Nonsteroidal anti-inflammatory analgesics in pain management in dogs and cats

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Divinum est opus sedare dolorem
(Divine is the work to subdue pain)
Hippocrates

Introduction

Concern for pain control has been with us for a long time! Unfortunately, it is not always applied in patient management by doctors of medicine or veterinary medicine, researchers using live animals in experimentation, or educators in teaching laboratories. However, during the past decade, the importance of pain management is being realized and various therapeutic agents and methods have been researched and reported. Nonsteroidal anti-inflammatory analgesics (NSAIAs) have been used for centuries, but only recently with the advent of potent injectable drugs has their potential for the treatment of moderate to severe acute pain been realized. Historically, NSAIAs were only recommended for mild, chronic pain, and their inadequacy for the treatment of moderate to severe acute pain, together with their association with severe gastrointestinal (GI) and renal problems, was heavily stressed. However, "not all NSAIAs are created equal" in this regard. The more recently developed injectable NSAIAs compare favorably (and sometimes are superior) to opioids in both humans and animals. This has contributed significantly to pain management in the research and teaching environment, where the control of narcotics is a major issue.

Cats and dogs are more susceptible to the adverse effects of NSAIAs; therefore, the reported safety of any one analgesic in the human patient should not be assumed to be so in the veterinary patient.

When discussing analgesics and their use, I compare them to antibiotics in that there is not a single analgesic that is appropriate for the control of all types of pain. Pain is caused by many different factors, as are infections, and it is necessary to consider an appropriate analgesic and dose, as you would for an antibiotic, for the particular pain (infection) you are dealing with. Because there are various mediators and modes of sensory input involved in nociceptive transmission, pain control is more successfully managed, in certain cases, when more than one modality of treatment is used, as in a mixed infection requiring more than one antibiotic. The excellent analgesic properties of opioids and the effects of local, regional, and epidural analgesia should be considered in all surgical procedures (1). Nonsteroidal anti-inflammatory analgesics can be used alone, but they are also synergistic with other analgesic drugs (opioids) or modalities (local, regional, and epidural analgesia). I must emphasize that the newer injectable NSAIAs discussed here are very good to excellent for alleviation of postoperative pain, especially orthopedic, and in some cases, are superior to opioids. Other uses are indicated below. Some of these drugs carry a high risk for gastric ulceration and nephrotoxicity, so the contraindications should be observed.

The purpose of this article is to inform you of parenteral and oral NSAIAs that are currently available, as well as those that will be available soon, and can be used in selected patients (cats and dogs) for moderate to severe acute pain (surgical, traumatic, neoplastic, inflammatory). The indications and contraindications for using NSAIAs will be stressed; patient selection and ulcer prophylaxis will also be discussed. A visual analogue scale with descriptors to assist you with pain assessment is given in Appendix 1.

Mechanism of action

Nonsteroidal anti-inflammatory analgesics are inhibitors of cyclo-oxygenase (prostaglandin synthetase), which catalyzes the incorporation of molecular oxygen into arachidonic acid to produce prostanoids (thromboxanes, prostacycline, and prostaglandins (PG)E_2, F_2, and D_2). These compounds serve as mediators of inflammation and amplifiers of nociceptive input and transmission to the spinal cord, via sensory afferents in the peripheral nerves (2). Prostaglandins have also been shown to have a powerful effect upon spinal nociceptive processing by facilitating the firing of central neurons and augmenting neurotransmitter release from primary spinal sensory afferents (3). Some NSAIAs inhibit both cyclo-oxygenase and lipo-oxygenase activity. Lipo-oxygenase also acts on arachidonic acid to form hydroperoxy- and hydroxy-eicosatetraenoic acids and the leukotriene group of compounds, which are mediators of inflammation. Arachidonic acid is detached from injured cell membranes by phospholipase A_2, which is inhibited by corticosteroids through the induction of lipocortin synthesis (2).

There are 2 isoforms of cyclo-oxygenases. Cyclo-oxygenase 1 (COX 1, the constitutive or nonregulated form) maintains physiological functions (modulation of renal blood flow, synthesis of gastric mucus, etc.) via prostaglandin synthesis. Cyclo-oxygenase 2 (COX 2, the cytokine-induced form) is activated in damaged or inflamed tissue with subsequent production of prostaglandins, including PGE_2. It is purported that the COX 2 is responsible for the hyperalgesia and pain response experienced after injury; therefore, the development of selective COX 2 inhibitors will provide safer NSAI analgesics (4).

