadvantages: expensive
Managing Pain: Local Anesthesia

Topical Anesthetics

• Non-Intact Skin
  – **TAC** (tetracaine 0.5%, adrenaline 0.05%, cocaine 11.8%)
    • 5-10 mL applied to open wound and covered with gauze dressing for 10-20 minutes
    • Appropriate for scalp, face, and extremities.
    • Advantages: painless application, fast onset of action
    • Disadvantages: expensive, high risk of systemic toxicity, risk of ischemia at peripheral sites, contraindicated on mucous membranes, and has abuse potential
Managing Pain: Local Anesthesia

Topical Anesthetics
- Non-Intact Skin
  - LET (lidocaine 4%, epinephrine 0.1%, tetracaine 0.5%)
    - 1-3 mL gel or solution applied to open wound and covered with gauze dressing for 15-30 minutes
    - Appropriate for scalp, face, and extremities.
    - Advantages: inexpensive, painless application, fast onset of action, safe
    - Disadvantages: risk of ischemia at peripheral sites, contraindicated on mucous membranes
Managing Pain: Local Anesthesia

Subcutaneous Infiltration

• Advantages
  – Provides thorough anesthesia of infiltrated field
  – Fast onset of action
  – Can be combined with vasoconstrictors to enhance hemostasis and prolong duration.

• Disadvantages
  – Painful infiltration
  – Dose limited by risk of systemic toxicity
Managing Pain: Local Anesthesia

Subcutaneous Infiltration

• Techniques to decrease pain of infiltration
  – Buffering with sodium bicarbonate
    • 1:10 ratio by volume to lidocaine
    • 1:50 ratio by volume to bupivicaine
  – Pre-application of topical anesthetic
  – Local massage of tissue prior to needle puncture
  – Using a small needle (27-30 gauge)
  – Injecting through inner wound edge instead of adjacent intact skin.
  – Slow infiltration of anesthetic (30 seconds/ mL)
  – Proximal to distal direction of infiltration
Managing Pain: Local Anesthesia

Subcutaneous Infiltration

- Lidocaine
  - Most commonly used, amide
  - 1% to 2% solution with a pH of 6.5 and pKa or 7.9.
  - Onset 4-7 minutes with 90 minute duration.
  - Maximum dose 3-5 mg/kg up to 300mg.
  - Epinephrine delays onset of action, prolongs duration to 3.5 hours, decreases bleeding, and decreases systemic absorption permitting maximum dose of 7mg/kg.
  - Advantages: inexpensive, safe, fast onset of action
  - Disadvantages: epinephrine contraindicated at peripheral sites
Managing Pain: Local Anesthesia

Subcutaneous Infiltration

• Bupivacaine
  – 0.25% to 0.5% solution
  – High pKa, therefore delayed onset of 20 minutes.
  – 3-6 hour duration because of high protein binding.
  – Maximum dose 2-2.5 mg/kg without epinephrine.
  – Maximum dose 3-3.5 mg with epinephrine.
  – Maximum dose 400 mg in 24 hours
  – Advantages: inexpensive, long duration
  – Disadvantages: slow onset, high risk of systemic toxicity, epinephrine contraindicated at peripheral sites
Managing Pain: Special Situations

• Lower Back Pain
• Migraine headaches
• Acute Abdominal Pain
• Biliary colic
• Renal colic
• Sickle Cell Disease
Managing Pain: Special Situations

Lower Back Pain

• Roughly 70% lifetime incidence
• Most patients improve in 6-12 weeks
• Relapses within 1 year common
• 5% of patients develop chronic pain
Managing Pain: Special Situations

Lower Back Pain

• Exclude etiologies with potential for acute death and disability (AAA, infections, fracture, neoplasm)
• Manage expectations
• Drug Therapy
  – NSAIDS have proven efficacy.
  – Acetaminophen/opioid combinations have more adverse effects.
  – Muscle relaxants are not much better than NSAIDS alone but have increased adverse effects. Use selectively.
• Instruction to maintain physical activity increases the speed of recovery, decreases pain, and minimizes disability.
• Temperature therapy offers a mild improvement in pain.
• Spinal manipulation has demonstrated little to no benefit in randomized controlled trials.
Managing Pain: Special Situations

Migraine headaches

• Antiemetics (dopamine antagonists)
  – Metoclopramide intravenous efficacy 50-90%, oral efficacy 30-50%. Better than NSAIDS and ergotamine, as good as sumatriptan.
  – Prochlorperazine reported to be better than metoclopramide.
  – Chlorpromazine is effective but has significant adverse effects.

• NSAIDS
  – Ketorolac efficacy is 55-85%.
Managing Pain: Special Situations

Migraine headaches

• Ergot alkaloids
  – Dihydroergotamine (DHE) binds to serotonin receptors to inhibit neurogenic inflammation.
  – Efficacy is 23-93%.

• Triptans
  – Bind to 5-hydroxytryptamine serotonin receptor to cause cranial vasoconstriction, trigeminal nerve inhibition.
  – Can be taken orally (efficacy 30-60%), intranasally, or subcutaneously (efficacy 70%).

• Opioids
  – Recommended only as a rescue medication when others fail.
Managing Pain: Special Situations

Undifferentiated Acute Abdominal Pain

• Judicious use of parenteral opioid analgesia is indicated for acute undifferentiated abdominal pain.

• Multiple randomized, controlled trials have demonstrated that titrated parenteral opioid administration to patients with acute undifferentiated abdominal pain did not decrease diagnostic accuracy or cause any bad outcomes.

