PAIN ASSESSMENT AND GENERAL APPROACH TO MANAGEMENT

Karol A. Mathews, DVM, DVSc

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

HIPPOCRATES

During the last decade, great strides have been made in the prevention, assessment, and treatment of pain in human and veterinary patients. Today, pain level is considered the fifth vital sign in human patients,[47] and hospital accreditation may include the institution's approach to pain assessment and management.[61] This assertive approach emphasizes the importance of pain management. As animals feel and anticipate pain by similar mechanisms as people,[64] this emphasis on pain management should also apply to research, teaching, and client-owned animals. Continual painful experience in an animal is detrimental to the overall healing process as well as to the general well-being of any animal or person.[3, 51, 60] Pain often results in a prolonged hospital stay and increases the potential for secondary problems such as immune suppression and secondary illness, inappetence, and cachexia. This is especially so in cats, where hepatic lipidosis may occur as a result of inappetence and inadequate caloric intake. As there may be a link between acute pain and chronic pain in human beings, with the hypothesis that if the acute pain were better controlled, the chronic pain would not develop,[33] this is also another factor to consider in animals. Animal pain is also an issue for both the research scientist and clinician-educator. Researchers must be aware that activation of the neuroendocrine system (as evidenced by increases in serum cortisol and catecholamine levels) in response to pain can be a confounding factor in the outcome of experimental studies in laboratory animals. Educators must emphasize the importance of pain assess-

From the Department of Clinical Studies, Ontario Veterinary College, University of Guelph, Guelph, Ontario, Canada

ment and management and teach the students the skills required to implement pain management strategies for clinical patients and animals used for demonstration of invasive procedures. Considering all the negative physiologic effects associated with the experience of pain, above all, one's actions should be governed by the inhumane aspects of this unnecessary experience.

CURRENT STATUS OF PAIN MANAGEMENT IN VETERINARY MEDICINE

Use of Pain Medication

Several years ago, a retrospective study on analgesic prescription in a veterinary teaching hospital indicated that two thirds of the dogs and nearly all the cats did not receive analgesia after various major surgical procedures.[22] Many written orders were worded to limit the actual administration of analgesics (e.g., "give if extremely painful" or "if in extreme pain"). A similar situation occurred in the management of pain in human beings, where many adult[4] or pediatric[13] patients with severe or extremely severe postoperative and post-traumatic pain or severe visceral pain were not effectively treated.

Based on surveys of animal health technicians in Canada[15] and veterinarians in Canada,[16] Britain,[37, 39] and Australasia,[68] veterinarians still remain reluctant to administer analgesics to animals after all surgical procedures. Based on these surveys, only 13% to 26% of cats and dogs undergoing routine ovariohysterectomy or castration received analgesics, and from 50% to 70% received analgesics for non-neutering soft tissue procedures. Encouragingly, on the positive side, more than 80% of practitioners used analgesics for potentially painful orthopedic procedures and severe trauma.[16, 37, 39, 68] One survey revealed that in most instances of orthopedic procedures performed in cats and dogs, butorphanol (which is inadequate to manage orthopedic pain) was the analgesic of choice.[16] Nonsteroidal anti-inflammatory analgesics (NSAIAs) were not listed on the questionnaire as a choice, because NSAIAs were not approved for veterinary use at that time. The British[37, 39] and Australasia[6, 7] studies included NSAIAs in their questionnaire. The most frequently prescribed preoperative analgesics were butorphanol or buprenorphine preoperatively and NSAIAs postoperatively.[37] These surveys also indicated that female veterinarians tended to use analgesics more than men. Patient care from nurses or animal health technicians, most of whom are women, is also associated with increased use of analgesics. Over 95% of these animal health technicians and nurses provided nursing care during postsurgical recovery and informed the veterinarian when the animals were in pain; analgesics were then administered.[15]

A comforting observation from all the surveys indicates that analgesic use by veterinarians graduating during the past 10 years is significantly higher than that by veterinarians graduating earlier. This may reflect greater emphasis on the importance of teaching pain assessment and management during the veterinary medicine undergraduate program and the dominance of this topic in many continuing education programs during the past few years. Nevertheless, the results of the various surveys from veterinarians indicate that undergraduate teaching of the topic is still inadequate and that continuing education lectures contributed only minimally to their knowledge of pain recognition and management.[16, 37] Most practitioners believed that most of their knowledge, although inadequate, was self-taught through clinical experience and reading journal articles.[16, 37] Canadian veterinary technicians surveyed believed that con-

tinuing education at the local or provincial level ranked as the most important source of knowledge for recognition and control of pain.[15]

Reasons for Withholding Pain Medication

Various reasons are given for withholding analgesics. A common misconception is that analgesics "mask" physiologic indicators (e.g., heart rate, respiratory rate) of patient deterioration (e.g., hypotension, hypoxia). This is not the case. Evidence exists in the human literature,[1] and it has also been observed in veterinary patients that analgesics do not mask the signs of patient deterioration and should not be withheld for this reason. Even when large doses of opioids are used as a constant-rate infusion (CRI) to treat pain, heart rate in response to hypotension, hypoxia, hypovolemia, or hypercarbia is still high. In fact, when the patient is treated adequately for pain, the potential for the tachycardia being related to pain is eliminated and the clinician is alerted to patient deterioration. If analgesics are not used, the tachycardia may be presumed to be a result of pain, and other reasons are not considered. With respect to ventilation, opioid administration after laparotomy or thoracotomy may improve ventilation rather than impair it.

Another major concern with analgesic use expressed by many veterinarians is the potential for toxicity or adverse reactions associated with drug administration.[16, 37, 68] It is my impression as well as that of others that these adverse effects, primarily those associated with opioid use but occasionally with the use of NSAIAs, are overemphasized. It is not known whether this may continue to deter veterinarians from using opioids for management of pain, but surveys indicate that seminars on this subject did not markedly improve the use of analgesics[16, 37] and that they may, in fact, reflect inappropriate content.[16] As most of these surveys were conducted before 1997 (with publication of some subsequent to this date), it is hoped that future pain management seminar content can become more informative with respect to pain assessment and the selection, dosage, and methods of administration of appropriate analgesic drugs.

The surveys also indicate that the concern for potential adverse effects of various analgesics is a major reason for less frequent analgesic administration to cats.[16, 37, 39] Given our current level of understanding of the adverse effects of many analgesics in cats,[69] however, there is no longer an overriding reason for withholding analgesics in this species. Throughout this issue, various analgesic regimens are suggested for many painful states in cats and dogs, and it is recommended that these "tried and true" guidelines be used rather than sticking to "traditional" or outdated single-study dogma.

It is interesting to note that a recent French study evaluating a quality-control program for improvement of pain treatment in the out-of-hospital emergency (trauma) setting in people showed a significant increase in morphine administration to patients after a 2-week training program.[55] The teaching session was designed to make emergency physicians aware of their inadequate use and dosing of analgesics to promote the greater use of opioids and to clarify the risk of opioids used in the emergent context. After the training session, physicians used analgesics, particularly morphine, more frequently and used more appropriate dosing schedules than those used before training. When physicians were made aware of how to administer these drugs, how to monitor the patient for potential side effects, and how to reverse side effects should they occur, their increased confidence in analgesic use resulted in improvement in the treatment of acute pain. This approach to acquiring the skill required to manage pain can

apply to veterinarians in a wide range of situations. One group's comment about pain management is that the key to success is not new drugs or "high-tech" delivery systems but appropriate use of existing therapies and education about the importance of pain recognition and management.[50]

A frequently cited reason for withholding analgesic treatment, especially in cats, is that pain is difficult to recognize. Pain can be difficult to assess; if it were not, veterinary practitioners would likely use analgesics much more frequently than the surveys indicated.

PAIN ASSESSMENT

Behavioral characteristics associated with pain in cats and dogs are listed in the box on this page. These signs are not consistently present in painful states and some may be present in any anxious or excited dog or cat.

Behavioral and physiologic characteristics associated with pain in cats and dogs

Abnormal posture
  Hunched up guarding or splinting of abdomen
  "Praying" position (forequarters on the ground, hindquarters in the air)
  Sitting or lying in an abnormal position
  Not resting in a normal position (e.g., sternal or curled up)
Abnormal gait
  Stiff
  No to partial weight bearing on injured limb
  Slight to obvious limp
Abnormal movement
  Thrashing
  Restless
  No movement when not sleeping
Vocalization
  Screaming
  Whining (intermittent, constant, or when touched)
  Crying (intermittent, constant, or when touched)
  None
Miscellaneous
  Looking, licking, or chewing at the painful area
  Hyperesthesia or hyperalgesia
  Allodynia
Behavioral characteristics associated with pain in cats and dogs, but
  may also be associated with poor general health (medical problems)
    Restless or agitated
    Trembling or shaking
    Tachypnea or panting
    Weak tail wag
    Low carriage of tail
    Depressed or poor response to caregiver
    Head hangs down
    Not grooming

Appetite decreased, picky, or absent
Dull
Lying quietly and not moving for hours and does not dream
Stuporous
Urinates or defecates and makes no attempt to move
Recumbent and unaware of surroundings
Unwilling or unable to walk
Bites or attempts to bite caregivers
May also be associated with apprehension or anxiety
Restless or agitated
Trembling or shaking
Tachypnea or panting
Weak tail wag
Low tail carriage
Slow to rise
Depressed (poor response to caregiver)
Not grooming
Bites or attempts to bite caregiver
Ears pulled back
Restless
Barking or growling (intermittent, constant, or when approached by
   caregiver)
Growling or hissing (intermittent, constant, or when approached by
   caregiver)
Sitting in the back of the cage or hiding under a blanket (cat)
May be normal behavior
Reluctant to move head (eye movement only)
Stretching all four legs when abdomen touched
Penile prolapse
Cleaning (licking) a wound or incision
Physiologic signs that can be associated with pain
Tachypnea or panting
Tachycardia (mild, moderate, or severe)
Dilated pupils
Hypertension
Increased serum cortisol and epinephrine

Note: Bradycardia may rarely be present in painful conditions associated with intra-thoracic structures, abdominal pathology, or after laparotomy because of the influence of the parasympathetic nervous system or decompensated shock.

