7-15-2018

Systemic Lidocaine as an Analgesic Technique in the Perioperative Setting

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SYSTEMIC LIDOCAINE INFUSION AS AN ANALGESIC TECHNIQUE IN THE PERIOPERATIVE SETTING

by

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Bachelor of Science in Nursing, University of North Dakota, 2012

An Independent Study

Submitted to the Graduate Faculty

of the

University of North Dakota

in partial fulfillment of the requirements

for the degree of

Master of Science

Grand Forks, North Dakota

December

2018

PERMISSION

Title Systemic Lidocaine as an Analgesic Technique in the Perioperative Setting

Department Nursing

Degree Master of Science

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ABSTRACT

Title: Systemic Lidocaine Infusion as an Analgesic Technique in the Perioperative Setting

Background: Systemic lidocaine has been hypothesized as a tool for the reduction of narcotic use in surgical patients. As opioid addiction continues to rise, anesthesia professionals continue to search for new methods of pain control through alternative modalities. It remains unclear how large of a role, if any, systemic lidocaine should take as perioperative analgesic.

Purpose: This literature review will examine existing evidence to determine effectiveness of pain control and practice recommendations for the use of systemic lidocaine as it applies to a specific case study involving a woman receiving an anterior cervical discectomy and fusion.

Process: A literature review was conducted using Cochrane, CINAHL, and MEDLINE databases through the University of North Dakota Health Sciences Library. Randomized controlled trials were included as well as systemic reviews provided they were within the last 10 years and applied to the perioperative setting.

Results: The role of systemic lidocaine as an analgesic in the perioperative setting remains unclear. Trials conducted within several surgical populations did provide evidence of pain reduction with lidocaine infusion. However, study methods varied between each trial. More research is needed, with a more uniform methodology, to make actionable practice recommendations.

Implications: Systemic lidocaine may be a useful tool in the reduction of pain within the surgical population while also reducing or possibly eliminating the use of narcotics when combine with other modalities. This could better control pain in the surgical patient, reduce complications, and increase patient satisfaction.

Keywords: Lidocaine, Intraoperative, Perioperative, Intravenous, Systemic, Infusion, Pain, analgesia.

Systemic Lidocaine as an Analgesic Technique in the Perioperative Setting

Recently, efforts have been made within the anesthesia community to reduce opioid use in the perioperative setting. It has long been known that opioids, while effective at managing acute pain, come with a host of undesirable side effects and large potential for addiction and abuse. Intravenous lidocaine infusion within the perioperative setting has been proposed as an opioid-sparing analgesic and one possible tool within a range of multimodal pain control techniques that could be used to reduce opioid use. The purpose of this paper is to perform a literature review to evaluate the effectiveness of systemic lidocaine in the operative setting on reduction of pain.

Case Report

The patient was a 71-year-old, 55 kg, 163 cm tall, female scheduled for a C5-C6 anterior cervical discectomy with a C5 corpectomy and C4-C6 fusion. She presented with numbness and pain to her upper extremities. The patient's medical history included hypertension, COPD, lumbar stenosis, diabetes mellitus, degenerative disc disease, arthritis, cervical cancer, depression, and anxiety. Her surgical history included a total hip arthroplasty, lumbar fusion, carpal tunnel release, appendectomy, and cataract extraction. She was an everyday smoker with a 55 year pack history, suffering from moderate COPD, with an exercise tolerance of two to three METS. She did not require home oxygen and denied any chest pain at rest or with activity. The patient's airway was a Mallampati two with adequate interincisor and thyromental distances and limited range of motion. She was given an ASA physical status classification 2. Following the preoperative anesthetic evaluation, and anesthetic plan for a general anesthetic with an oral endotracheal tube using video laryngoscopy was developed for the patient.

