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PAIN ASSESSMENT
Monitoring acute pain is a continuous process throughout the pre-, intra-, and postoperative periods.

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ANESTHESIA

Analgesic Options for Managing Acute Pain in Felines

MEET THE AUTHOR

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The first step in addressing pain is to understand what it is and how to recognize it. The International Association for the Study of Pain defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage."[1] That animals experience pain similarly to humans[2] is clearly established, but veterinary professionals still lack confidence in recognizing and effectively addressing pain in the domesticated feline.[3,4] For example, in surgical procedures recognized as equally painful for both dogs and cats, only 56% of cats received analgesics compared with 71% of dogs.[5]

As with any species, the feline population varies in experience of and response to pain as well as response to treatment.[6-8] Recognizing pain in the cat can be challenging. The American Animal Hospital Association and American Association of Feline Practitioners provide guidelines to help veterinary professionals improve their ability to recognize and address pain in our feline friends.[9]

Research in cats demonstrates that to identify pain, assessment of behavior is more valuable than objective measures, such as heart rate and blood pressure.[10,11] Assessing behavioral changes along with a thorough physical examination, when possible, is vital during the preanesthesia process. If a human would perceive a procedure as painful, assume that the veterinary patient will also experience pain.

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The veterinary professional must provide adequate and appropriate analgesia. Pain assessment should be implemented during every visit and at regular intervals after surgery (**FIGURE 1**). Furthermore, a standard best practice is to recognize and treat acute pain by providing analgesia during the perianesthesia period and upon presentation of a traumatic event. However, some practitioners still hesitate to provide appropriate analgesia to cats because they fear undesirable or harmful side effects (i.e., opioid mania, hyperthermia, renal injury).[12] This article focuses on identifying acute pain in our feline patients and explores analgesic options to improve awareness and veterinary care.

PAIN ASSESSMENT

As part of a thorough physical examination in a cat, the veterinary professional should initially assess for pain by interviewing the client. For hospitalized or frequently visiting patients, a nurse who spends the most time interacting with the patient should assess for pain. Assessment and monitoring of acute pain in the cat are a continuous process throughout the preoperative, intraoperative, and postoperative periods. In a conscious, unsedated patient, body posture and positioning, as well as normal eating, drinking, litter box, and grooming habits, can be helpful in assessing for pain (**FIGURE 2**). In recovering patients, assess for postoperative pain by first palpating a nonaffected area, then palpating the incision site and comparing responses.[13]

The Glasgow Feline Composite Measure Pain Scale, developed for evaluation of acute pain in cats, uses ear position and muzzle shape in addition to the previously mentioned measures to provide quantifiable, validated pain scoring. To download a PDF of the Glasgow Feline Composite Measure Pain Scale, go to the full online article at **todaysveterinarynurse.com**. Another measure, the Colorado Pain Scale, is not validated but is easy to implement and simple to use for routine pain scoring in a variety of clinical practices (**FIGURE 1**). A more complex, validated pain scoring option for cats is the Botucatu Multidimensional Pain Scale. It considers pain expression, psychological variables, and physiologic changes to quantifiably assess for pain.

PAIN MANAGEMENT

Once the patient has been identified as painful, how should we address the pain? It is important to use a combination of drugs (polypharmacy) and multimodal analgesic techniques and to implement routine pain scoring to ensure effective treatment and achieve optimal results while minimizing adverse side effects. Different classes of drugs address the variety of pain receptors within the body. Often, using a polypharmacy, multimodal analgesic technique can optimize successful management of acute pain while minimizing adverse effects by allowing lower dose of each medication.

Cats differ from other species when it comes to pharmacokinetics. The feline species vary from their canine counterparts in several drug conjugation pathways, leading to an increased likelihood of undesirable toxic effects if dose and frequency are not decreased or if certain drugs, such as acetaminophen or aspirin, are not completely avoided.