Where acute pain is present, certain behavioral characteristics are present and readily apparent (Appendix).[11, 21, 23, 24, 26, 44, 46, 51, 60] Experimental animal models of pain show that the animal tries to escape from a noxious stimulus of about the same intensity that causes human subjects to first report pain. Increasing the intensity of the acute noxious stimulus such as an electric current increases the vocalization, escape force, and reflex force by the animal.[65] Veterinarians routinely witness this behavior when patients are exposed to an acute painful stimulus; however, this type of behavior may not occur in animals with constant pain.[51] The veterinarian should become familiar with the subtle signs signaling the early onset of mild to moderate pain when administration of analgesics

may prevent the progression to refractory severe pain.[45, 51] Cats and dogs with undiagnosed mild to moderate osteoarthritis or other potentially painful conditions may present with nonspecific signs such as reduced exercise tolerance, gradually changed behavior, reduced appetite (especially in cats fed on a counter), poor grooming, or general lack of "enthusiasm" for life. These signs can easily be attributed to aging unless a complete physical (including orthopedic) examination reveals conditions associated with pain.

Based on physiologic and anatomic evidence of pain perception or anticipation, an anthropomorphic approach to management of pain should be used if the caregiver has difficulty in interpreting the behavioral characteristics associated with a situation known to cause pain. In human patients, the "gold standard" for pain assessment and its relief is verbal communication with the patient; unfortunately, this is not possible in veterinary patients.

Key Points in Assessment of Pain in Animals

- Think in terms of the similarities of pain perception and anticipation in human beings and animals, and treat with an analgesic appropriate for the level of pain likely to be present regardless of whether you are convinced that the animal is in pain. Occasionally, animals are in less or more pain than expected for the injury, illness, or surgical procedure they have.
- As is the case with human beings, age also contributes to certain behavioral patterns associated with pain. Like children, juvenile animals tend to be more vocal, whereas adults, especially geriatric animals, tend to contain their emotions, thus making pain assessment more challenging.
- Recognize the subtle as well as the more obvious signs of behavior associated with pain. Keep in mind that cats and many older animals of other species tend to withdraw and remain quiet through a wide range of painful experiences.
- Acknowledge that invasive procedures, trauma, and many medical illnesses cause pain that requires analgesics.
- Response to appropriate analgesic therapy is the closest marker we have to a gold standard for diagnosing pain at the present time.

General Considerations

In considering these points, the veterinarian rapidly gains experience and confidence in assessing and treating pain in animals. A simple effective way to gain skill in pain assessment is to observe the response to analgesic therapy in those equivocal situations where behavioral characteristics of pain are difficult to recognize. In the author's experience, ill animals and those in pain do not dream, yawn, "scratch," groom, or do the "normal" things cats and dogs do; therefore, a return to more normal behavior such as eating and grooming or a "more comfortable" appearance often confirms the prior presence of pain.

When a determined effort is made on a daily basis to study the behavior of cats and dogs of different ages with various traumatic injuries, after assorted surgical procedures, and with various medical problems, behavioral signs of pain are more readily detected. Anticipated levels of pain associated with surgical procedures, illness, or injuries are listed in the box on the facing page.

Anticipated levels of pain associated with surgical procedures, illness, or injuries

Severe to excruciating

Neuropathic pain, including nerve entrapment, cervical intervertebral disk herniation, and inflammation (e.g., bacterial, chemical, impingement)

Extensive inflammation (e.g., peritonitis, fasciitis [especially streptococcal], cellulitis)

Postsurgical pain when extensive tissue injury or inflammation exists

Multiple fracture repair when extensive soft tissue injury exists (tissue manipulation intraoperatively to be considered) or there is impingement of orthopedic implants on neural tissue

Necrotizing pancreatitis

Necrotizing cholecystitis

Pathologic fractures

Bone cancer (especially after biopsy)

Meningitis

Moderate to severe and severe (varies with degree of illness or injury)

Osteoarthritis, acute polyarthritis

Intra-articular surgical procedures (e.g., large dogs, extensive manipulation)

Fracture repair

Limb amputation

Onychectomy

Early or resolving stages of these soft tissue injuries, inflammation, or diseases

Peritonitis (e.g., bacterial, urine, bile, pancreatic)

Capsular pain as a result of organomegaly (e.g., pyelonephritis, hepatitis, splenitis, splenic torsion)

Hollow organ distention

Mesenteric, gastric, testicular, or other torsions

Ureteral, urethral, or biliary obstruction

After thoracotomy

After laparotomy

Pleuritis

Traumatic diaphragmatic hernia repair (associated with organ and extensive tissue injury)

Trauma (e.g., orthopedic, extensive soft tissue, head)

Thoracolumbar disk disease

Total ear canal ablation

Rewarming after accidental hypothermia

Frostbite

Cancer pain

Mucositis after radiation therapy

Thrombosis or ischemia (arterial or venous), aortic saddle thrombosis

Hypertrophic osteodystrophy

Panosteitis

Corneal abrasion or ulceration

Glaucoma

Uveitis

Whelping or queening

Mastitits

Moderate
  Extracapsular (articular) cruciate repair
  Minimally invasive orthopedic procedures (e.g., external fixator, tail am-
      putation)
  Laparotomy (i.e., short procedure with minimal manipulation and no
      inflammation)
  Inguinal hernia repair
  Diaphragmatic hernia repair (acute, simple with no organ injury)
  Mass removal (depends on location, size, and structures involved; if
      extensive, pain should be upgraded)
  Early or resolving pancreatitis
  Soft tissue injuries (i.e., less severe than those previously listed)
  Urethral obstruction
  Ovariohysterectomy (i.e., older obese animals and a more extensive
      procedure)
  Castration (some animals)
  Some dental procedures
  Enucleation
  Early or resolving conditions mentioned previously
Mild to moderate
  Ovariohysterectomy (young animals)
  Castration (some animals)
  Lump removal
  Some ophthalmic surgical procedures
  Some dental procedures
  Some lacerations
  Cystitis
  Otitis
  Chest drains
  Early or resolving conditions mentioned previously
Mild
  Early, resolving, or simple involvement of conditions mentioned pre-
      viously

This list is far from complete. These examples and their assessed levels of pain are only presumed. Tables 1, 2, and 3 provide guidelines for suggested analgesic therapy, with dose and interval adjustment based on the individual patient response.

When assessing pain in animals, it is important to observe the behavior and its response to analgesic therapy over time. The assessment must be appropriate for the age of the animal. Younger animals are much less tolerant of pain. This should not be interpreted as exaggerated puppy or kitten behavior, resulting in inadequate use of analgesics. Short-lived pain such as vaccination-related pain, is obviously acceptable; however, longer lasting pain requires some analgesic therapy. Based on reputation, certain breeds of dogs (small and toy breeds) or Siberian Huskies, for example, may be inadequately treated if the clinician decides that their exaggerated demonstration of pain is merely a behavioral characteristic. Conversely, pain may be undertreated in some of the larger working breeds that have a reputation for being "stoic" or "able to handle pain." Similarly, cats and geriatric animals tend to withdraw when in pain and may easily be ignored in a busy practice setting. Many elderly human patients

have pain independent of that related to a presenting complaint.[43] This is also true of geriatric veterinary patients, where chronic conditions such as osteoarthritis may contribute to their pain should they be positioned abnormally in the cage. On occasion, a dog may whine but stops this behavior when touched or spoken to. This is frequently interpreted as "attention seeking" behavior and not pain when, in fact, it is just the distraction from the pain that resulted in the dog becoming quiet. This can be compared with the situation in human beings where a distraction can produce a temporary reduction in pain perception.

Frequently, behavioral changes are similar whether the pain is mild or severe (e.g., quiet, withdrawn, "hangdog expression," inappetence), and it is necessary to consider the underlying cause to ensure appropriate selection of the analgesic. The severity, acuity, or chronicity of the surgical or medical problem should be evaluated when attempting to quantify the level of pain. Occasionally, pain is out of proportion to physical findings such as is the case with early presentation of an animal with streptococcal fasciitis (so-called "flesh-eating disease") or after a routine surgical procedure. For example a Golden Retriever recovering from laparotomy for intestinal resection was in so much pain that epidural morphine in combination with parenteral oxymorphone administered by CRI was required to control the pain. This patient was tachycardic and hypertensive, remained in lateral recumbency, and did not respond to the caregiver's voice. The only response was an increased respiratory rate, abdominal splinting, and whining when touched. Intermittent boluses of more oxymorphone were administered for breakthrough pain when the patient cried. Intense analgesic management was required for 16 hours, with a slow reduction over the following 24 hours. The possible cause for the pain may have been severe inflammation of the jejunum.

Another good guideline to follow in pain assessment and treatment is that pain is usually enhanced in the presence of inflammation; for example, a cystotomy in an extremely inflamed bladder may be more painful than one performed in a normal bladder. Stretching or distention of viscera is also extremely painful. Tissue handling also has an impact on postoperative pain; surgical procedures performed by a specialist potentially result in less inflammation than those performed by an inexperienced surgeon.

