



# Perioperative Pain Prevention & Treatment

## Part II: Evidence & Options

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# Today's Presentation

- Evidence behind the pain mgmt. standard suggestions
- Pain scoring in canine and feline patients
- Some particular drug classes & options
  - Opioids
    - In the national opioid crisis: what can you do?
  - NSAIDs
  - Locoregional blockades
- Some protocols & scenarios...what's missing?

# Two Key Perioperative Analgesic Tenets

## Preemptive Treatment

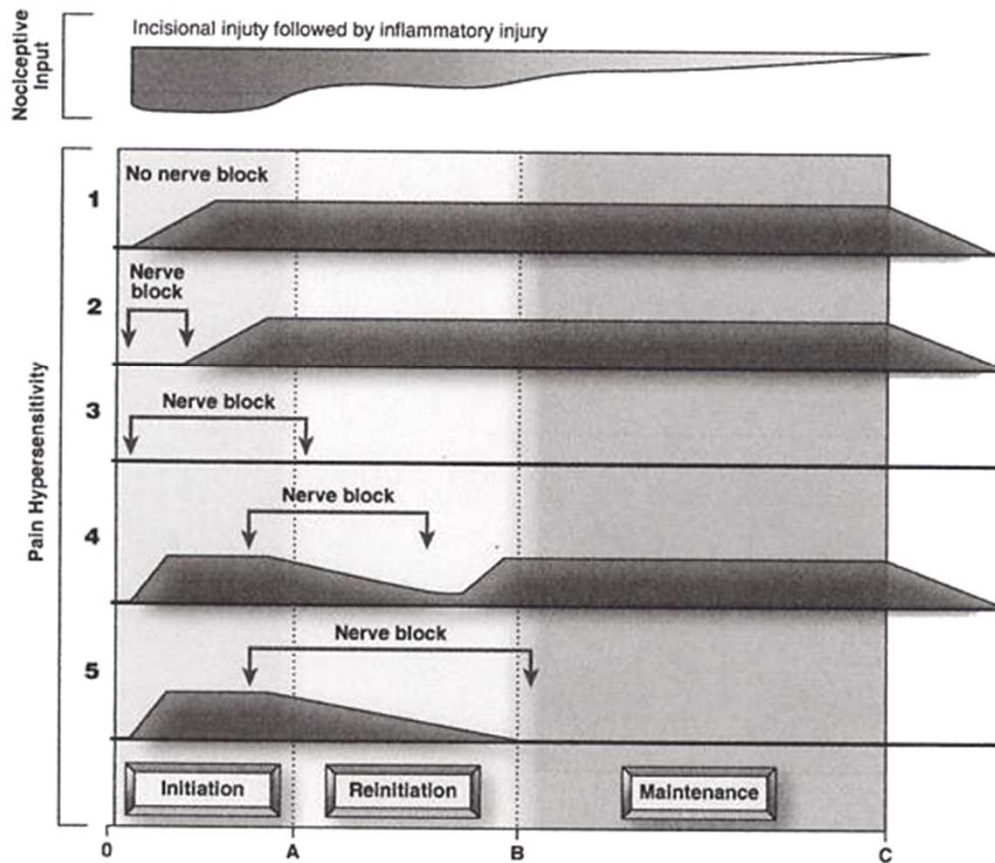
- “Better to prevent than to treat”
- “Think ahead”
- “A little now saves a lot later”
- “Be prepared”

## Multimodal Treatment



# Evidence for Effectiveness of “*Pre-emptive Analgesia*”

- Pre-emptive definition: analgesics given prior to surgical procedure, but *continuing during expected pain*
  - Less post op meds required
  - Less total pain
    - Intra op
    - Post op
    - Less chronic pain & pain associated disease
- Vs. “*as-needed*” dose schedules - less than optimal



