



**Pain Control For Animals  
During Disaster Situations**  
NDMS 2009  
Part 1  
Physiology Pathophysiology of Pain



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**Objectives for the Workshop**

- To develop a physiologic rationale for the need to alleviate pain in animals during a disaster situation.
- To develop the ability to recognize signs of pain in various species.
- To understand the myriad of scenarios under which animals may be painful but may not show signs of pain.

**Objectives for the Workshop**

- To understand the available pain relieving drugs, and rational dosing and routes of administration in companion animals (dogs, cats, horses) in the field setting or field hospital setting.
- To understand the available pain relieving drugs, and rational dosing and routes of administration in non-companion animals (cattle, pigs, sheep, etc) in the field setting or field hospital setting.



**What prevents us  
from treating pain?**

**Barriers to Treating Pain**

- Difficulty in assessment
- Lack of understanding of relevant drugs
- Misunderstanding side effects
- Lack of training
- Lack of supplies
- Myths

### Myths and Pain

- Analgesia will encourage a patient not to guard him/herself
- Costs too much
- Animals are stoic-normal behavior means no pain



Why should we treat pain?

We have a moral imperative to advocate on behalf of those who cannot advocate for themselves!

The Stress Response is Detrimental

Pain Control is Good Medicine

**Pain**

STRESS RESPONSE

Increased ACTH & Cortisol

Increased ADH

Increased Renin  
Aldosterone  
Angiotensin II

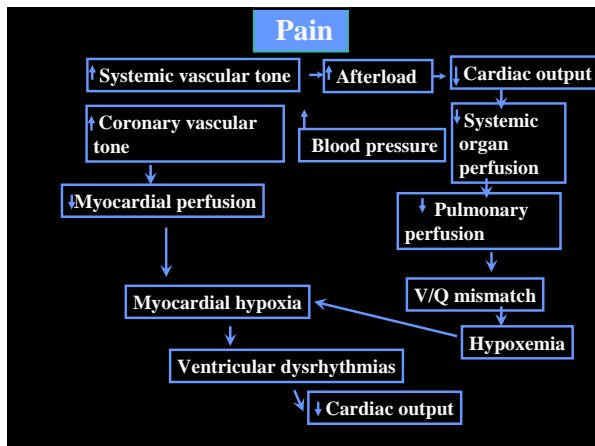
Increased Catecholamines

Decreased Insulin & Testosterone

Decreased GI motility  
Retention of sodium, water  
Decreased oxygenation, ventilation

General Catabolism, Lipolysis

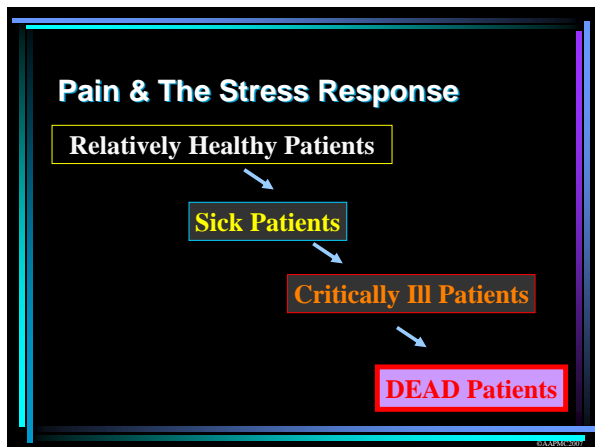
**DECREASED HEALING**



COMPLICATIONS

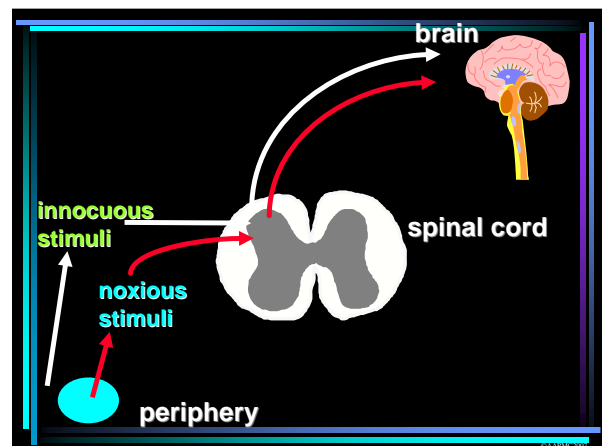
Finding	Intermittent Opioid	Continuous Opioid	P Value
Hypotension	11 (73%)	13 (43%)	0.055
Dysrhythmias	7 (47%)	6 (20%)	0.154
Sepsis	3 (20%)	0	0.032
DIC	3 (20%)	0	0.032
Death	4 (27%)	0	0.032

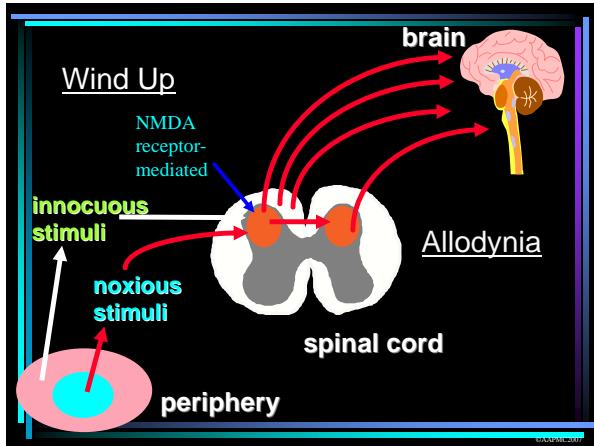
From Anand, KJS et al. NEJM 326:1-9;1992



- ### Principles of Pain Management
- Pain control is good medicine
  - Pre-emptive, intraoperative & postoperative, chronic analgesia
  - Multimodal approach