Physiologic parameters, including heart rate, respiratory rate, blood pressure, and temperature, are not consistent or reliable indicators of pain.[6, 7, 9, 23, 29] Pain associated with the abdominal viscera (e.g., correction of portosystemic shunt and other surgical procedures involving bowel) may produce a low heart rate (personal observations). Pain persisting or recurring after opioid administration is frequently not diagnosed because of the emphasis placed on the low to normal heart rate. As the autonomic effects of these drugs tend to persist beyond their analgesic effects, heart rate is frequently an insensitive indicator of pain.

Respiratory rate but not heart rate consistently correlated with visual analogue scores and numeric rating scales of pain assessment in one study.[9] Although respiratory rate was not shown to be a useful indicator of pain in another study,[29] I have found it to be of value in assessing the presence of pain in some patients. Pupillary dilation is loosely associated with pain[29]; however, one must keep in mind that there may be a drug effect causing mydriasis (atropine or opioids in cats) or myosis (high dose of opioids in dogs). Systolic hypertension may correlate with postoperative pain in cats.[60] In one study, cats receiving no (or inadequate) doses of butorphanol (0.1 mg/kg) after ovariohysterectomy often had increased systolic blood pressure and serum cortisol concentration compared with cats receiving adequate pain medication.[60] The cats with increased systolic

blood pressure also demonstrated behavioral changes associated with pain (withdrawn, remained still, and vocalized when moved) compared with the cats with lower blood pressure, which were willing to move and returned to a normal personality sooner. In summary, if the animal exhibits painful behavior, has a condition known to cause pain, has an increased heart or respiratory rate, or is hypertensive, the animal is likely to be in pain. Should this same behavior and condition not be associated with physiologic changes, the animal is still likely to be in pain.

Pain is an individual experience, and the analgesic regimen must be tailored to the individual's painful experience, personality, and environmental needs. In addition to providing analgesics, reducing patient anxiety is an important aspect to pain management, as anxiety lowers the threshold of pain perception. Sedatives may be required in some animals if anxiety is contributing to the pain experienced or if mild dysphoric behavior is suspected after opioid administration (Table 1). Reducing anxiety can also be achieved by maintaining a warm, clean, dry, and comfortable environment. For cats, this is preferably away from barking dogs and is facilitated by providing a "bed" where the cat can curl up (a large towel rolled up and placed in a circle and taped). Individual nursing care for certain periods during the day, especially while feeding the patient, reduces anxiety and often increases food intake.

Pain Scoring Systems

There are many different pain scoring or assessment systems in human medicine. These are used to assess the efficacy of analgesics in clinical trials as well as to assess pain in patients. Although some of these systems have proved to be effective in assessing pain, they are infrequently used in general hospital practice.[2] When a printed pain assessment form was provided to nurses, however, there was an increased awareness of patients' pain which resulted in an increase in the administration of analgesics with improved relief of pain.[2] Caution must be used when using only scoring systems to assess pain. In a study assessing postoperative pain in children, many children who were lying in one position with a calm expression (resulting in a low score) reported moderate to severe pain at the same time.[63]

Pain assessment measures have been used by veterinary researchers as a tool to quantify pain in various studies and to analyze data.[8, 14, 19, 38, 46, 50, 53, 58, 62, 67] These consist of verbal rating scales (VRSs) or simple descriptive scales (SDSs), numeric rating scales (NRSs), and the visual analogue scale (VAS). The VRSs and SDSs rate pain as none, mild, moderate, or severe; they seem simple to use[55] but may lack sensitivity, as the small number of levels does not provide sufficient discrimination from one level to the next.[55] A study investigating the number of response levels needed to assess pain intensity in human chronic pain patients reported that a 10- to 20-point scale provided sufficient levels of discrimination to describe pain intensity.[32]

An NRS, where numbers are assigned to a level of activity within a given category of behavior, may also lack sensitivity,[19] as the categories are frequently too simplified. One problem with the simple descriptors heavily weighted in some NRSs is a lack of specificity. For example, vocalization may be a manifestation of emergence delirium after anesthesia, dysphoria secondary to opioid administration, anxiety, or fear. Therefore, vocalization can be one of the most difficult behaviors to interpret when assessing pain but can contribute to a high pain score if recorded. In one survey, veterinarians rated vocalization as the

highest sign of pain.[68] In contrast, the worst pain possible may occur in an immobile quiet patient and the absence of vocalization would decrease the total pain score (personal observation).[63] A recently published pain scoring system for measurement of postoperative pain in dogs has addressed the issue of expanding descriptors to discriminate between some painful and nonpainful behaviors.[18]

The VAS is a ruler (usually 100 mm in length) with only a description of the limits of pain placed at either end of the scale such that 0 represents no pain and 100 represents the worst pain possible. The observer or patient is asked to mark anywhere along the scale where the perceived or experienced pain, respectively, would fall. This technique is widely used in human medicine[50] and has been used in many veterinary analgesic studies.[38, 58, 62, 67] The VAS has proved to be sensitive, reproducible, and feasible in studies requiring evaluation of pain.[31] Potential drawbacks are that observers must be experienced in assessing pain and trained in the use of the VAS. A modification of the VAS that incorporates a dynamic and interactive assessment has recently been reported on.[40] It is suggested that observer–patient interaction can more fully assess the overall state of the patient. In this study, an algometer, a nociceptiometric device, was used to obtain nociceptive threshold values as an additional tool for assessing pain after ovariohysterectomy in dogs.[40]

All measurement scales attach a number to our (individual) preconceived notions of what defines pain. The individual's definition (or interpretation) of pain differs, because pain assessment is a subjective interpretation of an animal's behavior; the level of pain assessed by different individuals also varies. This is frequently the case when an individual attempting to identify pain by examining the subtle behavioral changes associated with mild to moderate pain is in disagreement with someone relying on stereotypic signs of pain such as crying, thrashing, and other obvious signs of pain.

An important factor to consider in the method of pain assessment is the amount of variability among observers that each method may produce. When the results of an SDS, NRS, and VAS studying dogs recovering from various procedures were compared, significant variability among observers was reported with all three methods.[28] The conclusion of this study was that the NRS was the most suitable of the three scales used for recording assessment of pain in dogs.

Recently, a pain scoring system to assess postoperative pain in dogs[18] adapted from a similar system developed in children (Children's Hospital of Eastern Ontario)[48] has demonstrated excellent agreement between evaluators. This study was limited to healthy normal dogs recovering from ovariohysterectomy and was therefore not tested through a wide range and degree of painful states. This study also included preoperative behavior as compared with postoperative behavior, an aspect of pain evaluation not always available. This raises another important issue regarding pain assessment and management. Familiarity with the personality of the animal is important when assessing pain and designing an analgesic regimen. The pet owner may be the best person to evaluate the level of anxiety or pain that the patient may be experiencing. Treating anxiety, when this is a known characteristic of the patient, in addition to pain improves patient comfort.

Teaching animal health technician and veterinary students how to recognize, evaluate, and treat pain in dogs and cats is also a challenging task. Some common behavioral patterns and responses to caregivers during various activities associated with various arbitrary levels of pain are listed in the Appendix. This scale (0–10 with descriptors) is used as a teaching tool at the Ontario Veterinary College. The levels of pain were determined by the analgesic, dose,

and duration of action of the analgesic required to effectively control the animal's pain. The weakness in this scale is that not all possible combinations and permutations of behavior associated with each potential level are documented; therefore, it is incomplete. Also, a controlled study evaluating the efficacy of this system has not been performed. Documenting behavioral patterns with various conditions should be extremely helpful in designing pain assessment protocols in the future.[21] The design of an ideal pain scale to assess various types of pain (acute vs chronic, surgical vs medical, visceral vs somatic) in different species for various age groups is an extremely complex, difficult, and formidable task.

The pain scales described are designed to assess acute pain; however, chronic pain is experienced by millions of dogs and cats. The insidious onset of signs and their similarity to those associated with the infirmities of age make owner recognition of a pet's pain more difficult. Osteoarthritis and presumably other inflammatory states such as otitis externa, cystitis, stomatitis, and toothache are common causes of chronic pain in animals. A form with pain descriptors (e.g., inability to prehend or chew food, decreased enthusiasm for walks) designed for detection of chronic pain in cats and dogs may be a useful tool for veterinarians and clients. This could be given to the client to help localize pain (e.g., dental) or detect pain when reduced activity is presumed to be associated with simple aging. Although pain may be the cause of the "ADR" (ain't doin' right) animal, this must not be presumed, and other causes of this "syndrome" must not be overlooked. A complete history, physical examination, and appropriate laboratory evaluation must be performed to elucidate potential illness. This approach helps to avoid disasters, for example, prescribing an NSAIA for "presumed pain" in an animal with liver or renal disease.

