

PAIN PODCAST SHOW NOTES:

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An overview of ED visits published in 2011 by the Healthcare Cost and Utilization Project listed head injury, open wounds, non-specific chest pain, abdominal pain and back pain as the most common complaints among discharged patients so it's safe to say ED docs are frequently responsible for managing pain. We're not going to cover every analgesic under the sun but will cover the most used analgesics in the ED and some cutting-edge pain relievers.

KETAMINE:

Ketamine is especially useful for patients with allergies to certain analgesics, severe pain and low blood pressures which limits the use of opioids. A study by Dr. Sergey Motov et al published in the Annals of Emergency Medicine in September 2015 demonstrated that ketamine 0.3mg/kg has similar, and sometimes better, pain relief when compared to morphine 0.1mg/kg in the ED. Analgesic dosing of ketamine is 0.3mg/kg diluted in 100mls of NS given as a drip over 10 minutes. If the patient begins to experience dysphoria simply turn off the drip. The half-life is only 15-30 minutes so the symptoms should resolve quickly. There are side effects however. One of the most well renowned is psychoperceptual effects. Since ketamine is profoundly lipophilic it rapidly crosses the blood brain barrier, saturating N-M-D-A receptors. The "bad trip" side effects of ketamine are directly related to the time of administration- slower the drip, less likely the chance of a bad trip. And remember! Before using ketamine drips you should check with your department policies about ketamine use.

LIDOCAINE:

Our colleagues have been using IV lidocaine for some time in the PACU setting and there's been a surge of renal literature regarding use for renal colic. Recent 2016 literature from The American Journal of Emergency Medicine demonstrated IV lidocaine can be used safely in the emergency department. The dose of IV lidocaine for analgesia is 1.0-1.5 mg/kg slow push over 10-15 minutes, which can be achieved by adding the initial bolus into a 100ml bag of normal saline. It's important to remember that lidocaine has a narrow therapeutic window. Toxicity can have catastrophic effects, including cardiac arrest. Luckily, toxicity symptoms occur in a very predictable manner. First, the patient will experience a metallic taste, tinnitus and lightheadedness. These symptoms

will continue to unconsciousness, seizure and eventually cardiovascular collapse. Fortunately, the **CNS** symptoms precede the **cardiovascular** symptoms as cardiovascular collapse requires almost twice the concentrations of lidocaine, providing the opportunity to stop the medication.

CODEINE:

About 10% of codeine is demethylated to morphine by the liver so codeine. Some people are hypermetabolizers, resulting in a large influx of morphine. This and other issues prompted the FDA to release a warning against the use of codeine in patients under the age of 12 as well as some patients with certain genetic factors, obesity and sleep apnea in April 2017. This warning also includes breastfeeding mothers due to concerns about codeine in breastmilk and effects in the infant. The American Pain Association recommends codeine 30-60mg PO every four hours as needed for pain. This is usually prescribed in the form of Tylenol #3.

TRAMADOL:

Tramadol has the same FDA warning against use in minors and breastfeeding mothers. It has been known to reduce the seizure threshold making it a poor choice for patients with seizure disorders and those on other medications that reduce the seizure threshold such as bupropion. Tramadol can also lead to increased INRs, limiting use in patients on Warfarin. Additionally, tramadol has some norepinephrine and serotonin reuptake inhibition and should not be used in patients on similar psychiatric medications or other substances which can cause serotonin syndrome such as dextromethorphan. Dosing for this weak mu agonist in adults is 50-100 mg tablet PO every 4 to 6 hours.

MORPHINE:

A naturally occurring opioid and a mu receptor agonist acting on the central nervous system. Sometimes patients need pain relief before an IV can be established, in adults, morphine can be given subcutaneous at doses of 5-10 mg as needed every four hours. Subq dosing can lead to local irritation and is not the preferred route. IM administration is no longer recommended due to irritation and variable absorption. While subq dosing is an option, IVP is the more typical and preferred route. In the opioid naive adult doses range from 2mg-10mg IVP. Occasionally, we may need to use morphine for pain control in the pediatric population. Infants less than six months, the dose of 0.025-0.03 mg/kg/dose IVP or subcutaneous dosing may be given every 2 to 4 hours as needed. Extreme caution should be used with infants less than 3 months of age as they are more prone to respiratory depression. Older pediatric patients less than 50kg should receive 0.05 mg/kg/dose or, alternatively, 0.1-0.2 mg/kg/dose every 2 to 4 hours as needed. Children greater than 50 kg should receive 2-5 mg every 2 to 4 hours as needed. Caution, as morphine may cause respiratory depression and hypotension.