Kissin, I. Preemptive analgesia *Anesthesiology* 2000, 93(4) 1138-43

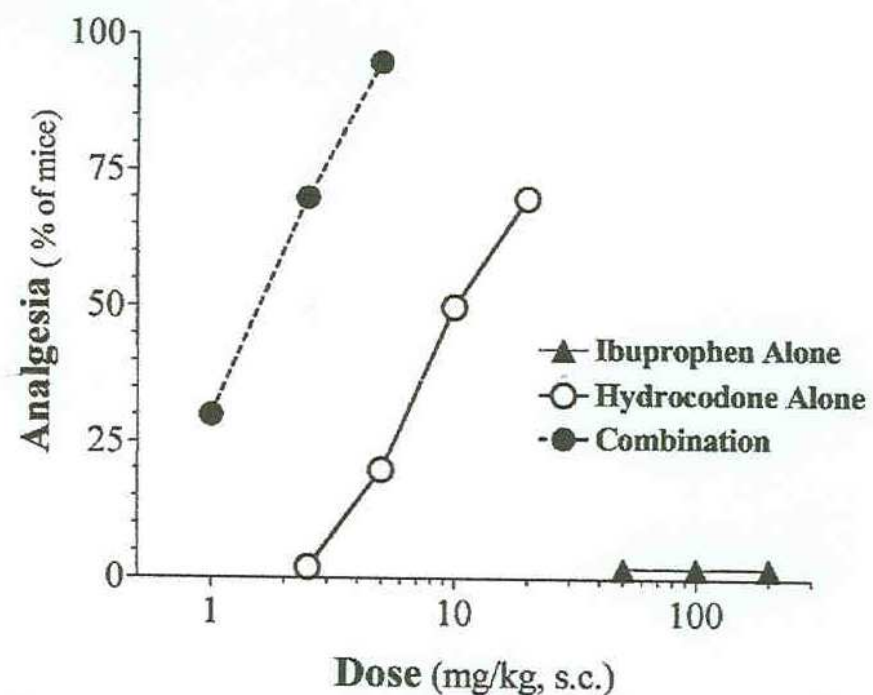
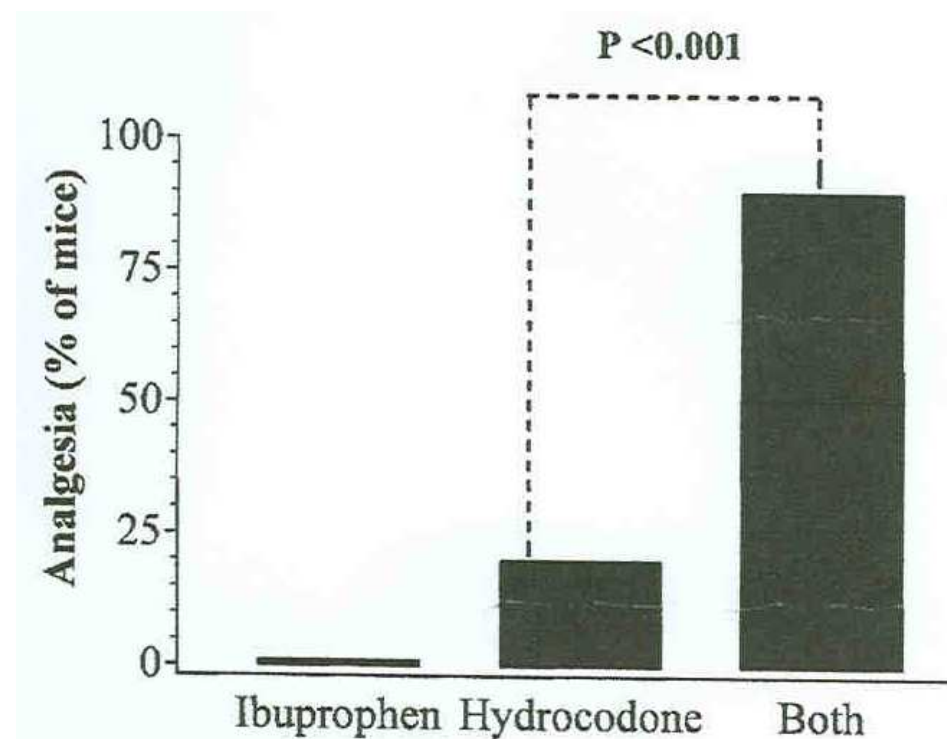
# Further Evidence for Preemptive Analgesia Benefits

- Katz J. Pre-emptive analgesia: Evidence, current status & future directions. Eur J Anaesthesiol Suppl 1995.
- Kelly DJ et al. Preemptive analgesia II: recent advances and current trends. Can J Anaesth 2001.
- Moiniche S et al. A qualitative and quantitative systematic review of preemptive analgesia for postoperative pain relief: the role and timing of analgesia. Anesthesiology 2002.
- Duellman TJ et al. Multimodal, preemptive analgesia decreases the length of hospital stay following total joint arthroplasty.
- Lascelles BD et al. Post operative central hypersensitivity and pain: the pre-emptive value of pethidine for ovariohysterectomy. Pain 1997.
- Lascelles BD et al. Efficacy and kinetics of carprofen, administered pre-operatively or postoperatively, for the prevention of pain in dogs undergoing ovariohysterectomy. Vet Surg 1998.
- Clark L. Pre-emptive or preventive analgesia-lessons from the human literature. Vet Anaesth Analg 2014.
- Moll X et al. Comparison of subcutaneous and transdermal administration of buprenorphine for pre-emptive analgesia in dogs undergoing elective ovariohysterectomy

# Evidence for Effectiveness of “Multimodal Analgesia”

- Multimodal therapy definition: combinations of analgesics result in less pain
  - Using lower doses of each individual drug
  - Fewer side effects of each individual drug
- Basic science animal models, surgical & analgesiometric
- Human clinical studies, acute, & chronic pain
  - Morphine/buprenorphine – lidocaine
  - Hydrocodone – ibuprofen
  - Morphine – gabapentin
  - Morphine – ketamine

# Synergistic Analgesic Interactions Between Hydrocodone & Ibuprofen



Kolesnikov, Y.A. et al. *Anesth. Analg.* 2003



# Further Evidence for Multimodal Analgesia Benefits

- Practice Guidelines for Acute Pain Management in the Perioperative Setting: An updated report by the American Society of Anesthesiologists Task Force on Acute Pain Management. *Anesthesiology* 2012.
- Cho et al. Multimodal approach to postoperative pain control in patients undergoing rotator cuff repair. *Knee surgery, sports traumatology, arthroscopy* 2011.
- Jarzynna et al. American society for pain management nursing guidelines on monitoring for opioid induced sedation and respiratory depression. *Pain management nursing* 2011.
- Steagall et al. Multimodal analgesia for perioperative pain in cats *J Fel Med Surg* 2013.
- Slingsby et al. Multimodal analgesia for postoperative pain relief. *In pract.* 2008.
- Brondani et al. Analgesic efficacy of perioperative use of vedaprofen, tramadol or their combination in cats undergoing ovariohysterectomy. *J Fel Med Surg.* 2009.
- Steagall et al. Analgesia for cats after ovariohysterectomy with either buprenorphine or carprofen alone or in combination. *Vet Rec* 2009.
- Cannon CZ et al. Analgesic effects of tramadol, carprofen or multimodal analgesia in rats undergoing ventral laparotomy. *Lab Anim* 2011

# What tells us they hurt?

- Behavior is key
- Other principles of scoring:
  - Interaction/handling
  - Movement
  - Palpation of surgical area

# Behaviors Which May Indicate Pain

## Dogs

- Abnormal posture
- Restlessness
- Anxiety
- Splinting of abdomen
- Abnormal vocalization
- Limping
- Reluctance to move
- Reduced appetite
- Increased respiratory rate
- Exophthalmos
- Pupillary dilation
- Aggression
- Hyperfocusing
- Palpation reluctance



## Cats

- Anxiety
- Aggression
- Cattitude
- Hyperfocusing
- Immobility
- Withdrawn or escape behavior
- Vocalizing
- Squinted palpebral fissure
- Flattened or backwards ear carriage
- Palpation reluctance



# When to Evaluate Pain in Surgical patients

## Not just once...but several times

- Pre anesthesia
- During anesthesia
- At extubation
- In recovery (assess & reassess)
- Before you leave for the day
- Next morning

## Extent of pain is dependent on:

- Pre-existing disease:
  - Ex: skin disease, URI, GI disease, Pyo, pregnancy, nutritional status
- Signalment
- Tissue handling
- Duration of surgery
- Whether pain is first perceived or not
  - The importance of premedication

“One of the psychological curiosities of therapeutic decision-making is the withholding of analgesic drugs because the clinician is not absolutely sure that the animal is experiencing pain.

