Intraoperative & Postoperative Orthopedic Analgesia – Part I

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Rachel Bassett CVT, VTS (Anesthesia)
Orthopedic Pain

-Pathologic Pain
  - Acute/Adaptive Pain
  - Chronic/Maladaptive Pain

-Wind up Phenomenon – nonresponsive, chronic intractable pain
  - Exaggeration of painful impulses and the transmission and interpretation of an innocuous impulse as being painful.
  - Consequence of continuous, unrelenting, and untreated pain that increases responsiveness of the CNS to further input.
  - Contributes to central sensitization, hyperalgesia, and allodynia
  - Osteoarthritis, Cancer

-Major surgery: Severe pain* (preemptive pain scoring system)
  - Fracture repair
  - Cruciate ligament repair
  - Limb amputation

*Handbook of Veterinary Pain Management
Gaynor & Muir 2009, p. 85
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Consequences of Pain

- Impaired immune function
  - Increased risk of sepsis
  - Delayed wound healing
- V/Q (ventilation/perfusion) abnormalities
- Decreased appetite
- Increased metabolic demand
- Cardiovascular stress
- Contribute to mortality
- Acute pain may precipitate to chronic pain syndrome and possibly wind up.
Intraoperative Analgesia

• 3 opportunities to provide analgesia (all should be addressed):
  - Preemptive
  - Intraoperative
  - Postoperative

• Multimodal/balanced analgesia approach:
  - The use of multiple drugs with different actions, which may act at different levels of the nociceptive pathways, to produce optimal analgesia.
    • Goals:
      - Calm patient
      - Minimize pain
      - Reduced overall dosages of anesthetic agents
      - Reduced adverse effects from analgesics and anesthetic agents
      - Stable intraoperative episode
      - Smooth recovery
Intraoperative Options

• Propofol & Inhalant?
  • Most potent cardiac and respiratory depressants

• Analgesia?

• Other Options:
  • Opioids
  • NMDA-receptor antagonists
  • Alpha-2 agonists
  • CRI (constant rate of infusion)
  • Local/Regional Anesthesia

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Opioids

• Pure mu agonists – potent, excellent analgesia for ortho procedures
  o Morphine, Hydromorphone, Fentanyl
    – Can be administered as intermittent bolus, but have adverse effects that may need to be managed:
      ▪ Respiratory depression, bradycardia, CNS depression, hypotension, gastric stimulation (watch for regurgitation)

• Intra-op Dosages –
  o Morphine **Cat** 0.25 mg/kg IV
    **Dog** 0.5 mg/kg IV – duration 2-4 hrs
  o Hydromorphone 0.05mg/kg IV – duration 4 hrs
  o Fentanyl 2 – 5 mcg/kg IV – duration 15-30 minutes
    ▪ Administer slowly (1-2 min) to avoid profound bradycardia

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NMDA-receptor antagonist

• **Ketamine – Dissociative**
  
  - interrupt process of central sensitization which may help control patients experiencing hyperalgesia and allodynia.
  - Useful in managing neuropathic pain to prevent wind up
  - Commonly used, in conjunction with opioids, for orthopedic trauma/surgery and limb amputation.
  - Avoid in patients with HCM or renal function

• **Intra-op Dosage –**
  
  ⊗ 1 – 2 mg/kg IV – duration 30 minutes
Alpha-2 agonists

• Dexmedetomidine –
  – Can provide good, short-term relaxation and analgesia, when combined with injectable anesthetic agents.
  – Can reduce overall dose of anesthetic agents
  – Side effects:
    • Decreased cardiac output, tissue perfusion and oxygenation
    • Avoid in patients with cardiopulmonary or renal compromise
  — Intra-op dosage
    ○ 0.5 – 1 mcg/kg IV – duration 60-90 minutes
Constant Rate of Infusion

- **CRI**s - Continuous titratable analgesia for extended periods
  - Produces steady plasma concentration of drug to avoid peaks and troughs associated with repeated administration
  - Can be used with a single drug or combination
  - Reduces overall use of inhalant & injectable agents = smooth episode
  - Lower doses reduce potential toxicity of each agent
  - Most reliable way to prevent and/or manage wind up
  - Easy transition to postoperative period/pain management
  - Inexpensive
CRI Methods

1. Add drug to IV fluids –
   Pros – no additional equipment needed
   Cons – inability to adjust fluid rate or CRI dosage

2. Add drug to separate IV fluids –
   Pros – freedom to adjust fluid rate and/or CRI dosage
   Cons – requires 2\textsuperscript{nd} pump +/- 2\textsuperscript{nd} IV catheter

3. Syringe pump –
   Pros – drug only, no additional fluids, ease of administration/programmable
   Cons – cost ($500-800 refurbished, $1000+ new)
Intra-op CRI Dosages

• Loading dose – initial IV drug bolus administered to establish and sustain therapeutic blood level while CRI is initiated.

• Opioids:
  o Morphine –
    o loading dose (LD) – Cat 0.1 mg/kg IV SLOW
      Dog 0.2 mg/kg IV SLOW
    o CRI – Cat 0.05-0.1 mg/kg/hr,
      Dog 0.1-0.2 mg/kg/hr IV
  o Fentanyl (mcg/kg) –
    o LD – 2 mcg/kg IV SLOW
    o CRI – 5-20 mcg/kg/hr IV
Intra-op CRI Dosages

• **Ketamine** –
  
  – Not recommended as single agent, combine with opioid +/- lidocaine
  
  – Good for ortho patients with wind up: IVDD, osteosarcoma, amputation, etc.
  
  o LD – 0.5mg/kg IV
  
  o CRI – 0.6mg/kg/hr IV
Intra-op CRI Dosages

- **Lidocaine – Synergistic drug**
  - Capable of enhancing analgesia while providing anti-inflammatory, reperfusion, and GI motility benefits.
  - Not recommended for use in cats d/t potential cardio-toxic effects.
  - Discontinue if signs of toxicity: muscle tremors, seizures, nausea or vomiting.
    - LD - 1-2 mg/kg IV
    - CRI – 3mg/kg/hr IV
      - CRI should not be used for more than 2 hrs in Cats and 4 hrs in dogs
CRI Combinations

• Use single drug (opioid) or in combination to provide multimodal analgesia.

  o Morphine or Fentanyl alone
  o Morphine/Fentanyl + Ketamine
  o Morphine/Fentanyl + Ketamine + Lidocaine (MLK/FLK)
  o +/- Dexmedetomidine (recovery phase)
Immediate Post-op Pain Management

- Opioid bolus – based on previous dose duration
- CRI can be continued post-op—
  - Can use for a few hrs to 24+ hrs (depending on the drug)
  - Reduce dose by 1/3-1/2
  - Keep patient warm
  - Monitor vitals
  - Decrease if excessive sedation or recumbent
  - For management of continued dysphoria/anxiety/pain:
    - Dexmedetomidine – added to current CRI
      - LD: 0.5 – 1 mcg/kg IV
      - CRI: 2 mcg/kg/hr IV
References

• Shaffran, N. Now and Then: How Far Have We Come With Pain Management in 20 Years? In: Proceedings International Veterinary Emergency and Critical Care Symposium; 2008: Phoenix, Arizona, USA.
Two Locations:

Oakdale
1163 Helmo Ave. N.
Oakdale, MN 55128
24-hours
(651) 501-3766

St. Paul
1542 W. 7th St.
St. Paul, MN 55102
6pm-8am/M-TH
Friday: 6pm-Monday 8am
(651) 293-1800

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