Several NSAIAs that have more than 1000-fold specificity for COX 2 over COX 1 are in the early stages of drug development (4). These agents will revolutionize pain management without the concerns for nephrotoxicity, ulcerogenicity, etc., if they prove to be as effective in pain control as the more recent injectable drugs. The current NSAIAs vary in their inhibition of both COX 1 and COX 2; therefore, the potency and toxicity will differ.

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Because of their high protein binding, NSAIAs can displace other drugs from their plasma protein binding sites, inhibit their metabolism, and interfere with their renal excretion. Drug interactions, therefore, need to be considered, especially in patients with even mild or potential organ dysfunction and in those receiving medication with a narrow therapeutic index.

Nonsteroidal anti-inflammatory analgesics commonly used in veterinary patients

Europe and Canada (approved for use in cats and dogs)

Only those NSAIAs that are currently available in North America for use in both small and large animals and those that potentially will be available in North America in the near future for use in small animals are described. The dosing regimen for all medications are listed in Table 1.

Flunixin meglumine (Banamine solution, Schering-Plough Animal Health, Pointe Claire, Quebec). Injectable. Approved for use in dogs in Europe. Although only recommended for dogs, I have also used it in cats at 0.25 mg/kg body weight (BW), given once. The elimination half-life in dogs is 4 h and cats 3 h. It is reported to be a very good analgesic for acute and surgical pain (6,7); however, the potential for an increase in alanine aminotransferase (ALT) production (7), nephrotoxicity (7–9), and gastric ulceration (10) is of major concern. Incisional oozing may also occur. Prior to the availability of ketorolac or ketoprofen, I used flunixin rarely for analgesia and as an antipyretic in both cats and dogs, especially when the temperature is rising quickly in the septic dog. In this situation, the patient is on IV fluids and ulcer prophylaxis is used. Here the benefit outweighs the risk. It has been used as an anti-inflammatory in ophthalmological cases and in sepsis prophylaxis in selected surgical candidates. It is approved for use in horses in North America.

Carprofen (Zenocarp in Europe. Rimadyl-V in North America. Pfizer). Available as a solution for injection, rectal suppositories, a paste, and tablets. Approved for use in cats and dogs in Europe. Recommended parenterally pre- and postsurgically and orally for chronic pain. The elimination half-life is 8 h. It is reported to be a very good analgesic for both orthopedic and soft tissue postoperative pain that can be effective for up to 18 h (11,12), and for pain associated with degenerative joint disease (13). In a group of dogs undergoing total hip arthroplasty, carprofen compared favorably with oxymorphone (Mathews, unpublished observations). So far, no nephrotoxicity, GI bleeding, or hemostatic deficiencies have been reported. Pfizer (USA) predicts this drug will be available for use in small animals in the USA in the fall of 1996.

Ketoprofen (Anafen, Rhône Merieux, Athens, Georgia, USA). Available as a solution for injection and tablets. Recommended for postoperative and chronic pain in both dogs and cats. The elimination half-life in both cats and dogs is 2 to 3 h. Ketoprofen is used extensively in Europe. It can be used for several months in dogs and cats for chronic pain (Rhône Merieux product monograph). The manufacturer states that ketoprofen blocks both the cyclo-oxygenase and the lipo-oxygenase pathways, as well as promoting proteoglycan synthesis. Ketoprofen has recently been approved for use in cats and dogs in Canada. There are no published controlled studies in pain management involving clinical cases or research animals; however, several studies are in various stages of publication. Ongoing studies in Canada (Pibarot, personal communication) indicate that ketoprofen is very effective in managing pain in dogs after orthopedic procedures. Very good analgesia was seen in a recent study after splenectomy in dogs (Mathews, unpublished observations). Serum urea, creatinine, and ALT were unchanged at 24 and 48 h after administration. Hemostasis studies are ongoing with presurgical administration of ketoprofen. Pre-emptive use should be withheld in surgical procedures where noncompressible hemorrhage may be a problem (laparotomy, laminectomy, hemangiopericytoma, etc.) until these studies have been completed. Patients undergoing orthopedic procedures (osteochondritis dissecans, fractures, etc.) appear to benefit from pre-emptive use with no reported problems (Pibarot, personal communication). Ketoprofen is a very good antipyretic in cats (14). Occasional vomiting may be seen. It is used extensively for osteoarthritic pain in humans and has a very good safety record.