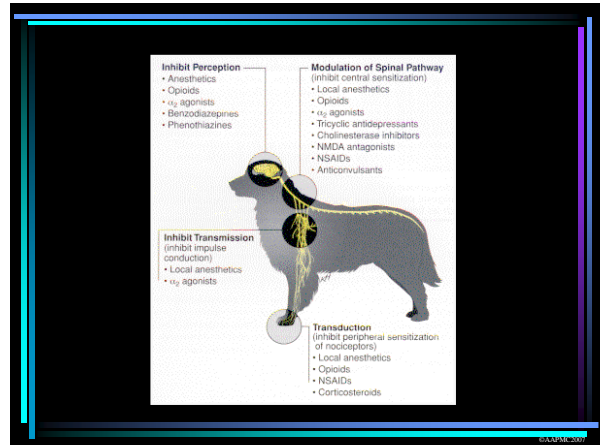
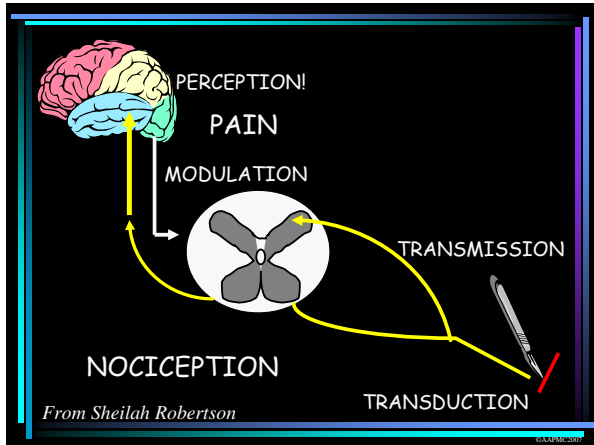
- ### Pre-emptive Analgesia
- Analgesia before the patient hurts
    - Not always possible
    - Before the next insult
  - Later analgesia : easier
  - Prevent wind up





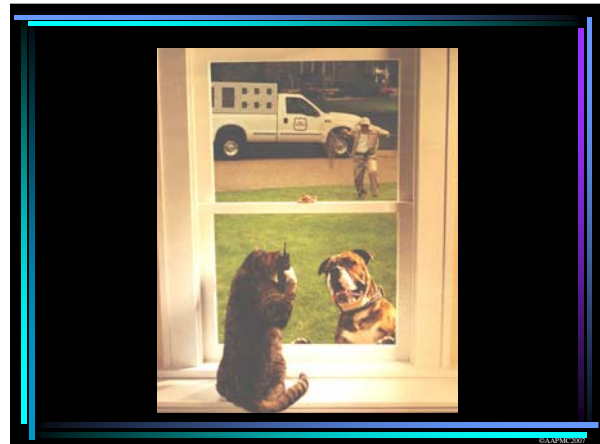
### Multi-Modal Approach

- Multiple drugs
- Different mechanisms
- Overall better analgesia



### Multi-Modal Approach

- Opioids
- Alpha-2 agonists
- Local anesthetics
- NSAIDs
- NMDA receptor antagonists



For Consultation



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Further Information

**Pain Control For Animals  
During Disaster Situations**  
NDMS 2009  
Part 2  
Assessment of Pain



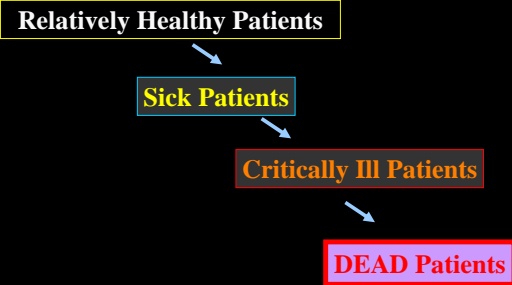
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**The Stress Response  
is Detrimental**

**Pain Control  
is  
Good Medicine**

**Pain & The Stress Response**



```
graph TD; A[Relatively Healthy Patients] --> B[Sick Patients]; B --> C[Critically Ill Patients]; C --> D[DEAD Patients];
```

**How Do We Recognize Pain?**

**Sometimes It Is Obvious**

**Every Species  
Has a Different  
Set of Behavioral  
Considerations**



### Recognition and Assessment Tools

- Can everybody see the same thing?
- Pain scores for training
- VAS

**Colorado State University**  
 Colorado State University  
 Veterinary Medical Center  
 Canine Acute Pain Scale

Pain Score	Example	Psychological & Behavioral	Response to Palpation	Body Tension
0		<input type="checkbox"/> Comfortable when resting <input type="checkbox"/> Happy, content <input type="checkbox"/> Not bothered by sound or surgery site <input type="checkbox"/> Interested in or curious about surroundings	<input type="checkbox"/> Nonreactive to palpation of wound or surgery site, or to palpation elsewhere	Minimal
1		<input type="checkbox"/> Content to slightly unsettled or restless <input type="checkbox"/> Distracted easily by surroundings	<input type="checkbox"/> Reacts to palpation of wound, surgery site, or other body part by looking around, flinching, or whimpering	Mild

2		<input type="checkbox"/> Looks uncomfortable when resting <input type="checkbox"/> May whimper or cry and may lick or rub wound or surgery site when unattended <input type="checkbox"/> Droopy ears, worried facial expression (arched eye brows, darting eyes) <input type="checkbox"/> Reluctant to respond when beckoned <input type="checkbox"/> Not eager to interact with people or surroundings but will look around to see what is going on	<input type="checkbox"/> Flinches, whimpers cries, or guards/pulls away	Mild to Moderate Requires analgesic plan
3		<input type="checkbox"/> Unsettled, crying, growling, biting or chewing wound when unattended <input type="checkbox"/> Guards or protects wound or surgery site by altering weight distribution (i.e., limping, shifting body position) <input type="checkbox"/> May be unwilling to move all or part of body	<input type="checkbox"/> May be subtle (shifting eyes or increased respiratory rate) if dog is too painful to move or is stoic <input type="checkbox"/> May be dramatic such as a sharp cry, growl, lunge or bite threat, and/or pulling away	Moderate Requires analgesic plan
4		<input type="checkbox"/> Constantly growling or screaming when unattended <input type="checkbox"/> May bite or chew at wound, but unlikely to graze <input type="checkbox"/> Potentially unresponsive to surroundings <input type="checkbox"/> Difficult to distract from pain	<input type="checkbox"/> Cries at non-painful palpation (may be experiencing allodynia, allodynia, or fearful that pain could be made worse) <input type="checkbox"/> May react aggressively to palpation	Moderate to Severe May be right to avoid further movement Requires analgesic plan