• In some instances, opioid analgesia increased diagnostic accuracy and decreased the number of unnecessary operations.
Biliary colic

- Morphine is better than meperidine for biliary colic.
- All opiates cause constriction of the sphincter of Oddi.
- Meperidine has been shown to raise common bile duct pressure 14% more than morphine.
- Meperidine has toxic metabolites which excite the CNS via its anticholinergic properties.
Managing Pain: Special Situations

Renal colic

• NSAIDS
  – Recommended as a first-line drug for renal colic.
  – Ketorolac is more efficacious than meperidine.
  – Avoid use when renal insufficiency exists.

• Opiates
  – Recommended as second-line medications.
Managing Pain: Special Situations

Sickle-cell Vaso-occlusive Crisis

• Multiple ED visits raises concerns for drug-seeking behavior, but the current standard requires the physician to treat pain as reported by the patient.

• Oxygen therapy (50%) significantly reduces reversibly sickled cells but has not been shown to reduce pain or hospitalization.

• Intravenous fluid hydration has not been shown to relieve pain but may help with impaired renal function.
Managing Pain: Special Situations

Sickle-cell Vaso-occlusive Crisis

- **Opioids**
  - Morphine and hydromorphone are recommended over meperidine.
  - Intravenous is recommended over intramuscular because it is easier to titrate, quicker to relieve, and less painful to receive.
  - PCA is preferred method of administration because it provides more controlled delivery of pain medication while requiring less frequent assessment by nurses and physicians.
Procedural Sedation

Goals

• Minimize pain.
• Decrease anxiety.
• Control patient position and responsiveness.
• Preserve baseline airway, breathing, and circulation.
Procedural Sedation

Levels of Sedation

• Minimal
  – Patient responds to verbal commands but has impaired cognition.
  – Baseline airway and ventilation maintained.

• Moderate
  – Patient responds to verbal commands with mild physical stimulus.
  – Baseline airway and ventilation maintained.

• Deep
  – Patient responds purposefully only to vigorous stimulation.
  – Intermittent airway and ventilatory support may be required.
Procedural Sedation

Important Considerations

• Pre-procedural fasting state (if possible)
• Current medications (or drug abuse) and allergies.
• Family history of anesthesia reactions.
• Co-morbid illness.
• Current State of airway, lungs, and heart.
• Equipment, resources, and personnel.
<table>
<thead>
<tr>
<th>ASA Class</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Normal health</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Mild systemic disease</td>
<td>Mild asthma, controlled diabetes</td>
</tr>
<tr>
<td>III</td>
<td>Severe systemic disease</td>
<td>Pneumonia, moderate to severe asthma, poorly controlled diabetes</td>
</tr>
<tr>
<td>IV</td>
<td>Severe systemic disease, constant threat to life</td>
<td>Severe CHF (LVEF &lt; 15%)</td>
</tr>
<tr>
<td>V</td>
<td>Critically ill patient</td>
<td>Septic shock, Severe trauma</td>
</tr>
</tbody>
</table>

Class I and II: good candidates for ED procedural sedation
Classes III, IV, and V: not good candidates for ED procedural sedation
Procedural Sedation

Airway: Mallampati Class

Class I

Class II

Class III

Class IV
Procedural Sedation

Equipment, Resources, and Personnel

• Monitoring: EKG, Pulse oximetry, End-tidal CO2
• Bag valve mask, oral and nasal airways, intubation equipment, suction, etceteras.
• Code cart with ACLS and RSI meds and defibrillator nearby.
• Nursing support.
• Physician proficient with ACLS and RSI.
### Procedural Sedation

#### Common Medications: Rapid Onset/Offset, Reversible

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Therapeutic Effects</th>
<th>Adverse Effects</th>
<th>Contraindication</th>
</tr>
</thead>
<tbody>
<tr>
<td>ketamine</td>
<td>1-2 mg/kg IV or IM</td>
<td>Dissociative sedation, analgesia, bronchodilation</td>
<td>Hypersalivation, Laryngospasm, hallucinations elevates ICP</td>
<td>elevated ICP</td>
</tr>
<tr>
<td>Propofol</td>
<td>1mg/kg bolus Then 0.5mg/kg Q 1 min</td>
<td>Rapid onset and offset, No analgesia</td>
<td>Hypotension, Laryngospasm, bronchospasm</td>
<td>Mitochondrial disorder, Egg, sulfite, soy allergy</td>
</tr>
<tr>
<td>midazolam</td>
<td>0.05-0.2mg/kg IV 0.1-0.2mg/kg IM</td>
<td>Anxiolysis, Amnesia, No analgesia</td>
<td>Airway compromise, hypoxemia</td>
<td>Pregnancy, Lactation, glaucoma</td>
</tr>
<tr>
<td>fentanyl</td>
<td>1-2mg/kg IV or IM</td>
<td>Rapid analgesia, Reversible with naloxone</td>
<td>Respiratory depression, Vomiting, hypotension</td>
<td>Severe respiratory disease, elevated ICP</td>
</tr>
</tbody>
</table>
Summary

• Pain has a physical and psychological components, both of which need to be addressed by the practitioner.
• Pain management needs to be multimodal and patient-specific.
• The adequacy of pain control is best determined by the patient, not the doctor or the disease process.
• Procedural sedation is indicated for anxiety-provoking, painful procedures which require patient cooperation to be successful.
References