Dipyrone (Novolate, Novin, Hoechst Canada, Regina, Saskatchewan). Available as a solution for injection and tablets (325 mg Novin). Approved for use in cats and dogs in Europe and Canada. It is recommended to be given IV or IM, but it causes irritation, so the IV route is preferred. In my experience, the analgesia produced is not adequate for moderate to severe postoperative pain. I have used it rarely as an antipyretic in cases where other NSAIAs are contraindicated (see contraindications). Nephrotoxicity and GI ulceration are not of major concern in the short term.

Meclofenamic acid (Arquel, Vetrepharm, London, Ontario). Available as granules, 50 mg/g, for use in horses. It is not yet approved for use in small animals. Meclofenamic acid is in the final stages of approval by the Federal Drug Agency (USA) for use in dogs. Ten and 20 mg tablets will soon be available for dogs. Recommended dose, 1.1 mg/kg BW, q24h for 5–7 d, dogs only. Used to treat inflammatory conditions of the musculoskeletal system in dogs. Gastrointestinal and renal problems can occur.

Approved use in Europe, Canada, and the USA (Label, or commonly accepted, use)

Phenylbutazone (Butazone, Bute, rogar/STB, Animal Health Division, London, Ontario). Available as a solution for injection and tablets. It is toxic to cats. Its use is for chronic pain only (osteoarthritis, inflammatory skin and soft tissue problems) and ophthalmic disease. It is not effective for acute or surgical pain. Pancytopenia and gastritis may occur.

Acetylsalicylic acid (Aspirin and many other trade names. Various manufacturers). Available as tablets, 80, 325, and 500 mg. Acetylsalicylic acid is also available in combination with codeine. As an analgesic, it is only effective for mild to moderate, usually musculoskeletal, pain (degenerative joint disease). There are various indications for its use other than for musculoskeletal pain; for example, pyrexia and antithrombotic and heartworm

Table 1. Nonsteroidal anti-inflammatory analgesic dosing regimen per body weight for acute and chronic pain[a]

Drug	Indication	Species, dose, route	Frequency
Ketoprofen	Surgical pain	Dogs 2.0 mg/kg, IV, SC, IM	Pre or postoperative
		Cats 2.0 mg/kg, SC	
		Dogs & cats 1.0 mg/kg	Repeat q24h
	Chronic pain	Dogs & cats 2.0 mg/kg, PO	Initially
		1.0 mg/kg	Repeat q24h
Flunixin meglumine	Surgical pain	Dogs 1.0 mg/kg, IV, SC, IM	q24h
		Cats 0.25 mg/kg, SC	q12–24h PRN for 1 or 2 treatments
	Pyrexia	Dogs & cats 0.25 mg/kg	q12–24h PRN for 1 or 2 treatments
	Ophthalmological procedures	Dogs 0.25–1.0 mg/kg	q12–24h PRN for 1 or 2 treatments
Carprofen	Surgical pain	Dogs & cats 4.0 mg/kg, IV, SC, IM	Once upon induction
		2.2 mg/kg	Repeat q12h PRN
	Chronic pain	Dogs & cats 2.2 mg/kg, PO	q12h
Ketorolac	Surgical pain	Dogs 0.3–0.5 mg/kg, IV, IM	q8–12h for 1 to 3 treatments
		Cats 0.25 mg/kg, IM	q8–12h for 1 to 3 treatments
	Panosteitis	Dogs 10 mg/dog ≥30 kg, PO	q12h for 6 treatments
		5 mg dog >20 kg <30 kg, PO	q12h for 6 treatments
Meclofenamic acid	Musculoskeletal pain	Dogs 1.1 mg/kg, PO	q24h for 5–7 d
Phenylbutazone	Chronic pain	Dogs 14 mg/kg (max 800 mg/24h), PO	q8h
Acetylsalicylic acid	Chronic pain	Dogs 10–25 mg/kg, PO	q8h
		Cats 10 mg/kg, PO	q72h
	Pyrexia	Dogs 10 mg/kg, PO	q12h
		Cats 6 mg/kg, PO	q48–72h
Piroxicam	Inflammation of the lower urinary tract	Dogs 0.3 mg/kg, PO	q24h for 2 treatments, then q48h

[a]See text for details on the contraindications for use
PRN = As required

therapy. The most common side effect is gastric irritation, especially when administered on an empty stomach. Enteric coated aspirin decreases gastric irritation, but absorption is less predictable. Toxicity is greater in cats than in dogs, and strict dosing regimens should be adhered to.

Acetaminophen (Tylenol, Tempra, and generic products. Various manufacturers). Available as tablets (325 mg, 500 mg) or elixir, 80 mg/mL. Acetaminophen is also available in combination with codeine. Acetaminophen is reported to be as effective as aspirin in the treatment of musculoskeletal pain in dogs but causes less gastric irritation. It is toxic to cats.