RIGHT

LEFT

Tender to palpation  
 Warm  
 Tense

**Colorado State University**  
**Colorado State University Veterinary Medical Center**  
**Feline Acute Pain Scale**

Pain Score	Examples	Psychological & Behavioral	Response to Palpation	Body Tension
0		<input type="checkbox"/> Content and quiet when unattended <input type="checkbox"/> Comfortable when resting <input type="checkbox"/> Interested in or curious about surroundings	<input type="checkbox"/> Not bothered by palpation of wound or surgery site, or to palpation elsewhere	Minimal
1		<input type="checkbox"/> Signs are often subtle and not easily detected in the hospital setting; more likely to be detected by the owner(s) at home <input type="checkbox"/> Earliest signs at home may be <b>subtle</b> (e.g., <b>subtle signs of changes in normal routine</b> ) <input type="checkbox"/> In the hospital, may be content or slightly unsettled <input type="checkbox"/> Less interested in surroundings but will look around to see what is going on	<input type="checkbox"/> May or may not react to palpation of wound or surgery site	Mild

2		<input type="checkbox"/> Decreased responsiveness, seeks solitude <input type="checkbox"/> Quiet, side of brightness in eyes <input type="checkbox"/> Legs tucked up or site tucked up (all four feet under body, shoulders hunched, head held slightly lower than shoulders, tail curled tightly around body) with eyes partially or mostly closed <input type="checkbox"/> Hair coat appears rough or fluffed up <input type="checkbox"/> May intensively groom an area that is painful or itchy <input type="checkbox"/> Decreased appetite, not interested in food	<input type="checkbox"/> Responds aggressively or tries to escape if painful area is palpated or approached <input type="checkbox"/> Tolerates attention, may even seek it when petted as long as painful area is avoided	Mild to Moderate Requires analgesic plan
3		<input type="checkbox"/> Constantly yowling, growling, or hissing when unattended <input type="checkbox"/> May bite or chew at wound, but unlikely to move if it aches	<input type="checkbox"/> Growls or hisses at non-painful palpation (may be experiencing ataxia, weakness, or fearful that pain could be made worse) <input type="checkbox"/> Reacts aggressively to palpation, intently pulls away to avoid any contact	Moderate Requires analgesic plan
4		<input type="checkbox"/> Prostrate <input type="checkbox"/> Potentially unresponsive to or unaware of surroundings, difficult to distract from pain <input type="checkbox"/> Responsive to care (even mean or wild cats will be more tolerant of contact)	<input type="checkbox"/> May not respond to palpation <input type="checkbox"/> May be rigid to avoid painful movement	Moderate to Severe May be rigid to avoid painful movement Requires analgesic plan

Tender to palpation  
 Warm  
 Tense

RIGHT      LEFT

**Visual Analog Scale**

No Pain
  Worst Possible Pain

**No Good Pain Scoring Systems In Other Major Species**

**More are Being Developed**

**Signs of Acute Pain in Dogs**

Posture	Temperament	Vocalization	Movement	Other
•Tail between legs •Arched / hunched back •Twisted body •Drooped head •Prolonged sitting •Tucked abdomen •Laying in a flat, extended position	•Aggressive •Clawing •Attacking, biting •Escaping	•Barking •Howling •Moaning •Whimpering	•Reluctance to move •Decreased weight bearing •Lameness •Unusual gait •Unable to walk •Frequent movement – unable to find a comfortable position	•Reluctance to move •Decreased weight bearing •Lameness •Unusual gait •Unable to walk •Frequent movement – unable to find a comfortable position

**Signs of Acute Pain in Cats**

Posture	Temperament	Vocalization	Movement	Other
•Tucked limbs •Arched or hunched head and neck or back •Tucked abdomen •Lying flat •Slumping of body •Drooping head	•Aggressive •Biting •Scratching •Chewing •Attacking •Escaping •Hiding	•Crying •Hissing •Spitting •Moaning •Screaming •Purring	•Reluctance to move •Decreased weight bearing •Lameness •Unusual gait •Unable to walk •Frequent movement – unable to find a comfortable position •Inactive	•Attacks if painful site is touched •Failure to groom •Dilated pupils •Decreased interest in food / play

### Signs of Acute Pain in Horses

- Reluctance to be handled
- Restlessness
- Prolonged pain may cause behavior to change from restlessness to depression with lowered head
- Rigid stance
- Head pressing
- Interrupted feeding (food held in mouth uneaten)
- Anxious appearance
- Dilated pupils and glassy eyes
- Flared nostrils
- Muscle tremors
- Profuse sweating
- Increased respiratory rate and pulse rate

### Signs Of Abdominal Pain in Horses

- Look, bite, or kick at abdomen
- Straining and splinting of the abdomen
- Get up and lie down frequently
- Walking in circles
- Sweating
- Rolling/thrashing
- Standing rigid and unmoving when near collapse
- Groaning, teeth grinding, and "calling" to herd members

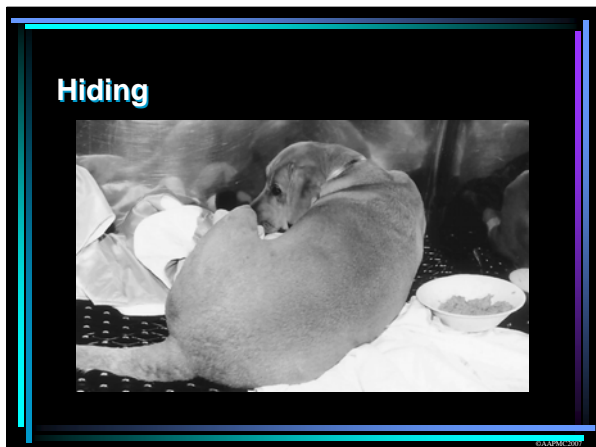
## Anthropomorphism

Treatment in the Absence of Clear Pain  
VS  
Prophylactic Antibiotic Therapy

### Pain Assessment

### Pain Assessment





**Lack of Connection**



**Submissive Behavior**



**Timid**



**Non-Weightbearing**



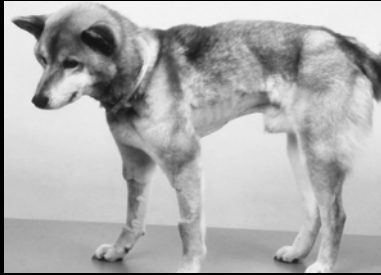
**Aggression**



**Aggression**



### Tucked Abdoman



### Praying Position



### For Consultation



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Further Information

### Signs of Musculoskeletal Pain in Horses

- Reluctance to move
- Limbs held in unusual positions
- Alterations in weight bearing, including weight-shifting from one limb to another
- Head and neck in a fixed position
- Head "bob" (change from neutral head position during walking, trotting, running)
- Head moves up from neutral with forelimb pain, and head moves down from neutral with hindlimb pain)
- Changes in recumbency time (increased or decreased)
- Abnormal gait
- Decrease in eating and drinking

