

Alternatives to Opioids for Perianesthetic Analgesia Management

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The current opioid shortage has resulted in challenges providing perioperative analgesia to dogs and cats. Although direct substitution is not appropriate for all situations, many alternatives are available.

To calm patients before and/or after anesthesia, gabapentin (5-10 mg/kg PO¹) or trazodone (3-5 mg/kg PO²) may be used in cats and dogs, respectively. To the author's knowledge, serotonin syndrome has not been reported with trazodone use in veterinary medicine.

Oromucosal dexmedetomidine may also be considered for prearrival sedation (125 µg/m² oromucosal).³ Oral acepromazine tends to have inconsistent effects, but injectable acepromazine (0.01-0.05 mg/kg IV, IM, or SC) is more reliable and may be used in patients that cannot receive oral medications.⁴

Other options, including alprazolam (0.01-0.02 mg/kg PO⁵), may be viable for some animals.

Oral Analgesia

Although popular, tramadol (5-10 mg/kg PO) has not been consistently reported to have good efficacy for pain management in dogs, as it has only weak opioid effects.⁶ However, it may provide a sense of well-being based on its non-opioid (serotonergic- and norepinephrine-based) actions.^{7,8} A serotonin-like syndrome has not been reported in animals but is theoretically possible when this drug is combined with similar medications (eg, trazodone, fluoxetine) or certain opioids (most notably meperidine).⁷

Perioperative NSAIDs (eg, carprofen [2.2-4.4 mg/kg PO or SC⁹], meloxicam [0.1-0.2 mg/kg PO or SC¹⁰], robenacoxib [1-2 mg/kg PO or SC¹¹]) may also be considered in animals with no GI or renal disease and in the absence of steroid administration. The sooner in the course of anesthesia they can be

administered so that tissue levels are reached, the more effective these medications are likely to be for postoperative pain management. It is important to remember, however, that hypotension under anesthesia may adversely affect renal blood flow and compound renal side effects.¹² Grapiprant (2 mg/kg PO¹³) is a newer noncyclooxygenase prostaglandin-receptor antagonist that has been shown to have efficacy in treating osteoarthritis pain in dogs. Its utility as a perioperative analgesic is not well studied, but an improved side effect profile may prove advantageous.¹³

Injectable Analgesia

Many µ-opioid agonists (eg, morphine, hydromorphone, oxymorphone, methadone, fentanyl, alfentanil, remifentanyl, sufentanil) have been sporadically available. In addition to analgesia and variable degrees of sedation, they provide anesthetic-sparing effects while maintaining cardiovascular safety. For premedication and intraoperative use by infusion, these drugs are largely

interchangeable, provided the clinician has knowledge of their relative potency, onset and duration of action, and side effect profile.⁶

Buprenorphine (20-30 µg/kg IV, IM, or buccal), a partial µ agonist, may be used alone or in combination with other medications as a substitute for other µ agonists in dogs and cats for mildly-to-moderately painful procedures.^{6,14} It may also be used with other drugs for more complex and painful surgical procedures to minimize pain. A dosing interval of approximately 6 to 8 hours has been suggested in the perioperative period.¹⁴ Salivation, bradycardia, and respiratory depression may be observed with use; drug effects are generally not thought to be reversible. Sustained-release or long-acting formulations of buprenorphine for subcutaneous administration are available and are reported to provide between 24 and 72 hours of analgesia.^{15,16}

Butorphanol (0.1-0.5 mg/kg IV, IM, or SC), a κ agonist and µ antagonist, is best used as a sedative and analgesic for presumed mildly painful procedures (eg, gastroduodenoscopy, colonoscopy, subcutaneous mass removal) or with adjunct analgesic techniques (eg, as a nerve block).⁶

Premedication with dexmedetomidine (3-10 µg/kg IM) can be considered in healthy dogs and cats to provide sedation and analgesia. Cardiovascular side effects may occur and present challenges with monitoring. If these effects are significant, partial reversal with atipamezole can lessen them; however alternative analgesia should be provided prior to reversal. Dexmedetomidine may also be administered as a

constant-rate infusion in healthy dogs and cats; an initial maintenance dose of 1 µg/kg/hr IV has been suggested to provide analgesia and anesthesia-sparing effects.¹⁷

Infusion Analgesia

Ketamine is an *N*-methyl-D-aspartate-receptor antagonist that, at subanesthetic doses, has been shown to mitigate or prevent spinal facilitation of pain (ie, the *wind-up* effect). Although the drug is administered during anesthesia, the greatest benefit is thought to occur postoperatively.¹⁸ However, even at low doses (eg, 10-20 µg/kg/min IV after a loading dose of 0.5 mg/kg IV), ketamine can reduce anesthetic requirements up to 25%.¹⁹ Higher doses in dogs and cats have been reported to further reduce inhaled anesthesia requirements but exhibit a ceiling effect.²⁰ Although reports of benefits are largely anecdotal, ketamine infusions may be continued into the postoperative period in conscious animals. Doses of 1-3 µg/kg/min IV have been suggested to minimize behavior changes.¹⁸ In patients for which preventing or reducing spinal facilitation is desirable but for which oral administration is preferred, amantadine (3 mg/kg PO q24h) may be considered.²¹

Intravenous lidocaine (2%) may be a cost-effective source of background analgesia and inhaled anesthetic dose reduction.²² Side effects include seizures but are rare if clinically appropriate doses are used. Nausea may also be noticed at high doses in conscious patients. Anesthetic dose reduction with 50 µg/kg/min CRI IV (low end of the antiarrhythmic dose range) has been reported in dogs¹⁹; however, the authors' experience suggests that doses as low as 20-30 µg/kg/min IV are beneficial in clinical patients. Lidocaine is not routinely recommended for use in cats, as, despite a reduction in isoflurane dose, cardiovascular depression is greater with a combination of lidocaine and isoflurane than with an equivalent dose of isoflurane alone.²³

Combinations of an opioid, lidocaine, and ketamine (opioid and ketamine for cats) may be used for their anesthesia-sparing effects to provide analgesia and reduce spinal facilitation of pain in dogs. When morphine, lidocaine, and ketamine are combined in dogs, the isoflurane dose is reduced by approximately 45%.¹⁹ Respiratory depression is generally less than with high doses of opioids alone.

Higher doses of ketamine in dogs and cats have been reported to further reduce inhaled anesthesia requirements but exhibit a ceiling effect.²⁰

Regional Anesthesia

Because of the shortage of drugs available for systemic administration, use of regional techniques (eg, injecting lidocaine [2%; up to 2 mg/kg] into the testicle prior to castration, providing a line block to the abdominal wall during an ovariectomy/ovariohysterectomy) when possible can be of significant

benefit. Targeted nerve blocks and intra-articular or epidural administration provide other options for localized pain relief. Longer-acting local anesthetics (eg, ropivacaine, bupivacaine) may be used as warranted by the procedure and with consideration to duration of motor effects and toxicity.

Liposomal bupivacaine recently became available as another alternative for long-acting pain relief following surgery when injected into tissues at the surgical site.²⁴ Label directions should be followed if this drug is being used with other regionally or systemically administered local anesthetics. ■

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