Perioperative Pain Prevention & Treatment
Part I: Basic Tenets

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Today’s Outline

• Why is pain so bad for our patients?
• Essential concepts
  o Preemptive pain control
  o Multimodal pain control
• Pain scoring in small animal patients
• Practically, What can we do?
  o Pain relievers at all levels of the “anesthesia menu”
  o Why it’s important to assess & reassess (score & rescore)
Why Bother Preventing & Treating Pain?
Detrimental Effects of Pain

- Anand KJ, Hickey PR:
  “Halothane-morphine compared to high dose sufentanil for anesthesia & postoperative analgesia in neonatal cardiac surgery”
  - 2 groups of infants
    - Infants undergoing cardiac surgery
    - **Pre-emptive** narcotic vs. “as needed” narcotic for pain control
Anand, KJ, et. al. 1992

Preemptive Group

- Constant infusion of fentanyl commences presurgically
- Reduced beta endorphin, stress hormones
- <1% mortality rate

PRN Group

- IV bolus morphine given when pain recognized
- Increased beta endorphin, stress hormones
- Increased lactate
- Sepsis, DIC
- 27% mortality rate
Cancer surgery: how may anesthesia influence outcome?

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Keywords:
Local anesthetics;
Opioids;
P-substance;
Propofol;
Regional anesthesia;
Cancer surgery

Abstract

Objective: To review the published literature regarding the effects of anesthesia on cancer surgery to prevent tumor cell proliferation/migration or induce apoptosis.

Background: Surgery is the main treatment for potentially curable solid tumors, but most cancer-related deaths in patients who have received previous surgical treatment are caused by metastatic disease. There is increasing evidence that anesthetic technique has the potential to affect long-term outcome after cancer surgery.

Methods: This work reviews the English published literature that was obtained by performing a search of the PubMed database up to January 2014. We selected articles that provided evidence or reviewed the possible actions of anesthetics on cancer cells or the influence of anesthesia in recurrence/outcome.

Results: Inhalation anesthetics induce immunosuppression and activate inflammatory cascade activation, whereas propofol has a protective action. Opioids might promote cancer recurrence and metastasis. In vitro and in vivo studies have demonstrated that local anesthetics inhibit proliferation and migration of cancer cells and induce apoptosis.

Conclusions: Anesthesiologists should follow current best clinical practice and include all strategies that effectively decrease pain and attenuate stress. Regional anesthesia and multimodal analgesia, adding anti-inflammatory drugs, play an unquestionable role in the control of perioperative pain and may improve recurrence-free survival.
Immediate Detrimental Effects of Uncontrolled Pain Stress & Inflammation

- Heightened metabolic rate
- Increased sympathetic tone
- Increased cardiac workload
- Diminished pulmonary function
- Decreased gastrointestinal blood flow
- Translocation potential
- Increased platelet aggregation
Delayed Detrimental Effects of Uncontrolled Pain Stress & Inflammation

- Increased incidence of arrhythmias
- GI stress ulceration/translocation
- Hemostasis-thromboembolism potential
- Reduced organ function
- Poor wound healing
- Infection
- Immunosuppression
- Chronic pain

Increased long term morbidity & mortality
AAHA/AAFP Pain Management Guidelines for Dogs & Cats

AAHA Anesthesia Guidelines for Dogs and Cats*

ISFM AND AAFP CONSENSUS GUIDELINES
Long-term use of NSAIDs in cats

GUIDELINES FOR RECOGNITION, ASSESSMENT AND TREATMENT OF PAIN
Key Points of Pain Standards

• Not just about the drugs
  o “Plate” protocol to treating pain

• One size doesn’t fit all

• Evaluate analgesia or pain frequently in periop period
  o Behavior is a key to recognition of acute pain

• Analgesic drugs or techniques without treatment of stress or inflammation is worthless

• Multimodal strategy treats pain better, faster, & without side effects

• Anticipatory analgesia better than post experience analgesia
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
Time Frames to Treat Pain for Surgical Patients

- **As part of a premedication**
  - Pre induction & pre inhalant

- **Within the surgical procedure itself**
  - Termed “rescue” analgesia
  - Because every patient is an individual
  - Because the premed may not be enough

- **Post operatively: 3 time periods**
  - In the immediate recovery period
  - During the first 24 hours postop
  - In the go home period
How Do We Know They Hurt?
Acute Pain Recognition