### Causes of Mild / Irritating Pain in Dogs & Cats

- Dried blood or urine scald
- Clipper burns or cuts
- Intravenous (IV) catheterization
- Full bladder, needing to urinate or defecate
- Minor cuts or scrapes
- Anal gland evacuation
- Surgery or other procedures on the eyelid (eyelash removal, entropion)

Adapted from Carroll GL. *Small Animal Pain Management*. AAHA Press, 1998.

### Causes of Mild-Moderate Pain in Dogs & Cats

- Endoscopy with biopsy?
- Dental cleaning with or without tooth extraction
- Arterial catheterization (A-line)
- Muscle biopsies
- Stabilized fractures of smaller leg bones (tibia/fibula, radius/ulna)
- Surgeries of the lower abdomen (castration, spay, cystotomy)

*Adapted from Carroll GL. Small Animal Pain Management. AAHA Press, 1998.*

### Causes of Moderate - Severe Pain in Dogs & Cats

- Small areas of burns or ulcerations
- Corneal ulcers\*Eye removal
- Surgery of the mid and lower spine, including disc surgery
- Declawing procedures (dewclaw removal)
- Stabilized fractures of larger leg bones (femur, humerus) or pelvis
- Mastectomy (breast tissue removal)
- Surgeries of the upper abdomen (diaphragmatic hernia, abdominal exploratory)

*Adapted from Carroll GL. Small Animal Pain Management. AAHA Press, 1998.*

### Causes of Severe Pain in Dogs & Cats

- Large areas of burns or ulcerations
- Infections within the abdomen (peritonitis, pancreatitis)
- Surgeries of the neck, including disc surgery
- Procedures in the nose (endoscopy)
- Leg amputations
- Surgery of the chest (opening the chest cavity)

*Adapted from Carroll GL. Small Animal Pain Management. AAHA Press, 1998.*

### Causes of Mild / Irritating Pain in Horses

- Intravenous (IV) catheterization
- Full bladder, needing to urinate or defecate
- Minor cuts or scrapes
- Fly bites or "strike"
- Improper shoeing

*Hendrickson DA. Personal communication, 2004. Carroll GL. Small Animal Pain Management. AAHA Press, 1998.*

### Causes of Mild - Moderate Pain in Horses

- Endoscopy with biopsy?
- Arterial catheterization
- Muscle biopsies
- Castration
- Hernia repair
- Joint strain
- Osteochondrosis dissecans (OCD)
- Bowed tendon
- Arthroscopy procedures (chip fractures)

*Hendrickson DA. Personal communication, 2004. Carroll GL. Small Animal Pain Management. AAHA Press, 1998.*

### Causes of Moderate - Severe Pain in Horses

- Small areas of burns or ulcerations
- Corneal ulcers
- Cellulitis
- Joint infections
- Arthroscopy procedures (severe ligament injury)
- Stabilization of fractures (any part of leg or foot)
- Surgeries of the abdomen (colic)

*Hendrickson DA. Personal communication, 2004. Carroll GL. Small Animal Pain Management. AAHA Press, 1998.*

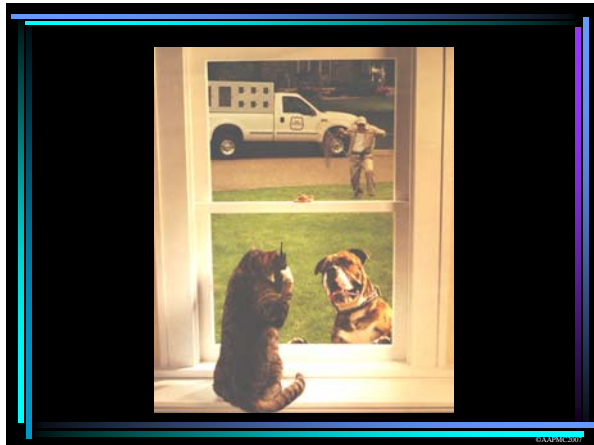
### Causes of Severe Pain in Horses

- Large areas of burns or ulcerations
- Infections within the abdomen (peritonitis)
- Surgeries of the neck, including disc surgery
- Laminitis
- Rhabdomyolysis

Hendrickson DA, Personal communication, 2004; Carroll GL, Small Animal Pain Management, AAHA Press, 1998.

### Signs of Pain in Ruminants (and others)

- Separation from flock or herd
- Lack of interest in surroundings
- Decreased mentation
- Decreased appetite
- Bruxism (teeth grinding)
- Drooping ears
- Head drooping below withers
- Vocalization
- Grunting (spontaneously, or when painful region palpated - may need to auscultate trachea)
- Hunched back
- Unwilling to stand, reluctance to move
- Sternal or lateral recumbency
- Restlessness
- Lameness
- Tachycardia



### For Consultation



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Further Information

### Pain Control For Animals During Disaster Situations

NDMS 2009

Part 3

Non-NSAID Analgesics



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The Stress Response is Detrimental

Pain Control is Good Medicine

## Every Species Has a Different Set of Behavioral Considerations

### Triaging Based on Injury & Pain

- Are the resources available to treat the injury AND the pain?
- Who can wait to be treated?
- Who needs to be treated right now?
- Who has a bad prognosis no matter what?

