Pain Management in Cats
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Veterinary Specialty Hospital San Diego

What is pain?
- Definition
  "Unpleasant sensory or emotional experience
  associated with actual or potential tissue
damage."
- The fourth vital sign
  Joint Commission on the Accreditation of Health
  Organization (JCAHO) implemented the
  assessment of pain in all human patients in 2001

Types of Pain
- Adaptive
  Normal response to tissue damage (e.g. surgical or
  inflammation)
- Protective mechanism
- Maladaptive
  Changes in the brain and spinal cord, leading to
  pain without tissue damage or inflammation
- Neuropathic, central pain
- No true purpose

Understanding the Pain Pathway

Pain Pathway
- Transduction
  Noxious stimuli which is translated to electrical
  impulse in response to mechanical, thermal or
  chemical noxious stimuli
- Causes release of bradykinin, serotonin, histamine,
  prostaglandins, etc.
- Transmission
  Signal is transmitted to dorsal horn of spinal cord
  via peripheral sensory neurons

Pain Pathway
- Modulation
  Pain signals are modulated in the spinal cord to
  either inhibit or facilitate further transmission to
  the brain and for perception
- Perception
  Occurs within the cerebral cortex
- Important to remember that an
  anesthetized patient can experience
  nociception but not conscious perception
Anticipating Pain
- Surgical
- Trauma (e.g. muscle pain)
- Abdominal pain (e.g. pancreatitis, sepsis)
- Cancer pain
- Orthopedic pain (e.g. Osteoarthritis, fractures, luxations)
- Neurologic pain (e.g. IVDD, spondylosis)
- Inflammatory (e.g. interstitial cystitis)

Recognition of Pain
- Changes in behavior
- Not jumping up
- Decreased grooming
- Soiling outside litter box
- Aggressive behavior becomes docile and vice versa
- Change in eating habits
- Hiding or appear distanced from environment
- Licking or chewing at site
- Hunched back with legs drawn back

Cats...A Different Species
- Hepatic metabolism
- Minimal ability for hepatic glucuronidation of exogenously administered drugs
- Have fewer UDP-UGT isoforms
- Produce only small amounts of M6G
- Therefore ...
  - Toxicity can occur from inappropriate doses or dosing intervals
  - Drugs may have much longer half-lives
  - Or be all together less effective

Treating Pain
- Pre-emptive analgesia
- Reduces cardiovascular, metabolic and hormonal responses to noxious stimuli
- Multimodal analgesia
  - Traditional
  - Complementary
- Treat whole patient
- Positioning
- Weight loss
- Dietary

A Multimodal Approach
- Local and regional
- Pharmaceutical
- Complementary

Local and Regional Techniques
- Local anesthetics
- Alpha2 Agonists
- Opioids
  - Can reduce or eliminate the need for high systemic opiates postoperatively
  - Minimizes dysphoria
  - Nausea, vomiting, regurgitation
  - Excessive sedation
Local and Regional Techniques
- Dental blocks
- Brachial plexus and thoracic paravertebral
- Epidural and spinals
- Sciatic and Femoral
- Incisional
- Intracavitary (abdominal and thoracic)
- Intercostal
- Intraarticular

Local and Regional Anesthesia
- Reversibly blocks sodium channels to prevent depolarization
- Producing reversible loss of sensation
- Alpha2 Agonists and Opioids
- Increase duration and intensity of block

Pharmaceuticals
- Opioids
- Alpha2 Agonists
- NSAID
- NMDA receptor antagonists
- Tricyclic antidepressants
- Anticonvulsants
- Tramadol

Opioids
- Among the most effective and potent drugs for pain control
- Receptors are classified as mu, kappa and delta
- High proportion of receptors located in spinal cord
- Smaller proportions located in hippocampus, cortex, spleen, kidney, intestines and retina
- Opioids classified as pure mu, mixed agonist-antagonists and partial agonists