Clinical Use of Pain Assessment Methods

Many tools exist to assess pain in human beings, and a few have been used in veterinary medicine. None are perfect, primarily because of the subjective and unmeasurable nature of pain even in people[20] and especially in veterinary patients, because they cannot communicate verbally. Pain assessment methods are necessary to evaluate pain and its relief after administration of analgesics when performing studies requiring analysis and reporting. Currently, there does not seem to be a suitable "tool" to accurately assess pain in animals. An extensive review of the human literature with respect to strategies of pain assessment and interpretation has been published.[49, 50] With all the information derived from these studies, the authors[49] state "that often the product of systematic review (often some sort of statistical output), is not usually readily interpretable or usable in day-to-day clinical practice." As individual practitioners want to know what is the best pain management strategy for each patient, their recommendation is that a "common currency" to help make the best treatment decision for a particular patient is what is needed. This common currency is the number needed to treat (NNT). The NNT is proving to be an effective alternative method of measuring the adequacy of pain management, with the advantage of applicability to clinical practice.[10, 41, 49] An NNT of 1 describes an event that occurs in every patient given the treatment but in no patient in a comparative group. This would be the perfect result. There are few situations where the treatment is close to 100% effective and the control or placebo is completely ineffective; therefore, an NNT of 2 or 3 often indicates an effective intervention. An NNT of 2 means that for every two patients treated with an analgesic, for example, one patient obtains relief from pain as predetermined by the goals of

the study. In people, this is usually defined as obtaining at least 50% improvement in pain relief as a result of treatment. With regard to unwanted effects, the NNT becomes the NNH (number needed to harm), which should be as large as possible when assessing the safety of the intervention. The details of calculating NNTs and NNHs is beyond the scope of this article, and interested readers are referred to published articles on this topic.[10, 41, 49]

GENERAL APPROACH TO PAIN MANAGEMENT

Analgesic Medications

There are many safe and effective analgesics available for cats and dogs, although all may not be licensed for use in animals. Off-label use of analgesics is common practice (e.g., injectable butorphanol is not licensed for cats or dogs in Canada); therefore, it is suggested that practitioners use the refereed veterinary literature or this issue for guidelines on analgesic use rather than restricting their practice to specific licensed drugs. The following analgesics may be administered to cats and dogs, and each group is discussed in detail elsewhere in this issue (indications for use are presented in Tables 1 and 2):

- Opioid pure agonists (oxymorphone, hydromorphone, morphine, fentanyl, sufentanyl, meperidine [pethidine], oxycodone, methadone, and codeine)
- Partial agonists (buprenorphine) or agonist–antagonists (butorphanol)
- NSAIAs (carprofen, ketoprofen, meloxicam, tolfenamic acid, etodolac, flunixin meglumine, ketorolac tromethamine)
- Local anesthetics (lidocaine, bupivacaine, mepivacaine)[57]
- Alpha-2 agonists (xylazine, medetomidine)[12]
- Ketamine
- Chondroprotective drugs[25, 34, 36]
- Adjunctive methods or "unconventional analgesics"

A few general comments concerning these classes of analgesics are warranted. With respect to dosing with the pure agonist opioids, there is no "ceiling" effect, which permits titration of dose "to effect." The opioid partial agonists or agonist–antagonists do have a ceiling effect, where giving more does not increase the analgesic effect (and, in fact, can reduce it). Strict adherence to maximum dosing is important with these drugs (the reader is referred to the article on opioids in this issue). The NSAIAs should be avoided until the renal, hepatic, circulatory, and coagulation status of the patient is known. The NSAIA dose must not exceed that recommended by the manufacturer because of the potential adverse affects associated with these drugs. Rather, NSAIAs should be "titrated down" to effect to obtain the lowest dose possible to alleviate pain, reducing the potential of adverse effects. The alpha-2 agents are effective for pre-emptive analgesic use and selected cases of pain management in the young otherwise healthy patient.[12] The medetomidine antagonist atipamezole may be administered if adverse effects occur. Although not commonly used as an analgesic, ketamine may be used for peracute pain management as an adjunct to other analgesics or sedative regimens, or when short-term analgesia is required (e.g., head trauma) and opioids are not available or are inadequate (the reader is referred to the article on adjunctive therapy in this issue). The chondroprotective or neutraceutical agents may be beneficial for the treatment of osteoarthritis[25, 34, 36] and are discussed in the article on the management of osteoarthritis in this

issue. Adjunctive therapy, including acupuncture, can be used in addition to conventional analgesics for many painful states, including cancer.

In general, the geriatric[56] or young patient and those patients with liver or renal disease should receive special consideration with regard to specific drugs and their dosage. These patients should receive a lower to average dose of an opioid analgesic initially depending on the intensity of pain. Additional doses may be slowly titrated intravenously over several minutes to the desired effect (the reader is referred to the article on perioperative management of pain in this issue for further details). Hepatic or renal impairment may lead to a prolonged effect rather than an overdose effect. A specific fixed dose cannot be recommended, because the pain may be difficult to quantify, and many of these animals may ultimately require the same dose as any other animal. I recall treating a dog in pain caused by severe acute hepatic necrosis with oxymorphone. This dog required 0.1 mg/kg every 4 hours, but no adverse effects were noted. The goal of administration of analgesics is to eliminate pain or, at the very least, make the animal comfortable. A more cautious approach is required when NSAIAs are considered. A relative contraindication exists for the use of NSAIAs in the geriatric patient in that normal renal and hepatic function should be established before administration.

Frequently, it is impossible to administer oral analgesics to cats and some dogs. Often, pills or capsules are formulated in large doses, making safe and accurate administration difficult. Veterinary pharmacies or local human pharmacies may formulate medications in appropriate concentrations with flavors appealing to dogs and cats. For example, codeine and morphine can be formulated in a malt syrup or fish paste palatable to cats. It is always advisable to leave the intravenous catheter in place while the animal is recovering from any surgical procedure to manage potential acute pain not otherwise adequately controlled with oral agents.

Acute Pain Management

A detailed discussion of pain management in acutely ill or injured animals is provided elsewhere in this issue. Chemical restraint and analgesia for diagnostic and emergency procedures are also outlined in elsewhere in this issue.

The management of acute pain frequently requires "acute" treatment in that the analgesic administered should have a rapid onset and effect (see Table 1). These situations are often related to trauma, surgery, or diseases such as pancreatitis, hepatitis, splenitis, pyelonephritis, enteritis, urethral obstruction, severe accidental hypothermia (extremely painful during and after rewarming for approximately 72 hours), and frostbite (the reader is referred to the article on the management of patients requiring emergency procedures in this issue). The preferred route of administration of opioids is intravenously; however, if morphine is given via this route, it must be given slowly.[27] Alternative routes are subcutaneously, intramuscularly, or per rectum. The beauty of opioid analgesics is the ability to titrate the dose to effect; if an overdose occurs, naloxone, a reversal agent, can also be titrated to remove the unwanted adverse effects. The analgesia is still preserved using this technique (the reader is referred to the article on opioids in this issue). In patients in pain, a naloxone "dose for dose of opioid" method of reversal is not recommended, as this frequently results in an overdose of the antagonist and reversal of analgesia.

For moderate pain (see Tables 1 and 2), lower doses of the pure agonist opioids or butorphanol are adequate with additional dosing if needed. For mild

Table 1. SUGGESTED ANALGESICS FOR THE INITIAL MANAGEMENT OF ACUTE PAIN IN CATS AND DOGS

Drug	Dose	Duration of Action or Dosing Interval
Moderate to severe pain		
Morphine	Cat: 0.1–0.2+ mg/kg IM, SC	2–6 h IM, SC
Use low end of the dose for moderate pain	Dog: 0.3–1.0+ mg/kg IM, SC For IV dosing use half the low-end dose, administer over 5 minutes	1–4 h IV
Oxymorphone	Cat: 0.02–0.1+ mg/kg IV, IM	2–6 h
Use low end of the dose for moderate pain	Dog: 0.05–0.2+ mg/kg IV, IM	
Hydromorphone	Cat and dog: 0.08–0.3+ mg/ kg IV, IM, SC	2–6 h
Use low end of the dose for moderate pain		
Fentanyl	Cat and dog: 0.001–0.01+ mg/kg	0.3 h
Use low end of the dose for moderate pain		
Ketamine	Cat and dog: 1–4 mg/kg IV	As needed (~0.5 h)
Use low end of the dose for moderate pain	Cat and dog: 2–10 mg/kg PO	
Mild to moderate pain		
Butorphanol	Cat and dog: 0.1–0.4 IV	0.25–1.0 h
Use low end of dose for mild pain	Cat: 0.4–0.8 mg/kg IM, SC Dog: 0.1–0.4 mg/kg IM, SC	2–4 h 1–2 (3) h
Buprenorphine	Cat: 0.005–0.01 mg/kg IV, IM	4–8 h
Use low end of dose for mild pain	Dog: 0.005–0.02 mg/kg IV, IM	4–8 h
Meperidine (pethidine)	Cat and dog: 5–10 mg/kg IM, SC	20–30 minutes

Opioids should be given to effect even beyond dosing and frequency noted.
See the article in this issue on chemical restraint for specific emergency situations.
IM = intramuscularly; SC = subcutaneously; IV = intravenously; PO = orally; h = hours.

pain (see Tables 1 and 2), the pure agonist opioids are excessive. Meperidine must not be administered intravenously. Because of its short duration of action (30 minutes), meperidine is usually reserved for short-term pain management such as in dogs and cats undergoing retropulsion for urethral obstruction. Meperidine may be used initially to reduce pain during patient assessment or perhaps combined with NSAIA administration. Butorphanol or buprenorphine is an appropriate analgesic for mild to moderate acute pain such as that associated with ovariohysterectomy[58] or the early stages of pancreatitis. The duration of effect is short (~2 hours) for butorphanol; therefore, repeat administration is required for ongoing painful conditions. CRI can be established to avoid the need for repeated administration. The onset of action of buprenorphine requires 45 minutes, with a reported duration of action of 12 hours; however, in practice, it more predictably lasts for 6 hours and is occasionally ineffective.[5, 39] Opioids, opioid agonist–antagonists, or partial agonists can be prescribed when NSAIAs are contraindicated.