Not approved for use in veterinary patients

(off label use)

Ketorolac (Toradol, Hoffmann-LaRoche, Mississauga, Ontario). Used in human patients for moderate to severe pain. It is comparable with morphine in efficacy (15). Available in solution for injection and in tablet form. The duration of effect depends on the individual patient and the degree of pain but is approximately 8–12 h. Pharmacokinetic studies recently performed at the Ontario Veterinary College confirm interpatient variability (elimination half-life 6.5 ± 5 h) (Pasloske, unpublished observations). Ketorolac can cause gastric ulceration and renal insufficiency in geriatric, hypotensive, and hypovolemic human and veterinary patients. We have used this analgesic for postoperative pain at the Ontario Veterinary College for 4 y. It is an excellent analgesic in both cats and dogs. I use it in patients where opioid analgesics fail to adequately relieve postoperative, especially orthopedic, pain. It has proved to be safer than flunixin meglumine (7). I frequently use this analgesic with sucralfate as a gastric protectant, because undetectable, pre-existing gastric erosions that occurred secondary to the traumatic incident, may be present. Although this analgesic has strong potential for causing gastric ulceration, I still use it where the benefit outweighs the risk in a suitable candidate (see indications and relative contraindications). It should only be used short term, 1 to 3 treatments postoperatively. Ketoprofen (2.0 mg/kg BW) has comparable duration and efficacy to ketorolac (0.3 mg/kg BW) in managing postlaparotomy pain in dogs. Another indication for use is panosteitis in dogs, where all other therapies have failed. Ketorolac given with food for 3 d has cured approximately 99% of these dogs; in the other 1%, signs have recurred within a few days to months (Mathews, unpublished observations). In addition, misoprostol (Cytotec, Searle Canada, Oakville, Ontario) should be given for 7 d for ulcer prophylaxis (see below). In patients where corticosteroids or other NSAIAs have been used, sucralfate should be prescribed for 10 d and ketorolac therapy delayed for 4 d.

Piroxicam (Feldene, Pfizer Canada, Kirkland, Quebec). Available as capsules of 10 and 20 mg. Used in human medicine for musculoskeletal pain. Possibly its most valuable use in dogs is for its anti-inflammatory effects on the lower urinary tract in patients with

Table 2. Ulcer prophylaxis or treatment[a]

Drug	Indication	Species, dose, route	Frequency
Sucralfate	Gastric ulcer prophylaxis and gastric/esophageal erosion treatment	Dogs 0.5–1.0 g, PO Cats 0.25 g, PO	q8h q8–12h
	Hemorrhaging ulcer	Dogs 1–2g, PO 0.5–1.0 g, PO	Initially Repeat q1h for 3 treatments tapering off to q4h, then q8h for 7 d
Misoprostol	Ulcer prophylaxis	Dogs 2–5 ug/kg, BW, PO	q8h
Ranitidine	Gastric ulcer/erosion treatment	Dogs 1–2 mg/kg, BW, PO 0.5–1.0 mg/kg, BW, IV Cats 3.5 mg/kg, BW, PO 2.5 mg/kg, BW, IV	q12h q12h q12h q12h
Omeprazole	Gastric ulcer/ erosion and lower esophageal ulcer/erosion	Dogs <20 kg & cats 0.7 mg/kg, BW, PO Dogs >20 kg, BW, 20 mg PO	q24h q24h

[a]See text for specific instructions

transitional cell carcinoma or cystitis and urethritis. Stranguria due to reflex dyssynergia associated with cystitis and urethritis has been relieved with appropriate antibiotic therapy, piroxicam, and phenoxybenzamine (Mathews, unpublished observations). Piroxicam has relieved stranguria associated with transitional cell carcinoma of the bladder and urethra (16). Misoprostol, 2–5 ug/kg BW, q8h, should also be prescribed. Owners should be instructed to monitor the stool for melena or blood and look for polyuria and polydipsia. Due to its side effects, piroxicam is not recommended for musculoskeletal pain, as other NSAIAs are as effective and less toxic.

