

The following excerpt is from *Managing the Canine Cancer Patient: A Practical Guide to Compassionate Care* (published by Veterinary Learning Systems, publisher of *Compendium*, © 2006). To order a copy of the book, see page 779.

BOOK EXCERPT

Oncologic Pain in Dogs: Prevention and Treatment

Gregory K. Ogilvie, DVM, DACVIM (Internal Medicine and Oncology)

Director, Angel Care Cancer Center, California Veterinary Specialists
Carlsbad, California

President, Special Care Foundation for Companion Animals
San Marcos, California

Antony S. Moore, BVSc, MVSc, DACVIM (Oncology)

Co-Director, Veterinary Oncology Consultants Pty Ltd
Wauchope, New South Wales, Australia

Adjunct Professor, Faculty of Veterinary Science
University of Sydney, Australia

Adjunct Professor, Institute of Veterinary, Animal and Biomedical Sciences
Massey University, New Zealand

Consulting Oncologist, Animal Referral Hospital
Sydney, Australia

The best way to manage pain is to prevent it. When prevention is not possible, discomfort and pain must be treated appropriately and the treatment adjusted continually as the disease or therapy progresses. Combinations of drugs are most effective and are less likely to result in side effects. Adequate pain therapy can be achieved only by ensuring that the entire team is highly knowledgeable about pain and all the approaches that can be employed to manage discomfort (Table 1). This includes the client, who is most intimately aware of the patient's quality of life and behavior patterns. The client's perception of the animal's quality of life should be trusted and believed above all.¹

tion of their mechanism of action, potency, duration of efficacy, effect on the central nervous system, antiinflammatory effects, toxicity, metabolism, drug interactions, and price. Table 2 lists selected analgesics and their dosing recommendations. The best practitioners gain experience with a set number of drugs, enabling them to prescribe maximum pain control. They educate their clients about realistic expectations as well as the benefits, deficiencies, and toxicoses of different pain therapies. They also provide analgesics before the onset of pain and then continually change therapy to meet the pet's needs throughout the course of the disease and its treatment.²

Nonopioids

Nonopioids, including NSAIDs (e.g., carprofen, etodolac, deracoxib, ketoprofen, piroxicam, meloxicam, firocoxib, tepoxalin), provide mild to moderate antiinflammatory

Send comments/questions via email to editor@CompendiumVet.com or fax 800-556-3288.

Visit CompendiumVet.com for full-text articles, CE testing, and CE test answers.

SELECTING MEDICATION TO MANAGE PAIN

Effective selection of analgesics depends on considera-

Table 1. General Approach to Pain Management

Degree of Pain	Clinical Approach ^a
Mild	Nonopioid ^b ± acupuncture
Mild to moderate	Nonopioid ± acupuncture + opioids
Moderate	Nonopioid ± acupuncture + opioids (low-dose) ± anxiolytics
Moderate to severe	Nonopioid ± acupuncture + opioids (dose escalation, different route of administration) ± anxiolytics
Severe	Nonopioid ± acupuncture + opioids (dose escalation, different route of administration) ± anxiolytics + other palliative procedures (e.g., radiation, surgery)

^aIn each case, treat the underlying disease.

^bNSAIDs and acetaminophen. Use with caution in patients with renal disease.

and analgesic effects. The older, nonspecific NSAIDs, such as aspirin, ibuprofen, ketoprofen, and piroxicam, may be associated with a greater risk for side effects because they inhibit two cyclooxygenase (COX) enzymes, COX-1 and -2. Inhibition of COX-1 can result in serious side effects such as gastrointestinal (GI) distress and perforation. However, these drugs are relatively simple to obtain, and their nonselective COX inhibition exerts central analgesic and peripheral anti-inflammatory effects that make them useful in treating pain associated with intrathoracic and intraabdominal masses and bony metastases.