Yet the same individual will administer antibiotics without documenting the presence of a bacterial infection.

Pain and suffering constitute the only situation in which I believe that, if in doubt, one should go ahead and treat.”

**- Dr. Lloyd Davis**

## If You Need to Figure Out if a Patient is Painful

- Administer an analgesic
  - Acutely: opioid, microdose alpha agonist or ketamine, iv lidocaine, local block
  - Then reassess within 10 mins to 15 mins
- If animal hasn't responded
  - Choose a different category analgesic
  - Consider an anti-inflammatory
  - Consider non surgical stimuli (nausea, bladder, bowel, dermatologic, etc.) & treat accordingly (take dog for walk, provide antiemetic)
- If animal responds paradoxically (more excited, anxious, frantic, non positive)
  - Administer a sedative, reduce the pure opioids
    - Microdose dexmed or acepromazine, butorphanol

# Opioids

## Classic Analgesics

## Common Opioid Doses Used in Combination With Sedatives for Premed

### Canine

- Hydromorphone 0.05-0.1mg/kg
- Oxymorphone 0.1mg/kg
- Methadone 0.5mg/kg
- Morphine 0.3-0.5mg/kg
- Butorphanol 0.2mg/kg
  - Butorphanol combined with dexmedetomidine

### Feline

- Buprenorphine 0.02mg/kg
- Simbadol 0.1mg/kg
- Oxymorphone 0.1mg/kg
- Hydromorphone 0.1mg/kg
- Methadone 0.3mg/kg
- Butorphanol 0.2-0.4mg/kg
  - Butorphanol combined with dexmedetomidine



# Simbadol: Zoetis Animal Health 2015

- 24-hour duration concentrated formulation of buprenorphine
  - *Not sustained release buprenorphine (buprenorphine SR)*
- 1.8mg/mL
  - 6 times current concentration
  - dose: 0.1-0.25mg/kg
- Pre release clinical trials
  - 221 cats soft tissue
  - 229 cats orthopedic
  - Analgesia up to 24 hours



- Not buprenex!!

# Bup<sup>sr</sup> (Buprenorphine Sustained Release)

- Repository=sustained release formulation of buprenorphine
  - [www.wildpharm.com](http://www.wildpharm.com)
- 72-hour duration
- Different formulations (1, 3 & 10mg/mL)
- Different dosing compared to regular buprenex or simbadol
- 0.03-1mg/kg dependent on dog-cat-lab animal

**Comparison of the efficacy and adverse effects of sustained-release buprenorphine hydrochloride following subcutaneous administration and buprenorphine hydrochloride following oral transmucosal administration in cats undergoing ovariohysterectomy**

Davina L. Catbagan, DVM, MS; Jessica M. Quimby, DVM; Khurshheed R. Manna, DVM;  
Jessica K. Rychel, DVM; Patrice M. Mich, DVM, MS



# Treating Pain & Stress Using a Balanced (Multimodal) Premed





# Alpha Agents

## Sedatives & Analgesic Agents

# Dexdomitor (Dexmedetomidine)

- Sedative analgesic
- Premedication
  - Provides “Conscious” analgesia sedation
- Intraoperative use = rescue medication
- Postoperative medication



# About the Same Great Analgesia Provided by Either/or

- Pure mu agonists



- Dexmedetomidine & butorphanol



# Evidence to Support Dexmedetomidine-based Analgesia

## **Duration of nonresponse to noxious stimulation after intramuscular administration of butorphanol, medetomidine, or a butorphanol-medetomidine combination during isoflurane administration in dogs**

Kurt A. Grimm, DVM; William J. Tranquilli, DVM, MS; John C. Thurmon, DVM, MS;  
G. John Benson, DVM, MS

## *Antinociceptive Interaction Between Opioids and Medetomidine: Systemic Additivity and Spinal Synergy*

Michael H. Ossipov, Ph.D.,\* Sarah Harris, B.Sc.,† Patricia Lloyd, A.Sc.,† Elina Messineo, B.Sc.,†  
B.-S. Lin, Ph.D.,‡ Jerome Bagley, Ph.D.§

## **INFLUENCE OF OPIOIDS ON ANALGESIC AND ANESTHETIC EFFECTS OF TILETAMINE/ZOLAZEPAM-DEXMEDETOMIDINE COMBINATION IN DOGS**

Paranjape V<sup>1</sup>, Ko J<sup>1</sup>, Grasso S<sup>1</sup>, Weil A<sup>1</sup>, Payton M<sup>2</sup>



# Typical Dexmedetomidine Combinations for Premed Analgesia, Stress Relief, & Anti-inflammatory Effect



## Common Doses of Dexmedetomidine Coupled with Opioids for Premed

### Low-risk Cases

- Canine: 3-7 mcg/kg IM
  - 3-5mcg/kg IV
- Feline: 5-15 mcg/kg IM
  - 3mcg/kg IV

### High-risk Cases

- Canine & feline: 1-2mcg/kg IV

### Requires

- “make your own” Dilute dexdomitor

Or

- 0.1mg/mL dexdomitor

# Two protocol premed method

## Examples of drugs and dosages

### Low risk premedication(ASA I, II)

- Dexmed 3-10mcg/kg
  - IV doses lower than IM doses
  - Larger patients lower doses than tiny patients
  - Older patients lower doses than younger patients
  - Dogs lower doses than cats
- Torb 0.2-0.4mg/kg
- Mu agonist pre incision in microdose +/-repeated intra and post op
- NSAID of choice pre-incisional