Indications for the use of nonsteroidal anti-inflammatory analgesics

The best indication for NSAIA use is for postoperative orthopedic pain in the well-hydrated, normotensive (received IV fluids intraoperatively), young- to middle-aged dog or cat with normal renal function, with no hemostatic abnormalities, not receiving corticosteroids or aspirin, and with no evidence or concern for gastric ulceration (see contraindications below). Ketoprofen, ketorolac, or carprofen can be given either presurgically to dogs when intraoperative IV fluids are administered with blood pressure monitoring and the above criteria are met or upon completion of the procedure (cats, dogs). I prefer to use opioids immediately after soft tissue surgery; however, carprofen, ketoprofen, or ketorolac can be administered initially or as the repeat, if the opioids are inadequate (efficacy, duration of action). Carprofen can be administered preoperatively, as demonstrated by previous clinical use (6,11). For pain due to meningitis, bone tumors (especially after biopsy), soft tissue swelling (mastitis), or injury (degloving), ketorolac appears to be more efficacious than opioids (Mathews, unpublished observations). As these patients may be more sensitive to NSAIA toxicity, ketorolac should only be administered twice. Ketoprofen or carprofen may also be appropriate. The side effects of ketoprofen (Rhône Merieux product monograph) and carprofen (13) appear minimal with long term use for osteoarthritis; however, the patient has to be monitored constantly for blood in the feces or melena, vomiting, and water consumption, with owner awareness of possible side effects. Other indications for the use of NSAIAs are panosteitis and dental pain. Nonsteroidal anti-inflammatory analgesics should be used with caution after dental extractions where bleeding is, or may be, of concern, or when creatinine is above the median for your laboratory and IV fluids were not administered during anesthesia.

Relative contraindications for the use of nonsteroidal anti-inflammatory analgesics

While the use of NSAIAs should be avoided in the geriatric patient, I have used ketorolac at the lower dose in older animals where opioids were not controlling postoperative pain (orthopedics, thoracotomy, etc.), provided that they had a creatinine level less than 120 umol/L, were well hydrated and receiving IV fluids, and had no evidence of gastric ulcer (vomiting, melena, etc.) or other contraindications (see below). I always administer sucralfate suspension 2.5–5 mL, q8h, (small to large dog). If the use of NSAIAs is being considered after a traumatic incident, the patient (see contraindications for NSAIA use) should be maintained on IV crystalloid therapy until adequate fluid intake has been guaranteed.

Absolute contraindications for the use of nonsteroidal anti-inflammatory analgesics

Nonsteroidal anti-inflammatory analgesics should not be administered to patients with renal insufficiency (creatinine >120 umol/L), dehydration, hypotension, conditions associated with low "effective circulating volume"

(congestive heart failure, ascites, diuretics, etc.), thrombocytopenia, von Willebrand's disease, concurrent use of other NSAIAs (aspirin etc.) or corticosteroids, evidence of gastric ulceration (vomiting with or without the presence of 'coffee ground material,' melena,) or GI disorder of any kind, intervertebral disc disease (NSAIAs are contraindicated with laminectomy as bleeding is increased in a noncompressible area) and its medical management (corticosteroids), geriatric patients (see relative contraindications), or shock or trauma cases upon presentation. Patients with severe or poorly controlled asthma or other moderate to severe pulmonary disease may deteriorate with NSAIA (which ones specifically unknown in veterinary patients) use, since PGE_2 and PGI_2 relax bronchial and tracheal muscle (17).

Ulcer prophylaxis and treatment

Sucralfate (Sulcrate, Carafate. Nordic Laboratories, Laval, Quebec). Available as tablets, 1 g, or a suspension, 1g/5mL. Sucralfate is an aluminum salt of sucrose sulfate that binds to mucosal defects providing a protective barrier to the penetration of gastric acid. Sucralfate accelerates healing of ulcers and erosions directly and stimulates the production of local prostaglandins. Sucralfate is recommended for all veterinary practices, as owner administration of NSAIAs is common and gastric ulcers have been reported with ibuprofen, naprosyn, ketorolac, etc. Sucralfate should be prescribed for concomitant use with some NSAIAs when gastric erosions could be present, as in a post-trauma surgical patient or in higher risk gastric ulcer patients, like an otherwise healthy older animal. Sucralfate is my preference for ulcer prophylaxis with short-term NSAIA use; for example, in perioperative patients, as they may have gastric erosions, due to stress or trauma, which cannot be detected. The suspension is effective for control of gastric ulcer hemorrhage (even 'big time') and is preferred in this situation to tablets. Constipation is the only reported side effect. Sucralfate should be administered on an empty stomach, 1 h before meals. Other prescribed oral medication should be given at least 1 h before, or 2 h after, sucralfate administration to avoid decreased absorption.