The newer NSAIDs, such as carprofen, etodolac, and deracoxib, primarily inhibit COX-2 and are often associated with fewer side effects. Regardless, liver and renal function should be evaluated periodically in all animals receiving these drugs. Drugs such as misoprostol are concurrently prescribed by some clinicians to reduce the risk for toxicity to the GI tract. Acetaminophen, which is believed to block the newly identified COX-3 enzyme, is related to NSAIDs but is not antiinflammatory; however, it is effective for treating discomfort without the side effects usually associated with NSAIDs. Newer drugs may inhibit only the COX-3 enzyme, resulting in fewer adverse effects.

α₂-Agonists

α₂-Agonists (e.g., clonidine, romifidine, medetomidine, xylazine) provide good to excellent analgesia with moderate to significant sedation and depression. Their short duration of action and tendency to reduce cardiac output and tissue oxygenation may make them an unwise choice for some frail or infirm patients. When combined with an opioid, they can enhance the analgesic effects of the opioid.

Opioids

Opioids (e.g., sustained-release morphine, morphine, fentanyl, oxymorphone, hydromorphone, codeine) can result in excellent analgesia with low to moderate behavioral changes, such as depression. These drugs are the most predictable, effective analgesics for use in cancer patients. They can be administered orally, subcutaneously, intramuscularly, intravenously, or transdermally, but the efficacy of oral therapy has not been clearly documented. As the severity of discomfort increases, the dose of the opiate can be increased. Toxicoses can include bradycardia, diarrhea, vomiting, constipation, and sedation, although careful dosing can mitigate any problems.

Oral Morphine

Oral morphine is most commonly used for long-term cancer pain management. Morphine is a natural opioid agonist. On rare occasions, it may produce depression and sedation or initial excitement manifested by panting, salivation, nausea, vomiting, urination, defecation, and hypotension when administered to dogs. These reactions arise from activation of the chemoreceptor trigger zone, vagal stimulation, and histamine release.

Oxymorphone

Oxymorphone is a semisynthetic opioid agonist with analgesic properties that are approximately 10 times more potent than those of morphine; its adverse effects on the respiratory, cardiovascular, and GI systems are less pronounced. Oxymorphone is indicated for moderate to severe visceral or somatic pain. Lower doses are used for intravenous administration. When used alone, however, oxymorphone may result in excitement or hyperalgesia.²⁻⁴ Diazepam given concurrently with oxymorphone may help reduce these side effects.

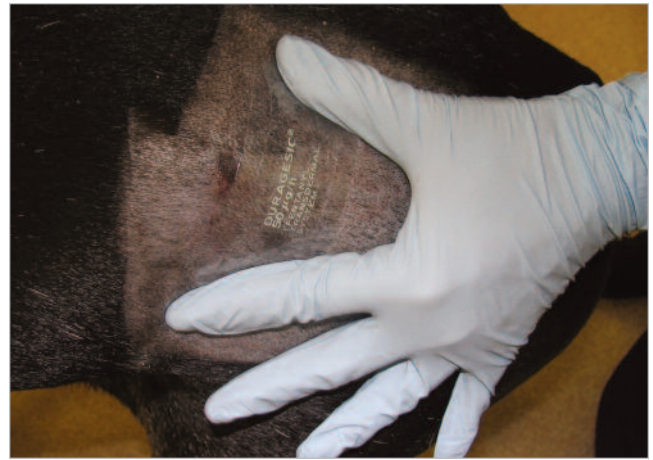
Table 2. Selected Analgesics for Pain Management in Canine Cancer Patients