Opioid Classifications
- Pure mu agonists
  - Hydromorphone, oxymorphone, fentanyl, morphine, methadone
- Mixed agonist-antagonists
  - Butorphanol, nalbuphine
- Partial agonists
  - Buprenorphine

Opioids
- Truths and misconceptions
  - Myth – “Cats are at a high risk for excitement or ‘mania’ following opioid administration”
  - Truth – With appropriate dosing, effects generally include euphoria, purring and kneading
  - Truth – Opioids can cause hyperthermia in cats
  - Truth – Opioids are great analgesics in cats
### Opioids

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Duration of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydromorphone</td>
<td>0.05 – 0.1 mg/kg IV, IM</td>
<td>6 hours</td>
</tr>
<tr>
<td>Oxymorphone</td>
<td>0.1 – 0.4 mg/kg IV</td>
<td>2-4 hours</td>
</tr>
<tr>
<td>Methadone</td>
<td>0.1 – 0.5 mg/kg IV, IM</td>
<td>3-6 hours</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>0.001 – 0.01 mg/kg IV CRI 0.1 – 0.5 mcg/kg/min</td>
<td>Single dose 20 minutes</td>
</tr>
<tr>
<td>Buprenorphine</td>
<td>10 – 40 mcg/kg IV, IM</td>
<td>2 hours</td>
</tr>
<tr>
<td>Butorphanol</td>
<td>0.1 – 0.4 mg/kg IV, IM, SQ Analgesia 45 minutes</td>
<td>Sedation 2 hours</td>
</tr>
</tbody>
</table>

### Alpha2 Agonists
- Medetomidine, dexmedetomidine, xylazine
- Profound cardiovascular effect
- Excellent for sedation and analgesia in healthy patients
- Epidural administration provides increased analgesia and duration of action
- Systemic effects occur but often are mild and short lived

### NSAID
- Cyclooxygenase inhibitors
- Therapeutic effects include reduction of fever, pain and inflammation
  - COX1 – Constitutively expressed in most tissues
  - Important for regulation of GI and renal blood flow, blood clotting and syntheses of thromboxane A2 in platelets
  - COX2 – Mostly an inducible enzyme
  - Induced in response to inflammatory mediators and expressed in some neoplasms
  - Constitutively expressed in the kidney and reproductive system

### NSAID
- Metabolism via liver (often by glucuronidation)
- Excretion of metabolites via kidney or bile
- Prolonged elimination half-life for some NSAIDs
  - Carprofen, aspirin, acetaminophen
  - Reduced elimination half-life for other NSAID
  - Meloxicam, piroxicam, ketoprofen

### NSAID
- Meloxicam
  - COX2 selective
  - Approved for use in cats for one time injectable dose
  - In the USA there is a bold type advisory warning against repeated injections or oral administration of meloxicam to cats
  - Oral suspension is only approved in dogs

### NSAID
- Ketoprofen
- Potent COX1 inhibitor
- Injectable formulation and ability to compound oral preparations
- Carprofen
- Preferential COX2 inhibitor
- Injectable formulation
- Large variation in half-life (9-49 hours)
- Piroxicam
- Little information in the cat
- Used mainly for treatment of epithelial neoplasia
- Little support for this in cats
NSAID

- All NSAIDs should be used in normovolemic patients without hypotension, platelet dysfunction, renal, hepatic or GI disease.
- Should not be used concurrently with steroids
- Pre versus postoperative administration is controversial

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<tr>
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<th>Duration of Action</th>
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<tr>
<td>Ketoprofen</td>
<td>2.0 mg/kg SQ once or 4.0 mg/kg PO x 5 days</td>
<td>Off label use in USA</td>
</tr>
<tr>
<td>Meloxicam</td>
<td>0.3 mg/kg SQ once</td>
<td>May cause renal failure with repeated doses</td>
</tr>
<tr>
<td>Carprofen</td>
<td>2.2 mg/kg SQ once</td>
<td>Used as a single dose</td>
</tr>
<tr>
<td>Piroxicam</td>
<td>0.3-0.5 mg/cat PO</td>
<td>24-48 hours off label</td>
</tr>
</tbody>
</table>