FIGURE 1. Assessment of a recovering patient using the Colorado Pain Scoring for the cat. The author suggests laminating your preferred pain scoring chart and hanging it on patient cages that require pain assessments. This gives a visual guide and reminds veterinary nurses that pain assessment is ongoing and important.

FIGURE 2. Characteristic postures and behaviors of a painful cat: arched back, appearing uncomfortable in back of cage, slanted/pinned ears, preparing to strike the veterinary nurse who dares to approach.

Alternatively, some drugs may not be metabolized to active metabolites because the deficient metabolic pathway decreases desirable effects or prolongs effects.[14] Cats may lack some of these metabolic pathways, in part because of their diet and the impact of the diet on evolutionary traits.[15]

Regardless of these species differences, cats benefit from implementation of pre-emptive, aggressive pain management to help decrease central sensitization (windup) and reduce postoperative analgesic requirements.[16] In addition to reducing the postoperative analgesic requirement, premedication with analgesics allows reduced induction and maintenance anesthetic requirements, smoother recoveries, and greater intraoperative stability. The synergistic activity achieved with combining a sedative, such as acepromazine or dexmedetomidine, with an opioid allows for lower doses of both classes of drugs. This maximizes benefit while minimizing negative side effects.

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Opioids

It is undeniable that opioids are the cornerstone for addressing acute pain, and their reversibility improves their safety. Opioids can be effectively used in cats. They can be administered systemically or in regional analgesic techniques, such as epidurals. With epidurals, it is important to recognize anatomic differences between cats and dogs. In cats, the spinal cord ends more often as distal as the first sacral vertebra, compared with the sixth lumbar vertebrae in the dog; this predisposes to the likelihood of subarachnoid injection (i.e., encountering cerebral spinal fluid [CSF]) and cranial migration of the epidural solution. If CSF is encountered, reducing the total volume of the epidural injection is indicated, along with giving the injection slowly, as with any epidural or subarachnoid injection.

Despite the differences between cats and other species, opiates should not be avoided if they are necessary to control feline pain. There are, however, some misconceptions regarding opiates and their use in cats.

"Morphine mania" originated from early reports of doses much higher (10 and 20 mg/kg) than routine clinically relevant doses.[17-19] Kamata et al looked at behavioral effects of morphine and fentanyl in cats and found that morphine delivered at doses closer to clinically relevant dosing (0.3 to 2.4 mg/kg) produced euphoria and decreased locomotor activity compared with fentanyl (5 to 40 mcg/kg), which produced increased locomotor activity in a majority of cats.[8] This is not to suggest that fentanyl cannot provide analgesia to cats but rather that cats respond differently to various opioids and differently than dogs do. Additionally, opioids provide less reduction in minimum alveolar concentration (MAC) in cats than in dogs.[20] Morphine, hydromorphone, methadone, meperidine, fentanyl, sufentanil, alfentanil, buprenorphine, and butorphanol have all been evaluated in cats and can be used safely and effectively with appropriate dosing and for appropriate pain management (butorphanol, for example, should not be used for moderate to severe pain).

Full agonist opioids cause hyperthermia in cats (hydromorphone at 0.1 mg/kg, morphine at >1 mg/kg).[21-23] There is a shortage of full agonists in the United States; if regular buprenorphine is available, intravenous administration has shown more predictable antinociception along with faster onset than subcutaneous or intramuscular injections.[24] Veterinary professionals should remain flexible in switching opioids if the response is inadequate or undesirable response and should consider adding adjunctive therapies when opioids alone are inadequate. Longer-lasting, extended-release formulations of buprenorphine are commercially available; for example, Simbadol® (zoetis.com) is labeled to be given subcutaneously q24 for up to 3 days, with the first dose given approximately 1 hour before surgery. The author elects to closely observe body temperature when any opiate is used.