Hydromorphone, Brand Name DILAUDID

Hydromorphone or, more affectionately known as, “The one that starts with a D.” Adult dosing is 0.2-1.0 mg every 2 to 3 hours as needed. Generally, hydromorphone is not recommended in the pediatric population. Both morphine and Dilaudid can cause respiratory depression and hypotension.

FENTANYL:

Less likely than other medications to cause a drop in blood pressure making it useful for patients with pain and borderline blood pressure or hypotension. Dosing for fentanyl is slow IV administration: 25 to 35 mcg (based on ~70 kg patient) or 0.35 to 0.5 mcg/kg every 30 to 60 minutes as needed for adults. If the patient does not have relief and side effects are minimal, this dose may be repeated after five minutes. Generally speaking, this medication is not appropriate for pediatrics.

ACETAMINOPHEN or APAP commonly referred by its brand name Tylenol:

The exact mechanism of action of Tylenol is not known. It is primarily metabolized by the liver so caution should be used in patients with underlying liver pathology or alcoholics. Acetaminophen is dosed 650 mg tablets by mouth every four to six hours or 1000mg tablet by mouth every 6 hours in adults. 650mg suppositories can be given rectally every 4 to 6 hours in adults. Pediatric dosing is 10-15 mg/kg every 6 to 8 hours, not to exceed 60mg/kg/day. IV acetaminophen can be dose at 12.5 mg/kg every 4 hours or 15 mg/kg every 6 hours in patients less than 50kg; maximum single dose: 15 mg/kg/dose (≤ 750 mg/dose); maximum daily dose: 75 mg/kg/day (≤ 3.75 g/day). Daily dose should not exceed 4 grams. Unfortunately, the price tag on the IV formulation is pretty obscene so it's not commonly used.

NSAIDs:

NSAID stands for non-steroidal anti-inflammatory drug, which work by **inhibiting** the cyclooxygenase (COX) enzymes, which convert arachidonic acid to prostaglandin, relieving pain and fever.

-Ibuprofen dosing is 400-800mg tablets PO every 6 to 8 hours. In the pediatric population greater than six months of age, the dosing is 10 mg/kg every 4 to 6 hours. The maximum allowed per dose is 400mg and daily use should not exceed 40 mg/kg per day or 1200mg. Due the mechanism of action, ibuprofen can irritate the stomach and long-term use can lead to gastritis and ulcers. Caution should be used in patients on chronic steroids, those with diagnosed peptic ulcer disease, and alcoholics.

-Naproxen can be dosed at 500mg every 12 hours, making compliance a little easier. Alternatively, patients can take 250mg every 6 to 8 hours. Daily doses should not exceed 1,250mgs on day **one** and 1,000 mg on **subsequent** days.

-IV or IM ketorolac. Current FDA dosing guidelines are 30 mg IVP and 60 mg IM for patients less than 65 years of age. Ketorolac for pediatrics is dosed at 0.5 mg/ kg not to exceed 15mg IV or 30mg IM. Ketorolac is not for use in patients less than 6 months of age. **However**, ketorolac has a number of negative side effects including nausea, vomiting, gastrointestinal bleeding and renal insufficiency. Like many drugs, higher doses increase the risks of these side effects. A **recent** 2016 paper in Annals of Emergency Medicine by Motov et al compared single dosing IV ketorolac at 10, 15 and 30mg IV and did not find a significant difference in pain relief between the three, suggesting that the ketorolac ceiling may be 10mg IV. As with most medications, the negative side effects of ketorolac are dose related so we should give the lowest dose possible.