NMDA Receptor Antagonist

- By blocking the activation of these receptors, a reduction hyperalgesia and “wind-up”
- Allows other analgesics to function more effectively.
- Act to increase opioid receptor sensitivity, reduce opioid tolerance and minimize rebound hyperalgesia

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<tr>
<td>Ketamine</td>
<td>0.5-1 mg/kg IV</td>
<td>4-6 hours</td>
</tr>
<tr>
<td>Gabapentin</td>
<td>5-10 mg/kg PO</td>
<td>8 hours</td>
</tr>
<tr>
<td>Amantadine</td>
<td>3-5 mg/kg PO</td>
<td>12-24 hours</td>
</tr>
</tbody>
</table>

NMDA Receptor Antagonist

- Amantadine
  - Antiviral
  - Inhibits NMDA receptor mediated stimulation of acetylcholine release
  - Little literature in cats regarding analgesic efficacy but appears to be clinically efficacious
Tricyclic Antidepressants

- Amitriptyline and Clomipramine
- Effects via 5HT, noradrenaline and sodium channel blockade
- Antihistaminic, anticholinergic and anti-inflammatory effects
- Use for interstitial cystitis
- Should not be used in conjunction with Tramadol

### Tricyclic Antidepressants

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<th>Duration of Action</th>
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<tr>
<td>Amitriptyline</td>
<td>2.5 – 12.5 mg/cat PO</td>
<td>24 hours</td>
</tr>
<tr>
<td>Clomipramine</td>
<td>0.5 mg/kg PO</td>
<td>24 hours</td>
</tr>
</tbody>
</table>

Other

- Tramadol
  - Centrally acting analgesic via opioid, serotonergic, and adrenergic pathways
  - Suspected to have some NNDA antagonistic effects
  - Although pharmacokinetic studies available, there are few controlled analgesic studies in cats
  - Does appear to have MAC sparing properties similar to hydromorphone

### Other

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<tr>
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<th>Dose</th>
<th>Duration of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gabapentin</td>
<td>5 – 10 mg/kg PO</td>
<td>8 hours</td>
</tr>
<tr>
<td>Tramadol</td>
<td>3 – 5 mg/kg PO</td>
<td>24 hours</td>
</tr>
<tr>
<td>Trazadone</td>
<td>7 mg/kg PO</td>
<td>(dog)</td>
</tr>
<tr>
<td>Pregabalin</td>
<td>1.5 mg/kg PO</td>
<td>8 hours</td>
</tr>
<tr>
<td>Maropitant</td>
<td>1 mg/kg SQ</td>
<td></td>
</tr>
</tbody>
</table>
Complementary Therapies

- Nutrition
- Nutriceuticals
- Chondroprotective agents
- Physical rehabilitation
- Acupuncture and PENS
- Low level laser therapy
- Myofacial trigger point release/massage

Questions
The Ophthalmic Exam: Tips and Tricks
Nicole Roybal
Veterinary Specialty Hospital
February 27, 2012

Purpose
• Develop a systematic approach
  – Helps avoid missing subtle abnormalities
  – Helps organize thought process
• Techniques to help identify and localize lesions

Supplies
• Bright, focal source of light
• Magnification (loupes, Optivisor, Slit lamp)
• Assistant to hold the patient
• Dark room
• Ophthamoscope: direct and indirect
• Tonometer
• Fluorescein stain, Schirmer Tear Test strips
• Proparacaine, Tropicamide

Exam from a distance
• Globe size, position, symmetry
  – Bupththalmos, microphthalmos, phthisis
  – Exophthalmos, enophthalmos
  – Dorsal view helps
• Eye movement
  – strabismus, nystagmus
• Ocular discharge
• Signs of pain/rubbing
  – Blepharospasm, hair loss around eyes, discharge on paws
Vision Assessment