The patient arrived in the operating room at and was placed on standard monitors with the addition of an arterial line with blood pressure monitoring, which was placed while the patient was awake. A dexmedetomidine infusion was started after monitors were applied with a 0.5 mcg/kg bolus over 10 minutes, and followed with a 0.5 mcg/kg/hr infusion. Ketamine 20 mg was given during multiple attempts with arterial line insertion. A lidocaine infusion was started at 2 mg/min prior to induction. Induction medications included another ketamine 30 mg, Propofol 70 mg, rocuronium 30 mg, and esmolol 50 mg. The patient was intubated using video laryngoscopy, with head midline and neutral, and an endotracheal size 7 tube was visualized through the glottic opening with bilateral breath sounds heard. Blood pressure increased roughly 10% in response to intubation and laryngoscopy. Sevoflurane was maintained at 0.5-0.7 MAC with 45% FiO2 and two liters of fresh gas flow, utilizing volume controlled ventilation. A phenylephrine infusion was started and titrated to keep mean arterial pressure greater than 90 mmHg per surgeon request. Following incision, heart rate increased from 60-70 beats per minute to 80-90 beats per minute. Lidocaine infusion was increased to 3 mg/min at this time. The heart rate returned to normal roughly ten minutes later.

The patient remained stable throughout the procedure. Paralytic was antagonized with neostigmine 2.5 mg, paired with glycopyrrolate 0.5 mg. Sevoflurane was stopped. The lidocaine and dexmedetomidine infusions were stopped 13 minutes prior to extubation. The patient was extubated with minimal coughing or change in vital signs. Upon arrival to the recovery area, the patient reported that she had pain but was unable to rate pain. She rested comfortably for 30 minutes before she became more alert. At 45 minutes postoperatively, she rated her pain 3/10 with an acceptable pain score of 5/10.

Literature Review

Background

Pain control, intraoperatively and postoperatively, is a vital component of an anesthesia professional's anesthetic plan. Traditionally, narcotics have had a large role in pain control within this setting. However, new modalities of pain control warrant investigation as a reduction in narcotic use could potentially reduce side effects, abuse, and dependence. Systemic lidocaine is one such tool that has been hypothesized to reduce narcotic load in the operative setting while controlling intraoperative and postoperative pain. This literature review will focus on lidocaine infusions in the perioperative setting and the effect on pain.

Literature Search

The literature review was conducted utilizing several databases through the University of North Dakota Library of the Health Sciences. The CINAHL database was searched with the key words, "intravenous, lidocaine, intraoperative". Results were limited to the last 10 years. This search produced in 26 results with 5 eventually being included in the literature review. The Cochrane database of systemic reviews was searched using the same keywords, which produced a systemic review pertinent to the topic. From these sources, trials were searched for directly by name and author using PubMed and MEDLINE with 5 more being included in this way.

Pain Pathway

The pain pathway is a complex interaction between ascending and descending neuronal pathways, affected by many chemical mediators. Nociceptors are the receptors that respond to painful stimuli in tissue. These receptors can be sensitized by inflammatory mediators such as prostaglandins, cytokines, and bradykinins. Painful stimuli is primarily conducted via A-delta and C afferent nerve fibers. A-delta fibers are myelinated and responsible for sharp pain and pain

reflexes. C fibers are unmyelinated and responsible to dull pain, often related to visceral pain. Sodium channels are responsible for conduction along the axon. Both fibers synapse to secondary afferent neurons in the dorsal horn of the spinal column. It is at this level that modulation can occur, increasing or decreasing threshold for secondary afferent neurons. N-methyl-D-aspartate receptors are one such modulator, which respond to glutamate released from stimulated C fibers, causing sensitization of the secondary neurons (Almeida, Roizenblatt, & Tufik, 2004). Pain is further modulated at the spinal column via a descending pathway. Descending pathways can be either inhibitory or excitatory. Once threshold is met at the secondary afferent neuron, depolarization is communicated to one of several locations in the brain.

Lidocaine

Lidocaine is a local anesthetic of the amide group. Which is to say, lidocaine has an amide linkage rather than an ester link between the lipophilic benzene ring and the hydrophilic amine group. As a local anesthetic, its mechanism of action is the blockade of sodium channels within neurons, preventing depolarization and neuronal transmission (Eipe, Gupta, & Penning, 2016). The volume of distribution of lidocaine is large when given systemically and it is 60% bound to plasma proteins. As a result, continuous infusion, without a bolus dose, can take 4-8 hours to reach steady state (Eipe, Gupta, & Penning, 2016). There is also a temporary 40% first pass effect via the lungs. Lidocaine undergoes hepatic metabolism with a half-life of 1.5 hours (Oliveira, Issy, & Sakata, 2010). Systemic lidocaine has a narrow therapeutic index, with toxicity occurring at 5 mcg/ml plasma concentration and therapeutic levels ranging from 2-3.5 mcg/ml (Eipe, Gupta, & Penning, 2016). However, systemic lidocaine is well studied, with a predictable

dose response curve and metabolism (Eipe, Gupta, & Penning, 2016; Oliveira, Issy, & Sakata, 2010).