### High risk premedication (ASA III, IV)

- Torb 0.2-0.3mg/kg
- Midazolam 0.2-0.3mg/kg
- +/- Dexmed 1-2 mcg/kg
- Mu agonist pre-incision in microdose +/- repeated intra and post op
- NON NSAID Anti-inflammatory: pick an option from many or administer NSAID post op

# Other Antianxiety Agents

Add These to Your Opioid

# Other Great Stress Relievers: Remember - Relief of Stress Helps Analgesia!

## Phenothiazines

- Cons
  - Can result in vasodilation
  - Increased bleeding potential
  - Doses need to be less than 0.3mg/cat or 1mg/dog
  - Splenic enlargement
- Pros
  - Reliable
  - Cheap



## Benzodiazepines

- Cons
  - Very reliable in sicker patients,
  - but can excite healthier individuals
    - Sniffing
    - Head sway
    - Aggression
- Pros
  - Very safe regardless of dose
  - Especially safe for sick patients



# Anti-inflammatories

## NSAIDS, Steroids & Other Options

# Perisurgical/Injectable NSAIDs



## Evidence of Safety of Surgical NSAIDs in Dogs

- Matthews K. et al – *“Safety and efficacy of preoperative administration of meloxicam compared with that of ketoprofen and butorphanol in dogs undergoing abdominal surgery”*
- Brainard B et al. – *“Changes in platelet function, hemostasis, and prostaglandin expression after treatment with nonsteroidal anti-inflammatory drugs with various cyclooxygenase selectivities in dogs”*
- Bostram IN et al. – *“Effects of meloxicam on renal function in dogs with hypotension during anesthesia”*



## More Evidence for Canine Preoperative vs. Postoperative NSAIDs

- Lascelles D. et al. – *Efficacy & kinetics of carprofen administered preoperatively or postoperatively for the prevention of pain in dogs undergoing ovariohysterectomy*
  - “Preoperative administration of carprofen has a greater analgesic effect than postoperative administration in the early postoperative period in dogs undergoing ovariohysterectomy”
- Bostrom et al. - *Effects of carprofen on renal function & results of serum biochemical & hematologic analyses in anesthetized dogs that had a low blood pressure during anesthesia*
  - “Carprofen administered IV before or during anesthesia did not cause detectable significant adverse effects on renal function in healthy beagles with low blood pressure during anesthesia”

# What About Surgical NSAIDs in Cats?

## How times are a changing!

- Metacam 2010
  - FDA approved for single dose 0.3mg/kg parenteral for acute surgical pain
- Black Box Warning – product insert for Metacam reads: “Repeated use of meloxicam in cats has been associated with acute renal failure & death. Do not administer additional doses of injectable or oral meloxicam to cats”
- ISFM-AAFP guidelines 2016
  - Characterize NSAIDs including meloxicam as “an important class of drug in feline medicine” & contrary to the advice of U.S. regulators — explores treating cats with acute & chronic pain with NSAIDs

# Synergism of periop NSAIDs in Cats for OVH

- Steagall P et. al., Vet Rec 2009
  - *Analgesia for cats after ovariohysterectomy with either buprenorphine or carprofen alone or in combination*
  - “The combination of an opioid and an NSAID is more effective in the peri-operative setting than an NSAID or opioid alone”
- Brondani JT et. al., JFMS 2009
  - *Analgesic efficacy of perioperative use of vedaprofen, tramadol or their combination*
  - “Combination of vedaprofen & tramadol was superior to either drug alone”

# Comparison of Injectable Robenacoxib vs. Meloxicam

- Kamata M et al., Veterinary Journal, 2012
  - Multicenter, randomized, blinded controlled trial
  - 96 cats undergoing surgery, mostly OVH
- Meloxicam 0.3mg/kg or Robenacoxib 2mg/kg SQ *pre-op*
- Pain score & CBC chem 3 & 22 hours post
- No adverse events
- CBC & chem values not different between groups
- Robenacoxib better for posture, behavior, overall pain score
- Meloxicam better for wound heat

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Total clinician score (TCS, primary endpoint)

Posture

Behaviour

Pain on palpation (PP)

Overall pain control (OPC)

Sedation

Wound redness

Wound heat

Wound swelling

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## Evaluation of Glomerular Filtration Rate in Cats with Reduced Renal Mass

- Surdyk KK et al. AJVR, 2013
  - 3 boy cats & 3 girl cats all intact
  - Surgically reduced kidney volume to equal stage 2 & 3 renal failure
- Placebo
  - Or
- Meloxicam 0.2mg/kg sq day one, with 0.1 mg/kg po day 2-7
  - Or
- Aspirin 20mg/kg po day 1, 3, & 7

## Surdyk KK et al., 2013

- Exogenously administered Cr clearance
- Creatinine
- UPC ratio
- No changes between groups
- Cats on NSAIDS
  - Lower Creatinine!
  - Better QOL
    - Less clinical for renal disease
    - Appetite improvement
    - Attitude improvement
- “GFR of cats undergoing surgery with normal or reduced renal function is not solely dependent on cyclooxygenase function”