When intravenous access cannot be obtained in the intractable animal, 2 to 10 mg/kg of ketamine can be sprayed onto the oral mucous membranes. When the patient is sedated, one can insert an indwelling intravenous catheter and

Table 2. SUGGESTED ANALGESIA FOR VARIOUS LEVELS OF ONGOING PAIN*

Drug	Dose	Duration of Action or Dosing Interval
Moderate to severe pain		
Morphine	Cat: 0.1–0.2+ mg/kg IV	1–4 h
	0.1–0.5 IM, SC	2–6 h
	Dog: 0.3–1.0 mg/kg IV, IM, SC	2–4 h
	Dog and cat: 0.1–0.2 mg/kg/h	CRI
Oxymorphone	Cat: 0.02–0.1+ mg/kg IV, IM, SC	2–4 h
	Dog: 0.05–0.2 mg/kg IV, IM, SC	2–4 h
Hydromorphone	Cat and dog: 0.08–0.3+ mg/kg IV, IM, SC	2–6 h
Fentanyl	Cat and dog: 0.004–0.01+ mg/kg IV bolus	0.3 h
	0.001–0.004+ mg/kg/h	CRI
Fentanyl patch	Cat and dog ≤10 kg: 25 µg/h	
	Dogs: 10–20 kg: 50 µg/h	
	20–30 kg: 75 µg/h	
	>30 kg: 100 µg/h	
Ketamine† combined with an opioid or sedative	Cat and dog: 1–4+ mg/kg/h IV, SC	CRI
Ketoprofen‡	Cat: ≤2 mg/kg SC, then ≤1.0 mg/kg	Once, then Every 24 h up to 4 days
	Dog: ≤2.0 mg/kg IV, IM, SC, PO, then ≤1.0 mg/kg	Once, then Every 24 h up to 4 days
Meloxicam‡	Cats: ≤0.2 mg/kg SC, PO, then ≤0.1 mg/kg	Once, then Every 24 h up to 3 days
	Dog: ≤2.0 mg/kg IV, SC, PO, then ≤0.1 mg/kg	Once, then Every 24 h
Carprofen‡	Cats: ≤4.0 mg/kg SC	Once
	Dogs: ≤4.0 mg/kg SC, IV, PO, then ≤2.2 mg/kg	Once, then Every 12–24 h
Flunixin meglumine‡	Cat and dog: 1.0 mg/kg SC	Once
Ketorolac tromethamine‡	Cat: 0.25 mg/kg IM	Repeat once in 8–12 h
	Dog: 0.3–0.5 mg/kg IM, IV	Repeat once in 8–12 h
Etodolac‡	Dog: ≤10–15 mg/kg PO	Every 24 h
Tolfenamic acid‡	Cat and dog: ≤4.0 mg/kg SC, PO	Every 24 h for 4 days, then 3 days off and repeat cycle
Mild to moderate pain		
Opioids listed above	Low dosages	Titrate down to lowest effective dose
Buprenorphine	Cat: 0.005–0.01 mg/kg IV, IM	4–8 h
	Dog: 0.005–0.02 mg/kg IV, IM	4–8 h
NSAIAs listed above	Low dosages	Titrate down to lowest effective dose
Butorphanol	Cat and dog: 0.1–0.4 mg/kg IV, IM, SC	2 h
Meperidine (pethidine)	5–10 mg/kg IM, SC for short duration analgesia or administered at time of NSAIA injection	20–30 minutes
Morphine syrup	0.5 mg/kg PO titrated to effect	Every 4–6 h
Codeine	0.5–2 mg/kg PO titrated to effect	Every 6–12 h
Bupivacaine (0.5%)	Dog: 1 mg/kg (0.2 mL/kg of lean weight) + 0.02 mEq/kg of sodium bicarbonate diluted to 12 mL with saline for intrapleural and peritoneal use	6 h

Table 2. SUGGESTED ANALGESIA FOR VARIOUS LEVELS OF ONGOING PAIN*
(Continued)

Drug	Dose	Duration of Action or Dosing Interval
Sedatives combined with opioids		
Midazolam	Cat and dog: 0.1–0.5 mg/kg IV, IM	Dog: up to 6 h Cat: can be >6 h
Diazepam	Cat and dog: 0.1–0.5 mg/kg IV	Dog: up to 6 h Cat: can be >6 h
Acepromazine	Cat and dog: 0.01–0.05 mg/kg IV	1–2 h
	Cat and dog: 0.02–0.1 mg/kg IM, SC	2–6 h
Medetomidine	0.002–0.004 mg/kg IM, SC	

*Severe to excruciating pain requires high-dose opioids. Oxymorphone must be given at a rate of at least 0.2 mg/kg of body weight in dogs or 0.1 mg/kg of body weight in cats; hydromorphone at a rate of 0.3 to 0.4 mg/kg of body weight or morphine at a rate of 1.0 mg/kg of body weight in dogs and 0.2 mg/kg of body weight in cats intramuscularly, subcutaneously, or 0.2+ mg/kg/h as CRI (cats and dogs) to effect; or fentanyl up to 50 μg/kg/h as CRI (cats and dogs) with or without NSAIAs where not contraindicated. Ketamine, 4 mg/kg, can be combined with the opioid. Tachycardia may persist. It may be impossible to control the pain. Consider combining the analgesic with epidurally placed analgesics or local blocks, or anesthetize the patient while attempting to find or treat the inciting cause. Remove the inciting cause immediately. This degree of pain can cause death.

Ketamine, 2–4+ mg/kg intravenously or 10 mg/kg orally, may be an alternative to control pain quickly if opioids are not available and renal function or hypertrophic cardiomyopathy is not a concern. For severe to excruciating pain in patients with normal renal function, and after appropriate dosing with an opioid agonist, ketamine (100 mg/L) and diazepam (5 mg/mL) or midazolam (5 mg/mL) mixed 1:1 and administered at 0.05 to 0.15 mL/kg to effect should also be considered. General anesthesia is another alternative.

As pain sensation is an individual experience, with one animal seeming to be in greater pain than another with a similar condition, an individual approach to pain management is required. Although suggestions for treatment can be made for mild, moderate, and severe pain, response to analgesic therapy is the best approach. If the animal is still considered to be in pain, increase the dose or add another type of analgesic. Assigning the severity of trauma or degree of surgical invasiveness and tissue manipulation to a case may guide you as to which analgesic to use and how much to give, but even this has variability. Surgical "trauma" (tissue handling) and duration of the surgical procedure influence the degree of postoperative pain. The combination of NSAIAs and opioids confers excellent analgesia for moderate to severe orthopedic procedures and certain soft tissue injury (including surgical) where inflammation is a feature.

†Not first line, but may be beneficial in cases that are difficult to manage.

‡See article on NSAIAs in this issue for safety information. It is not always necessary to administer the recommended loading dose. The dose is determined based on the degree of pain assessed. It is advised that a dose as low as possible be used to manage the varying degrees of pain. This reduces the potential for adverse effects. Severe pain requires the higher dose.

IV = intravenously; IM = intramuscularly; SC = subcutaneously; PO = orally; h = hours; CRI = constant rate infusion.

The drugs and doses given are suggestions. If the pain is not being managed, increase to effect (opioids only). Oxymorphone or fentanyl is preferred to morphine when given intravenously to cats, as some cats may vomit or become excited with morphine if the level of pain is overdiagnosed. If given slowly to effect, this may not happen. Morphine should be administered slowly to prevent hypotension.

administer midazolam or diazapam. A continuous-delivery system of a balanced electrolyte solution containing an analgesic facilitates therapy at a distance.

To reduce the pain of intravenous catheter placement, especially in animals that are difficult to handle or when catheter placement into the jugular, lateral, or medial saphenous vein is required, I use a topical anesthetic cream such as lidocaine-prilocaine (EMLA cream, Astra, Mississauga, Ontario, Canada), which is applied over the previously shaved and cleansed venipuncture site. After 20 to 30 minutes of contact under an occlusive dressing for skin desensitization,

EMLA cream consistently facilitates ease of catheter placement. Benzocaine cream must be avoided because of the potential for formation of methemoglobin.

In addition to analgesics, sedatives such as acepromazine (in the young stable patient) or diazepam or midazolam (in the geriatric or cardiovascularly compromised animal) may be useful in calming the anxious patient (see Table 2). Sedatives have no analgesic properties when used alone; in fact, pain perception may be heightened.[30]

Ongoing acute pain should be monitored so that the analgesic agent (see Table 2) can be administered before the recurrence of moderate to severe pain; recognition of subtle signs of pain can guide the veterinarian as to earlier repeat dosing if required. The duration of effect of any analgesic is dependent on the dose administered and the degree of pain experienced; therefore, monitoring the patient's response can dictate the appropriate regimen in each case. Dosing at set intervals is recommended initially. If pain is not adequately controlled, a higher dose or more frequent administration of an opioid may be necessary.

For continuous delivery of an analgesic, CRI, intravenously (preferred) or subcutaneously when no intravenous access can be obtained, can be established. Initially, the dose is determined by administering a dose of pure agonist opioid or butorphanol to confer an analgesic state. The same volume (dose) can be assumed to last 2 to 4 hours depending on the drug used. This may be divided into hourly infusions and added to a burette placed between the fluid bag and the intravenous delivery set. If delivered intravenously, crystalloid fluids are added to the burette and delivered at the hourly maintenance fluid rate. Should excessive sedation occur, the rate of fluid administration can be reduced or the contents of the burette can be diluted. Alternatively, a syringe pump may be used to inject the analgesic into the administration set. Again, the dose can be titrated up or down depending on the patient's response. The major drawback to CRI is the difficulty associated with delivering the opioid intravenously to patients that are not supervised. If a mechanical delivery system is not used, catheter occlusion or inadvertent overdosing may occur. Opioids may cause heavy sedation when overdosed, requiring temporary cessation of CRI with reinstitution at a lower dose.