Systemic lidocaine provides sodium channel blockade, NMDA blockade, and substance P reduction. With blockade of sodium channels, lidocaine can inhibit conduction of A-delta and C nerve fibers. This sodium channel blockade also reduces the hyperactivity created by the pain feedback mechanisms. Lidocaine also reduces glutamate activity at NMDA receptors of the dorsal horn. Lidocaine's anti-inflammatory properties are thought to be related to its effect on G protein-coupled receptors to reduce free radicals, secretion of cytokines, and neutrophil sensitization (Oliveira, Issy, & Sakata, 2010). The combination of these actions does seem to provide some nociceptive pain relief but excels at visceral pain relief and reduction/prevention of hyperalgesia.

A randomized controlled trial in 2013 by Farag et al. examined the efficacy of lidocaine infusions on a similar population. In this study 116 adults having complex spine surgery were randomly placed into a lidocaine or placebo group. The lidocaine was started with induction of anesthesia at 2 mg/kg/hr and discontinued upon discharge from the PACU. In both groups, no narcotics were used intraoperatively, with beta-blockers used to control heart rate and blood pressure. Patients were given patient-controlled analgesia pumps with morphine in PACU. Pain scores and PACU narcotic use was measured in the two groups. Pain scores, based on a zero to ten scale, were roughly one point lower on average in the lidocaine group and morphine use was roughly 20 mg lower on average. Based on their results, the researchers were able to conclude that lidocaine is effective at producing intra-operative and post-operative pain control for this patient population.

A randomized controlled trial by Koppert et al. (2004) examined lidocaine infusion intraoperatively versus placebo and post-operative patient-controlled analgesia pump (PCA) usage. Forty patients were tested with twenty in the lidocaine group and twenty in the placebo group. All the patients tested were receiving a major abdominal surgery. The lidocaine group received a bolus injection of 1.5 mg/kg followed by an infusion of 1.5 mg/kg/hr of lidocaine, which was started 30 minutes prior to incision. Patients were placed on PCA pumps with morphine in the post-operative setting and usage was monitored for three days. The lidocaine group used a significantly lower amount of morphine with the greatest reduction occurring on the third day post-operatively. The researchers go on to discuss that perhaps the reduction in narcotic on day three is a reduction in central hyperalgesia.

Kim et al. (2013) performed a randomized controlled trial observing the effect of intraoperative lidocaine infusion on postoperative pain score and PCA usage. This study included 34 patients receiving a laparoscopic assisted distal gastrectomy which were split into a lidocaine group and a placebo group. Researchers were blinded to grouping. The lidocaine group received a 1.5 mg/kg bolus of systemic lidocaine followed by a 2 mg/kg/hr lidocaine infusion. The placebo group received the same volume of saline. General anesthesia with an endotracheal tube was performed using thiopental, rocuronium, and sevoflurane. No other analgesics or narcotics were given intraoperatively. Postoperatively, a Fentanyl PCA was provided and pain scores were assessed every fifteen minutes. The two groups were compared and a significant reduction in PCA use and pain scores was found in the lidocaine group. This disparity between the groups was most evident within the first twelve hours postoperatively. This study further suggests that there is an analgesic effect of systemic lidocaine in abdominal surgeries. However, Kim et al. did not compare lidocaine to the traditional narcotic technique.

Kuo et al. (2006) compared systemic lidocaine with epidural lidocaine and placebo in their randomized controlled trial, measuring cytokine response as well as pain in patients receiving bowel surgery. Sixty patients were randomly placed in one of the three groups. The lidocaine group received 2 mg/kg of lidocaine IV bolus, followed by 3 mg/kg/hr infusion. The epidural group received the same dose of lidocaine via the epidural. The placebo group received saline in both routes. Patients received fentanyl only for induction and were placed on a morphine PCA post-operatively. Labs were drawn prior to incision, at the end of the procedure, 12 hours postoperatively, and 24 hours postoperatively. It was found that PCA usage and pain ratings were significantly lower within the IV and epidural lidocaine groups, with the epidural group lowest. Serum cytokines mirrored that pattern, with both lidocaine groups lower than placebo and the epidural group the lowest. This study demonstrates both the analgesia and anti-inflammatory properties of systemic lidocaine as well as epidural.