Analgesic	Dosage	Some of the Side Effects & Contraindications	Comments
Ketamine	1.5 to 2.0 mg/kg IV in children 1.0-1.5 mg/kg IV in adults, administered over 30 to 60 seconds OR 4-5mg/kg IM OR 0.3mg/kg diluted in 100mls of NS giveN as a drip over 10 minutes	Psychoperceptual effects Age under 3 months	Avoid if concern for increased intracranial pressures or if tachycardic
Lidocaine	1-1.5 mg/kg slow push over 10- 15 minutes, which can be achieved by adding the initial bolus into a 100ml bag of normal saline	Metallic taste, tinnitus, lightheadedness, altered mental status, <i>seizure</i> cardiovascular collapse Avoid in WPW patients, renal or hepatic impairment	CNS symptoms precede the cardiovascular
Codeine	30-60mg PO every four hours		Avoid in those under the age of 12, or those with certain genetic factors, obesity or sleep apnea. Caution in breastfeeding mothers.
Tramadol	50 to 100 mg tablet PO every 4 to 6 hours	Lowers the siezure threshold. Avoid in patients on psychiatric medications or other substances which	Can also lead to increased INRs, limiting use in patients on Warfarin

		can cause serotonin syndrome such as dextromethorphan.	
Morphine	<p>Adults: Subcutaneous 5-10 mg as needed every four hours 2mg to 10mg IVP</p> <p>Children: <50kg: 0.05 mg/kg/dose or 0.1-0.2 mg/kg/dose every 2 to 4 hours PRN >50 kg: 2 to 5 mg every 2 to 4 hours PRN Infants < 6 months: 0.025-0.03 mg/kg/dose IVP or SubQ every 2 to 4 hours as needed.</p>	Hypotension, respiratory depression, especially in those less than 3 months of age	
Hydromorphone	Adult: 0.2-1 mg every 2 to 3 hours as needed	As above	Generally not recommended for pediatric patients in the ED
Fentanyl	Adult: 0.35-0.5 mcg/kg every 30 to 60 minutes PRN	As above	Less likely to cause hypotension or respiratory depression than morphine, dilaudid
Acetaminophen	<p>Adults: PO/rectal: 650 mg tablets by mouth every four to six hours *not to exceed 4g/day</p> <p>Pediatrics PO/rectal: 10-15 mg/kg every 6 to 8 hours, not to exceed 60mg/kg/day IV: <50kg, 12.5 mg/kg every 4 hours or 15 mg/kg every 6 hours max single dose: 15 mg/kg/dose (≤ 750 mg/dose); max daily dose: 75 mg/kg/day (≤ 3.75 g/day)</p>	Hypersensitivity reaction, hepatotoxicity	
Ibuprofen	<p>Adult: 400 to 800mg tablets PO every 6 to 8 hours.</p> <p>Peds: >6mo: PO/rectal 10 mg/kg every 4 to 6 hours. Max dose 400mg, daily use should not exceed 40 mg/kg per day or 1200mg</p>		Caution in recent MI Caution in those with bleeding disorder or bleeding ulcer

Naprosyn	Adult: 500mg every 12 hours, making compliance a little easier. Alternatively, patients can take 250mg every 6 to 8 hours. Daily doses should not exceed 1,250mgs on day one and 1,000 mg on subsequent days.		As above
Ketorolac	Adult: 10, 15, 30mg IM/IV		As above

References:

1. **Intravenous Subdissociative-Dose Ketamine Versus Morphine for Analgesia in the Emergency Department: A Randomized Controlled Trial** Motov, Sergey et al. Annals of Emergency Medicine , Volume 66 , Issue 3 , 222 - 229.e1
2. **Clinical practice guideline for emergency department ketamine dissociative sedation: 2011 update.** Green SM et al. Ann Emerg Med. 2011;57:(5)449-61. PMID: [21256625](https://pubmed.ncbi.nlm.nih.gov/21256625/)
3. **3. Does lidocaine as an adjuvant to morphine improve pain relief in patients presenting to the ED with acute renal colic? A double-blind, randomized controlled trial.** Firouzian, Abolfazl et al. The American Journal of Emergency Medicine, Volume 34 , Issue 3 , 443 - 448
4. <https://www.fda.gov/Drugs/DrugSafety/ucm085729.htm>
5. <http://painassociation.org/>
6. **Comparison of Intravenous Ketorolac at Three Single-Dose Regimens for Treating Acute Pain in the Emergency Department: A Randomized Controlled Trial.** Motov, Sergey et al. Annals of Emergency Medicine , Volume 70 , Issue 2 , 177 - 184