Drug	Dosing Regimen
Opioid Agonists	
Fentanyl	2–5 µg/kg IV bolus before CRI
Postoperative	2–5 µg/kg/hr CRI for the duration of infusion
Operative	10–45 µg/kg/hr CRI for the duration of infusion
Patch	2–3 mg/kg/hr topical application; replace q3–5d
Hydromorphone	0.05–0.2 mg/kg IV, SC, or IM q2–6h
Meperidine	3–5 mg/kg SC or IM q1–2h
Methadone	1–1.5 mg/kg IV, SC, or IM once
Morphine	0.5–2 mg/kg PO, IM, or SC q2–4h
Morphine, sustained-release	2–5 mg/kg PO q1–4h
Oxymorphone	0.05–0.4 mg/kg IV, SC, or IM q2–4h
Remifentanyl	4–10 µg/kg IV bolus before CRI q2–6h
Postoperative	4–10 µg/kg/hr CRI for the duration of infusion
Operative	20–60 µg/kg/hr CRI for the duration of infusion
Sufentanyl	5 µg/kg IV bolus before CRI q2–6h
Postoperative	0.1 µg/kg/hr CRI for the duration of infusion
Opioid Agonist–Antagonists	
Buprenorphine	0.005–0.02 mg/kg IV, IM, or SC q8–12h
Butorphanol	0.1–0.4 mg/kg IV, IM, or SC q1–4h or 0.5–2 mg/kg PO q6–8h
Nalbuphine	0.5–1 mg/kg IV, IM, or SC q4h
Pentazocine	1–3 mg/kg IV, IM, or SC q2–4h
NSAIDs	
Carprofen	2.2 mg/kg PO q12h
Firocoxib	5 mg/kg PO q24h
Deracoxib	1–2 mg/kg PO q24h
Etodolac	10–15 mg/kg PO q12h
Ketoprofen	1–2 mg/kg IV, IM, or SC q24h or 1 mg/kg PO q24h
Meloxicam	0.1–0.2 mg/kg IV, IM, or SC q24h; 0.1 mg/kg PO q24h
Piroxicam	0.3 mg/kg PO q24–48h
Tepoxalin	10 mg/kg PO q24h
Tolfenamic acid	4 mg/kg PO or SC q24h for 3 days on, 4 days off
α₂-Agonists	
Medetomidine	5–10 µg/kg IM or SC once or 1–4 µg/kg IV once
Romifidine	10–20 µg/kg IM or SC once
Xylazine	0.2–0.5 mg/kg PO q12h
Local Anesthetics	
Bupivacaine	2 mg/4.5 kg as local nerve blocks q2–4h; intrapleural administration as needed
Lidocaine	1.5 mg/kg intrapleurally before bupivacaine q1–1.5h
Mepivacaine	1 mg/kg SC q1.5–2.5h
Ropivacaine	1 mg/kg SC q1.5–2.5h
Other Drugs	
Acetaminophen (paracetamol)	5–10 mg/kg PO q12h
Amantidine	3–5 mg/kg PO q24h
Amitriptyline	1–4 mg/kg PO q24h
Glucosamine, chondroitin	13–15 mg/kg PO q24h
Ketamine	0.5–1 µg/kg IM q30min or 1 µg/kg/min CRI for the duration of infusion and postinfusion
Pamidronate	1 mg/kg slow IV as needed q3–6wk with diuresis
Tramadol	2–4 mg/kg PO q6–8h

Figure 1. Use of the fentanyl patch. Latex gloves should be worn when these patches are handled. The patches can deliver the analgesic over a 72-hr period.



The backing of the transdermal fentanyl patch is removed.



The patch is placed on a flat, hairless area of skin, where it is unlikely to be removed by the dog.

Fentanyl

Fentanyl is an effective analgesic that can be given intramuscularly, subcutaneously, or intravenously as a preanesthetic. It can be administered via an intravenous bolus, constant-rate infusion (CRI), or transdermal patch. Fentanyl can cause respiratory depression, bradycardia, and somnolence at higher doses. It can also prolong return to normal body temperature during recovery from anesthesia. Fentanyl-impregnated transdermal patches (25, 75, and 100 $\mu\text{g/hr}$) reliably release a controlled amount of fentanyl over a 72-hour period (Figure 1). The patches maintain adequate blood levels of fentanyl for 72 hours, but therapeutic levels are not attained for 12 to 24 hours; thus patches may be most effective when used in conjunction with other analgesics or in addition to fentanyl administered by CRI during surgery or other painful procedures.

Opioid Antagonists

Opioid antagonists (e.g., butorphanol) are generally not as effective as opioids. Butorphanol is a synthetic opioid agonist-antagonist that has five times the analgesic potency of morphine, but its duration of analgesia is short (approximately 1 to 4 hours). Adverse effects such as nausea and vomiting are rare, but the drug can induce sedation. Higher doses are needed for somatic pain, and analgesia lasts only about 2 to 4 hours. Intravenous butorphanol may result in transient hypotension or bradycardia.²⁻⁴ Because butorphanol possesses antagonist properties, it reverses the effects of narcotics.