- Navigation from lobby to exam room
- Menace response
  - Vision pathway (afferent), CN VII (efferent)
  - If negative, check palpebral/blink reflex
  - May be absent in puppies < 8-9 weeks
- Visual Tracking (“Cotton Ball Test”)
  - Requires higher visual acuity than menace
- Visual placement reflex
  - Useful in uncooperative cats
- Maze Testing/Obstacle Course
  - Repeat in dim light

Pupil Assessment

- Symmetry
  - Retroillumination from a distance
  - Anisocoria: which is one is abnormal?
    - Assess with dark and light stimulus
- Pupillary Light Reflex
  - Retina, CN II, midbrain, CN III, iris sphincter muscle
  - Swinging Flashlight Test
    - unilateral retina/CN II lesion
    - No direct PLR but pupil constricts consensually

Diagnostic Tests

- Schirmer Tear Test
  - Prior to excessive manipulation that could stimulate tearing
    - mm/min or 15 mm/? sec
- Microbial sample collection
- Tonometry for any red eye
  - Tono-pen more user-friendly and accurate than Schiotz
    - False elevation: tension around neck, traction on lids
    - IOP should correlate with clinical signs
Anterior Segment Exam

• Light source and magnification
  – Eyelids
  – Conjunctiva and third eyelid
  – Cornea and sclera
  – Anterior Chamber
  – Iris
  – Lens
  – Anterior vitreous


Eyelids

• Position
  • Entropion: primary vs. secondary, skin maceration
  • Ectropion
• Abnormal Hairs
  • Distichia, ectopic cilia, trichiasis
• Tumors
  • Meibomian adenoma/adenocarcinoma, melanoma
• Inflammation
  • Impacted glands (Chalazion, Hordeolum)
  • Blepharitis/Meibomitis
• Defects
  • Previous surgery, trauma, congenital

Feline eyelid agenesis
Blephartitis


Conjunctiva and Third Eyelid

• Hyperemia
• Chemosis
• Lymphoid follicles
• Observe palpebral puncta
• Masses:
  – Neoplasia: hemangioma, mast cell tumor, melanoma
  – Benign: granuloma, fat prolapse
• Third eyelid
  – Masses: gland prolapse, neoplasia
  – Depigmentation (“Atypical Pannus”)
  – Scrolled cartilage

Cornea and Sclera

• Cornea
  – Protrusions: granulation tissue, iris prolapse, neoplasia, inclusion cyst, bullous keratopathy
  – Opacities: edema ('cobblestone' pattern), blood vessels, fibrosis, pigment, inflammatory cells, mineral, cholesterol, foreign body, sequestrum

• Sclera
  – Episcleral injection, masses or thickening
  – Limbal melanoma
  – Defects: traumatic rupture, staphyloma, coloboma

Anterior Chamber

• Flare: cells and protein (grade 1-4)
  • Purkinje Images (pinpoint or slit beam): Tyndall Effect
  • Fibrin: amorphous, white-yellow
  • Hyphema
  • Hypopyon: often settled ventrally
  • Fat: lipid aqueous (hazy, gray/blue, translucent)
  • Uveal Cysts: Labs, Goldens, Bostons, Rottweilers
  • Tumors: uveal melanoma, iridociliary adenoma

Anterior Chamber

• Change in depth
  – Too deep
    • Posterior lens luxation/subluxation
      – Look for iridodonesis (wiggly iris)
    • Hypermature cataract (wrinkly lens capsule)
  – Too shallow
    • Anterior lens luxation/subluxation
    • Iris bombe
    • Aqueous humor misdirection (cat)
Iris

- **Color changes**
  - Brown: melanoma, nevus, chronic inflammation
  - Red: hemorrhage, blood vessels (rubeosis iridis)
  - Blue eyes turn yellow/green with inflammation
- **Texture changes**
  - Smooth/swollen: iritis
  - Velvety: feline diffuse iris melanoma
- **Atrophy**: 'moth eaten', sluggish/absent PLR
- **Synechia**: Anterior (iris to cornea), posterior (iris to lens)
- **Persistent pupillary membranes**
  - Arise from collarette
- **Masses**: cyst, melanoma, iridociliary adenoma, lymphoma

Iridocorneal Angle

- **Visible in cats without special equipment**
  - Useful for suspicious pigmented lesions
  - Affects prognosis and treatment decisions
- **Requires gonioscopy lens in dogs**
  - Primary glaucoma
  - Angle width, pectinate ligament morphology

Dilate the pupils?

