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ANESTHESIA & PAIN MANAGEMENT
Perioperative Analgesia for Cats

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Introduction
Compared to other companion animals, cats are under-treated for pain [1]. Most veterinarians agree that cats require analgesics after surgery, so the reasons for this under-treatment may be explained by the difficulty in assessing pain in cats, lack of licensed products and fear of harmful side effects. However, based on recent studies, many drugs can be used safely and effectively in cats in the perioperative period.

Opioids
In spite of reluctance to use this group of drugs, there is now sufficient experience with several opioids to recommend their use in cats. In contrast to other species, opioids cause marked mydriasis in cats which may cause them to bump into other objects and they may not see a handler approaching. Therefore, cats that have received opioids should be approached slowly, while being spoken to, so they are not startled. They should also be kept away from bright light while their pupils are dilated. Cats rarely become excited with clinically appropriate doses of opioids are given. It is more common to see euphoria, with purring, rolling, and kneading with the front paws. When used alone for premedication in pain-free cats, some opioids may cause nausea, vomiting, and salivation; this is common after morphine and hydromorphone, but not after buprenorphine, pethidine or butorphanol.

Morphine, a mu-receptor agonist opiate, has been widely used in cats and does not produce excitation at doses of 0.1-0.2 mg/kg that are effective in clinical settings [2]. Both clinically, and in research models, onset of action is slow [2, 3]. Morphine appears less effective in cats when compared to dogs and this may be related to their limited production of morphine metabolites [4]. Cats produce very little morphine-6-glucuronide, which may contribute significantly to morphine’s overall analgesic effect in humans and other species.

Pethidine (meperidine, Demerol), is another mu agonist opioid, that has been widely used in cats. It should only be given intramuscularly or subcutaneously, as intravenous injection can produce excitement. Pethidine rarely causes vomiting. The main drawback of pethidine is its short duration of action. In clinical practice, it performs as predicted in experimental studies, producing good analgesia for little more than 1-2 hours [5, 6].

Hydromorphone was found to be a good antinociceptive agent in a research model [7] but has been implicated to cause post-anesthetic hyperthermia in clinical settings [8, 9]; this effect is unpredictable but often severe, with temperatures reaching over 42°C in some cats.

Fentanyl is a potent, short-acting pure mu agonist which is most commonly used to supplement general anaesthesia where it can be given as intermittent boluses or by infusion. Transdermal fentanyl (TDF) patches that release fentanyl over several days have been used for acute perioperative pain in cats. This formulation provides a “hands-off” approach to pain management that is especially attractive in cats that are difficult to medicate. The plasma concentrations associated with analgesia in cats has been established [10] and is similar to dogs and humans (>1 ng/ml). Plasma fentanyl concentrations are variable after patch placement in cats, and in one study, 2 out of 6 cats had undetectable plasma fentanyl concentrations, emphasizing the need for careful evaluation of each patient for pain. This variability may be related to the size of the patch compared to the weight of the cat, skin permeability and body temperature. TDF patches have proved useful in a clinical setting for routine
ovariohysterectomy [11]. The dangers of accidental or deliberate human ingestion must be considered and TDF patches should not be placed on cats that are being discharged to a home with young children.

Butorphanol is a μ-antagonist, which produces analgesia through its kappa agonist activity. It is licensed for use in cats in many countries although its analgesic properties have been questioned [12]. Agonist-antagonist opioids such as butorphanol exhibit a “ceiling” effect after which increasing doses do not produce any further analgesia [13]. Butorphanol appears to be an effective visceral, but poor somatic analgesic. Both clinical studies and experimental investigations indicate that butorphanol is very short acting and requires frequent dosing to be effective.