Therefore, butorphanol must not be given within 12 hours of any pre- or intraoperatively administered narcotics. Buprenorphine HCl, an agonist-antagonist, can reverse opioid-induced respiratory depression while maintaining analgesia.

Ketamine

Ketamine is an *N*-methyl-D-aspartate (NMDA) receptor antagonist that is important in the wind-up phenomenon, in which pain makes certain nerve receptors more sensitive to subsequent impulses, which are perceived as a greater degree of discomfort than before. When the drug is administered at microdoses during and up to 24 hours after a painful procedure, the need for additional analgesics is reduced and pain control maximized with few, if any, behavioral or cardiovascular effects. Typically, a bolus of 0.5 mg/kg IV is administered, followed by 2 $\mu\text{g/kg/min}$ CRI for the first 24 hours after surgery. For simplicity, if an infusion pump is not available, 60 mg (0.6 ml) of ketamine can be mixed in a 1-L bag of crystalloids. When the fluid is administered at a drip rate of 10 ml/kg/hr, the ketamine is delivered at 10 $\mu\text{g/kg/min}$. To decrease the dosage to 2 $\mu\text{g/kg/min}$, the fluid rate should be reduced to 2 ml/kg/hr.

Tranquilizers

Tranquilizers (e.g., acepromazine, diazepam, midazolam) do not provide analgesia, but their use in the management of canine cancer patients can be profound because fear, apprehension, and anxiety may magnify the

response to pain. To avoid excitation, diazepam and midazolam should be administered only with an opioid in alert patients.

Tricyclic Antidepressants

Tricyclic antidepressants (e.g., amitriptyline, imipramine) have antihistamine effects. They block the reuptake of serotonin and norepinephrine to the central nervous system. They are used at very low doses to induce analgesic effects and enhance the analgesic effects of opiates.

Radiation

Palliative radiation is commonly used to reduce discomfort associated with some tumors, especially those involving the skeletal system. When combined with low-dose chemotherapy (doxorubicin or cisplatin), the enhanced effect may be prolonged. In general, one-third of treated patients have good to excellent results, one-third have transient adequate responses, and one-third have no noticeable improvement in pain control.

Strontium-89, when administered intravenously, is taken up in places of active bone turnover. This uptake results in local release of high quantities of radiation, with enhanced comfort in approximately 50% of cases.

Bisphosphonates

Bisphosphonates are being used more commonly in veterinary medicine to treat primary or metastatic bone disease. Pamidronate and alendronate given every 3 to 6 weeks have been associated with enhanced comfort and reossification of lytic sites associated with osteosarcoma, mammary cancer, prostate cancer, and other malignant processes.

Acupuncture

Acupuncture is used to treat many kinds of pain due to cancer or cancer therapy (e.g., surgery, radiation therapy). It is often used in concert with pharmacologic agents to reduce their dose and enhance overall wellness. The effect of acupuncture appears to be mediated through opioids. Stimulation of acupuncture points induces the release of endogenous opioids. Opioid antagonists block acupuncture analgesia. Acupuncture analgesia is transferable with cerebrospinal fluid transfer. In humans, acupuncture analgesia appears to be most effective against the emotional aspects of pain.⁵ Acupuncture can also be helpful in reducing nausea associated with chemotherapy, anesthesia, and administration of certain antibiotics.