A transdermal fentanyl patch is an excellent delivery system for continuous administration of an analgesic in dogs and cats. There is individual variation in reaching therapeutic plasma drug concentrations after patch application in cats (6–12 or more hours)[42] and dogs (12–24 or more hours).[17] Some animals never achieve effective drug concentrations. Adjunct analgesia is required until effective analgesia is reached. Morphine, oxymorphone, hydromorphone, or a reducing dose such as CRI fentanyl can be used as supplemental pain medication along with the fentanyl transdermal patch.

Respiratory depression, frequently mentioned as a serious side effect of therapeutic doses of opioids, is overemphasized (I have never noted this when animals are in pain) and primarily extrapolated from the human experience. Respiratory depression may rarely occur in the postoperative setting when fentanyl patches are applied, especially in smaller animals when the 25-μg/h patch is used. This is easily detected early in the course of treatment, and if it is observed, the patch should be removed. Carefully titrated naloxone may be given for a more rapid reversal if needed. Any opioids used in combination with sedatives as a form of chemical restraint in geriatric animals that are not in pain or with general anesthesia can produce respiratory depression. Hypotension may result because of changes in heart rate or effects of the other drugs used. Morphine given intravenously as a bolus may cause hypotension and possibly excitement and vomiting. If morphine is given as a slow push over

5 minutes in the patient with pain, these side effects are readily avoided.[27] Pain frequently results in tachypnea; as opioids reduce the perception of pain, the respiratory rate is also lowered to within the normal range. Panting may occur with opioid agonists, especially if the dose is excessive for the pain experienced. This is a result of the effects of the opioids on the thermoregulatory center. When head injury, either alone or in conjunction with other injuries, is causing pain, intravenous fentanyl is the analgesic of choice. Fentanyl's duration of action is approximately 20 to 30 minutes, permitting a more accurate titration of dose without compromising the patient's long-term neurologic status. The CRI can be stopped or reduced temporarily to evaluate the patient. Low-dose oxy-morphone or morphine carefully titrated to effect may also be useful as a sedative analgesic in these patients. Increased intracranial pressure (ICP) is a concern in all patients with head injuries. Carbon dioxide retention, a potential side effect of opioid administration, can potentiate an increase in ICP. Pain can also increase the ICP and may be more of an issue than a carefully administered opioid. Ketamine has been used as an analgesic in human patients with head injuries in Europe.[35] Ketamine administered after experimental head injury in rats reduced post-traumatic memory dysfunction.[59] Ketamine's analgesic effect is caused, in part, by the N-methyl-D-aspartate receptor blockade, which may also be of benefit in preventing secondary brain injury. Although its use in patients with head injuries has not been reported in clinical veterinary medicine, 0.25 to 2.0 mg/kg of ketamine administered intravenously and 0.05 to 0.1 mg/kg of diazepam or midazolam administered intravenously as needed (approximately 20–30 minutes) or as a CRI may be beneficial when opioids are not available. In combination with midazolam and glycopyrrolate, ketamine was proven safe, effective, and practical when managing selected pediatric injuries in the emergency department.[54] I have used a low-dose ketamine–opioid combination in traumatized cats and dogs when it was impossible to assess the extent of injuries in these animals with standard analgesics alone.

In my experience as well as that of other investigators, the newer NSAIAs are excellent analgesics for severe pain even when the opioids have failed. Meloxicam, carprofen, ketoprofen, tolfenamic acid, flunixin meglumine, and ketorolac tromethamine are available as injectable formulations. Ketorolac tri-methamine is mentioned here, as this NSAIA may be available at research institutions. Once acute severe pain is controlled with an opioid and the patient is assessed as having normal renal and hepatic function, is well hydrated and normotensive, and has no gastrointestinal pathology or ongoing hemorrhage (this usually takes several hours), an NSAIA may be administered. It usually takes 45 to 60 minutes for an intravenous, intramuscular, or orally administered NSAIA to become effective (potentially longer when administered subcutaneously); therefore, supplemental analgesia is required during this time.

Local and regional anesthesia and analgesia are useful adjuncts to other perioperative regimens.[57] Local anesthetic such as 1% lidocaine should also be used (if time permits) in a sedated, depressed, or comatose animal before any emergency procedure (e.g., chest drain placement, venous cutdown), as this reduces the nociceptive input and thus pain perception when the animal's condition improves. Depressed animals may still feel the pain of the procedure but are unable to respond (the reader is referred to the articles on local anesthesia and emergency treatment in this issue).

Epidural analgesia is frequently used to prevent, reduce, or treat pain in dogs and cats. Its use is encouraged to provide intraoperative analgesia, reduce anesthetic demands, and provide total anesthesia for procedures performed caudal to T13 innervation (when local anesthetics are used). Epidural analgesics

can provide good postoperative pain relief and pain control in patients with pancreatitis, an abdomen open and draining because of peritonitis, post-traumatic but preoperative fracture pain, or following various soft tissue or orthopedic procedures.

Most cats and small dogs require dental care during their lifetime. The recommended analgesic regimen for tooth extraction in these patients is to use an opioid preanesthetic and local anesthetic blockade of the appropriate nerves with 0.25% bupivicaine. When there are no contraindications for their use, NSAIAs may be administered on extubation. If hemorrhage is a concern, ketoprofen or aspirin should be avoided. Should NSAIAs be contraindicated, opioids are recommended. Depending on the level of pain, codeine or morphine oral formulations can be administered as soon as the animal is able to swallow for at least 12 to 24 or more hours if parenteral formulations have not been given.

Painful sensations such as dull aching, sharp shooting, throbbing, and stinging can be experienced in any individual as a single or multiple experience. A combination of these painful sensations can be experienced by a single patient after trauma or major orthopedic surgery. Combination opioids and NSAIAs are recommended in these animals, as one analgesic class alone is usually not adequate to control all types of pain sensation.

Chronic Pain Management

Osteoarthritis as a result of degenerative joint disease causes chronic pain in cats and dogs and should be on the list of differential diagnoses when a patient is presented with nonspecific complaints. Medical management for osteoarthritis is discussed in elsewhere in this issue. Pain associated with cancer, especially the orofacial region, is debilitating and must be treated. A detailed discussion is presented elsewhere in this issue.

Many medical problems such as cystitis, meningitis, or otitis are painful, and analgesics should be administered while the primary condition is treated with gradual reduction and discontinuation as the primary problem resolves. Table 3 outlines suggested treatment for general conditions of chronic pain.

Recommendations for Improving Pain Management

- Be familiar with the various analgesic drugs, dosages, treatment intervals, and combination therapy proved to be safe and effective in the different species and in various ill or injured states in various age groups.
- Take time to observe behaviors that could be associated with pain and the response of the patient to analgesic therapy.
- Assess and record pain regularly—be proactive.
- Establish protocols for monitoring and treating pain in your practice.
- Look for potential adverse effects.
- Establish protocols for monitoring and treating adverse effects in your practice.
- Titrate doses of analgesic drugs until the pain is relieved to become familiar with appropriate doses for different painful states.
- Do not be afraid to use more than one approach to alleviate pain.
- Individualize treatment.
- Provide education for staff and clients.
- Continue in-service training and education for all patient caregivers.

Table 3. SUGGESTED TREATMENT FOR CHRONIC PAIN (>5 DAYS) IN CATS AND DOGS

Drug	Dose	Duration of Action or Dosing Interval
Fentanyl patch	See Table 2	As needed up to every 3 days (dogs) 5 days (cats)
Meloxicam	Cat: ≤0.2–0.3 mg/kg SC, PO, then ≤0.1 mg/kg PO ≤0.025 mg/kg PO Dog: ≤0.2 mg/kg PO, then ≤0.1 mg/kg	Once Daily for 3 days, then 2–3 times weekly Once, then Every 12–24 hours
Carprofen	Dog: ≤2–4 mg/kg PO, then ≤2.2 mg/kg PO	Once, then Every 24 or 12 hours (if needed)
Etodolac	Dog: ≤10–15 mg/kg PO	Once daily
Tolfenamic acid	Cat and dog: ≤4.0 mg/kg PO	Every 24 hours for 4 days, then 3 days off and repeat cycle
Codeine	Cat and dog: ≤0.5–2.0 mg/kg PO	Every 8–12 hours
Morphine syrup	Cat and dog: ≤0.5 mg/kg PO	Every 4–6 hours
Aspirin	Cat: ≤10 mg/kg PO Dog: 10 mg/kg PO	Every 72 hours Every 8 hours
Corticosteroids	1–2 mg/kg Not in combination with NSAIAs	Every 24 hours with reduced daily dose based on the underlying disease
Polysulfated glycosaminoglycans	Manufacturer's recommendations	
Glucosamine chondroitin sulfate	Manufacturer's recommendations	
Shark or bovine cartilage	Manufacturer's recommendations	

See articles on management of cancer pain and management of osteoarthritis in this issue for additional analgesic regimens.

CONCLUSIONS

Pain is present in many diseases and in surgical and traumatic conditions. Veterinarians must develop skills in detection of the subtle signs of pain. The staff of each practice should devote time for in-house seminars and case discussion for self-directed learning in pain management. The current literature, this issue, proceedings from meetings, or video case-based electronic material[44] can be used for discussion. The demonstration of pain is not always obvious; therefore, an animal should be assumed to be experiencing pain in any condition expected to produce pain in human beings. Response to analgesic administration (as is the case with any other therapy-directed treatment of a problem) can guide the veterinarian in the management of pain (or presumed pain). Return of normal behavior, including eating, sleeping, dreaming, yawning, normal stretching, and grooming, and a general appearance of well-being are the goals to achieve. This allows the practitioner to gain experience in recognizing and treating pain in cats and dogs.