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Nonsteroidal Anti-Inflammatory Drugs

Nonsteroidal anti-inflammatory drugs (NSAIDs) help reduce and prevent inflammation after surgery, thereby improving a patient's comfort during recovery. They exert their effects by inhibiting cyclooxygenase enzymes; these enzymes synthesize prostaglandins, which in turn precipitate the inflammatory process. They should be used cautiously in cats because of felines' limited ability for the hepatic glucuronidation required to metabolize NSAIDs. When dose, frequency, and duration are not carefully administered, this limited ability can increase the potential for toxic effects.

Cats seem to be particularly susceptible to the negative renal effects of NSAIDs. Preoperative use is somewhat controversial because intraoperative hypotension can exacerbate the incidence of renal effects. Postoperative administration is advantageous for patients that remain normotensive under anesthesia.

Because of these factors, labeling for NSAIDs—including which agent is on-label for use in felines, variations in dose, duration of action, frequency of dosing, and routes of administration—varies by country. In the United States, meloxicam is labeled for use as a single injection at 0.3 mg/kg; however, lower doses are routinely used with beneficial results. Single doses can provide up to 24 hours of relief. In studies that used injectable NSAIDs as the sole analgesic agent after extubation, patients still had postoperative wound tenderness.[25] (When used alone, NSAIDs are not sufficient to relieve all pain following procedures of equal or greater invasiveness than an ovariohysterectomy.) Robenacoxib is the most recent NSAID to be labeled for use in cats in the United States for up to 3 days. Long-term use is not on-label in the United States; in Europe, however, some NSAIDs (e.g., meloxicam at 0.05 mg/kg q24h) are labeled for treating chronic pain conditions, such as osteoarthritis, with monitoring for gastrointestinal, renal, and hepatic side effects. Some studies support meloxicam at even lower doses (0.01 to 0.03 mg/kg q24h) for effective long-term use.[26]

NSAIDs require a washout period between interchanging of their use. Additionally, they should never be used with corticosteroids or aspirin.

Local Analgesics

Local analgesics are likely the cheapest, most accessible, and most underused analgesics. Frequently used drugs in this category include lidocaine, bupivacaine, and mepivacaine. They exert their analgesic ability by blocking sodium channels and subsequently the transduction of nociceptive signals to the spinal cord, thereby helping to inhibit central sensitization. The hesitation to use these agents in cats may be attributed to cats' lower tolerance to toxic effects; however, this concern is easily mitigated by using appropriate dosing and always aspirating to avoid accidental intravenous injection. Toxic doses, onset of action times, and duration of action differ; lidocaine has the fastest onset time, the shortest duration of action, and the highest toxic dose, followed, respectively, by mepivacaine and bupivacaine (**TABLE 1**).

Another benefit to this class of analgesics is the many ways to implement their use. From infiltrative, splash, transdermal, and regional applications, these techniques can be effective in a variety of clinical situations, such as dentistry, soft tissue surgeries, and orthopedics. Lidocaine patches can be placed over incisions to provide local relief after surgery. Splash blocks, although their efficacy is questionable, can be used before closing of the subcutaneous layer following an open–body cavity procedure.

Infiltrative line blocks can be used before an incision is made or after closure. Infusion or "soaker" catheters

TABLE 1 Local Analgesics

LOCAL ANALGESIC	ONSET (MIN)*	DURATION (MIN)*	RECOMMEND MAXIMUM DOSE FOR CATS (MG/KG)
Lidocaine	1-5	60-120	2-5
Mepivacaine	5-10	90-180	2
Bupivacaine	20-30	180-480	2

**Many factors can influence onset and durations of local analgesics. Numbers provided are a guide and should not replace continual monitoring of patient; adjunctive therapies should be applied if needed.*

can be used for large wound closures. It is important to be cautious when using infiltrative blocks if cancer is suspected because the needle used to distribute the local analgesic can seed neoplastic cells. Regional nerve blocks can be used throughout the body, specifically for thoracic and pelvic limb surgeries, as well as for facial nerves for surgery or dental extractions. To reduce stress and pain upon catheter placement, topical anesthetic creams are helpful when applied over catheter sites before venipuncture is performed. Additionally, studies have found EMLA cream (lidocaine/prilocaine; astrazeneca.com) improved feline cooperation during jugular catheter placement.[27,28]