## Other Evidence of Safety & Efficacy of Surgical NSAIDs in Cats

- Speranza C et al. - *Robenacoxib versus meloxicam for the control of peri-operative pain & inflammation associated with orthopaedic surgery in cats: a randomised clinical trial. 2015*
- King S et al. - *Evaluation of injectable robenacoxib for the treatment of post-operative pain in cats: results of a randomized, masked, placebo-controlled clinical trial. 2016*
- Murison PJ et al. - *Postoperative analgesic efficacy of meloxicam compared to tolfenamic acid in cats undergoing orthopaedic surgery. 2010.*
- Charlton AN et al. - *Evaluation of the clinical use of tepoxalin and meloxicam in cats. 2013.*
- Kamata M et al. - *Comparison of injectable robenacoxib versus meloxicam for peri-operative use in cats: results of a randomised clinical trial. 2012*
- Polson S et al. - *Analgesia after feline ovariohysterectomy under midazolam-medetomidine-ketamine anaesthesia with buprenorphine or butorphanol, & carprofen or meloxicam: a prospective, randomised clinical trial. 2012*
- Ingwerson W et al. - *Efficacy & safety of 3 versus 5 days of meloxicam as an analgesic for feline onychectomy and sterilization. 2012*



# Common Means to Treat Feline Operative Inflammation

- As part of your premed =preoperatively (low risk cases)
- Administration intra- or post-op (high risk cases)



# NSAID Administration Timing

## Pre- or Intra-op

- Elective cases
- ASA I & II cases
- Lower risk cases
- Much evidence in favor of pre-op administration
  - Meloxicam less than label dose

## Post op

- ASA III-IV
- Higher risk cases
- Severe upper airway issues
- Preexisting hypovolemia
- Coagulopathy
- Preexisting hypotension

## Common Doses of Systemic Anti-inflammatory Agents Administered Perioperatively

- Dexamethasone sodium phosphate 0.1-0.2mg/kg
- Meloxicam 0.1-0.2mg/kg
- Carprofen 2-4mg/kg
- Robenacoxib 0.5-1mg/kg
- Local anesthetic dosed according to block

# Ketamine's anti-inflammatory actions

- Lois X et al 2011. **The anti-inflammatory effects of ketamine: state of the art.**
- Do Vale EM et al. 2016. **Antinociceptive and Anti-Inflammatory Effects of Ketamine and the Relationship to Its Antidepressant Action and GSK3 Inhibition**
- *Decreased inflammatory cell recruitment*
- *Cytokine management*
- *Apoptosis of inflammatory cells*
- *Reduced calcium precipitated potassium currents*

# Photobiomodulation therapy: anti-inflammatory actions

- Magnitude of tissue's reaction are based on:
  - Output wavelength/frequency
  - Power and density of power
  - Duration of treatment
  - Vascularity of target tissues
- Direct effect - occurs from absorption of photons
- Indirect effect – produced by chemical events that occur through the absorption of photons

## Proposed mechanisms

- Cellular migration and proliferation
- Modulatory effect on ATP synthesis
- Upregulation of myogenic factors
- Endothelial growth factor up regulation
- Displacement of nitric oxide (NO) from cytochrome c oxidase
- Decreased mitochondrial membrane potential in neurons
- Mitochondrial cytoskeleton “pile up” in neurons
- Endorphin release in dorsal root ganglia



Chung H et al. 2012 The Nuts and Bolts of Low-level Laser (Light) Therapy

Chow R 2011 Phototherapy and the Peripheral nervous system

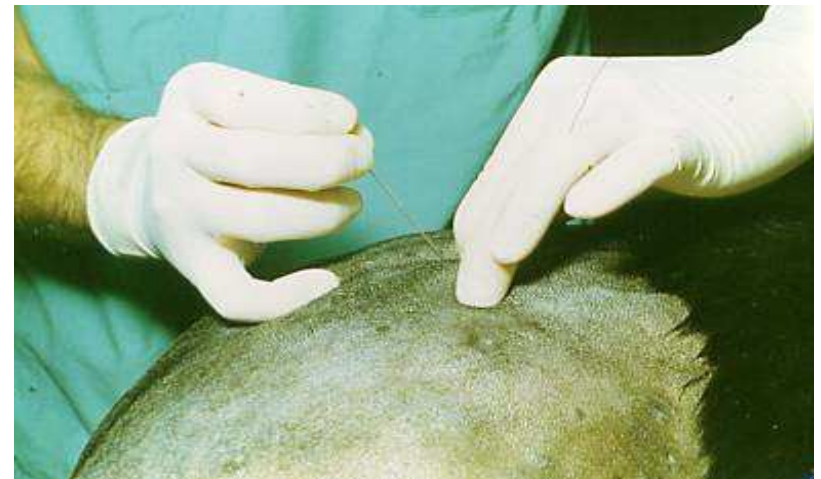
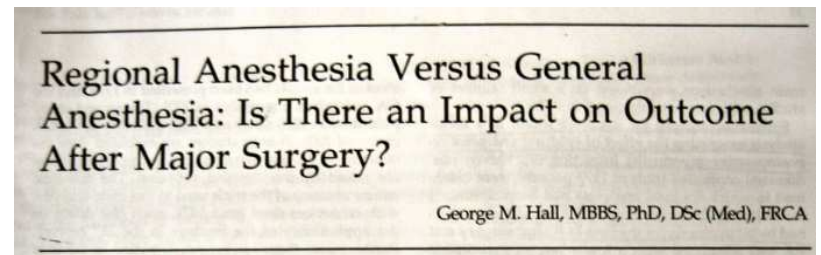
Hamblin MR et al. 2006. Mechanisms of low level light therapy

# Locoregional Blockade

How Something So Simple Can Help So Much

# Local Block Benefits

- Randomized-controlled studies in people suggest that regional techniques provide
  - superior pain relief
  - faster postoperative recovery,
  - reduced hospital stay compared to systemic opioids
- Singelyn et al., 1998, Capdevila et al., 1999



# LA vs. GA in Human Surgery Supportive Literature

- Regional Versus General Anesthesia in Surgical Patients with Chronic Obstructive Pulmonary Disease: Does Avoiding General Anesthesia Reduce the Risk of Postoperative Complications? Hausman 2014
- Anesthesia technique, mortality, & length of stay after hip surgery. Neuman 2014
- Comparison of anesthesia technique on outcomes of endovascular repair of abdominal aortic aneurysms: a five-year review of monitored anesthesia care with local anesthesia vs. general or regional anesthesia. Franz 2013
- General anaesthesia for caesarean section. Devroe 2015
- Cancer surgery: how may anesthesia influence outcome? Cassinello 2015



# Analgesic Benefit of Local Blocks Supporting Veterinary Evidence

## **Epidural vs. intramuscular oxymorphone analgesia after thoracotomy in dogs.**

Vet Surg. 1991 Nov-Dec;20(6):462-7.