Universal Non-verbal Pain Indicators

- Loss of normal behaviors
- Abnormal posture or movement
  - Restlessness
  - Unwillingness to move
- Splinting
- Vocalizing
- Trembling/shivering
- Aggression
- Self mutilation
- Appetite changes
- Different physiologic vital parameters

Validated Scales

- Colorado State University acute pain scale
- Glasgow composite measures pain scale
- Botucatu multidimensional pain scale
- French 4 A vet
- University of Melbourne pain scale
- Japanese Society of the Study of Animal Pain scale
Pain Recognition

Pain scale:

No Pain  Mild  Moderate  Severe Pain

0 1 2 3 4 5 6 7 8 9 10

Shelter ID No.  Group #  Date

POSTOPERATIVE CHECKS
Animals are to have TPR every hour until they are afebrile. They will be fed once they are eating and drinking.

EOA: End of anesthesia time (as on your anesthesia sheet)
DATE
TEMP
PULSE
RESP
CRT
PAIN SCORE:
MEDS GIVEN
NAME
Comments

Time animal is eating and drinking:

*PAIN SCALE * If animal scores 3 or 4, please call ICU to have on-call intern page.

<table>
<thead>
<tr>
<th>Pain Score</th>
<th>0 (no pain)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical site</td>
<td>Does not notice palpation</td>
<td>Orient to site, may be slightly uncomfortable, normal respiration</td>
<td>Orient to site, may be slightly uncomfortable, slight objection to palpation</td>
<td>withdrawn from pain, quiet, may vocalize, occasional guarding, may chew, box, shake, snort, rub</td>
<td></td>
</tr>
<tr>
<td>Attitude</td>
<td>Normal attention, alert, well-oriented, normal respiration</td>
<td>Observer, has interest, shifts position occasionally, responds to interaction</td>
<td>Occasionally shifts position, but basically &quot;calm,&quot; allows observation</td>
<td>Restless, unsettled</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2: Sample postoperative monitoring protocol from the North Carolina State University veterinary program. This form was adapted to meet both the JAAH standards and the institutional Animal Care and Use Committee standards.
# Pain Recognition

## Short Form of the Glasgow Composite Pain Scale

<table>
<thead>
<tr>
<th>Dog’s name</th>
<th>Hospital Number</th>
<th>Date</th>
<th>Time</th>
<th>Surgery Yes/No</th>
<th>Procedure or Condition</th>
</tr>
</thead>
</table>

*In the sections below please circle the appropriate score in each list and sum these to give the total score.*

### A. Look at dog in Kennel

#### Is the dog?

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 - Ignoring any wound or painful area</td>
</tr>
<tr>
<td>1</td>
<td>1 - Looking at wound or painful area</td>
</tr>
<tr>
<td>2</td>
<td>2 - Licking wound or painful area</td>
</tr>
<tr>
<td>3</td>
<td>3 - Rubbing wound or painful area</td>
</tr>
<tr>
<td>4</td>
<td>4 - Chewing wound or painful area</td>
</tr>
</tbody>
</table>

### B. Put lead on dog and lead out of the kennel

#### When the dog rises/walks is it?

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 - Do nothing</td>
</tr>
<tr>
<td>1</td>
<td>1 - Look round</td>
</tr>
<tr>
<td>2</td>
<td>2 - Pinch</td>
</tr>
<tr>
<td>3</td>
<td>3 - Growl or guard area</td>
</tr>
<tr>
<td>4</td>
<td>4 - Snap</td>
</tr>
<tr>
<td>5</td>
<td>5 - Cry</td>
</tr>
</tbody>
</table>

### D. Overall

#### Is the dog?

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 - Comfortable</td>
</tr>
<tr>
<td>1</td>
<td>1 - Unsettled</td>
</tr>
<tr>
<td>2</td>
<td>2 - Restless</td>
</tr>
<tr>
<td>3</td>
<td>3 - Hunched or tense</td>
</tr>
<tr>
<td>4</td>
<td>4 - Rigid</td>
</tr>
</tbody>
</table>

**Total Score** \( (H+I+M+H+V+Y) \)

---

*In the case of spinal, pelvic or multiple limb fractures, or where assistance is required to aid locomotion do not carry out section B and proceed to C.