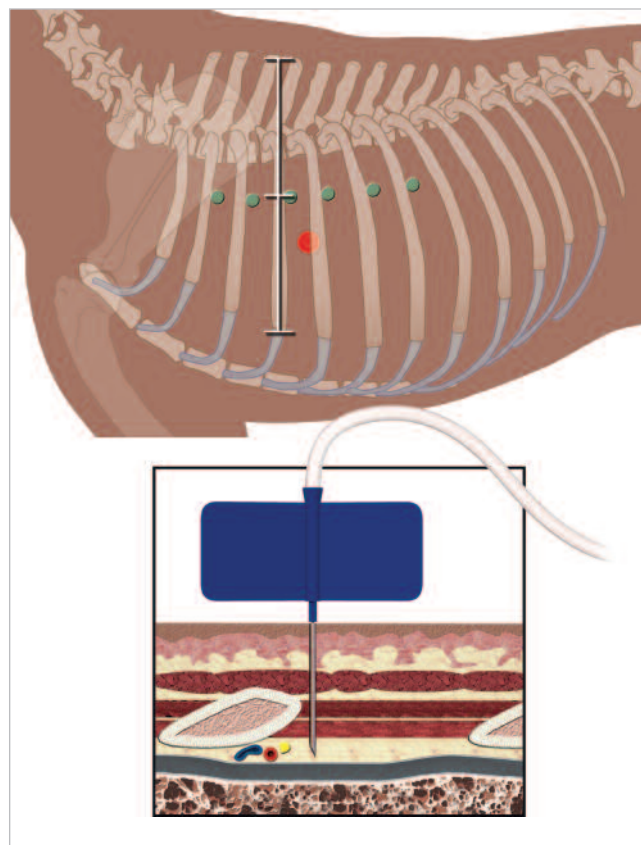


Figure 2. An intercostal nerve block is very helpful in providing analgesia during thoracotomies and chest wall resections.

Illustration by Biomedical Visuals

Local Anesthesia: Nerve Blocks

Local anesthetic agents (e.g., lidocaine, bupivacaine) can be injected to block sensory or motor nerve fibers. Lidocaine HCl (2%) administered near an incision provides regional analgesia for about 1 hour. Bupivacaine HCl (0.75%) can be given to provide 6 to 10 hours of regional analgesia for periincisional pain. More sustained analgesia can be achieved by placing “soaker catheters” into the surgical wound at the time of surgery for subsequent pump-delivered CRI of lidocaine and/or bupivacaine along the length of the entire surgical bed through tiny holes in the catheter. Lidocaine can be administered at or near intercostal nerves proximal to a thoracotomy incision to reduce postsurgical pain. This agent is also frequently administered into the pleural cavity before bupivacaine administration to decrease discomfort associated with thoracotomy. Lidocaine or bupivacaine can be used as a maxillary or mandibular nerve block for oral surgery or in the brachial plexus nerve roots before sectioning during forelimb amputa-



Illustration by Biomedical Visuals

Figure 3. An infraorbital block is an excellent method to provide good-quality analgesia to the rostral maxilla and nearby lip, nose, nasal cavity, and skin ventral to the infraorbital foramen (arrow).

tion. Lidocaine can also be administered by CRI to enhance the analgesic effect of other drugs while causing depression and anesthesia.

The specific nerve blocks commonly used to treat cancer patients are the intercostal (Figure 2), infraorbital (Figure 3), and mandibular (Figure 4) nerve blocks.

ROUTES OF ADMINISTRATION

The efficacy of a drug or drug combination can be enhanced by using the optimal route of administration.^{1-4,6} As a general rule, oral analgesics can be effective for mild to moderate discomfort. However, when the degree of discomfort increases, efficacy can be increased by administering the same or related drugs intramuscularly, subcutaneously, or intravenously. The efficacy can be improved even further by giving the same drug epidurally. A brief discussion of the routes of administration follows:

- **Oral administration** is the easiest and least expensive route and can be performed on an outpatient basis, but it is associated with the lowest level of compliance or efficacy. NSAIDs are most often administered via this route; however, orally administered codeine, morphine, and sustained-release morphine are also effective for mild to moderate pain.
- **Intravenous, intramuscular, and subcutaneous administration** of drugs is associated with the most



Illustration by Biomedical Visuals

Figure 4. Mandibular nerve blocks are very helpful in providing analgesia to the skin and mucosa at or near the incisor, canine, premolar, and molar teeth on the side to be injected.

predictable efficacy. The intravenous CRI technique is optimal. However, this route cannot easily be used in an outpatient setting.