Mixing short- and long-lasting local anesthetics is no longer recommended. Mixing 2 agents, such as lidocaine and bupivacaine or ropivacaine, resulted in fast onset of block (similar to that achieved with lidocaine alone) but decreased the duration of the block.[29] If the anesthetist continues to combine a fast-onset with a long-duration local anesthetic, the total dose should not exceed 2 mg/kg. Systemic administration of lidocaine can reduce the MAC in isoflurane; however, this mode of delivery should be avoided in cats because it can lead to significantly increased cardiovascular effects and blood lactate levels.[30,31]

α_2 Agonists

Xylazine, medetomidine, and dexmedetomidine are α_2 agonists that provide sedation, muscle relaxation, and analgesia. They work synergistically with opioids and are routinely used as part of the premedication before induction of anesthesia because of their predictable effect. They can significantly reduce induction and maintenance drug requirements and have potent cardiovascular side effects, including vasoconstriction with a reflex bradycardia, followed by centrally mediated hypotension. When these agents are used intravenously or in debilitated patients, judicious dosing is warranted. Xylazine has been identified as a contributor to perioperative mortality in cats.[32] Safer alternatives, such as medetomidine and dexmedetomidine, exist for the perianesthetic periods; thus, xylazine is no longer recommended as a premedicant for cats.

Like opiates, α_2 agonists have a reversal agent, atipamezole. They provide better sedation and analgesia when used with opiates.[33] The α_2 agonists can be used as single injections for premedication and to help

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Providing a warm, dry, quiet space where the patient can rest comfortably, separate from dogs, can reduce feline patients' stress and improve recovery.

smooth postoperative recovery (often as microdoses); they can be given as a constant rate infusion for sedation and analgesia intra- or postoperatively, and they can be administered epidurally[34] and buccally.[35] Because of their reversibility and quick onset, they can facilitate a quick diagnostic test, blood draw, or physical examination while minimizing the stress on the patient.

Adjunctive Analgesics

Other frequently overlooked drugs with analgesic benefits include maropitant, ketamine, gabapentin, and tramadol. Maropitant at 1 mg/kg intravenously can help reduce the MAC requirement of sevoflurane by 15% and provide some visceral analgesia. In addition, it has antinausea benefits in cats undergoing ovariohysterectomy.[36] Ketamine has a variety of applications in cats depending on the dosing and route of administration. It can be used as a chemical restraint orally or intramuscularly, although excessive salivation and muscle rigidity occur. It can be given as an intravenous induction agent as well as a constant rate infusion at subanesthetic doses to provide analgesia as an *N*-methyl-D-aspartic acid antagonist. It helps address somatic pain and reduces windup, and it may decrease other analgesic requirements after surgery. As an analgesic, gabapentin may provide adjunctive analgesia in the treatment of acute pain while also providing sedation to help with restraint of cats that may resent a veterinary visit.[37] Owners can give an oral dose of gabapentin in the morning before the surgery or veterinary visit; the resulting sedation reduces stress for the patient and improves ease of handling. Tramadol, a drug with a weak mu affinity, inhibits the reuptake of serotonin and norepinephrine. Oral tramadol

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combined with an NSAID produces superior analgesia compared with when used alone[38] and has provided antinociception to thermal thresholds in cats.[39]

Nonpharmacologic Options

Sufficient pain relief results from a combination of pharmacologic and nonpharmacologic approaches and is an important part of outstanding patient care in cats. Providing a warm, dry, quiet space where the patient can rest comfortably, separate from dogs, can reduce feline patients' stress and improve recovery. For patients placed under anesthesia, expressing the bladder before recovery can improve patient comfort. Cats tend to like a box to hide in or to shield them from the disruptive nature of a veterinary hospital.