Buprenorphine is the most popular opioid used in small animals practice in the United Kingdom and is also widely used in the rest of the world, Australia and South Africa. Transmucosal absorption through oral mucous membranes (OTM) is more effective in cats than in humans, with almost 100% bioavailability by this route [14]. OTM administration has proved to be both effective and acceptable in cats and can be mastered by owners for at-home treatment. At a dose of 0.02 mg/kg the OTM route was as effective as the intravenous route, providing analgesia for more than 6 hours [15]. In clinical studies, buprenorphine has produced better analgesia than morphine, oxymorphone and pethidine [16-18]. Buprenorphine rarely causes vomiting or dysphoria in cats and is highly suitable for perioperative pain management in cats as it is easily administered, highly effective, and long acting.

**Tramadol** - Although not classified as an opioid, tramadol has weak binding affinity at μ-receptors. It is available as an injectable and oral formulation. Until recently the use of tramadol in cats has been empirical but new pharmacokinetic data [19] should lay the foundation for selecting doses for clinical evaluation. A 1 mg/kg SQ dosing failed to provide thermal antinociception in research cats [20] but compared to post-operative tolmetin alone, premedication with tramadol (4 mg/kg SQ) improved the comfort level of cats for the first 8 hours after ovariohysterectomy [21].

For a comprehensive review of opioid use in cats see Robertson 2007 [22].

**Local anaesthetics**

The value of local anaesthetics is greatly underestimated and under-utilized in small animal surgery patients where they can provide complete analgesia with minimal side effects. A particularly useful technique is to implant a “soaker” catheter into a wound (for example a post amputation wound or after large tumour removal) to provide a method for maintaining continuous analgesia. After fibrosarcoma removal in cats the use of a wound infusion catheter [23] significantly reduced the time the cat was hospitalized suggesting that this technique improves mobility and time to resume eating (the criteria used for discharge) [24]. Lidocaine (2-4 mg/kg) can be repeated every 2-3 hours or as needed based on wound palpation. Bupivacaine is longer acting and 2 mg/kg would be expected to last 4-5 hours. Both these drugs can be diluted with sterile saline to provide a suitable volume to instil into the catheter.

**Non-steroidal anti-inflammatory Drugs (NSAIDs).**

NSAIDs are excellent analgesics for acute pain, can provide up to 24 hours of analgesia, and are not subject to the legal regulations of opioids. Although care must be taken when using this class of drug in cats, they can be a very valuable component of a pain management plan.

The use of carprofen, meloxicam and ketoprofen is well documented in cats [6, 16, 25-27]. There seems to be little difference in the efficacy of the NSAIDs for the treatment of acute surgical pain [26]. Comparison of injectable NSAIDs given subcutaneously at extubation following ovariohysterectomy (carprofen 4 mg/kg, ketoprofen 2 mg/kg and meloxicam 0.2 mg/kg), resulted in 9 out of 10 cats in each group having desirable overall clinical assessment scores for 18 hours. Despite the cats’ apparent comfort, none of the NSAIDs prevented postoperative wound tenderness [26]. If used as part of an analgesic plan, the choice of NSAID will depend on personal preference. NSAIDs should not be used in cats that are hypovolemic, hypotensive or with compromised renal function, platelet dysfunction, or...
have gastrointestinal ulceration and never concurrently with corticosteroids.

For a review of NSAID use in cats see Lascelles et al 2007 [28].

**Alpha2-adrenoceptor agonists**

An important point to remember when using these drugs is that the dose required to provide sedation may be lower than that needed for analgesia; in cats dose dependent sedation was seen with doses of dexmedetomidine between 2 and 40 µg/kg (IM) but analgesia as determined by a noxious thermal stimulus was only associated with the highest dose [29].

The main concerns with the use of alpha2-agonists are their cardiovascular effects. Although doses of medetomidine between 40 and 150 µg/kg have been recommended, clinical experience shows that 20 µg/kg (IM) provides reliable sedation and analgesia for up to one hour. However even this lower dose causes a significant decrease in cardiac output, stroke volume and heart rate and an increase in systemic vascular resistance [30]. It should not be used in cats with cardiovascular disease or that are hypotensive or hypovolemic.

**References**