*S Popilskis<sup>1</sup>; D Kohn; J A Sánchez; P Gorman*

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## **Evaluation of the analgesic effect of lidocaine and bupivacaine used to provide a brachial plexus block for forelimb surgery in 10 dogs**

Vet Rec. May 2005;156(20):639-42.

*S Wenger<sup>1</sup>; Y Moens; N Jägglin; U Schatzmann*

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## **Comparison of bupivacaine femoral and sciatic nerve block versus bupivacaine and morphine epidural for stifle surgery in dogs.**

Vet Anaesth Analg. January 2012;39(1):91-8.

*Luis Campoy<sup>1</sup>; Manuel Martin-Flores; John W Ludders; Hollis N Erb; Robin D Gleed*

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## **Peripheral nerve blocks of the pelvic limb in dogs: a retrospective clinical study.**

Vet Comp Orthop Traumatol. 2012;25(4):314-20.

*E Vettorato<sup>1</sup>; C Bradbrook; M Gurney; F Aprea; L Clark; F Corletto*

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# Safety of Local Blocks in Veterinary Patients

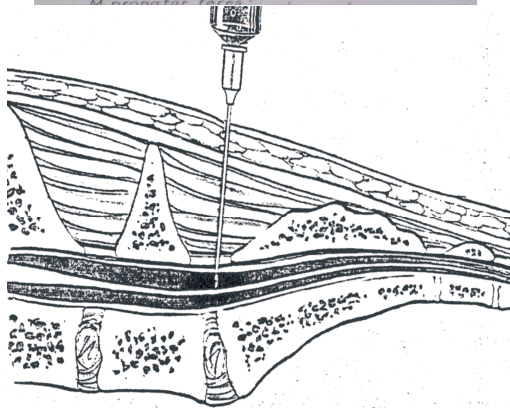
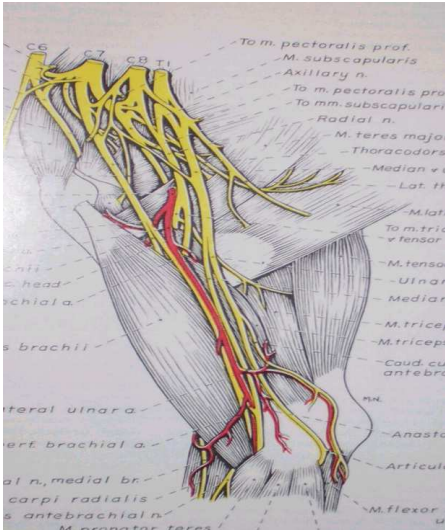
- Retrospective clinical study
- Intra-operative & postoperative clinical records of dogs that underwent orthopaedic surgery of the pelvic limb were reviewed
- In group PNB, the prevalence of intra-operative hypotension was 7.8% (9/115)
  - 1/95 (1.05%) LP-SN block manifested transient postoperative bilateral pelvic limb paralysis
  - 0/265 dogs in group PNB manifested neurological complications at 6 weeks postoperatively
- Success rate & the absence of neurological complications obtained support the use of lumbar plexus, sciatic & femoral nerve block for loco-regional anaesthesia & analgesia in dogs undergoing orthopaedic surgery of the pelvic limb.

## **Peripheral nerve blocks of the pelvic limb in dogs: a retrospective clinical study.**

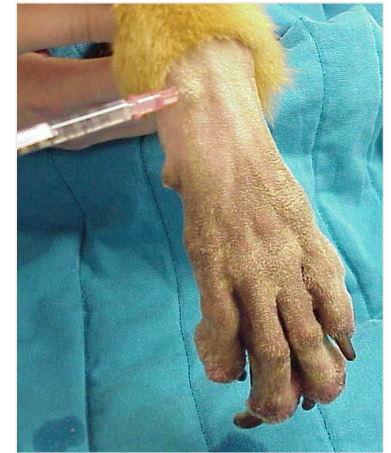
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# Most Common Blocks Used in Small Animal Shelter Patients



- Incisional, line or splash blocks
- Perilesional blocks
- Retrobulbar blocks
- Dental blocks
- Brachial plexus block
- Femoral & Sciatic blocks
- Epidurals

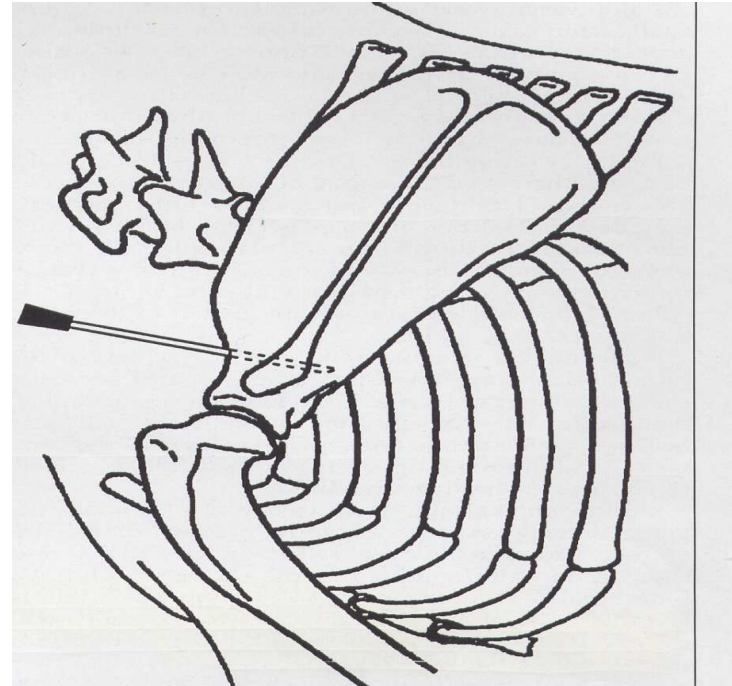


## Common Doses of Local Anesthetics for Blockades

- Use common sense volumes dependent of blockade
  - 0.3-0.5mg/kg bupivacaine
  - 0.5-1mg/kg lidocaine
  - Various volumes of saline
- Motor sparing?
  - Lidocaine is not at any dose
  - Bupivacaine at above doses motor sparing
- Do not inject nerves! Rather, “splash” them proximal to resecting



