Principles of Pain Management

1. Preemptive analgesia
2. Balanced analgesia
3. Dose to effect

Advances in Local Anesthetics:
- Halsted - Peripheral nerve block and Spinal anesthesia
- Cocaine, 1884 - topical anesthetic - abuse potential
- Procaine, 1905
- Lidocaine, 1943 - standard of comparison
- Bupivacaine
- Ropivacaine
- Septocaine (Articaine with epinephrine)
- Applications:
  - Regional, Specific Nerve Blocks, Infiltration
  - Neuroaxial
    - Epidural, Spinal
  - Intravenous - Lidocaine C.R.I.
- Locals can be very cheap and effective!

Powerful Techniques:

Local and Regional Anesthetics

Analgesic Therapies Available:
- Thorough Nursing Care
- Alteration of the Environment
- Distraction and Relaxation Technique
- Opioids
- Local or Regional Anesthesia
- Alpha-2 Agonist
- Others

Structure-Activity Relationships

Lipophilic Portion (unsaturated aromatic ring)
Amide or Ester linkage
Hydrophilic portion (tertiary amine)

Mechanism of Action
- Conduction blockade — prevents increases in permeability of nerve membranes to sodium ions
- Slows rate of depolarization
  - Threshold potential is not reached
  - Action potential is not propagated
- No alteration of resting membrane potential or threshold potential
Locally active reversible blockade of conduction of nerve impulses -

- Somatic sensory - anesthesia
- Somatic motor - paralysis
- Autonomic - autonomic NS blockade

Order of sensory blockade:

1. pain
2. cold
3. warmth
4. touch
5. deep pressure
6. motor

Recovery in reverse order

Toxicity associated with local anesthetics

Adverse effects of overdosing local anesthetics

- Nausea, CNS stimulation, Cardiac depression

Maximum dose guidelines:

- Total dose 2 mg/kg (bupivacaine cardiotoxic)
- Total volume 0.4 ml/kg
- Lidocaine 2% (20 mg/ml)
- Bupivacaine 0.5% (5 mg/ml)

Specific Local Anesthetics

Lidocaine – reference, and most widely used local anesthetic
Procaine - Novocaine
Mepivacaine - Carbocaine
Bupivacaine – delayed onset, long duration
Benzocaine – caution! methemoglobin
Proparacaine – ophthalmic topical
Articaine – Septocaine – dental, etc.

Specific Local Anesthetics

Bupivacaine – delayed onset, long duration
Septocaine (Articaine + Epinephrine)
dental, etc.
Adding Bicarbonate to Lidocaine

Discomfort during injection is associated with pH, needle size & rate of administration.
Neutralizing the pH of the local anesthetic solution somewhat reduces discomfort during injection.
Bicarbonate (1 mEq/L) can be added to 2% lidocaine in 1:10 or 2:10 dilution w/o precipitation.
But not with bupivacaine...
The addition of bicarb in this proportion to 0.5% bupivacaine yields an impressive white precipitate.

Application

Local Injection (Infiltration)
“Splash Block”
Topical (e.g. Laryngeal, Ophthalmic, Intranasal)
Spinal/Epidural Anesthesia/Analgesia
Regional blockade or specific nerve blocks
IVRA – Intravenous Regional Anesthesia, “BIER Block”
Analgesic/Anesthetic adjunct c.r.i.

Local Anesthetics:
Many excellent uses of bupivacaine:
- Regional
- Specific Nerve Blocks (e.g. maxillary n.)
- Infiltration

Maxillary Nerve Block:
- Maxilla, upper teeth, lip, nose
- Insert needle toward the pterygopalatine fossa from ventral margin of zygomatic arch, 0.5 cm lateral to lateral canthus of the eye.
- Aspirate, deposit drug at surface of bone.
- Dose: 0.1-1.0 ml bupivacaine or Septocaine (preferred)

Infra-orbital Nerve Block:
- Maxilla, upper teeth, lip, nose
- Insert needle into infra-orbital foramen
- Apply digital pressure over foramen
- Aspirate, deposit drug into foramen with digital pressure
- Drug courses through foramen to bifurcation
- Dose: 0.1-1.0 ml bupivacaine or Septocaine (preferred)

Mandibular Nerve Block:
- (Inferior Alveolar Branch of Mandibular Nerve)
- Mandible, lower teeth, lip +/- lingual branch (?)
- Insert needle at lower angle of jaw, rostral to angular process, advance dorsally to mid-portion on medial aspect.
- Dose: 0.1-1.0 ml bupivacaine or Septocaine (preferred)
Mental Nerve Block:
- Rostral Mandible, lower incisors, +/- canine lip, chin
- Insert small needle slightly into mental foramen
- Apply digital pressure over foramen
- Aspirate, deposit drug into foramen with digital pressure
- Drug courses through foramen
- Dose: 0.1-1.0 ml bupivacaine or Septocaine (preferred)

Periodontal Ligament Injection
- The needle is introduced into the gingival sulcus along the mesial or distal tooth surface until the alveolar bone crest is contacted (2-3 mm into the periodontal space).
- To avoid trauma of the root surface, the needle should be introduced with the bevel facing the root.