A meta-analysis by Yanxia et al. (2012) reviewed a number of randomized control trials observing the efficacy of systemic lidocaine infusion on postoperative pain and recovery following abdominal surgery. Twenty one trials were included with 1108 patients in total and roughly half having received systemic lidocaine. Fifteen of the trials involved open abdominal procedures and six laparoscopic. Dosing of lidocaine varied from boluses of 100 mg or 1.5-2 mg/kg and infusion rates of 1.5-3 mg/kg/hr or 2-3 mg/min. In those studies that reported post-operative pain at these intervals, pain was significantly reduced in lidocaine groups at six and twenty four hours post-operatively. Combined data did not show a significant reduction in post-operative pain at 72 hours. Sixteen of the selected studies reported cumulative opioid use and the combined data showed a significant decrease within the lidocaine group. Time to both flatus and

first bowel movement were significantly reduced. The researchers concluded that lidocaine is an efficacious adjunct for pain control in abdominal surgeries.

A Terkawi et al. (2015) randomized controlled trial observed lidocaine infusion and its role in decreasing chronic post-surgical pain. The patient population was females receiving mastectomies, which are known to have high incidence of chronic pain resulting from the procedure. Patients were randomly assigned to lidocaine versus placebo infusions with a lidocaine bolus of 1.5 mg/kg and an infusion rate of 2 mg/kg/hr. The lidocaine infusion was continued two hours into the PACU. Anesthesia professionals did use narcotics intraoperatively as well as in the PACU. Interviews were conducted six months after surgery to assess for persistent pain. There were 61 patients that responded to interviews. Of these patients, twelve were determined to have chronic pain with eight in the placebo group and four in the lidocaine group. The researchers were able to conclude that there is a significant reduction in chronic post-surgical pain within the lidocaine group. While this finding does not directly relate to lidocaine as an opioid sparing tool it does provide insight into potential impact on patient's surgical recovery.

Martin, Cherif, Gentili, Enel, and Abe (2008) produced a randomized controlled trial testing the efficacy of intraoperative systemic lidocaine on postoperative pain. The patient population in this study included 58 patients all receiving a total hip arthroplasty. The patients were split randomly into two groups. Both groups utilized a general anesthetic with endotracheal tube, using sufentanil infusion intraoperatively to keep heart rate and systolic blood pressure within 15% and 20% respectively. The lidocaine group received the same anesthetic with the addition of a 1.5 mg/kg bolus of lidocaine 30 minutes prior to incision, followed by an infusion of 1.5 mg/kg/hr. Postoperatively, both groups were assessed every five minutes with IV

morphine given for pain scores above two, in a zero to four scale. Cumulative morphine dose at 24 and 48 hours and pain scores were compared between groups. The researchers found that there was no significant difference in morphine requirements or pain scores. This might suggest that the benefits of lidocaine infusion are sensitive to the type of surgery the patient is undergoing.

Grady et al. (2012) produced a randomized controlled trial measuring the effectiveness of systemic lidocaine within the laparoscopic gynecologic population. The researchers were measuring postoperative pain and return of bowel function among 50 patients that were randomly assigned to either a lidocaine group or placebo group, in this double-blind study. The lidocaine group received an intravenous bolus of 1 mg/kg of lidocaine, followed by an infusion at a rate of 2 mg/kg/hr. The experimental group received the same volume of saline. The lidocaine infusion was stopped 15-30 minutes prior to emergence. A 0-10 verbal pain scale was used to assess pain as soon as the patient was able and at frequent intervals following. The researchers found that pain scores were similar until day three postoperatively, where the lidocaine group reported significantly less pain. The lidocaine group also received significantly less narcotic and was faster to pass first flatus. No significant difference was observed in time to first bowel movement. This study is unique in that it focuses on short out-patient gynecologic procedures, suggesting that short duration of infusion does not hinder potential benefits of lidocaine infusion.