- Consider volumes necessary
- Aspirate first
- Avoid pressure on injection



**nocita**  
(bupivacaine liposome injectable suspension)

## A New Beginning in Post-Operative Pain

**nocita**  
(bupivacaine liposome injectable suspension)



A new long-acting local anesthetic formulation of bupivacaine for single-dose infiltration into the surgical site to provide local postoperative analgesia for cranial cruciate ligament surgery in dogs.

- Bupivacaine in a liposome injectable suspension that releases over time
- Long-acting analgesia lasts up to 72 hours post-surgery
- Single dose administered by infiltration injection into the tissues of a CCL surgical site during closure

**IMPORTANT SAFETY INFORMATION:** NOCITA® (bupivacaine liposome injectable suspension) is for use in dogs only. Do not use in dogs younger than 6 months of age, dogs used for breeding, or in pregnant or lactating dogs. Do not administer by intravenous or intra-arterial injection. Adverse reactions in dogs may include discharge from incision, incisional inflammation and vomiting. Avoid concurrent use with bupivacaine HCl, lidocaine or other amide local anesthetics. Please see the full Prescribing Information for more detail.

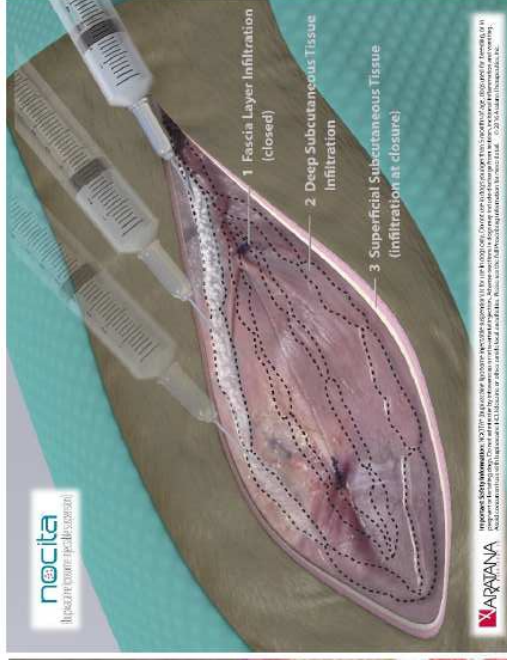
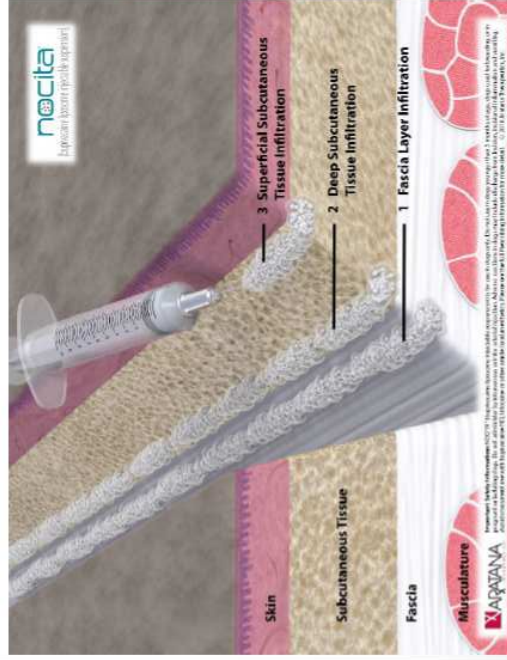
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## Infiltration Injection Technique



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# Rescue Agents

## Intra-op Fixes That Can Save the Day



# Intraoperative Wakening

- Happens to 30-50% of your patients
- Fix your premed
  - Premed should contain:
    - Opioid
    - Tranquilizer or sedative
    - Anti-inflammatory
    - GI agents
    - +/- anticholinergic

Happens to a few (<10%) patients

- Use “rescue” drugs INTRAVENOUSLY

A rescue drug is an agent that “rescues” your patient from feeling pain, stress, or inflammation, and “waking up” during surgery

# Rescue Agents for Patients While on the Surgery Table

- Pain treatment:
  - 30-50% dose of whatever opioid you used in premed IV
  - 0.05mg/kg hydromorphone IV
  - 5mcg/kg fentanyl
  - 1mg/kg ketamine IV
  - 3mg/kg lidocaine IV
- Inflammation treatment:
  - 0.1mg/kg dex na phos IV
  - 0.1mg/kg meloxicam IV
  - 2mg/kg carprofen IV
- Stress or anxiety treatment:
  - 0.005mg/kg acepromazine
  - **0.3 mcg** /kg dexmedetomidine IV (wow what a tiny tiny dose!!!)
    - Requires a microdose dilution of dexmed 50mcg/ml vs. 500mcg/mL
  - Turn up oxygen flowrate with mild increase (50%) in vaporizer setting
  - Propofol 1mg/kg IV

# Opioid reduced anesthesia: what to do

- Conserve Conserve Conserve
- Rethink timing of MOR agents
- Risk classification of patients
- Open mind to new agents; new uses
  - Local blocks
  - Nocita
  - NSAIDs pre-emptively
  - Alpha two combinations

