

# Evaluation of signs of postoperative pain and complications after forelimb onychectomy in cats receiving buprenorphine alone or with bupivacaine administered as a four-point regional nerve block

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**Objective**—To evaluate signs of postoperative pain and complications after forelimb onychectomy in cats receiving buprenorphine alone or with bupivacaine administered as a 4-point regional nerve block.

**Design**—Prospective, randomized, double-blind clinical trial.

**Animals**—20 cats.

**Procedure**—All cats received buprenorphine (0.01 mg/kg [0.004 mg/lb], IM) preoperatively. One forelimb of each cat also received bupivacaine (1 mg/kg [0.45 mg/lb] of a 0.75% solution) administered as a 4-point regional nerve block. After onychectomy, discomfort (lameness, foot reaction, and pain) scores were evaluated by 2 experienced observers 2, 4, 6, 8, 24, and 168 hours postoperatively. Complication (hemorrhage, swelling, and infection) scores were evaluated 24 and 168 hours postoperatively. Surgeries were performed by 1 experienced veterinary surgeon. Rescue analgesia was provided if needed.

**Results**—6 cats required rescue analgesia postoperatively. There was no difference in discomfort or complication scores between control limbs and limbs in which a nerve block was administered. Additionally, there was no difference in discomfort and complication scores between cats that did or did not require rescue analgesia.

**Conclusions and Clinical Relevance**—Bupivacaine administered as a 4-point regional nerve block in addition to a systemic analgesic did not decrease discomfort or complication scores in cats undergoing forelimb onychectomy. (*J Am Vet Med Assoc* 2006;228:65–68)

Onychectomy (declaw) in cats is a common surgical procedure that is performed in the United States to prevent damage to furniture and injury to owners and other animals.<sup>1-3</sup> Results of 1 study<sup>1</sup> indicate that approximately 24.4% (14 million) of cats in the United States have been declawed. The most commonly used

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methods for onychectomy are amputation of the distal phalanx with a sterile guillotine-type nail trimmer or disarticulation of the distal phalanx with a scalpel blade or laser.<sup>4</sup> Reportedly, complications after surgery include signs of pain, lameness, bleeding, swelling, infection, and nerve trauma.<sup>1-3</sup> Long-term complications include lameness, chronic draining tracts, regrowth of claws, development of palmagrade stance, and behavioral problems.<sup>1-3</sup> The onychectomy procedure has become increasingly controversial during the past decade for various reasons. Opponents of the procedure say that it is inhumane because of pain and postoperative complications and that, for ethical reasons, it is a needless mutilation performed strictly for the convenience of owners.<sup>1</sup> Proponents of the procedure claim that the postoperative complications are minimal and easily managed and that the behavioral problems are anecdotal.<sup>1</sup> In addition, many cats would be euthanized if onychectomy were not available.

Onychectomy is a potentially painful procedure, as are many surgical procedures; medication for relief of pain should be given appropriately. During the past 10 years, there have been several reports<sup>5-8</sup> on various pain management protocols in cats undergoing onychectomy. One case report<sup>9</sup> concerns the use of a 4-point regional nerve block by use of bupivacaine as an additional form of analgesia for onychectomy in cats. The use of nerve blocks with a local anesthetic (bupivacaine or lidocaine) has been limited in cats because of concerns regarding toxic effects.<sup>10,11</sup> Clinical signs of toxicosis usually involve the cardiovascular (bradycardia and arrhythmias) and neurologic (muscle twitching, convulsions, and seizures) systems.<sup>11</sup> The dose of bupivacaine that causes toxic effects is 5 mg/kg (2.3 mg/lb), which is greater than that which is typically used.<sup>9</sup> When performed appropriately, local administration of anesthetics can provide an excellent form of analgesia because they block nerve transmission at the level of the sodium ion channels, which blocks pain transmission. They can also be used preemptively to obliterate the pain stimulus before it reaches the spinal cord.<sup>10</sup> Regional nerve blocks can also be used as a multimodal form of analgesia, which can help decrease the systemic use of other pain medications.<sup>10</sup> To the authors' knowledge, studies evaluating the efficacy of a 4-point regional nerve block administered alone or in combination with a systemic analgesic for controlling pain postoperatively in cats undergoing onychectomy have not been performed.

The purpose of the study reported here was to evaluate signs of postoperative pain and complications after forelimb onychectomy in cats receiving buprenorphine alone or with bupivacaine administered as a 4-point regional nerve block as a form of multimodal analgesia. Our null hypotheses were that there would not be any difference in signs of discomfort or complication scores between control limbs and limbs in which a 4-point regional nerve block was administered.