Periodontal Ligament Injection
- With the needle in the injection site, rotate the needle a few degrees to allow an unobstructed flow into the spongious bone.

Neuroaxial Analgesia:
- Powerful and sustained analgesia
- Effective throughout the body
- Technically easy
- Cost effective
- Numerous benefits

Landmarks: Iliac crests, dorsal midline, and dorsal lumbar vertebral spinous processes

Epidural analgesia / anesthesia
- 12-24 hours of substantial analgesia
- Decreased "Stress response"
- Epidural Morphine Duramorph (preservative free)
  (or Morphine USP)
- Bupivacaine or Lidocaine
  (give extra IV fluids to compensate for decreased vascular tone)
Brachial Plexus Nerve Block:

Keys to success:
- Distribute drug
- Aspirate to avoid IV injection and toxicity
- Minimize volume at each injection site to avoid nerve damage due to pressure
- Ultrasound guided nerve location
- Peripheral nerve stimulation
- 0.5% Bupivacaine, 0.4 ml/kg max. dose

Nerve Locator Needle

Specific Nerve Blocks with the Nerve Locator Needle

Peripheral nerve stimulation
Intra-Articular Stifle Block:
- Distention of the joint with long-lasting local anesthetic
  - Bupivacaine 0.5%
  - 3-6+ hours duration
dose 0.2 ml/kg (0.1 ml/lb)
- Injection pre-op and post-op for best effect

Operative Injection of Nerve Sheaths
- Great value of local anesthetics in surgical oncology
  (recognize that some controversy remains...)
- Injection of nerve sheath prior to transection
  - Lidocaine + bupivacaine rapid onset plus long duration

Intercostal Nerve Blocks

Intrapeural Blocks
Continuous ambulatory infusion of local anesthetics

“Pain Buster” pump www.iflo.com

“Diffusion”, “Soaker”, “Wound” Catheters

Provides continuous infusion of a local anesthetic directly into the surgical site. Effective, non-narcotic post-operative pain relief for up to five days.

Available in 2.5 inch and 5 inch (6.5 cm and 12.5 cm) infusion lengths, the Soaker Catheter is ideal for post-operative pain relief in large incisions.

Custom Fabricated Catheters:

- red rubber catheters
- polyethylene tubing

Distal Limb Blocks (declaw analgesia)

- Superficial Radial Nerve
dorsomedial carpus
- Ulnar N. (branches)
lateral carpus
- Median N. Ulnar N. (branch)
palmar carpus adjacent to the accessory carpal pad

0.1-0.2 ml Bupivacaine (0.5%) at each of three sites

*Note: Never use locals containing epinephrine for any extremities! (e.g. Septocaine or lidocaine with epi. = Risking loss of foot!)

- Median nerve
- Ulnar nerve
  - Palmar branch
  - Dorsal branch
- Radial nerve
  - Superficial branches

“Ring block” at carpus serves the same purpose
0.1-0.2 ml Bupivacaine (0.5%) at each site

Median nerve
Ulnar nerve
Dorsal branch
Palmar branch

0.1-0.2 ml Bupivacaine (0.5%) at each site

Radial nerve
Superficial branches

Previously used techniques, such as this “field” block or a “splash block” are less effective

Testicular Block with lidocaine/bupivacaine

Techniques Influence Outcome!
Laser declaw, rather than sharp surgical techniques.

Less tissue trauma
Decreased need for heavy and bothersome bandages
More rapid and pleasant recovery in many cats

EMLA Cream
EMLA Cream

- Cover with an occlusive barrier
  Tegaderm plastic kitchen wrap
- Wait 30-60 minutes

Lidocaine CRI (constant rate infusion)

- Analgesic contribution and reduction in anesthetic requirements
- Reduced inhalant anesthetic requirement improves blood pressures
- Mild prokinetic – reduces post-operative ileus
- Possible anti-inflammatory contribution
- Very cost-effective analgesic contribution to opioid analgesics

Lidocaine CRI (constant rate infusion)

- Loading dose 1-2 mg/kg by slow IV injection over three minutes.
  Constant Rate Infusion at 50-100 micrograms/kg/minute (0.05-0.1 mg/kg/min) by syringe pump or by controlled drip.
- Easy set-up method: 68 cc of 2% lidocaine added to liter bag of IV fluid, administered at 1 cc/pound/hour will provide 50 micrograms/kg/min. Reduce or discontinue if clinical signs of intolerance or overdose occur: nausea, CNS stimulation (twitching or seizures).

Analgesic CRI (constant rate infusion)

Other CRI options for analgesia:

- Low-dose ketamine
- Fentanyl
- Morphine
- Dexmedetomidine
- Combinations of analgesics

(See vasg.org for many useful suggestions)

Clinical Use of Local and Regional Anesthetics

Schedule a “wet lab” to introduce these techniques!

Powerful Techniques Using Local and Regional Anesthetics

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