Please tick if this is the case and then proceed to C.*

### C. If it has a wound or painful area including abdomen, apply gentle pressure 2 inches round the site.

#### Does it?

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 - 0</td>
</tr>
<tr>
<td>1</td>
<td>1 - 1</td>
</tr>
<tr>
<td>2</td>
<td>2 - 2</td>
</tr>
<tr>
<td>3</td>
<td>3 - 3</td>
</tr>
<tr>
<td>4</td>
<td>4 - 4</td>
</tr>
</tbody>
</table>

*IT IS NOT THE INTENT OF THIS FORM TO REQUIRE THAT ANIMALS PROVE THEY ARE IN PAIN BEFORE THERAPY IS INSTITUTED. Instead, this form is intended to aid in the evaluation of dogs and cats that may be in pain following surgery or trauma. The most objective method to determine that measures for pain are appropriate will vary from individual to individual. Animals that are expected to be experiencing moderate to severe pain, based on the surgical procedure performed, should be treated before assessment indicates severe pain. Many animals will receive analgesia before pain is detected, based on this scoring system. Nevertheless, a score ≥ 15 should result in treatment unless there is a compelling reason to withhold analgesia.*

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Pain Recognition

• Common practical characteristics of acute pain analysis
  o Distant observation of the patient for behavioral signs of pain?
  o Interaction with patient & response to this?
  o Movement excessive or diminished?
  o Palpation of the surgical area & response to this?
  o What is the patient’s respiratory rate & pattern?

• Dynamic Interactive Visual Analogue Scale (DIVAS)
Pain scoring of surgical patients needs to include some physiologic parameters

At Intake

• Behavior
  o But need baseline vital parameters
    ▪ TPR & pain score

Post operatively

• Behavior & physiologic
  o Regularly once extubated
  o With vital parameters
    ▪ TPR & pain score

Intraop pain:
1. Respiratory rate
2. Respiratory character
3. Tachycardia
4. Hypertension
What Can We Do About Pain in Our Patients?
Typical Anesthesia Menu

- Premedication
- Preoxygenation
- Induction agent
- Inhalant
- Local blockade
- Postoperative medication
Typical Anesthesia Menu

- Premedication
- Induction agent
- Inhalant
- Local blockade
- Intraoperative “rescues”
- Postoperative medication

We can treat pain stress & inflammation within all these areas!
Premedications
The Anesthesia Protocol
Premedication Definition

- Substance(s) which provide:
  - Analgesia
  - Sedation
  - Anti-inflammatory effect
  - PONV (post op nausea & vomiting) prevention
  - Anxiolysis
  - Muscle relaxation

  - “Pre meds” implies “Pre-”emptive treatment

Benefits must continue through “insult”

Postop meds may still be necessary
Route & Site of Premed is Important

Route of Administration

- Most premeds: Intramuscular (quads/hamstrings most reliable in quadruped)
  - Vs. subcutaneous or IF (intrafat)
- Rapid need: Partial dose intramuscular & partial dose intravenous
- Fat patients, high risk=critical patients: Intravenous

Site of IM Injection
**Classes of Agents Used in Premedication**

For Small Animal Surgery Patients

**Must Have:**
- Potent pain relievers
  - Opioids
- Anti anxiety/sedative agents
  - Benzodiazepines
  - Phenothiazines
  - Alpha agents
- Anti-inflammatory agents or modalities
  - NSAIDs
  - Steroids
  - Local anesthetics
  - Microdose ketamine

**Optional:**
- Gastrointestinal agents
  - Antiemetics/motility agents
  - Gastric protectants
- Anticholinergics
  - Glycopyrrolate
Keep in Mind That Premeds…

- Decrease mortality & morbidity (*Brodbelt*, 2009)
- Are the most important aspect of treating surgical pain stress & inflammation
  - Induction agents & inhalants offer no treatment of pain stress or inflammation
    - Inhalant use increases mortality
  - Premeds allow for less induction agent & less inhalant agent
- Should be administered regardless of health (=ASA status=risk)
  - The More sick=high risk a patient, the more reliance on premed
    - Vs. inhalant
    - Vs. induction agent boluses
Relation between ASA risk & Drug Usage

![Graph showing the relation between ASA risk and drug usage](image)
Why Use Opioids as Part of Your Premed?