### Multi-Modal Approach

- Opioids
- Alpha-2 agonists
- Local anesthetics
- NSAIDs
- NMDA receptor antagonists

This Concept Crosses All Species Lines

## Companion & Non-Companion Animal Medications

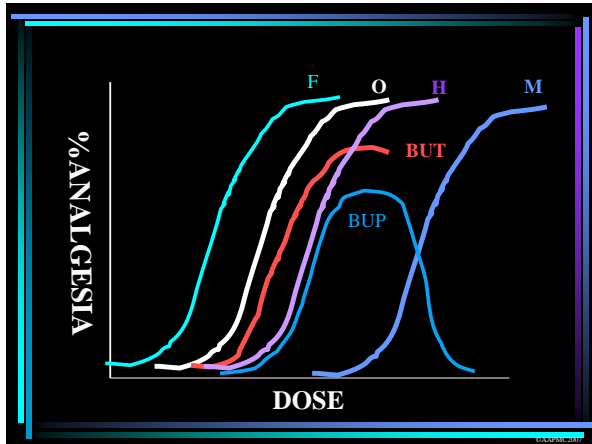
### Opioids



- Morphine
- Hydromorphone /oxymorphone
- Fentanyl
- Remifentanyl
- Buprenorphine
- Butorphanol
- Nalbuphine

### Opioids

- Mu agonists = most effective
- Excellent analgesia
- Depression or excitement
- Emesis with 1st dose?
- Pre-, intra-, postoperative
- Dysphoria



### Morphine

- Very inexpensive
- Premed 0.2-1.0 mg/kg SQ, IM
- Post-op 0.1-0.2 mg/kg/hr
- Relatively long lasting
- Most likely to cause vomiting as premed

*Doses are for Dogs/Cats*



### Hydromorphone / Oxymorphone



- 5-10x more potent than morphine
- Less vomiting
- No histamine release concerns
- 0.1-0.2 mg/kg SQ, IM
- 0.05-0.01 mg/kg IV

*Doses are for Dogs/Cats*

### Fentanyl

- 100x more potent than morphine
- Short duration
  - 20 min IV
  - 40 min SQ
- Unlikely to induce vomiting
- Infusions
  - 2 ug/kg IV
  - 5-20 ug/kg/hr
- Variable metabolism



*Doses are for Dogs/Cats*

### Remifentanyl



- Ultrashort duration = 8-10 minutes
- General esterase degradation
- Ultimate control
- 2x fentanyl dose

### Buprenorphine

- Partial mu agonist - antagonist
- Mild - moderate analgesia
- **NOT** good for severe pain
- Long duration 6-12 hrs
- Feline differences - better analgesia?



## Butorphanol

- Kappa agonist- mu antagonist
- Mild to moderate analgesia
- 45 minute duration in dogs
- 4 hr duration in cats
- 1 hr in most large animals

When would you use it?



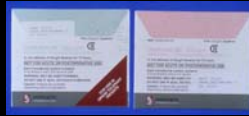
## Nalbuphine

- **Not Scheduled!**
- Kappa agonist / mu antagonist
- Equivalent or better analgesic than butorphanol
- Usable in all species



## Fentanyl Patches

- Theoretical efficacy
- Good data in multiple species
- Must maintain good patch adherence
- Clinical effectiveness?



## Alpha-2 Agonists

- Xylazine
- Medetomidine
- Romifidine
- **Adjunct** analgesia/sedation
- Synergistic analgesia-G-proteins
- Very low - bottle doses
- **Reversible**



## Alpha-2 Agonists

- Major cardiac effects
  - Decreased heart rate
  - Increased afterload
  - Decreased cardiac output and perfusion
  - Hypertension -> hypotension



## Alpha-2 Agonists

- Major pulmonary effects
  - Pulmonary artery constriction ->  $\pm$  pulmonary hypertension: edema
- Hypoxemia



### Alpha-2 Agonists

- Medetomidine
- Anticholinergic?
- Postoperative /ICU
  - Microdose dose -> significant beneficial
  - Ultra low dose: 0.25-1 ug/kg IV
- Xylazine
- Reversible with atipamezole



Doses are for Dogs/Cats

### Alpha-2 Agonists for Large Animals

- Xylazine
- Detomidine
- Romifidine
  
- Reversible with atipamezole



Swine require very high doses

Ruminants require very low doses

### Ketamine



- NMDA receptor antagonist
- Prevents windup
- No direct analgesia
- Useful for postop control
  - Less need for opioids
  - Less dysphoria

### Ketamine

- Start before surgical stimulus
- Continue thru end
- 0.5 mg/kg bolus
- 10 ug/kg/min thru surgery
- 2 ug/kg/min 1st 24 hrs postop
- 1 ug/kg/min 2nd 24 hrs
  
- 0.6ml ketamine in 1L fluids @ 10 ml/kg/hr

### Ketamine

- Potentially useful for patients who have had chronic pain with poor control
- Allows analgesia with lower opioid dose



### Local Anesthetics

- Lidocaine
- Bupivacaine
- Specific blocks
- Epidurals



### Lidocaine

- Short duration: 60 minutes
- 2 mg/kg for dogs
- 1 mg/kg for cats
- High doses -> neurotoxicity
  - Confusion
  - Seizures

### Bupivacaine



- Longer duration: 4 hours
- 2 mg/kg
- Avoid IV injection
  - Cardiotoxicity
  - Cardiac arrest

### Epidurals

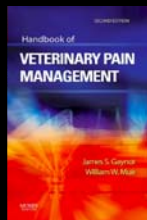
- Morphine
  - Analgesia with no muscle effects
  - Up to 24 hours of pain control
- Local anesthetics
  - Likely to induce recumbency
  - May be appropriate in the hospital setting