## Materials and Methods

**Cats**—The Michigan State University All-University Committee on Animal Use and Care approved the study design. Twenty client-owned cats were admitted to the Michigan State University Veterinary Teaching Hospital. Informed consent was obtained from the owner of each cat. For each cat, a history was obtained and a physical examination was performed; blood was also obtained to assess PCV and total solids concentration. Cats that were healthy as determined on the basis of history and physical examination findings, admitted for elective forelimb onychectomy only, and > 6 months old were included in the study. Cats of any breed or either sex were included. Cats were excluded from the study if they had concurrent diseases, inadequate vaccination status, or PCV or total solids concentration values that were not in reference ranges or if they were given any medications other than those prescribed by the standard operating procedure for anesthesia in cats undergoing forelimb onychectomy. Cats were also excluded if their owners did not return them for a recheck appointment 7 days postoperatively.

**Anesthetic protocol**—All cats were given buprenorphine (0.01 mg/kg [0.004 mg/lb], IM) and acepromazine maleate (0.1 mg/kg [0.04 mg/lb], IM) 20 minutes prior to induction. Anesthesia was induced by administering thiopental sodium (6 mg/kg [2.7 mg/lb], IV, of a 2.5% solution) to effect. Anesthesia was maintained with isoflurane in oxygen through an orotracheal tube. All digits on both forelimbs were aseptically prepared by use of a 2% solution of chlorhexidine surgical scrub and 0.9% solution of sodium chloride. A standard 4-point regional nerve block<sup>9</sup> by use of bupivacaine<sup>a</sup> (1 mg/kg [0.45 mg/lb] of a 0.75% solution) was performed on 1 foot (determined randomly by a coin toss) by an experienced veterinary anesthesiologist (GVB). Physiologic variables (heart rate, respiration rate, oxygen saturations as measured by pulse oximetry [SpO<sub>2</sub>], CO<sub>2</sub>, and blood pressure measured noninvasively) were monitored during anesthesia.

**Surgical procedure**—One experienced surgeon (JGH) performed all onychectomy procedures. Cats were brought into the surgical suite and placed in lateral recumbency. A tourniquet (Penrose drain) was placed on the antebrachium just distal to the elbow joint. The foot was draped routinely. A circumferential skin incision was made with a No. 11 scalpel blade at the level of the distal interphalangeal articulation. The soft tissues, joint capsule, collateral ligaments, and tendons were incised, separating the third phalanx from the second phalanx. The same procedure was performed on the remaining 4 digits. The surgical wounds were swabbed with a cotton-tip applicator. Two drops of surgical adhesive were placed in each wound. The wound was squeezed shut from lateral to medial and from proximal to distal for 2 seconds. The same procedure was performed on the opposite foot. The feet were not bandaged after surgery.

**Assessment of discomfort and complications postoperatively**—Discomfort scores were determined 2, 4, 6, 8, 24, and 168 hours after extubation. Complication scores were determined 24 and 168 hours after extubation. Two trained observers (KC and LAB), who were unaware of treatment group allocations, determined all scores. The discomfort score

was determined by means of a combination score (0 to 11) by use of the sum of the variables lameness (0 to 4), foot reaction (0 to 3), and pain response (0 to 4; Appendix 1). Complication scores (0 to 9) were the sum of the variables swelling (0 to 3), hemorrhage (0 to 3), and infection (0 to 3; Appendix 2). A rescue protocol of oxymorphone (0.02 mg/kg [0.01 mg/lb]) and acepromazine maleate (0.02 mg/kg) was administered IV if there was excessive excitement postoperatively, as determined subjectively, or if at any time a cat had a discomfort score > 8.

**Statistical analysis**—The discomfort and complication scores (mean of the 2 observers) for the control limb and the limb receiving a nerve block at each time were compared by use of the Wilcoxon signed rank test. A value of  $P < 0.05$  was considered significant.

## Results

Twenty cats were enrolled in the study. There was an equal number of females and males. The mean  $\pm$  SD age was  $36.5 \pm 27.2$  months; 7 cats were < 24 months old. Mean  $\pm$  SD weight was  $4.7 \pm 2.33$  kg ( $10.3 \pm 5.1$  lb). Mean  $\pm$  SD surgical time was  $5.98 \pm 0.87$  minutes for control limbs and  $6.18 \pm 0.96$  minutes for limbs in which a nerve block was administered. Six cats received the rescue protocol, 4 because of excitement postoperatively and 2 because of emergency evacuation of the veterinary clinic. There was no difference in discomfort scores and complication scores between control limbs and limbs receiving nerve blocks at any time for cats that did or did not require rescue analgesia (Figures 1 and 2).