- Best acute severe analgesics
  - Regardless of ASA class – 1\textsuperscript{st} line treatment for acute & severe pain
- Cardiovascularly “soothing”
  - No change in cardiac CNS or metabolic parameters
- Respiratory pattern improvement or mild minute vent reduction
  - Unless potent INTRAVENOUS fentanyl utilized
- Improve postoperative hemodynamics
- may also provide some sedation
  - Species, breed, individual dependent
Currently Available Opioids
Opioids for Premeds

• Best for acute surgical pain; options are:
  o Pure Mu agonists: morphine, hydromorphone, oxymorphone, methadone, buprenorphine (for cats only)
  o Butorphanol will not provide enough analgesia unless combined with other drugs: dexmedetomidine, buprenorphine, hydromorphone, etc.

• Opioid downfalls:
  o Do not treat inflammation
    ▪ May contribute to increased inflammation
  o Do not relieve stress
  o May cause Ileus, vomiting, nausea
  o May cause narcosis
  o May cause urinary retention
How to get around the Downfalls

1. Always combine opioids with a solid sedative (acepromazine, dexmedetomidine or midazolam)
   
   Examples:
   
   o  Dexmedetomidine & hydromorphone
   o  Acepromazine & morphine
   o  Dexmedetomidine & butorphanol

2. Add an anti-inflammatory

   Examples:
   
   o  Hydromorphone, acepromazine, & carprofen
   o  Buprenorphine, dexmedetomidine, & meloxicam
How to Treat Pain & Stress Using a Balanced (Multimodal) Premed
How to Treat Pain & Stress Using a Balanced (Multimodal) Premed
How to Treat Pain & Stress Using a Balanced (Multimodal) Premed
Some Issues with Opioids

- Overall, no patient undergoing surgery should be denied an opioid
- Morphine increases vomiting potential
- Hydromorphone may increase vomiting potential
- Certain fentanyls can depress respiratory function
  - Compromised individuals
- Any opioid administered repetitively or continuously (in infusion) can cause ileus or urinary retention
2017-2018 Opioid Backorder Crisis

- Shortages of potent mu agonist receptor (MOR) drugs
- Morphine, Hydromorphone, Methadone, Oxymorphone, Fentanyl
- Some preservative free vials still available
  - Oxymorphone 1mg/ml
  - Morphine 1mg/ml
- Butorphanol and Buprenorphine spared for time being
Opioid-free anaesthesia in three dogs

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Abstract
Opioid-free anaesthesia (OFA) is a relatively new and growing field in human medicine. There are multiple motivations behind this emerging practice with the recognition of several serious potential opioid-related adverse effects including opioid induced hyperalgesia, opioid tolerance and immunomodulatory effects of opioids. Opioids have long been the mainstay of veterinary anaesthesia and pain management practice. The feasibility of OFA in veterinary patients is presented here. A case series of three dogs that underwent OFA for canine ovariohysterectomy is reported. The authors conclude OFA is possible in veterinary medicine; however the move away from the familiar effects of opioids perioperatively is challenging. Gaining experience with these types of protocols for standard procedures in healthy animals, such as neutering, will provide the anaesthetist with the building blocks for more invasive surgeries.

Keywords: Anaesthesia, Analgesia, Dog, Pain.
### Table 2. OFA protocol for each case.

<table>
<thead>
<tr>
<th>Drugs</th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medetomidine (ug/kg) IM</td>
<td>10</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Ketamine (mg/kg) IM</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Acepromazine (mg/kg) IM</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Alfaxalone (mg/kg) IV</td>
<td>0.4</td>
<td>2</td>
<td>2.7 mg/kg</td>
</tr>
<tr>
<td>Lidocaine (mg/kg) IV</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Isoflurane (ET%)</td>
<td>0.8-1.4</td>
<td>0.9-1.1</td>
<td>0.9-1.3</td>
</tr>
<tr>
<td>Ketamine CRI (ug/kg/min)</td>
<td>10/0.8</td>
<td>5-10/1.2</td>
<td>10/1.3</td>
</tr>
<tr>
<td>total dose (mg/kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lidocaine CRI (ug/kg/min)</td>
<td>50/1.3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>total dose (mg/kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dex/Medetomidine CRI (ug/kg/hr)</td>
<td>M2/2.4</td>
<td>M2/4.6</td>
<td>M2/4.4</td>
</tr>
<tr>
<td>/total dose (ug/kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ketamine bolus IV (total dose mg/kg)</td>
<td>N</td>
<td>N</td>
<td>Y (0.5)</td>
</tr>
<tr>
<td>Lidocaine bolus IV (total dose mg/kg)</td>
<td>N</td>
<td>N</td>
<td>Y (2)</td>
</tr>
<tr>
<td>TAP block</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
Opioid Reduced Anesthesia: What to Do