The management of pain can be approached in a similar way to the treatment of infections. We often assume the presence of infection (pain), with no *supporting culture (serum cortisol or epinephrine measurements), based on a* patient's history and physical examination. We administer an antibiotic (analgesic) at a dose and dosing regimen to be effective for the presumed infection (pain) we are treating and rely on clinical outcome (return to normal) to confirm our diagnosis and the appropriateness of treatment. We may add to or change the antibiotic (analgesic) if there is no improvement. We may give a high dose

of antibiotic (opioid) initially for severe infections (pain) to ensure adequate blood concentrations and a more rapid control of infection (pain) to prevent the ultimate demise of our patient. Where mixed infections (combination of orthopedic and soft tissue pain) are suspected, combination antibiotics (analgesics) are used. Prophylactic (pre-emptive) antibiotics (analgesics) are used when infection (pain) is anticipated after surgery. This approach to the management of suspected or confirmed infection is practiced by all practitioners and should also be used in pain control. The assessment and control of pain is an art as well as a science; as with everything else in life, "practice makes perfect."

References

1. Attard AR, Corlett MJ, Kidner NJ, et al: Safety of early pain relief for acute abdominal pain. BMJ 305:554–556, 1992
2. Baillie L: Clinical pain management: A review of pain assessment tools. Nursing Standard 7:25–29, 1993
3. Benson GJ, Wheaton LG, Thurmon JC, et al: Postoperative catecholamine response to onychectomy in isoflurane-anesthetized cats: Effect of analgesics. Vet Surg 20:222–225, 1991
4. Bonica JJ: General considerations of acute pain. In Bonica JJ (ed): The Management of Pain, ed 2. Philadelphia, Lea & Febiger, 1990, p 159
5. Brock N: Treating moderate and severe pain in small animals. Can Vet J 36:658–660, 1995
6. Buchholz M, Karl HW, Pomietto M, et al: Pain scores in infants: A modified infant pain scale versus visual analogue. J Pain Symptom Manage 15:117–124, 1998
7. Coffman S, Alvarez Y, Pyngolil M, et al: Nursing assessment and management of pain in critically ill children. Heart Lung 26:221–228, 1997
8. Conzemius MG, Brockman DJ, King LG, et al: Analgesia in dogs after intercostal thoracotomy: A clinical trial comparing intravenous buprenorphine and interpleural bupivicaine. Vet Surg 23:291–298, 1994
9. Conzemius MG, Hill CM, Sammarco JL, et al: Correlation between subjective and objective measures used to determine severity of postoperative pain in dogs. JAVMA 210:1619–1622, 1997
10. Cordell WH: Number needed to treat (NNT). Ann Emerg Med 33:433–436, 1999
11. Crane SW: Perioperative analgesia: A surgeon's perspective. JAVMA 191:1254–1257, 1987
12. Cullen LK: Medetomidine sedation in dogs and cats: A review of its pharmacology, antagonism and dose. Br Vet J 152:519–535, 1996
13. Cummings EA, Reid GJ, Finley GA, et al: Prevalence and source of pain in pediatric inpatients. Pain 68:25–31, 1996
14. Day TK, Pepper WT, Tobias TA, et al: Comparison of intra-articular and epidural morphine for analgesia following stifle arthrotomy in dogs. Vet Surg 24:522–530, 1995
15. Dohoo SE, Dohoo IR: Attitudes and concerns of Canadian animal health technologists toward postoperative pain management in dogs and cats. Can Vet J 39:491–496, 1998
16. Dohoo SE, Dohoo IR: Factors influencing the postoperative use of analgesics in dogs and cats by Canadian veterinarians. Can Vet J 37:552–556, 1996
17. Egger CM, Duke T, Archer J, et al: Comparison of plasma fentanyl concentrations by using three transdermal fentanyl patch sizes in dogs. Vet Surg 27:159–166, 1998
18. Firth AM, Haldane SL: Development of a scale to evaluate postoperative pain in dogs. JAVMA 214:651–659, 1999
19. Grisneaux E, Pibarot P, Dupuis J, et al: Comparison of ketoprofen and carprofen administered prior to orthopedic surgery for control of postoperative pain in dogs. JAVMA 215:1105–1110, 1999
20. Hamill-Ruth RJ, Marohn M: Evaluation of pain in the critically ill: Perspectives in pain management. Crit Care Clin 15:1, 1999
21. Hansen B: Through a glass darkly: Using behavior to assess pain. Semin Vet Med Surg 12:61–75, 1997

22. Hansen B, Hardie E: Prescription and use of analgesics in dogs and cats in a veterinary teaching hospital: 258 cases (1983–1989). JAVMA 202:1485–1494, 1993
23. Hansen BD, Hardie EM, Carroll GS: Physiological measurements after ovariohysterectomy in dogs; What's normal? Appl Anim Behav Sci 51:101–109, 1997
24. Hardie E, Hansen B, Carroll G: Behaviour after ovariohysterectomy in the dog: What's normal? Appl Anim Behav Sci 51:111–119, 1997
25. Hardie EM: Management of osteoarthritis in cats. Vet Clin North Am Small Anim Pract 27:945–953, 1997
26. Haskins SC: Use of analgesics postoperatively and in a small animal intensive care setting. JAVMA 191:1266–1268, 1987
27. Hellyer PW, Gaynor JS: Acute postsurgical pain in dogs and cats. Compend Contin Educ Pract Vet 20:140–153, 1998
28. Holton LL, Scott EM, Nolan AM, et al: Comparison of three methods used for assessment of pain in dogs. JAVMA 212:61–66, 1998
29. Holton LL, Scott EM, Nolan AM, et al: Relationship between physiological factors and clinical pain in dogs scored using a numerical rating scale. J Small Anim Pract 39:469–474, 1998
30. Jenkins WL: Pharmacologic aspects of analgesic drugs in animals: An overview. JAVMA 191:1231–1239, 1987
31. Jensen MP, Karoly P, Braver S: A comparison of six methods. Pain 27:117–126, 1986
32. Jensen MP, Turner JA, Romano JM: What is the maximum number of levels needed in pain intensity measurement? Pain 58:387–392, 1994
33. Katz J, Jackson M, Kavanagh B, et al: Acute pain after thoracic surgery predicts long-term post-thoracotomy pain. Clin J Pain 12:50–55, 1996
34. Kendall RK: Therapeutic nutrition for the cat, dog and horse. In Schoen AM, Wynn SG (eds): Complimentary and Alternative Veterinary Medicine: Principles and Practice. St Louis, Mosby, 1998, pp 53–69
35. Kolenda H, Gremmelt A, Rading S, et al: Ketamine for analgosedative therapy in intensive care treatment of head-injured patients. Acta Neurochir (Wien) 138:1193–1199, 1996
36. Kyles AE, Ruslander D: Chronic pain: Osteoarthritis and cancer. Semin Vet Med Surg 12:122–132, 1997
37. Lascelles BD, Capner CA, Waterman-Pearson AE: Current British veterinary attitudes to perioperative analgesia for cats and small mammals. Vet Rec 145:601–604, 1999
38. Lascelles BD, Cripps PJ, Jones A, et al: Post-operative central hypersensitivity and pain: The pre-emptive value of pethidine for ovariohysterectomy. Pain 73:461, 1997
39. Lascelles BDX, Waterman A: Analgesia in cats. In Practice 19:203–213, 1997
40. Lascelles BDX, Cripps PJ, Jones A, et al: Efficacy and kinetics of carprofen, administered preoperatively or postoperatively, for the prevention of pain in dogs undergoing ovariohysterectomy. Vet Surg 27:568–582, 1998
41. Lauacis A, Sackett DL, Roberts RS: An assessment of clinically useful measures of the consequences of treatment. N Engl J Med 318:1728–1733, 1988
42. Lee D, Papich M, Hardie EM: Pharmacokinetic distribution of transdermal fentanyl in cats. Am J Vet Res, in press
43. Lynch D: Geriatric pain. Current Review of Pain 3:388–399, 1999
44. Mathews KA: Relieving Pain: Assessment and Management of Post-Operative Pain in Dogs and Cats [CD-rom]. Guelph, Centre for the Study of Animal Welfare, University of Guelph, 1998
45. Mathews KA: Non-steroidal anti-inflammatory analgesics for acute pain management in dogs and cats. Vet Comp Orthop Traumatol 10:122–129, 1997
46. Mathews KA, Foster R, Gallivan J: A prospective study of the analgesic efficacy and potential side effects of ketoprofen in dogs after splenectomy. In Proceedings of the International Veterinary Emergency and Critical Care Symposium, San Antonio, TX, 1996, p 886
47. McCaffrey M: Pain ratings: The fifth vital sign. Am J Nurs 97:15–16, 1997
48. McGrath PJ, Johnson G, Goodman JT: CHEOPS: A behavioural scale for rating postoperative pain in children. Advances in Pain Research and Therapeutics 9:395–402, 1985
49. McQuay H, Moore A: In An Evidence-Based Resource for Pain Relief. New York, Oxford University Press, 1999, pp 32–38