# What Can We Do in the Postoperative Period?

- Continue to score: after all, every patient is different
- Three areas of concern
  - Immediately upon extubation
  - Recovery First 2-3 hours
  - Overnight
- Scoring
  - Is different for each period
  - But still dependent mainly on behavior
- Immediately post op
  - Gross behavioral signs
  - Respiratory and pulse rate changes
- Recovery period
  - Mobility, lack thereof
  - Facial expression
  - Focusing
- Overnight
  - Return to normal behaviors or not

# Pain Scoring Upon Extubation

Remember: not all patients are analgesic with only their premedication

## Pain post surgery depends on

- Premed effectiveness intra-op
- Pre-existing problems
- Signalment
- Tissue handling and extent of incision
- Inhalant depth
- Positioning on table
- Perfusion & adequacy of circulation
- Duration of surgery

## What to look for

- Sudden anxiety of waking
- Vocalizations
- Aggression
- Escape attempts
- Drastic movements of limbs
- Facial/mouth grimacing
- Increasing resp and pulse rate

# Pain Scoring Upon Extubation

- Focus on gross behavioral signs, respiratory and pulse rate changes

## What to give IV

- Opioid
  - ½ to full dose of whatever was used in the premed
- If no response: pick another class of drug
  - Alpha two micro dose
  - Anti-inflammatory if not already given
  - Ketamine micro dose
- If paradoxical response, give additional sedative
  - ½ of whatever was used in the premed



# Common Immediate Post-op Analgesics & Doses

- Very similar to intraoperative “rescue” doses

## Opioids

- Morphine 0.1mg/kg IV
- Hydro or oxymorphone 0.1mg/kg IV
- Buprenorphine 0.02mg/kg IV
- Methadone 0.2mg/kg IV

## Other Analgesics

- Dexmedetomidine 1-2mcg/kg IV
- Ketamine 1mg/kg IV
- Dogs only Lidocaine 2mg/kg IV
- Anti-inflammatory of choice IV

## Sedatives

- Butorphanol 0.1-0.2mg/kg IV
- Dexmedetomidine 1-2mcg/kg IV
- Acepromazine 0.01mg/kg IV
- Midazolam or valium 0.1 mg/kg IV

## Pain Scoring in the First 2-3 Hours Post

- Who knows how long the premed or immediate post op med will last?



- What to look for:
  - Mobility issues
  - Odd body positions
  - Salivating
  - Lip smacking, licking
  - Protectiveness
  - Focusing on wound
  - Eye & ear expressions
  - Resp rate elevation
  - Odd respiratory pattern or character
  - +/- tachycardia



## Pain Scoring for Overnight Care

- Focus is on return to semi normal behavior (walking, eating, resting naturally, etc.)
- What to do?
  - Encourage trial movement
  - Offer food
  - Provide thermocare
  - Bladder & bowel care
  - Instead of E-collars
  - Why is the patient picking on the wound?

# Recovery & Next-Day Analgesia

## Recovery doses q 4-8 hrs prn

- Microdose dexmed
  - 1-2mcg/kg IM or IV
  - Alternating with
- Opioid
  - 0.05mg/kg hydromorphone or oxymorphone IM or IV
  - 0.1mg/kg morphine IM or IV
  - 0.01mg/kg buprenorphine IV

## Later that day or before going home

- Score the patient's pain
  - Repeat opioid dose
  - Continue a CRI for the day
- Score the stress level
  - Repeat the anxiolytic
  - Continue a CRI for the day
  - Start oral meds
  - Trazadone, gabapentin
- Assure anti-inflammatory has been administered

# Going Home Analgesic Options for the Week

- Dogs and cats: Oral NSAID or Steroid
- Dogs: acetaminophen
- Cats: Oral transmucosal buprenorphine
  - SQ simbadol
  - SQ buprenex SR
- Trazodone
- Gabapentin
- Muscle relaxants
- Topical
  - Anti-inflammatory crème OTC
  - Hydrocortisone
  - Lidocaine
  - Arnica

# Does This Protocol Satisfy Analgesia Requirements?

- Premed
  - Acepromazine
  - Hydromorphone
- Induction
- Ket: midazolam
- Isoflurane inhalant

If not, how can this be altered?



# Does This Protocol Satisfy Analgesia Requirements?

- Premed
  - Acepromazine
  - Hydromorphone
- Induction
- Ket: midazolam
- Isoflurane inhalant

If not, how can this be altered?

- Add anti-inflammatory such as meloxicam 0.1 mg/kg SQ or IV
- Add local block such as lidocaine 2mg/kg around abdominal incision

# Does This Protocol Satisfy Analgesia Requirements?

- Premed
  - Acepromazine
  - Butorphanol
- Induction
- Ket: midazolam
- Carprofen injection dogs
- Isoflurane inhalant

If not, how can this be altered?



# Does This Protocol Satisfy Analgesia Requirements?

- Premed
  - Acepromazine
  - Butorphanol
- Induction
- Ket: midazolam
- Carprofen injection dogs
- Isoflurane inhalant

If not, how can this be altered?

- Replace butorphanol with a better opioid
  - Such as hydromorphone at 0.1mg/kg IM with acepromazine
- Add local block such as dental maxillary block with bupivacaine 0.3mg/kg

# Does This Protocol Satisfy Analgesia Requirements?

- Premed
  - Acepromazine
  - Atropine
- Induction
- Ket: midazolam
- Lidocaine splash block
- Isoflurane inhalant

If not, how can this be altered?





# Does This Protocol Satisfy Analgesia Requirements?

- Premed
  - Acepromazine
  - Atropine
- Induction
- Ket: midazolam
- Lidocaine splash block
- Isoflurane inhalant

## If not, how can this be altered?

- Add an opioid such as buprenorphine
- Or use dexmed/torb as premed
- Drop atropine; use glycopyrrolate only if needed intraop
- Add NSAID such as robenacoxib

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