- **First:**
  - Rule out glaucoma
  - Mydriasis can exacerbate elevated IOP
  - Observe and document any iris or pupil lesions
- **Allows much better view of fundus and lens**
- **Skip if planning on immediate referral**

Mydriatic Agents

- **Tropicamide**
  - Maximum onset 15-30 minutes, lasts 5-9 hours
  - Preferred for diagnostic purposes
  - Minimum cycloplegic effect
    - Doesn’t help with ciliary spasm-associated pain
- **Atropine**
  - Maximum onset 1 hour, lasts 3-5 days
**Lens**

- Nuclear sclerosis vs. cataract: retroillumination
- Cataract
  - Stage
    - Incipient vs. immature vs. mature vs. hypermature
  - Location
    - Cortex vs. suture vs. equator vs. nucleus
    - Anterior vs. posterior
- Pigment
  - Synechia, PPM, ruptured uveal cyst
- Lens capsule integrity
  - Essential to evaluate with corneal puncture/laceration
  - Rapid-onset cataracts can cause rupture (diabetics)

**Vitreous**

- Asteroid hyalosis
  - Suspended refractile white bodies (calcium/lipid)
- Vitreal syneresis: swirl with eye movement
- Large bullous retinal detachment
- Hemorrhage
- Blood vessel
  - Persistent hyaloid artery (optic nerve to lens)

**Fundic Exam**

- Direct vs. indirect ophthalmoscopy

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
<th>Indirect (monocular)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnification</td>
<td>17x (dog), 20x (cat)</td>
<td>1.7x (dog), 2x (cat)</td>
</tr>
<tr>
<td>Image</td>
<td>Real, upright</td>
<td>Virtual, inverted</td>
</tr>
<tr>
<td>Depth perception</td>
<td>possible, difficult</td>
<td>poor</td>
</tr>
<tr>
<td>Area visualized</td>
<td>small</td>
<td>large</td>
</tr>
<tr>
<td>Uses</td>
<td>Detailed lesion observation</td>
<td>Broad, scanning view</td>
</tr>
</tbody>
</table>

Fundic Exam

• What’s Visible?
  • Retina
    • Mostly translucent when normal
    • Blood vessels
    • Retinal pigment epithelium (RPE)
      • Pigmented ventrally, transparent over tapetum
    • Optic nerve head
      • Degree of myelination varies with species and individual
  • Choroid
    • Tapetum
    • Blood vessels in poorly pigmented patients
      • “Tigroid Fundus”: lack of pigment in RPE and choroid

Fundic Exam

• Retina
  • Folds: worm-like wrinkles
  • Dysplasia: altered reflectivity, often breed-specific
  • Detachment
    • Bullous
    • Rhegmatogenous
  • Edema

Fundic Exam

• Retinal Vessels
  • Too small – atrophy, anemia
  • Too big – hypertension, vasculitis
  • Tortuosity – subjective, variation in normal
  • Hemorrhage – subretinal, intraretinal, preretinal


Rhegmatogenous Retinal Detachment

Bullous Retinal Detachment


Vascular Attenuation due to PRA

Hypertensive Retinopathy
Fundic Exam

• Tapetal Reflectivity
  – Increased: less overlying tissue
    • Degeneration, retinal detachment
  – Decreased:
    • Fluid, cells, blood between light and tapetum
    • Distortion of globe (orbital mass effect)

HYPER-reflective:
Taurine Deficiency Retinopathy in a cat

HYPO-reflective:
Multifocal retinal edema due to systemic hypertension in a cat