A Cochrane systemic review of perioperative lidocaine infusion was conducted by Kranke et al. (2015) to determine efficacy in postoperative pain control. Forty-five trials were included in the review, with a total of 2802 participants. The procedures within trials included abdominal, spinal, breast surgery, CABG, and gynecological. Dosing was variable from trial to

trial. The most common dosing used was a bolus of 1.5 mg/kg and an infusion of 2 mg/kg/hr. However, dosing ranged from boluses of 1-3 mg/kg and infusions of 1.5-5 mg/kg/hr or 2-4 mg/min. The trials were also highly variable on when infusion was stopped, ranging from 30 minutes prior to skin closure to 48 hours postoperatively. Sample sizes were generally small, ranging from 20 participants to 241. The reviewers found low to moderate evidence that lidocaine infusion reduced post-operative pain, most significantly during the immediate postoperative period. There was also a reduction in postoperative nausea and vomiting. Of the studies reporting adverse effects, there was no increase in arrhythmias or signs of lidocaine toxicity. The limitations of this review are largely due to the small study sizes and highly variable dosing and timing of lidocaine infusions from one study to the next.

Discussion

The Farage et al. (2013) study relates well to this case study as a direct comparison of surgical procedure. However, some issues can be raised. Due to the design of the placebo group, this study is comparing lidocaine infusion to a placebo group with little to no analgesia intraoperatively. This allows the researchers to conclude that lidocaine does provide some analgesia. This design does not allow the researchers to compare lidocaine with traditional narcotic technique. It is reasonable to theorize that, since lidocaine infusion does provide analgesia for this population, it would reduce narcotic use. However, a direct comparison of the two would provide greater insight as to the role of lidocaine infusion within the population and potentially answer more questions relatable to practice. For example, is lidocaine a viable replacement for narcotics or merely an adjunct?

The Terkawi et al. (2015) study has an interesting correlation to this case study as well. The trial observed for reduction in chronic pain, in a population with high incidence of chronic

postsurgical pain, using lidocaine infusion. They did see a significant reduction in chronic pain. Chronic pain is also common following spinal surgical procedures. Lidocaine is known to disrupt feedback mechanisms the can result in hyperalgesia and chronic pain. One might expect a reduction in chronic pain with lidocaine infusion within the spinal surgical patient population as well. However, this would be hypothetical until tested directly.

Abdominal surgical patients were the most established population for systemic lidocaine research. This is an ideal population to establish benefit because these patients frequently have visceral pain, which lidocaine should be effective at treating, as well as bowel complications potentially worsened by narcotic use. The research did find reduction in pain scores with lidocaine use within the abdominal surgical population. However, the timing of when pain was reduced was more variable than anticipated. Some trials found that pain was reduced only during the first four hours postoperatively, while others found it was only reduced after several days. Regarding return of bowel function, all of the studies measuring these outcomes found that flatus returned faster with lidocaine groups but, in general, lidocaine did not reduce time to first bowel movement significantly.

As Kranke et al. (2015) discussed in their review, there are problems with drawing conclusions based on these studies. Many of the studies on lidocaine infusion are small sample sizes taken from within a single hospital. It is also difficult to compile these small samples to form a larger patient pool, as each study is highly variable in lidocaine dosing and infusion start and stop times. Also, outside of the abdominal surgical population, the surgical procedures are highly variable with only one directly relating to this case study. There is also some evidence that lidocaine efficacy is sensitive to procedure type (Martin, Cherif, Gentili, Enel, & Abe, 2005)

With this combination of issues, one can understand why the Cochrane reviewers were only able to grade the evidence for lidocaine infusion as low to moderate strength, despite the quantity.

Local anesthetic toxicity is a valid concern in the operative setting, even more so when administering a local anesthetic intravenously as a continuous infusion. Local anesthetic toxicity symptoms start with tinnitus, circumoral numbness, blurred vision, and dizziness. If plasma levels continue to rise, symptoms can escalate to seizures, widened QRS complexes, and on to cardiovascular collapse. Of the trials that reported on adverse effects from lidocaine infusion, there were no significant lidocaine-associated adverse events (Kranke et al., 2015).