### For Consultation



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Further Information

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NSAIDs & Beyond



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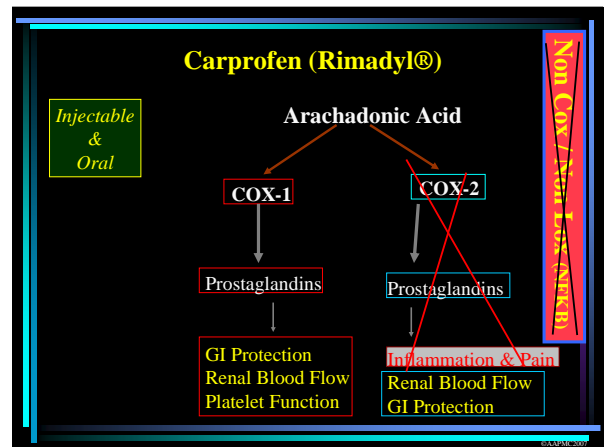
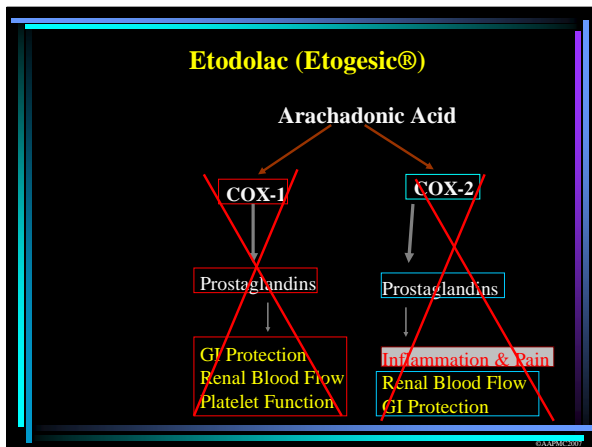
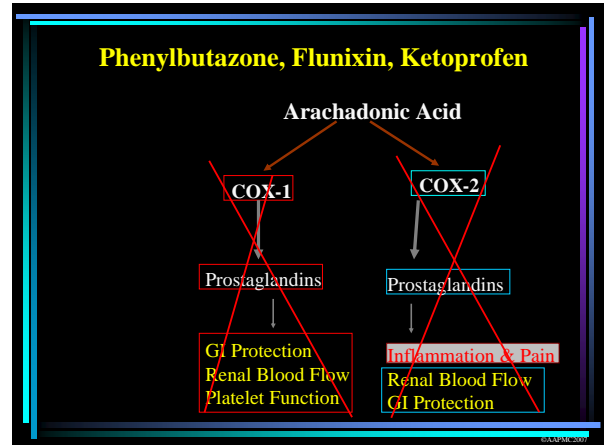
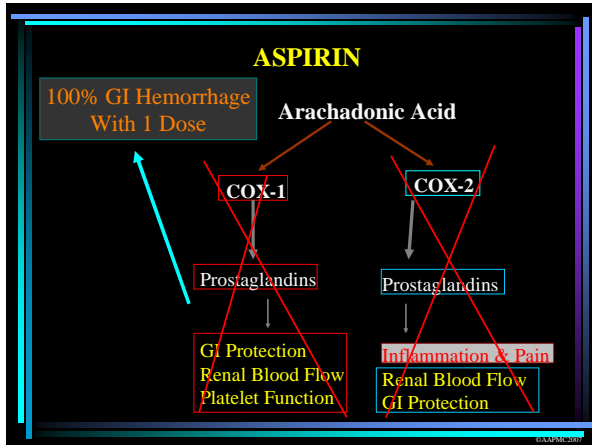
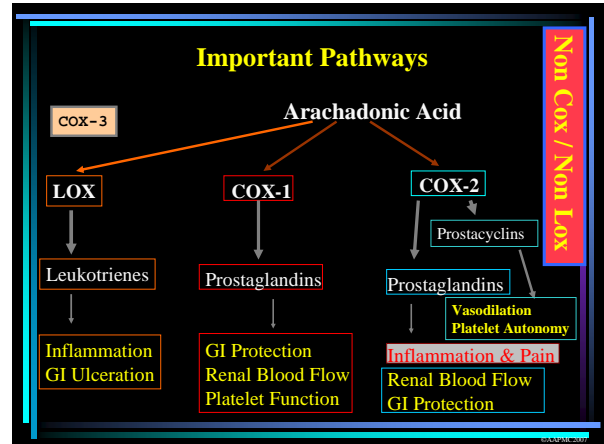


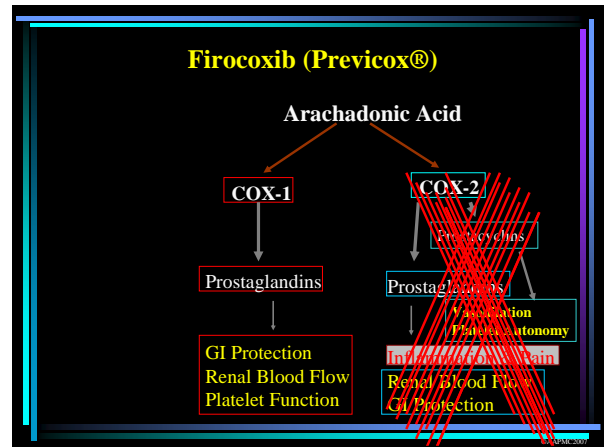
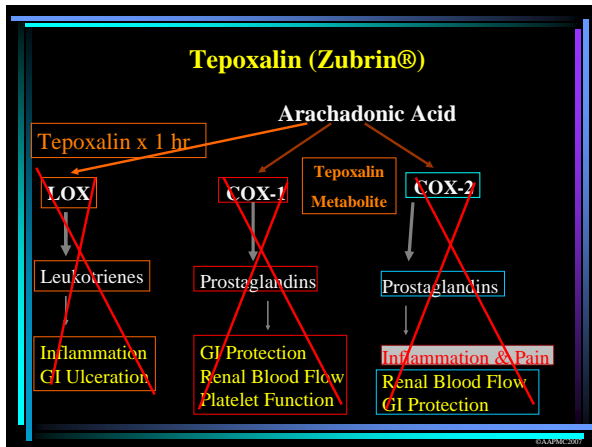
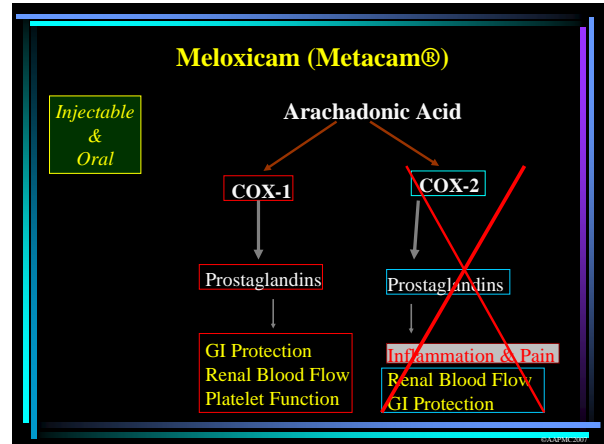
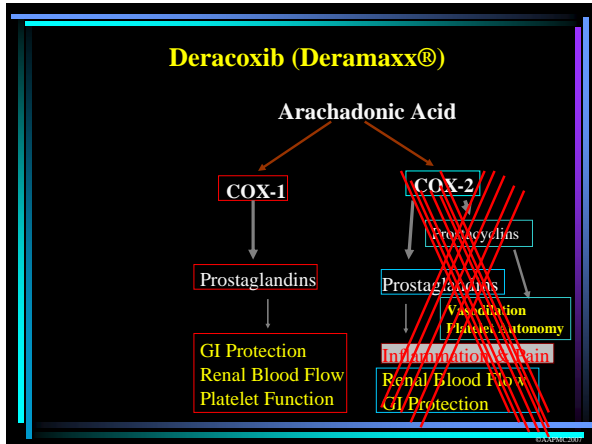
### NSAIDs