• Conserve Conserve Conserve
• Rethink timing of MOR agents
• Risk classification
• Open mind to new agents; new uses
  o Local blocks
  o Nocita
  o NSAIDs pre-emptively
  o Alpha two combinations
  o Ketamine microdose
• Multimodal and preemptive theory still valid
Practical Options

• Premed options
  o Butorphanol and dexmedetomidine IM
  o Butorphanol, dexmed and dissociative IM
• If you still have better opioids, use sparingly
  o Low dose morphine IV post induction slow
  o High dose buprenorphine IV post induction slow
• Pre-incision NSAID
• Pre-incision Local block (lido and bupiv) if possible
• Rescue options: microdose ketamine, micromicro dose dexdomitor (dilute!), IV lidocaine, opioid (whatever you have)
• Nocita™ during closure if affordable
Alpha Two Agents
Alpha agonist produces rapid sedation & pain relief by selectively binding to $\alpha_2$ ADRs in the neuron, inhibiting release of NA necessary for neurotransmission.
Why Use Alpha Agents as Your Sedative?

Great sedatives & analgesics!

1. Dexmedetomidine (3-in-1!)
   - Pain reliever
   - Stress reducer = anxiolytic
   - Muscle relaxant

2. Titrable (vs. acepromazine & midazolam)

3. Reversible if needed (atipamezole)

4. Vasoactive (assist in hemostasis control & blood pressure maintenance)
## Comparison of Available Sedatives

<table>
<thead>
<tr>
<th></th>
<th>Muscle Relaxant</th>
<th>Amnesia</th>
<th>Sedative/Anxiolytic</th>
<th>Analgesic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midazolam &amp; diazepam</td>
<td>+/-</td>
<td>+</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Acepromazine</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Dexmedetomidine</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>+</td>
</tr>
</tbody>
</table>
Clinical evaluation of the efficacy and safety of a constant rate infusion of dexmedetomidine for postoperative pain management in dogs

Chiara Valtolina*, DVM, MRCVS, Joris H Robben* DVM, PhD, Diplomate ECVIM-CA, Joost Uilenreef* DVM, Diplomate ECVAA, Joanna C Murrell* BVSc, PhD, Diplomate ECVAA, John Aspegrén† MSc, Brett C McKusick† DVM, MS, PhD & Ludo J Hellebrekers* DVM, PhD, Diplomate ECVAA

Medetomidine and dexmedetomidine: a review of cardiovascular effects and antinociceptive properties in the dog

Joanna C Murrell* BVSc, PhD, Diploma ECVA & Ludo J Hellebrekers† DVM, PhD, Diploma ECVAA

Anaesthetic, analgesic and cardiorespiratory effect of three intramuscular anaesthetic protocols in cats

GARETH EDWARD ZEILER
How to Use Dexdomitor for Analgesia

- Synergistic analgesic effect when combined with opioids
- Pronounced synergism ironically with butorphanol
  - Vs. other opioids
  - (Ko, Grimm, Ossipov)
Alpha Two Agent **Caveats/Nuances**

**Potent agents – require training**

- Heart rate is reduced cf other sedatives
  - Cardiac output reduction
  - Requires a different understanding of cardiovascular physiology to understand benefit
- Reduced need for induction & inhalant agents
  - Contributes to reduced M & M
  - Dexdomitor use
    - Less induction agent (30-50% less)
    - Less inhalant agent (30-50% less)
Contraindications to Using Dexdomitor

- **Pre-existing hypertension**
  - Aged cat with renal disease, on amlodipine & atenolol
  - Uncontrolled hyperthyroidism
- **Clinical=collapsing bradycardia**
  - Schnauzer with sick sinus syndrome
- **Pre-existing cardiac output reduction**
  - Heart failure
    - E.g., Dog with MVI, on enalapril & pimobendan, coughing, ascites, truly clinical for the murmur
  - Shock
    - E.g., Septic abdomen patient
    - E.g., Pyometra
  - Hemorrhage
    - E.g., Unstabilized HBC with fractured femur needing radiographs & pain relief
    - E.g., Hemoabdomen with pcv of 20% & tachycardia
Anticholinergics and Alpha Agonists