- **Epidural or subarachnoid drug therapy** can result in good to excellent long-term analgesia. Sterile, preservative-free drugs that have been used in this manner include opiates, NSAIDs, ketamine, α_2 -agonists, and local anesthetic agents. However, this therapy cannot be administered on an outpatient basis.
- **Transdermal administration** of fentanyl and clonidine, or topical treatment with drugs such as lidocaine and eutectic mixture of local anesthetics (EMLA) cream can result in good long-term pain management but is subject to many variables, such as rate of absorption and body condition. Transdermal pain management can be administered as outpatient therapy.

- **Transmucosal therapy** with drugs such as codeine, morphine, and buprenorphine may be very helpful in controlling mild discomfort.
- **Local nerve blocks** deliver local anesthetics precisely and directly to the anatomic site of choice with reduced toxicity.

MILD PAIN

The treatment of mild pain must begin with eliminating the underlying cause and providing general compassionate care, including a comfortable environment, appropriate bedding, and effective bandaging, if indicated.¹⁻⁴ Dogs respond well to comforting, petting, and talking. This is often followed by administration of an oral NSAID (e.g., carprofen, firocoxib, deracoxib, etodolac, piroxicam, meloxicam, ketoprofen, tepoxalin) and, if indicated, local nerve blocks, acupuncture, or both. Nonopioids may be used if renal and hepatic functions are normal and there is no evidence of gastric inflammation. If NSAIDs are ineffective, an agent from one of the other categories of analgesics should be selected based on the patient's response.

Therapy for mild pain can include the use of a local lidocaine or bupivacaine nerve block to reduce the local acute discomfort from a needle-core biopsy. An oral NSAID can be given before and after the procedure to manage the relatively minor pain in the hours or few days that follow. If apprehension is an issue, a tranquilizer such as acepromazine can be used at the time of the procedure.

MODERATE PAIN

Moderate pain can be treated by eliminating the cause while providing compassionate care, local analgesia (e.g., nerve blocks or "soaker" catheters), acupuncture when possible, and nonopioids, including NSAIDs (e.g., carprofen, firocoxib, etodolac, deracoxib, piroxicam, meloxicam, ketoprofen), in judicious combination with opiates. As with all analgesics, parenteral, continuous administration of these drugs usually results in a more optimal effect than does oral therapy.¹⁻⁴ CRI of fentanyl or microdose ketamine is an excellent example. Transdermal delivery of drugs such as fentanyl can provide a background of analgesia via a continuous-release delivery system; however, this alone is rarely adequate to prevent perioperative or procedural discomfort. When these therapies are inadequate, an α_2 -adrenergic agonist, opioid agonist-antagonist, anxiolytic, or tricyclic antidepressant can be considered.

When an acutely painful procedure is being consid-

Treatment of Moderate Pain Associated with Invasive Procedures

Indication: Simple, minimally painful, short-term procedure (e.g., needle-core biopsy of tumor, small incisional biopsy)

- **Preemptive analgesia:** Oxymorphone (0.05–0.1 mg/kg SC), acepromazine (0.02–0.04 mg/kg SC), and atropine (0.04 mg/kg SC)
- **Anesthesia (as indicated):** Propofol or thiopental induction followed by inhalant anesthesia
- **Postoperative analgesia:** Ketoprofen (2.2 mg/kg SC)

Indication: Simple, moderately painful, short-term procedure (e.g., nasal or bone biopsy in a dog with normal organ and cardiovascular function)

- **Preemptive analgesia:** Oxymorphone (0.05–0.1 mg/kg SC) and atropine (0.02–0.04 mg/kg SC)
- **Anesthesia (as indicated):** Propofol or thiopental induction followed by inhalant anesthesia; xylazine (0.1 mg/kg IV) administered just before biopsy to enhance analgesia
- **Postoperative analgesia:** Ketoprofen (2.2 mg/kg SC)

Indication: Relatively short, simple procedure (e.g., thoracoscopy, laparoscopy, abdominal exploration, skin biopsy)