Recommendations

There is some evidence that Lidocaine has a benefit as an adjunct to pain control which, combined with an established safety profile, makes it a tool that can be used in the intraoperative setting. Intraoperative lidocaine infusion should be used at the discretion of the provider on a case-by-case basis. Lidocaine, at doses of 1.5 mg/kg bolus and 2 mg/kg/hr, does appear to be safe with very little reported side effects. However, the use of systemic lidocaine should be communicated to the surgeon so that infiltration of local anesthetic does not increase plasma levels into toxic ranges. The provider should also consider the type of surgical procedure, as there is evidence that lidocaine infusion does not reduce pain in all surgeries.

Future research should be performed regarding lidocaine infusion in the intraoperative setting. Larger study sizes with a standardized dosing protocol between trials are needed to form concrete practice recommendations. A broader range of surgical procedures should also be trialed to ascertain effectiveness outside of the few studied populations. The lidocaine infusion shows promise as a multimodal tool to control surgical pain and reduce the use of narcotics.

With more research, it is possible that lidocaine will continue to have an expanding role in the surgical setting.

Conclusion

The intravenous lidocaine infusion continues to be an interesting modality for pain control within the operative setting. Following this literature review, there does appear to be a benefit with little increased risk for this relatively low-cost intervention. This benefit, as it relates to pain reduction, has yet to be well defined amongst patient populations. Reduction and prevention of chronic pain is also a potentially impactful benefit of lidocaine infusion. Chronic pain is a very unpleasant and disruptive adverse event for patients and any reduction would be an important improvement in healthcare. Anesthesia professionals should consider the intravenous lidocaine infusion as they look to other means of analgesia outside of narcotics.

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Appendix

Intraoperative Lidocaine Infusion as an Analgesic
Joe Lennon, SRNA

UND Nurse Anesthesia
University of North Dakota

Introduction

- Opioids have long been the analgesic of choice for anesthesia providers
- Current trend is to avoid opioid use when possible
  - Opioid crisis and abuse potential
  - Respiratory depression
  - Decreased patient satisfaction
  - PONV
- When regional anesthesia is not an option, what do we do?

UND Nurse Anesthesia University of North Dakota

Introduction

- Non-opioid analgesia
  - Ketamine
  - Dexmetetomidine
  - N2O
  - Acetaminophen
  - Gabapentin
  - IV Lidocaine??

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Case Information

- C5-6 anterior cervical discectomy/corpectomy, C4-6 fusion
- 71 years old
- 55 kg
- Female
- ASA 2
- Presents with numbness/pain to BUE

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Pre-operative Evaluation

- Past Medical History
  - COPD
  - Lumbar stenosis
  - DM2
  - Depression/anxiety
  - Everyday smoker
  - METS tolerance 2-3
- Surgical History
  - THA
  - Lumbar fusion
  - Appendectomy

- Pre-op VS
  - BP 134/72, SpO2 95%, HR 82, Temp 98.2F
- Labs/EKG/Imagining
  - WNL
- Airway
  - Mallampati 2 with adequate distances

UND Nurse Anesthesia University of North Dakota

Anesthetic Course

- Induction
  - Ketamine 30 mg (20 mg given during A-line)
  - Propofol 70 mg
  - Rocuronium 30 mg
  - Esmolol 50 mg
- Infusions
  - Dexmedetomidine 0.5 mcg/kg bolus, 0.5 mcg/kg/hr
  - Lidocaine 2 mg/min
    - 2.18 mg/kg/hr
  - Phenylephrine titrated to keep MAP >90
- Video laryngoscopy
  - 7.0 ETT
  - BP 10% increase on intubation
- Maintenance
  - Volume-controlled ventilation
  - Sevo 0.5-0.7 MAC
  - 45% FiO2
- Incision
  - HR increased 10 BPM
  - Lidocaine 3 mg/min
    - 3.27 mg/kg/hr
  - HR returned 10 minutes later

UND Nurse Anesthesia University of North Dakota

Wake up

- Lidocaine and dexmedetomidine stopped 13 minutes prior to extubation.
  - Smooth wake up
  - Minimal coughing
  - Minimal vital sign changes

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PACU

- Patient unable to rate pain immediately post-op
- 30 minutes post-op
  - Restful
  - Pain 3/10 (acceptable 5/10)