• Usually not advocated
• Exceptions:
  o Puppies younger than 2.5-3mos of age
  o Bradycardic kittens
• If you must use anticholinergics
  o Use glycopyrrolate vs atropine
  o Give at different time points (vs. simultaneously)
  o Give via different routes (one iv, one Im)
Classes of Perisurgical Anti-Inflammatories

• Steroids
• Nonsteroidal anti-inflammatory drugs (NSAIDs)
• Microdose ketamine
• Local anesthetics:
  o lidocaine & bupivicaine
  o NocitaR
• Physical medicine techniques
  o Low level light therapy
  o Transcutaneous electrical nerve stimulation
  o Cryotherapy
Slowing the Prostanoid Array

- Redness
- Heat
- Swelling
Why Should We Use Anti-inflammatories?

- Inflammation is structural & functional disease…which quickly escalates existing disease
  - Unlike pain (more of a functional slowly progressing addition to disease)
- Opioids & alpha two agents do not treat inflammation
  - In fact, unopposed opioids often add to inflammation
- Anti-inflammatories are needed where inflammation is caused
  - Clip and scrub
  - Skin incision
  - Tissue manipulation
What Are NSAIDs?

- Potent anti-inflammatory drugs
- Mechanism similar to steroids
  - Prostaglandin production decreases!
  - Central & peripheral effects
- Analgesic
- Antipyretic
- Anti-neoplastic & anti-angiogenic
- Non-dependence
Historical NSAIDs Used in Vet Medicine
Current NSAIDs Used in Vet Medicine
Perisurgical/Injectable NSAIDs
Relative Contraindications of NSAIDs

- Bronchospasm
- Coagulopathy
- Pregnancy (late)
  - If you desire live delivery
- Renal failure
  - Vs. disease
- Severe gastrointestinal disease
- Hepatic failure
  - Vs. disease
Rationales for Preoperative Use of NSAIDs

- NSAIDs combined with other agents produce less sympathetic wind up intraoperatively
- Some NSAIDs have a “MAC sparing” effect
  - Carprofen
- NSAIDs delivered PRE-incision have a profound effect on reduction of inflammation post surgically vs. those delivered POST incision

- Yin Z. et al. 2014 – “DNA Replication Is the Target for the Antibacterial Effects of Nonsteroidal Anti-Inflammatory Drugs”
Injectable Steroids

- Excellent anti-inflammatories
- Used at appropriate doses
  - 0.1-0.2mg/kg dex na phos
- Safer (vs. NSAIDs) in:
  - Brachycephalics
  - Disc disease
  - Laryngeal surgery
  - CNS surgery
  - Renal disease
  - Older cats
Topical Anti-inflammatory Options
4% Lidocaine Transdermal

- Transdermal lidocaine
- Penetrates intact skin
- Used for superficial applications
  - Will only penetrate 1-3mm
- May be helpful around incisional areas for inflammation
- Cassuto J, et al. 2006 – “Anti-inflammatory properties of local anesthetics & their present & potential clinical implications”
Other Anti-inflammatory Techniques
Support for Local & Regional Techniques

• Guideline support for local & regional techniques as part of veterinary anesthesia

• “The Task Force supports a position that, because of their safety & significant benefit, local anesthetics should be utilized, insofar as possible, with every surgical procedure”

2015 AAHA/AAFP Pain Management Guidelines for Dogs and Cats*

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Lidocaine & Wound Healing

• Potent anti-microbial effects

• Anti-inflammatory effects of local anesthetics

• Improved wound healing

• Reduction in ischemia-reperfusion injury
  o Kaczmarek et al. Anesthesiology, 2009
NocitaR: new addition to analgesic options

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
Intraoperative analgesia, antianxiety meds and anti-inflammatory
Repetitive Intraoperative Wakening

Due to many things – amongst them…

• Poorly balanced premedication

• Pain
  o Operative or surgical
  o Equipment (ET tube, ECG clips, blood pressure cuff, cautery)
  o Positioning
  o Visceral = bladder & bowel

• Awareness & anxiety

• Inflammation (ironically…worsened by opioids)

• Intraoperative gastrointestinal motility (nausea, regurgitation, reflux, diarrhea)

• Catecholamine release (thyroid, adrenal, gastric tumor)