Misoprostol (Cytotec, Searle Canada , Oakville, Ontario). Available in 100 and 200 ug tablets. Misoprostol is a synthetic analogue of prostaglandin E_1. It is recommended for use with NSAIAs to enhance the natural mucosal defense mechanisms, but it must not be used in pregnant animals. Misoprostol can cause diarrhea if the patient is overdosed. Its use in epileptic patients is contraindicated, unless the benefit outweighs the risk of increasing seizure activity.

Ranitidine HCl (Zantac, Glaxo Canada, Mississauga, Ontario). Available as a solution for injection, 25 mg/mL; tablets, 150, 300 mg; and a syrup, 15 mg/mL. Ranitidine is an antagonist at H2-receptor sites, resulting in reduced gastric acid secretion. It will not necessarily prevent gastric ulcers but may be more protective against duodenal ulcers. I prefer using ranitidine to cimetadine, another H_2-receptor antagonist, as it does not affect hepatic microsomal enzyme metabolism and, therefore, has fewer drug interactions; also, the frequency of administration is q12h instead of q6h.

Omeprazole (Losec, Astra Pharmaceutical, Mississauga, Ontario). Available as 20 mg capsules. Omeprazole is a proton pump inhibitor and a very potent reducer of gastric acid secretion. Its use is indicated for the treatment, but not the prophylaxis, of erosions or ulcers (except for distal esophageal stricture associated with erosions).

Addendum: If you have used the ketorolac regimen for panosteitis, I would appreciate it if you could send me the details of the case with the results. Please include duration of clinical signs, if radiographs were taken prior to (and post) therapy, previous therapy and duration with response, time to resolution of clinical signs with ketorolac (dose), and time of remission.

We must all die. But that I can save him from days of torture, that is what I feel as my great and ever new privilege. Pain is a more terrible lord of mankind than even death itself.

Albert Schweitzer

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Appendix 1. Pain assessment using a visual analogue scale of zero to ten

The following observations of behavior and physiological parameters are used to assess pain in cats and dogs at the Ontario Veterinary College. This list is not complete, as you may have noted other changes in pained patients, but it serves as a guide and a standard for caregivers:

0 No pain. Patient is running, playing, eating, jumping, bouncy. Sitting or walking normally. Sleeping comfortably with dreaming. Normal, affectionate response to caregiver. Heart rate should be normal, but if elevated, it is due to excitement.

1 Probably no pain. Patient appears to be normal but condition is not as clear-cut as above. Heart rate should be normal, or slightly increased due to excitement.

2 Mild discomfort. Patient will still eat or sleep but may not dream. **May** limp slightly or resist palpation of the surgical wound, but otherwise shows no other signs of discomfort. Not depressed. There may be a slight increase in respiratory rate; heart rate may or may not be increased. **Reassess within the hour, then give an analgesic if condition appears worse.**

3 Mild pain or discomfort. Patient will limp or guard incision and looks a little depressed. Cannot get comfortable. Appears to be interested in food and may still eat a little but somewhat picky. This could be a transition from 2 above, so you notice a change from being comfortable to becoming restless, as though the analgesia is wearing off. Respiratory rate may be increased and a little shallow. Heart rate may be increased or normal, depending on whether an opioid was given previously. **Needs analgesia.** The analgesic selected will depend on whether i) it is a repeat in a patient with moderate to severe pain (fracture repair) or ii) the patient has a problem resulting in mild to moderate pain. If i), continue with morphine (0.3–0.5 mg/kg BW, or oxymorphone 0.05–1.0 mg/kg BW, or an injectable NSAIA; see indications and contraindications for NSAIA use). If ii), administer butorphanol 0.2–0.4 mg/kg BW or an NSAIA, where appropriate. If this is a mild to moderate pain situation, oxymorphone or morphine is not necessary and the patient may become dysphoric.

4 Mild to moderate pain with the patient resisting touching of the operative site, injured area, painful abdomen, or neck, etc. The patient may sit or lie in an abnormal position and is not curled up or relaxed. May or may not appear interested in food. May start to eat and then stop after 1 or 2 bites. Respiratory rate may be increased or shallow. May whimper occasionally, be slow to rise, and hang the tail down. There may be no weightbearing or a toe touch on the operated limb. Will be somewhat depressed. **Needs analgesia.** Butorphanol 0.4 mg/kg BW, q2–4h, for soft tissue injury, surgery, or pancreatitis, or oxymorphone 0.05 mg/kg BW or morphine 0.3 mg/kg BW for soft tissue injury or orthopedic problems. Consider NSAIAs for orthopedic procedures or soft tissue injury or surgery where there are no concerns for hemorrhage, renal insufficiency, or gastric ulceration. If patient has already received an opioid, consider an NSAIA as an adjunct to opioid therapy.