- **Preemptive analgesia:** Morphine (1 mg/kg SC), acepromazine (0.02 mg/kg SC), and atropine (0.04 mg/kg SC) with oral NSAID pre- and postoperatively (ensure adequate hydration and renal function)
- **Anesthesia (as indicated):** Propofol or thiopental induction followed by inhalant anesthesia
- **Postoperative analgesia (one of the following):**
 - Carprofen (4 mg/kg SC)
 - Ketoprofen (2 mg/kg SC)
 - Morphine (0.5–1 mg/kg SC as needed q4–6h)
 - Nalbuphine (1 mg/kg SC as needed q4–6h)
- **Home analgesia (one of the following):**
 - Morphine (0.5 mg/kg PO tid or qid)
 - Transdermal fentanyl (2–3 mg/kg/hr); may be administered with or without one of the following: ketoprofen (1 mg/kg PO), piroxicam (0.3 mg/kg PO q24–48h), meloxicam (0.1 mg/kg PO q24h), carprofen (2.2 mg/kg PO q12h), etodolac (10–15 mg/kg PO q12h), firocoxib (5 mg/kg PO q24h)

ered, drugs for cancer patients are often divided into pre-, peri-, and postoperative analgesics.^{1,4} Preoperative analgesics often include an opiate such as morphine with or without acepromazine to calm the patient and to relieve anxiety. Atropine or glycopyrrolate is often administered to prevent bradycardia associated with the opiate. Nerve blocks are used when possible. Periopera-

Treatment of Severe Pain Associated with Invasive Procedures

Indication: Procedure thought to cause moderate to severe discomfort (e.g., maxillectomy, hemipelvectomy, chest wall resection)

- **Preemptive analgesia:** Morphine (1 mg/kg SC) and acepromazine (0.02 mg/kg SC) with nerve block, including the use of “soaker” catheter, if appropriate, to the local area of concern; ketamine microdose CRI (10 µg/kg/min) after an IV bolus of ketamine (0.5 mg/kg) can reduce the need for analgesics postoperatively
- **Anesthesia (as indicated):** Propofol or thiopental induction followed by inhalant anesthesia
- **Postoperative analgesia:** Fentanyl bolus (2 µg/kg IV) followed by fentanyl infusion (3–5 µg/kg/hr IV CRI) by syringe pump or IV pump; bupivacaine nerve block and acupuncture
- **Home analgesia (one of the following):**
 - Morphine (0.5 mg/kg PO tid or qid)
 - Transdermal fentanyl (2–3 mg/kg/hr); may be administered with or without one of the following: ketoprofen (1 mg/kg PO), piroxicam (0.3 mg/kg PO q24–48h), meloxicam (0.1 mg/kg PO q24h), deracoxib (3–4 mg/day PO for 7 days then 1–2 mg/kg long-term), carprofen (2.2 mg/kg PO q12h), etodolac (10–15 mg/kg PO q12h), firocoxib (5 mg/kg PO q24h)

Indication: Procedure thought to cause severe discomfort (e.g., mandibulectomy, laminectomy in combination with hemipelvectomy)

- **Preemptive analgesia:** Hydromorphone (2 mg/kg SC) and atropine (0.04 mg/kg SC) with nerve block, if appropriate, to local area (e.g., infraorbital block for maxillectomy, “soaker” catheter for incision or surgical wound)

- **Anesthesia (as indicated):** Propofol or thiopental induction followed by inhalant anesthesia
- **Postoperative analgesia:** Fentanyl bolus (2 µg/kg SC) followed by fentanyl infusion (3–5 µg/kg/hr IV CRI) by syringe pump or IV pump; bupivacaine nerve block
- **Home analgesia (one of the following):**
 - Morphine (0.5 mg/kg PO tid or qid)
 - Transdermal fentanyl (2–3 mg/kg/hr); may be administered with or without one of the following: ketoprofen (1 mg/kg PO), piroxicam (0.3 mg/kg PO q24–48h), meloxicam (0.1 mg/kg PO q24h), carprofen (2.2 mg/kg PO q12h), deracoxib (3–4 mg/day PO for 7 days then 1–2 mg/kg long term), etodolac (10–15 mg/kg PO q12h), firocoxib (5 mg/kg PO q24h)

Indication: Procedure thought to cause severe discomfort (e.g., hindlimb amputation, hemipelvectomy)