Remember, cats do not always express their pain with outward signs as humans or other common species do. Behavioral activities, such as return to grooming, litter box use, and eating/drinking, should be monitored as part of the pain assessment.

Pheromone therapies can be used to reduce stress and encourage normal behavior. Minimizing excessive restraint with the use of towels and avoiding scruffing can also improve the patient's experience. A toothbrush is a vital tool to allow the handler to comfort or distract the cat while maintaining a safe distance (**FIGURE 3**). Also worth considering are emerging nonpharmacologic therapies for postoperative pain and inflammation, including acupuncture, ultrasound, laser therapy, cryotherapy, and pulse electromagnetic field therapy.

FIGURE 3. Assisted "fear-free" restraint and distraction with standard toothbrush to allow evaluation of wound on leg.

CONCLUSION

As veterinary nurses we have an obligation to be our patients' advocate for a comfortable, positive experience without pain. Our challenge is to recognize our patients' pain and communicate their needs to the veterinarian. Given the challenges of today's climate of opioid limitations, understanding polypharmacy analgesic options and how the cat may respond to them is vital for successful outcomes. TVN

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Analgesic Options for Managing Acute Pain in Felines

LEARNING OBJECTIVE

The objective of this article is to encourage the veterinary team member to recognize pain in the feline population and learn options for the effective management of acute pain.

OVERVIEW

This article will help readers to recognize that cats differ from other species in how they express pain and respond to analgesics. It will also help readers to know what analgesics are available to effectively provide a multimodal, analgesic technique for acute pain situations.

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1. **Which is true about pain scoring?**
   a. Routine pain scoring helps ensure analgesic treatment is adequate.
   b. Pain scoring should be part of the routine physical examination.
   c. Caretakers may be the most observant person to recognize changes in behavior to identify that a patient/pet is painful.
   d. All of the above

2. **Studies have shown that combining this oral drug with an NSAID provided better analgesia than when administered alone in cats.**
   a. Morphine
   b. Ketamine
   c. Dexmedetomidine
   d. Tramadol

3. **Validated pain scoring techniques in cats include:**
   a. Glasgow Feline Composite Measure Pain Scale
   b. Colorado Pain Scoring
   c. Botucatu Multidimensional Pain Scale
   d. Both a and c

4. **Which of the following has been determined as most valuable for evaluating pain in the cat?**
   a. Heart rate
   b. Body temperature
   c. Behavioral changes
   d. Blood pressure

5. **Which of the following statements is false regarding opioids and their use in cats?**
   a. Opioids cause excitement in cats and should be avoided.
   b. Cats may respond differently to opioids than dogs.
   c. Cats may become hyperthermic and should be monitored closely.
   d. Buprenorphine was shown to be more reliable when given intravenously.

6. **This class of drugs can cause an increase in renal toxicity in the face of intraoperative hypotension but can be a helpful postoperative analgesic:**
   a. Dissociatives (e.g., ketamine)
   b. α_2 Agonists
   c. Opioids
   d. NSAIDs

7. **What oral medication can be administered by the owner before a scheduled appointment to provide sedation and improved ease of handling?**
   a. Tramadol
   b. Gabapentin
   c. Meloxicam
   d. Ketamine

8. **Pain is defined as an emotional or physical experience.**
   a. True
   b. False

9. **Which class of drugs are cats particularly sensitive to compared to dogs, making it important to stay below a toxic threshold?**
   a. Opioids
   b. Local anesthetics
   c. Ketamine
   d. α_2 Agonists

10. **The following may give comfort to cats while in the hospital:**
    a. Pheromone treatment of blankets or pheromone diffuser
    b. Box or cubby in which to hide
    c. Expressing of bladder before recovery
    d. All of the above