- Etodolac
- Carprofen
- Deracoxib
- Meloxicam
- Tepoxalin
- Firocoxib
- Aspirin
- Piroxicam
- Phenylbutazone\*
- Flunixin\*
- Ketoprofen\*

*\*Commonly used in large animals*

Acetaminophen





### NSAIDs

- More efficacious than placebo
- A few comparisons
- Little difference in pain relief

### NSAIDs

- Individuals will respond better to one NSAID than another
  - Pain relief
  - Adverse responses



### NSAIDs & Cats



- Single Rimadyl SQ dose 1-2 mg/kg
- No repeat dosing injectable or oral

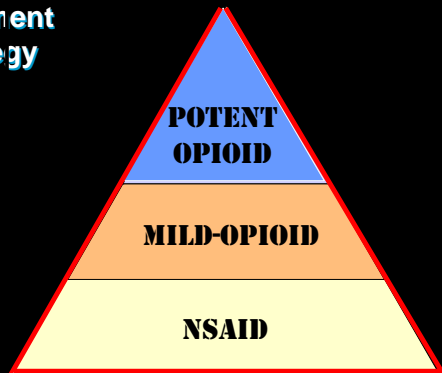


### Meloxicam in Cats for Acute Pain

- 0.2 mg/kg SQ
- 0.05 mg/kg PO daily for 4 days
- Do **NOT** use bottle injectable dose and follow with oral



### Treatment Strategy



### Treatment Strategy

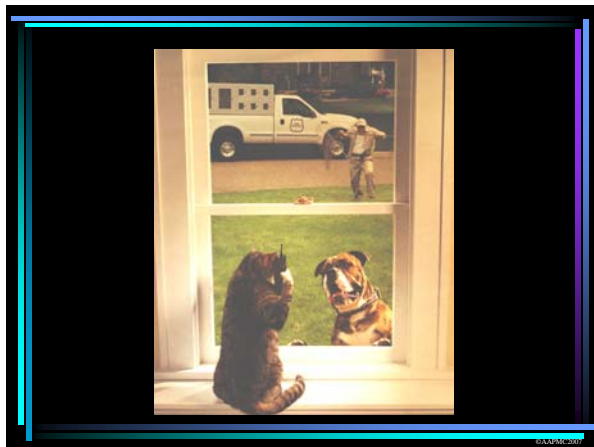
- Get the patient comfortable quickly (IV is ideal)
- Maintain the comfort
- Prevent problem pain



# Nonmedical Aspects of Maintaining Comfort

## Non Drug Options

- Pulsed electromagnetic field therapy
- Acupuncture
- Good nursing care!!!!



## For Consultation



719-266-6400  
800-791-2578  
[www.peakvets.com](http://www.peakvets.com)



Further Information

# Useful Doses & Information

## NSAID Doses in Small Animals

NSAID	Canine (mg/kg)	Feline (mg/kg)
Etodolac	10-15 PO QD	Not Recommended
Carprofen	4.4 PO, IV, SQ QD	1-3 SQ ONCE
Deracoxib	1-2 PO QD	Not Recommended

### NSAID Doses in Dogs and Cats

NSAID	Canine (mg/kg)	Feline (mg/kg)
Tepoxalin	10 PO QD	5 PO BID
Meloxicam	0.1 SQ ONCE 0.1 PO QD	0.3 SQ ONCE, 0.1 SC then 0.05 PO QD x 5 days
Firocoxib	5 PO QD	Not Recommended

### NSAID Doses in Small Animals

NSAID	Canine (mg/kg)	Feline (mg/kg)
Ketoprofen	2 IV, IM, SC q12-24h	1-2 IV, IM, SC q12-24h
Phenylbutazone	10-15 PO q8-12h max 4 days	Not Recommended

### NSAID Doses in Small Animals

NSAID	Canine (mg/kg)	Feline (mg/kg)
Flunixin	1.0 IV, SC ONCE 1.0 POMax 3 days	Not Recommended
Aspirin	10-25 PO q8- 12h	10 q2-3 days

### Mu Agonist Opioid Doses in Small Animals

Opioid	Canine (mg/kg)	Feline (mg/kg)
Morphine	0.1-2.2 IV, IM, SC q1-4 h	Not Recommended
Oxymorphone / hydromorphone	0.05-0.2 IV, IM, SQ q 0.6- 3h	0.05-0.1 IV, IM, SQ q 0.6- 3h
Fentanyl	0.01 IM, SQ q1h, 0.002 IV followed by 0.003- 0.01 mg/kg/hr	0.005 IM, SQ q1h, 0.002 IV followed by 0.003- 0.01 mg/kg/hr

### Transdermal Fentanyl Patch Dosing in Dogs and Cats

Patch Size	Canine (mg/kg)	Feline (mg/kg)
25 ug/hr	5-10 kg	All Cats (<5 kg 1/2 patch peeled back)
50 ug/hr	10-20 kg	Do Not Use
75 ug/hr	20-30 kg	Do Not Use
100 ug/hr	30-40 kg	Do Not Use

### Other Opioid Doses in Small Animals

NSAID	Canine (mg/kg)	Feline (mg/kg)
Butorphanol	0.2-0.8 IV, SC, IM q0.75-2h	0.2-0.6 IV, SC, IM q1-4h
Buprenorphine	0.01-0.02 IV, SC, IM q6- 12h	0.01-0.02 IV, SC, IM, buccal q6-12h