- **Preemptive analgesia:** Morphine (1 mg/kg SC) and atropine (0.04 mg/kg SC) with bupivacaine epidural, local lidocaine block
- **Anesthesia (as indicated):** Propofol or thiopental induction followed by inhalant anesthesia
- **Postoperative analgesia:** Fentanyl bolus (2 µg/kg SC) followed by fentanyl infusion (3–5 µg/kg/hr IV CRI) by syringe pump or IV pump; bupivacaine nerve block
- **Home analgesia:** Sustained-release morphine (0.5 mg/kg PO tid); may be administered with or without one of the following: ketoprofen (1 mg/kg PO), piroxicam (0.3 mg/kg PO q24–48h), meloxicam (0.1 mg/kg PO q24h), carprofen (2.2 mg/kg PO q12h), deracoxib (3–4 mg/day PO for 7 days then 1–2 mg/kg long term), etodolac (10–15 mg/kg PO q12h)

tive therapy is often accomplished by adding fentanyl as a CRI. This can decrease the need for additional analgesia and may be combined with microdose ketamine to prevent the wind-up phenomenon. Pain management in the immediate postoperative period is optimal when local nerve blocks are used in combination with fentanyl and microdose ketamine. Later, acepromazine, diazepam, or midazolam can be used to reduce dysphoria. See the box on page 783 for examples of pre-, peri-, postoperative, and home analgesia to treat moderate pain.

SEVERE PAIN

Therapy for moderate to severe pain can be emotionally and physically difficult for the entire veterinary health care team and the family.^{1,3,5} Everyone should be aware of the difficulty associated with emotional and

physical stress and be supportive to prevent compassion fatigue.

Therapy for severe pain is similar to that outlined for moderate pain; however, the doses of certain drugs, notably the opiates, are continually adjusted to a balance between maximal efficacy and minimal toxicity. The efficacy of drugs can be maximized by switching to more effective routes of administration, such as epidural morphine and fentanyl administered by CRI. When drugs are combined, efficacy is often enhanced and reduction of individual drug doses may be possible; however, the patient must be monitored for additive toxicity. Palliative procedures such as the use of radiation therapy at sites of bone pain can be profoundly beneficial, as can the administration of intravenous bisphosphonates. When the degree of discomfort increases,



Figure 5. General approach to the management of pain in dogs with cancer.

doses can be escalated for opiates with no ceiling effect (e.g., morphine); changing the route of analgesic administration (e.g., switching from subcutaneous to intravenous administration or to epidural therapy) may also be effective. As with moderate discomfort, sustained-release fentanyl patches, which are applied to the skin and slowly release the analgesic over 72 hours, may be helpful. See the box on page 784 for examples of pre-, peri-, postoperative, and home analgesia to treat severe pain.

CONCLUSION

Pain therapy is one of the most important aspects of cancer therapy, not only for the patient and the client but also for the entire veterinary health care team. Well-thought-out therapeutic approaches are key to the anticipation and prevention of pain (Figure 5). It is the

responsibility of the veterinary health care team to stay up-to-date on the many current and emerging pain therapies and to gain experience in the optimal management of canine cancer patients.

REFERENCES

1. Gaynor JS, Muir WS (eds): *Handbook of Veterinary Pain Management*. St. Louis, Mosby, 2002, pp 13–447.
2. Hellyer PW, Gaynor JS: Acute postsurgical pain in dogs and cats. *Compend Contin Educ Pract Vet* 20:140–153, 1998.
3. Lascelles BD: Relief of chronic cancer pain, in Dobson JM, Lascelles BD (eds): *BSAVA Manual of Canine and Feline Oncology*, ed 2. Gloucester, England, British Small Animal Veterinary Association, 2003, pp 137–151.
4. Tranquilli WK, Grimm KA, Lamont LA (eds): *Pain Management for the Small Animal Practitioner*. Jackson, WY, Teton NewMedia, 2000, pp 13–69.
5. Filshie J, Redman D: Acupuncture and malignant pain problems. *Eur J Surg Oncol* 11(4):389–394, 1985.
6. Hendrix PK, Hansen B: Acute pain management, in Bonagura JD (ed): *Current Veterinary Therapy XIII: Small Animal Practice*. Philadelphia, WB Saunders, 2000, pp 57–61.