50. McQuay H, Moore A: *In* An Evidence-Based Resource for Pain Relief. New York, Oxford University Press, 1999, p 191
51. Morton DB, Griffiths PHM: Guidelines on the recognition of pain, distress and discomfort in experimental animals and an hypothesis for assessment. Vet Rec 116:431–436, 1985
52. Pascoe P: Control of postoperative pain in animals receiving inhalant anesthetics. *In* Short CE, Van Poznak A (eds): Animal Pain. New York, Churchill Livingstone, 1992, pp 348–352
53. Popilskis S, Kohn D, Sanchez J, et al: Epidural vs intramuscular oxymorphone analgesia after thoracotomy in dogs. Vet Surg 20:462–476, 1991
54. Pruitt JW, Goldwasser MS, Sabol SR, et al: Intramuscular ketamine, midazolam and glycopyrrolate for pediatric sedation in the emergency department. J Oral Maxillofac Surg 53:13–17, 1995
55. Ricard-Hibon A, Chollet C, Saada S, et al: A quality control program for acute pain management in out-of-hospital critical care medicine. Ann Emerg Med 34:738–744, 1999
56. Sackman JE: Geriatrics: Pain and its management. Vet Clin North Am Small Anim Pract 27:1487–1505, 1997
57. Skarda RT: Local and regional anesthetic and analgesic techniques: *In* Thurmon JC, Tranquilli WJ, Benson GJ (eds): Lumb and Jones Veterinary Anesthesia. Baltimore, Williams & Wilkins, 1996, pp 426–447
58. Slingsby LS, Waterman-Pearson AE: Comparison of pethidine, buprenorphine and ketoprofen for postoperative analgesia after ovariohysterectomy in the cat. Vet Rec 143:185–189, 1998
59. Smith DH, Okiyama K, Gennarelli TA, et al: Magnesium and ketamine attenuate cognitive dysfunction following experimental brain injury. Neurosci Lett 157:211–214, 1993
60. Smith JD, Allen SW, Quandt JE, et al: Indicators of postoperative pain in cats and correlation with clinical criteria. Am J Vet Res 209:1674–1678, 1996
61. Staats P: Pain: Assessment and approach to practical pain management in the ICU. Presented at the Society of Critical Care Medicine 29th Educational and Scientific Symposium, Orlando, February 12–15, 2000
62. Taylor PM, Houlton JEF: Post-operative analgesia in the dog: A comparison of morphine, buprenorphine and pentazocine. J Small Anim Pract 25:437–441, 1984
63. Tesler MD, Holzemer WL, Savedra MC: Pain behaviours: Postsurgical responses of children and adolescents. J Pediatr Nurs 13:41–47, 1998
64. Vierck CJ: Extrapolation from the pain research literature to problems of adequate veterinary care. JAVMA 168:510–514, 1976
65. Vierck CJ, Jr, Cooper BY, Franzen O, et al: Behavioural analysis of CNS pathways and transmitter systems involved in conduction and inhibition of pain sensations and reactions in primates. Progress in Psychobiology, Physiology, and Psychology 10:113–165, 1983
66. Wall PD: Defining "pain in animals." *In* Short CE, Van Poznak A (eds): Animal Pain. New York, Churchill Livingstone, 1992, pp 63–79
67. Waterman AE, Kalthum W: Use of opioids in providing postoperative analgesia in the dog: A double-blind trial of pethidine, pentazocine, buprenorphine, and butorphanol. *In* Short CE, Van Poznak A (eds): Animal Pain. New York, Churchill Livingstone, 1992, p 466
68. Watson ADJ, Nicholson A, Church DB, et al: Use of anti-inflammatory and analgesic drugs in dogs and cats. Aust Vet J 74:203–210, 1996
69. Wilcke JR: Idiosyncracies of drug metabolism in cats: Effects on pharmacotherapeutics in feline practice. Vet Clin North Am Small Anim Pract 14:1345–1354, 1984

Address reprint requests to
Karol A. Mathews, DVM, DVSc
Department of Clinical Studies
Ontario Veterinary College
University of Guelph
Guelph, Ontario N1G 2W1
Canada

APPENDIX

Descriptive Pain Assessment Scale

The following is a suggested pain assessment scale that may be used in clinical or laboratory practice. This is only a guide. Response to analgesic therapy with improvement in behavioral characteristics towards normal behavior should be the ultimate goal. Should pain-induced tachycardia and tachypnea also be present, a reduction in heart rate and respiratory rate towards normal should be established. The reader should refer to lists found in the text of this article for individual characteristics of pain, anticipated levels of pain associated with various surgical procedures, and levels of illness or injury. The reader should refer to Tables 1, 2, and 3 for suggested analgesia.

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; if elevated, it is due to excitement. Cats rub their face on the caregiver's hand or cage, may roll over and purr. Cats and dogs groom themselves when free of pain. Appetite is normal. Behavior different from this not associated with pain may be associated with apprehension or anxiety. Apprehension or anxiety can be a feature of hospitalized patients.

1 Probably no pain. Patient seems to be normal, but condition is not as clear-cut as previous category. Heart rate should be normal or slightly increased because of excitement.

2 Mild discomfort. Patient still eats or sleeps but may not dream. May limp slightly or resist palpation of the surgical wound, but otherwise shows no signs of discomfort. Not depressed. There may be a slight increase in respiratory rate; heart rate may or may not be increased. Dogs may continue to wag their tail and cats may still purr during interaction with the caregiver. Reassess within the hour, and then give an analgesic if condition seems worse.

3 Mild pain or discomfort. Patient limps or guards incision, or the abdomen may be slightly tucked up if abdominal surgery was performed. Looks a little depressed. Cannot get comfortable. May tremble or shake. Seems to be interested in food and may still eat a little but somewhat picky. This could be a transition from category 2, 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. Cats may continue to purr and dogs may wag their tail even when they are in pain; therefore, disregard these behavioral patterns as indicators of comfort. Needs analgesia. The analgesic selected depends on whether (1) it is a repeat administration or dose in a patient with moderate to severe pain (e.g., fracture repair, pancreatitis) or (2) the patient has a problem resulting in mild to moderate pain (e.g., lump removal).

4 Mild to moderate pain with the patient resisting touching of the operative site, injured area, painful abdomen, or neck, for example. Guarding or splinting of the abdomen or stretching all four legs. May look, lick, or chew at the painful area. The patient may sit or lie in an abnormal position and is not curled up or relaxed. May tremble or shake. May or may not seem interested in food. May start to eat and then stop after

one or two bites. Respiratory rate may be increased or shallow. Heart rate may be increased or normal. Pupils may be dilated. May whimper (dogs) or give a plaintive meow (cats) occasionally, be slow to rise, and hang the tail down. There may be no weight bearing or only a toe touch on the injured limb. Is somewhat depressed in response to the caregiver. Cats may lie quietly and not move for prolonged periods.

5 Moderate pain. Similar to previous category, but condition progressing. Patient may be reluctant to move, depressed, or inappetent and may bite or attempt to bite when the caregiver approaches the painful area. Trembling or shaking with head down may be a feature, depressed. The patient may vocalize when caregiver attempts to move it or when it is approached. There is definite splinting of the abdomen if affected (e.g., peritonitis, pancreatitis, hepatitis, incision) or the patient is unable to bear weight on an injured or operative limb. The ears may be pulled back. The heart and respiratory rates may be increased. Pupils may be dilated. The patient lies down but does not really sleep or may stand in the praying position if there is abdominal pain.

6 Increased moderate pain. Similar to previous category, but patient may vocalize or whine frequently without provocation and when attempting to move. Heart rate may be increased or within normal limits if an opioid was administered previously. Respiratory rate may be increased with an abdominal lift (an abdominal lift usually occurs when a patient attempts to cry but there is no associated vocalization. Pupils may be dilated.

7 Moderate to severe pain (including signs from categories 5 and 6). The patient is quite depressed and is not concerned with its surroundings but usually responds to a direct voice (this may be a stop in whining, turning of the head or eyes). The patient urinates and defecates (if diarrhea) without attempting to move, cries out when moved, or spontaneously or continually whimpers. Occasionally, an animal does not vocalize. Heart and respiratory rates may be increased. Hypertension may also be present. Pupils may be dilated.

8 Severe pain. Signs same as previous category. Vocalizing may be more of a feature, or animal is so consumed with pain that it does not notice your presence and just lies there. With severe trauma, the patient may not be able to move or cry because of the increased pain with this activity and therefore remains motionless and extremely depressed. The patient may thrash around in the cage intermittently. With some traumatic or neurologic pain, the patient may scream, especially cats, when being approached. Tachycardia with or without tachypnea, with increased abdominal effort and hypertension, is usually present even if an opioid was given previously, although these can be unreliable parameters if not present.

9 Severe to excruciating pain. Signs same as previous category, but patient is hyperesthetic. The patient trembles involuntarily when any part of the body in close proximity to wound or injury is touched because of neuropathic or severe inflammatory pain. This degree of pain can cause death.

10 Signs same as previous category, but patient emitting piercing screams or almost comatose. The patient is hyperesthetic or hyperalgesic. The whole body is trembling, and pain is elicited wherever you touch the patient. 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 may be experiencing moderate to severe pain. Therefore, a tail wag should not be used to judge a pain-free situation. Cats typically remain quiet and motionless, but occasionally they may growl when in mild to moderate pain and thrash, growl, and scream when pain is severe. Cats may still purr when in pain to any degree and, in fact, up until death. The term *depressed* in this context means slow or a "hang-dog" response to a situation where the dog or cat would normally act as described at pain level 0. They may appear "tired," and the palpebral fissures may be incompletely open with a low carriage of the head. The level of depression may vary from that just described to poor or nonresponsive to caregiver.