• Drug reaction (antibiotic, too much opioid, etc.)
Intraoperative Wakening

With 30-50% of your patients

• Fix your premed
• Premed should contain:
  o Opioid
  o Tranquilizer or sedative
  o Anti-inflammatory

With a few patients

• Use “rescue drugs”

A rescue drug is an agent that “rescues” your patient from feeling pain, stress, or inflammation, essentially “waking up” during surgery.
Turning Up the Inhalant

- Doesn’t correct the problem for the patient (pain or awareness)
  - Definitely helps the surgeon & the technicians (gets the job done)
  - Subduing the CNS will allow surgery to continue, but actually escalates the patient’s pain pathways
- Think of Anand & Hickey study (infant mortality related to pain)
- Intraop catecholamines & inflammatory mediators will:
  - Cause post-op pain
  - Cause poor recovery
  - Cause poor healing
  - Increase morbidity
So…What Does One Do when a Patient “wakes up during surgery”? 

- Turn up the inhalant
- Turn up the oxygen flow
- Administer an intravenous
  - Opioid
  - Ketamine
  - Antianxiety drug
  - Anti-inflammatory
  - Dexmedetomidine*
  - Lidocaine
Post-op Medications
After the Surgery… Pain Relief Should Continue
Is the Premed alone sufficient? No, probably not.

- Not all patients become sufficiently analgesic from just premed
- Some need another dose of analgesic at extubation
- Some need sedation due to dysphoria
  - Opioid induced
  - High inhalant induced
- Some need more analgesic within 2-3 hours of extubation
- Some need additional analgesic prior to leaving for the night
What Can Be Done for Post-op Pain?

Scoring Pain

- Differentiating pain from dysphoria
  - High inhalant induced
  - Roller coaster induced
  - +/- high dose opioid induced
Immediate & In-recovery Analgesia

Immediate Post-sx
- Microdose dexmed
  - 1-2mcg/kg IV
- Opioid
  - 0.05mg/kg hydromorphone
- 0.1mg/kg morphine SLOW IV
- 0.02mg/kg buprenorphine

Later That Day/Before Release
- Score patient’s pain
  - Regular intervals post-op
  - Repeat opioid dose
- Score the stress level
  - Repeat the anxiolytic
  - Start oral meds (trazadone, gabapentin)
- Assure anti-inflammatory has been administered
Go Home or Discharge Options for Analgesia
What Will Patients Need Day After Sx?

Scoring of Pain

- Often done with daily check
- TPR, incision, behavior score, bladder & bowel habits, appetite, pain assessment

Transition to:

- Oral meds
- Longer lasting parenteral analgesics
- Some patients may need an additional injection of
  - Opioid
  - Anti-inflammatory
  - Stress reliever
Tramadol’s Pain Relieving Actions (or not...)

- Davilia D., 2013 – *Comparison of the analgesic efficacy of perioperative firocoxib and tramadol in dogs undergoing TPLO.*
  - “When used alone, oral administration of tramadol may not provide sufficient analgesic efficacy to treat dogs with pain after orthopedic surgical procedures.”

  - “Tramadol did not induce antinociception at any dose. This contrasts to many clinical situations describing tramadol in the literature.”
Other Out-the-Door Analgesia options

- Oral Nonsteroidal anti-inflammatory agents
- Decreasing dose steroids
- Topical applications
  - Hydrocortisone
  - A & D ointment
  - Arnica based ointment
- Dogs: Tylenol, acetaminophen, paracetamol
- Cats: Oral transmucosal (OTM) buprenorphine

- Quality care instructions
- Check wound daily
- Teach owners to pain score
- Appetite
- Bladder & bowel care
- Restraint
- Clean living arrangement
- Movement
Take Home

• Score pre & post op
• Opioids alone…no more
  o Use stress/anxiety & inflammation relief as well
• Use preemptive treatment (as in the premed)
  o But don’t rely on it alone
• Think multimodal
  o “Anesthesia menu”
• Reassess frequently
  o One size does NOT fit all
  o Gold standard: via treatment, determine if pain was present
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Part Two in the Series

ASPCApro.org/webinars

Perioperative Pain Prevention & Treatment: Evidence and Options

Tuesday, January 30 - 12:00pm – 1:00pm (EST)

Andrea L. Looney, DVM, DACVAA, DACVSMR, CCRP, Massachusetts Veterinary Referral Hospital