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Pain Pathway

- A-delta and C fibers
  - Sensitization by prostaglandins, cytokines, etc.
- Dorsal horn
  - Synapse to secondary afferent fibers
  - Modulation occurs
    - N-Methyl-D-aspartate (NMDA) receptors
    - Descending pathways
- Secondary afferent neuron
  - Transmission to brain

(Almeida, Roizenblatt, & Tufik, 2004)

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Systemic Lidocaine

- Amide local anesthetic
- 60% plasma protein bound
- 40% first pass via lungs
- Biphasic half life of infusion
  - 8-16 minutes followed by 1.5 hours
  - Hepatic metabolism
- Therapeutic index: 2-3.5 mcg/ml
- Toxicity: >5 mcg/ml (plasma concentration)

(Eipe, Gupta, & Penning, 2016; Oliveira, Issy, & Sakata, 2010)

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Systemic Lidocaine MOA

- Na channel blockade
- NMDA receptor blockade
  - Reduction in hyperactivity/hyperalgesia
- Anti-inflammatory
  - G protein-coupled receptors
    - Reduced free radicals, cytokines, neutrophils

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Literature Review

Farag et al. 2013 (RCT)

- 116 adults having spine surgery
  - Half lidocaine, half control
- 2 mg/kg/hr lidocaine infusion
  - No narcs
  - Beta blockers for HR/BP
- Morphine PCA in PACU
- Lidocaine group
  - Pain scores one point lower (0-10)
  - 20 mg less morphine on average

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Literature Review

Terkawi et al. 2015 control trial on chronic pain

- 61 females receiving mastectomies
- Lidocaine
  - Bolus 1.5 mg/kg, infusion 2 mg/kg/hr
  - Continued 2 hours into PACU
  - Narcs used
- 6 months post-op
  - Control: 8 had chronic pain
  - Lidocaine: 4 had chronic pain

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Literature Review

- Lidocaine in abdominal cases
  - Most studied population
  - C fiber visceral pain
- Dosing
  - Bolus: 1.5-2 mg/kg
  - Infusion rate: 1.5-3 mg/kg/hr or 2-3 mg/min
  - Duration of infusion: 20 min before emergence – 24 hours

(Yanxia et al., 2012; Kuo et al. 2006; Kim et al., 2013; Koppert et al., 2004)

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Lidocaine in Abdominal cont.

- Results (combined data)
  - Pain
    - Post-op: mild reduction
    - 6 hour: significant reduction
    - 24 hour: significant reduction
    - 72 hour: no reduction
  - Opioid use: significant decrease
  - Time to flatus and first BM: significant decrease

(Yanxia et al., 2012; Kuo et al. 2006; Kim et al., 2013; Koppert et al., 2004)

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Literature Review

Dose lidocaine work in all patient populations?

- RCT of 58 patient receiving THAs
- Lidocaine
  - 1.5 mg/kg bolus
  - 1.5 mg/kg/hr infusion
- Results
  - No difference in morphine use or pain

(Martine, Cherif, Gentili, Enel, & Abe, 2008)

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Literature Review

Cochrane Review

- 45 RTCS with 2,802 patients
  - Abd, spinal, breast, CABG, gyn
- Dosing: 1.5-3 mg/kg bolus, 1.5-5 mg/kg/hr infusion
- Duration: 30 min < closure – 48 hours
- Samples sizes: 20 – 241

(Kranke et al., 2015)

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Cochrane cont.

- Cochrane Review Cont'd
  - Results
    - Pain: most reduced immediate post-op
    - PONV: significantly reduced
    - Adverse effects: none reported

(Kranke et al., 2015)

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Discussion

- What we did right
  - Use lidocaine (chronic pain, COPD, smooth emergence)
- Improvements based on literature review
  - No bolus dose
    - 4-5 hours to reach steady state

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Recommendations

- Bolus 1.5 mg/kg, infusion 2-3 mg/kg/hr
- Use at provider discretion
  - Hepatic metabolism
  - Surgeon administered local
- Future research is needed
  - More uniform study design and dosing
  - Expand research to other patient populations

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Conclusion

- Lidocaine is safe
- Mild to moderate analgesia
  - Potentially procedure dependent
- Reduction in chronic pain
- Lidocaine shows promise as a non-opioid analgesic in the operative setting

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Thank You
Are There Any Questions?

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