### Tranquilizer /Sedative Doses in Small Animals

Drug	Canine (mg/kg)	Feline (mg/kg)
Acepromazine	0.01-0.1 IV, SC, IM	0.05-0.1 IV, SC, IM
Medetomidine	0.001-0.02 IV, SC, IM	0.001-0.04 IV, SC, IM
Xylazine	0.1-1.0 IV, SC, IM	0.1-1.0 IV, SC, IM

### NSAID Doses in Horses & Cattle

NSAID	Horses (mg/kg)	Cattle (mg/kg)
Ketoprofen	1-2.2 IV, SC q12-24h	1-2 IM, SQ q12-24h
Phenylbutazone	2-4 IV, PO q12-24h	Unclear
Flunixin	1.1 IV, IM QD	1.1 - 2.2 IV QD

### Opioid Doses in Horses and Cattle

NSAID	Horses	Cattle
Butorphanol	0.05-0.75 IV, IM, SC q4-6h	0.5 IM, SC q8-12h
Buprenorphine	Unclear	0.005-0.01 IM, SC q8-12h
Morphine	0.03-0.1 IV q4-6h	0.01-0.05 IV q4-6h

### Tranquilizer / Sedative Doses in Horses & Cattle

Drug	Horses (mg/kg)	Cattle (mg/kg)
Acepromazine	0.02-0.1 IV, IM	0.025-0.05 IV
Detomidine	0.0025-0.01 IV	0.0025-0.01 IV
Xylazine	0.3-2.2 IV SC, IM	0.01 - 0.05 IV

### NSAID Doses in Swine & Small Ruminants

NSAID	Swine (mg/kg)	Sheep (mg/kg)	Goats (mg/kg)
Ketoprofen	1-3 IV, IM, SC PO QD	3 IV, IM QD	3 IV, IM QD
Phenylbutazone	4-8 PO BID 2-8 IV QD	2-4 IV, PO QD	2-4 IV, PO QD

### NSAID Doses in Swine & Small Ruminants

NSAID	Swine (mg/kg)	Sheep (mg/kg)	Goats (mg/kg)
Flunixin	0.5-2.2 IV, SQ QD Max 3 days	0.5 - 2.2 IV, IM, PO QD- TID Max 3 days	0.5 - 2.2 IV, IM, PO QD- TID Max 3 days
Carprofen	2-4 IV, SC, PO BID	4 SQ QD	4 SQ QD

### Mu Agonist Opioid Doses in Swine & Small Ruminants

Opioid	Swine (mg/kg)	Sheep (mg/kg)	Goats (mg/kg)
Morphine	2.0 IV Q4-6h	2.2 IV Q4-6h	2.2 IV Q4-6h
Oxymorphone	0.15 IM Q4h	0.1 IV, IM, SQ Q2-4h	0.1 IV, IM, SQ Q2-4h
Fentanyl	0.02-0.05 IM Q2h	2.0 IV, 3-10 mg/kg/hr	2.0 IV, 3-10 mg/kg/hr

### Mu Agonist Opioid Doses in Swine & Small Ruminants

Opioid	Swine (mg/kg)	Sheep (mg/kg)	Goats (mg/kg)
Meperidine	2-10 IM, SQ Q 2-4 hrs	2-10 IM, SQ Q 2-4 hrs	2-10 IM, SQ Q 2-4 hrs
Transdermal Fentanyl Patch	Unclear	50 ug/hr	50 ug/hr

### Other Opioid Doses in Swine & Small Ruminants

Opioid	Swine (mg/kg)	Sheep (mg/kg)	Goats (mg/kg)
Butorphanol	0.1-0.3 IM, IV BID, TID	0.2-0.5 SQ, IM Q4h	0.2-0.5 SQ, IM Q4h
Buprenorphine	0.05-0.1 IM Q12	0.005-0.015 SQ IM Q 4-12 hrs	0.005-0.015 SQ IM Q 4-12 hrs

### Tranquilizer / Sedative Doses in Swine & Small Ruminants

Drug	Swine (mg/kg)	Sheep (mg/kg)	Goats (mg/kg)
Acepromazine	0.05-0.2 IM, SC	0.05-0.1 IM, SC	0.05-0.1 IM, SC
Xylazine	2-4 IM	0.01 - 0.05 IV	0.01 - 0.05 IV, 0.1-0.2 IM

### Analgesia Considerations in Horses

- Opioids: may cause excitement in the pain free horse, can be prevented with concurrent administration of a tranquilizer
- Alpha-2 agonists: well tolerated and accepted
- NSAID's: well tolerated and accepted •local anesthesia, neurectomies: well tolerated and accepted
- Epidural  $\alpha_2$ -adrenergic agonists - perineal analgesia

### Analgesia Considerations in Food Animals

- Little information on these species
- Opioids: partial agonists appear to work well
- NSAID's: seemly work well •local anesthesia: is a vital option
- Food Residues

### Analgesia Considerations in Cats

- Opioids: produce excitement at high doses, however, these drugs can work well if use appropriate dose; if excitement occurs, a tranquilizer, such as acepromazine, will calm the animal
- NSAID's (acetaminophen, aspirin): toxicity is a major problem
- Local anesthesia: more sensitive than dogs to get overdose
- Epidural opioids  $\pm$  local anesthetics\*
- Transdermal fentanyl

### Analgesia Considerations in Dogs

- Opioids: work well, widely documented in the literature\*
- NSAID's: work well, widely used, some toxicity problems with some drugs
- Local anesthesia: techniques established, may be an option
- Epidural opioids  $\pm$  local anesthetics
- Transdermal fentanyl

### Resources

- *Handbook of Veterinary Pain Management*. Eds: Gaynor JS & Muir WW. Mosby, St. Louis, 2002
- University of Rochester Medical Center, Committee on Animal Resources  
<http://www.urmc.rochester.edu/ucar/manual/table1.htm>
- Yale Animal Resource Center  
<http://www.med.yale.edu/yarc/vcs/drugs.htm>
- Wake Forest University Animal Resources Program  
<http://www1.wfubmc.edu/ARP/health/index.htm>
- Cornell University Center for Animal Resources and Education  
[http://www.research.cornell.edu/care/documents/SOPs/CAR\\_E102.pdf](http://www.research.cornell.edu/care/documents/SOPs/CAR_E102.pdf)
- *Small Animal Pain Management*, Carroll GL. AAHA Press 1998