5 Moderate pain. Condition progressing from above or patient reluctant to move, depressed, inappetant and may bite or attempt to bite when the caregiver approaches the painful area. The patient may vocalize when caregiver attempts to move the patient or when it is approached. There is definite splinting of the abdomen if affected (peritonitis, pancreatitis, hepatitis, incision, etc.), or the patient is unable to bear weight on an injured or operative limb. The heart and respiratory rates may be increased. The patient is not interested in food, will lie down but does not really sleep, and may stand in the praying position if there is abdominal pain. **Needs analgesia.** Butorphanol at 0.4 mg/kg BW, q2–4h, for soft tissue, surgical (laparotomy, etc.), or medical problems (pancreatitis, etc.), or oxymorphone 0.05–0.1 mg/kg BW or morphine 0.3–0.5 mg/kg BW, q3–6h, for soft tissue or orthopedic problems. Consider an injectable NSAIA, either alone or as adjunct to opioids, if after orthopedic or soft tissue surgery or injury where there are no contraindications.

6 As above, but patient may vocalize or whine frequently, without provocation and when attempting to move. Heart rate will be increased, or be within normal limits if an opioid was administered previously. **Needs analgesia.** If butorphanol was given within the last 20 min and the condition is still painful, oxymorphone 0.1–0.2 mg/kg BW or morphine 0.5 mg/kg BW, q3–6h, should be given (a higher dose is required due to the antagonistic effects of butorphanol); alternatively, give an injectable NSAIA, especially if the pain is associated with an orthopedic procedure and there are no contraindications.

7 Moderate to severe pain. The patient is very depressed and is not concerned with its surroundings. The patient will urinate and defecate (if diarrhea) without attempting to move and will cry out with slight movement, or will spontaneously or continually whimper. Occasionally an animal doesn't vocalize. Heart and respiratory rates are increased. Patients require a high dose of morphine or oxymorphone, an NSAIA (if orthopedic pain), or a combination of an NSAIA and opioids.

8 Severe pain. Signs as above (7). Vocalizing may be more of a feature, or being so consumed with pain, the patient will not notice your presence. The patient may thrash around the cage intermittently. If it is traumatic or neurological pain, the patient may scream when being approached. Tachycardia and tachypnea are present, even if an opioid was previously given. **Requires high dose oxymorphone or morphine administered as a constant rate infusion — given to effect. Add an injectable NSAIA, if it is orthopedic pain and there are no contraindications.**

9 Severe to excruciating. As above (8), but patient is hyperesthetic. The patient will tremble involuntarily when any part of the body in close proximity to wound, injury, etc. is touched. Neurological pain (entrapped nerve or inflammation around the nerve) or extensive inflammation anywhere (peritonitis,

pleuritis, fascitis, myositis, etc., especially when caused by a streptococcal organism; severe necrotizing pancreatitits; etc.). **Requires high dose oxymorphone or morphine administered as a constant rate infusion — given to effect.** Tachycardia may still persist and it may be impossible to control the pain. Consider combining analgesics with epidurally placed analgesics or local blocks, where appropriate, or anesthetize the patient while attempting to find or treat the inciting cause. You have to find the inciting cause and remove it immediately. **This degree of pain can cause death.**

10 As above (9), but patient emitting piercing screams or almost comatose. The patient is hyperesthetic/hyperalgesic. The whole body is trembling, and pain is elicited wherever you touch the patient. Very high doses of opioids do not relieve this pain; however, you must give at least 0.2 mg/kg BW oxymorphone or 1.0 mg/kg BW morphine and consider combining this with epidurally placed analgesics or local blocks, where appropriate, or anesthetize the patient while attempting to find or treat the inciting cause. **This degree of pain can cause death.**

In general, dogs may continue to wag their tail in response to touch or commands even though they are experiencing moderate to severe pain. Therefore, a tail wag should not be used as an indicator of a pain-free situation. In addition to the above signs of pain, some male dogs may prolapse their penis. Cats typically remain quiet and motionless, though occasionally may growl, when in mild to moderate pain, but they will thrash, growl, and scream when pain is severe.

The drug doses given are suggestions. If the pain is not being managed, then increase to effect (opioids only). In my experience, there are no side effects with high dose opioids when animals are in pain. Avoid morphine in cats.

BW = body weight

COMING EVENTS

ÉVÉNEMENTS À VENIR

CVMA Conventions/ Congrès de l'ACMV

1997
Saskatoon, Saskatchewan
July/juillet 9–12

1998
Toronto, Ontario
July/juillet 8–11

OCTOBER/OCTOBRE 1996

Anesthesia Update Workshops. October 5–6, 1996 at Sheraton Parkway, Richmond Hill, Ontario. Technologist program: October 5, $120; DVM program: October 6, $250; instructor Dr. Nancy Brock (contributing author to *CVJ Anesthesia Update* column). Contact: Dr. Nancy Brock, tel.: (800) 338-9986; e-mail: Go zzzz@AOL.com.

La Practique de L'an 2000/Veterinary Practice in the Year 2000. October 6, 1996 at the Sheraton Laval, Québec. Featuring guest speaker Mark Opperman (English). Contact: M^me^ Lucie Lamarche, secrétaire, Académie de médecine vétérinaire du Québec, 5929 route TransCanadienne, Bureau 120, Ville St.-Laurent (Québec) H4T 1Z6; tel.: (514) 855-0077; fax: (514) 629-8386.

28th International Congress on the History of Veterinary Medicine. October 16–20, 1996 in Vienna/Austria. Main themes: Contributions of veterinary medicine to national, social, and economic development; and national constraints in the recognition of veterinary professional rights. Contact: Secretariat, Dr. G. Forstenpointner, Institut für Anatomie, Veterinärmedizinische Universität Wien, Josef Baumanngasse 1, A-1210 VIENNA, Austria; tel.: 0043/222/25077-2503.

Western Canadian Association of Swine Practitioners Annual Meeting. October 18–19, 1996 at the Travelodge Hotel in Saskatoon, Saskatchewan. Contact: Dr. Chuck Rhodes, Western College of Veterinary Medicine, University of Saskatchewan, 52 Campus Drive, Saskatoon, Saskatchewan S7N 5B4; tel.: (306) 966-7068; fax: (306) 966-8747.

Sheep Flock Disease Control Programs. October 18–19, 1996 at Ontario Veterinary College, University of Guelph, Ontario. Topics: Principles of Disease Control Programs, Basic Flock Health Programs Suitable for Both the Small and Large Flock Owner, Control Programs Within Sheep Flocks, Seven Silent Travellers. Contact: Office of Open Learning, University of Guelph, Guelph, Ontario N1G 2W1; tel.: (519) 767-5000; fax: (519) 767-1114; e-mail: info@openlrng.uoguelph.ca.

Canadian Pet Expo 1996. October 18–20, 1996 at Exhibition Place in Toronto, Ontario. National consumer show of pets, pet products, and services. Contact: Canadian Pet Expo, 100 Sandiford Drive, Unit 41, Stouffville, Ontario L4A 7X5; tel.: (905) 642-2422; fax: (905) 642-2660.

XXIst Congress of the World Small Animal Veterinary Association (WSAVA) 1996. October 20–23, 1996 at the Jerusalem International Congress Center, Jerusalem, Israel. Contact: Dr. Ray Markus, Chairman, Organizing Committee, WSAVA 1996, P.O. Box 50006, Tel Aviv 61500, Israel; tel.: 972 3 5140014; fax: 972 3 5175674.

2nd World Congress: Alternatives and Animal Use in the Life Sciences. October 20–24, 1996 in Utrecht, The Netherlands. Sessions on: welfare/ethics, pharmacology, toxicology, developments in animal alternatives, humane endpoints, validation/legislation, education/databases. Contact: FBU Congress Bureau, Utrecht University, P.O. Box 80.125, 3508 TC Utrecht, The Netherlands; tel.: +31.30.253.5044/2728; fax: +31.30.253.3667; e-mail: l.donkers@pobox.ruu.nl.

10th Annual Veterinary Dental Forum. October 31–November 3, 1996 in Houston, Texas. Sessions on: feline dentistry, oral disease management, equine dentistry, oral surgery, treatment of peridontal disease, microbiology and pharmacology of the oral cavity, evaluation and treatment of fractured teeth, and crown restorations. Contact: Program Co-chair Ed Eisner, tel.: (303) 757-8481; fax: (303) 759-4729; e-mail: Dog2thdoc@aol.com.

Electrotherapeutic modalities in veterinary medicine: A practical approach. Course offered by the Center for the Advancement of Applied Veterinary Physical Therapy. Limited enrolment. Course covers TENS, ultrasound, phonophoresis, electromagnetic field, and other modalities. Learn what these modalities are and what their applications are in veterinary medicine. October 19–20, 1996 (in english). Contact: Dr. J. Kader, 75 Chartrand, Aylmer, Quebec J9H 6Y1; tel. (819) 682-2120; fax (819) 685-1642.