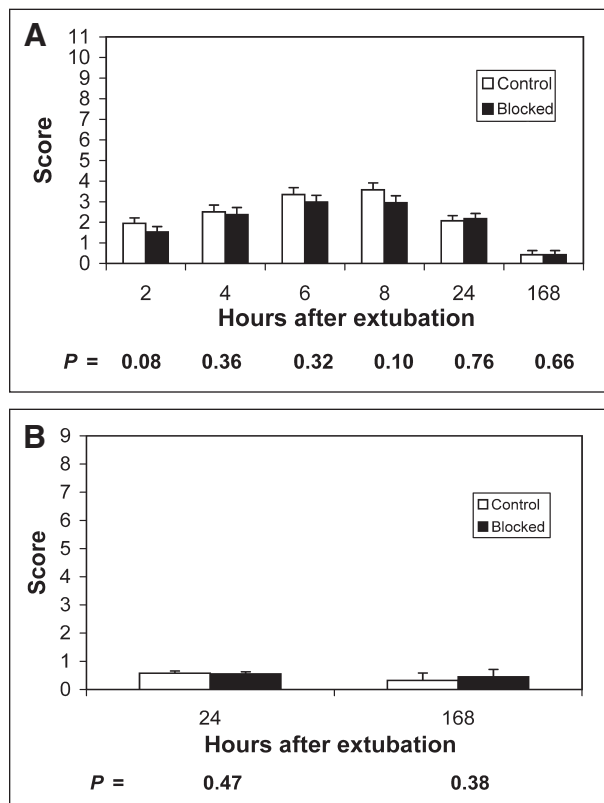


Figure 1—Mean  $\pm$  SEM discomfort (A) and complication (B) scores after forelimb onychectomy in cats ( $n = 20$ ) receiving buprenorphine (0.01 mg/kg [0.004 mg/lb], IM) in which 1 forelimb received bupivacaine (1 mg/kg [0.45 mg/lb] of a 0.75% solution) administered as a 4-point regional nerve block (blocked); the other forelimb was used as a control.

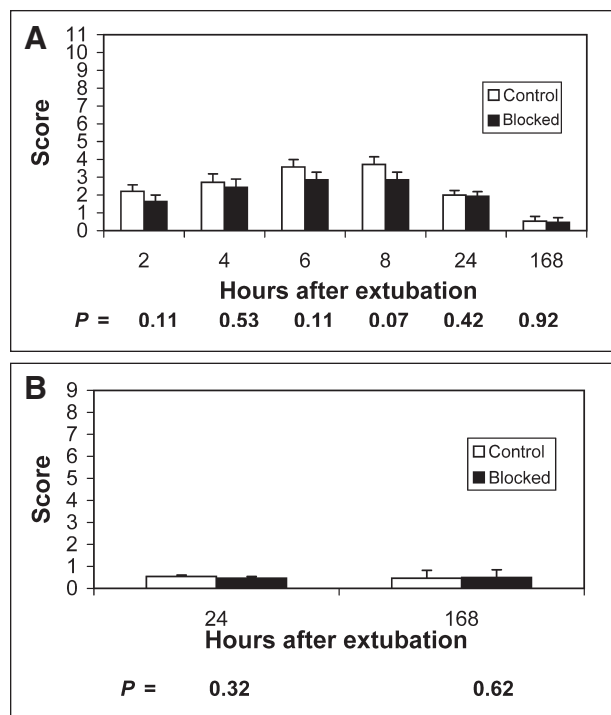


Figure 2—Mean  $\pm$  SEM discomfort (A) and complication (B) scores after forelimb onychectomy in cats ( $n = 14$ ) receiving buprenorphine (0.01 mg/kg, IM) and not receiving rescue analgesics. A 4-point regional nerve block with bupivacaine (1 mg/kg of a 0.75% solution) was performed on 1 forelimb (blocked); the other forelimb was used as a control.

## Discussion

Use of nerve blocks along with systemic analgesia as a form of multimodal analgesia for cats undergoing onychectomies has increased during the past decade.<sup>10</sup> Use of nerve blocks has been advocated because they are inexpensive, are easy to perform, use a noncontrolled substance, and are safe when substances are used at appropriate doses. Additionally, the use of a nerve block may allow for a decrease in the concentrations of systemic analgesics given postoperatively. Anecdotally, most veterinarians believe that cats recover from onychectomy better when nerve blocks are used.

Results of the study reported here indicated that the use of nerve blocks in addition to a systemic analgesic did not decrease discomfort scores postoperatively. Several reasons may explain why a difference in discomfort scores was not detected, such as technique error; inconsistent analgesia of all nerves to the distal portion of the foot; ineffective drug; drug used; or adequate effect of the systemic analgesic, which masked clinical differences between feet. A standard 4-point regional nerve block involves depositing a local anesthetic agent around the main sensory nerves to the foot (branches of radial, median, and ulnar nerves). A complication of the procedure is failure to block all of the nerve branches supplying the foot.<sup>9</sup> In our study, we used a standard technique and 1 veterinarian experienced in anesthesia performed the nerve blocks to increase the likelihood that all nerve branches would be blocked. Bupivacaine was chosen because of its long duration of effect (6 to 8 hours),<sup>9</sup> compared with lidocaine. As long as 20 minutes may be required before

the full onset of action of bupivacaine is reached, compared with 5 minutes for lidocaine.<sup>9</sup> The nerve block should help prevent the windup effect if the anesthetic is in full effect before the procedure begins. When onychectomy is the only procedure being performed, enough time may not elapse for the full effect of bupivacaine to be reached. In our study, cats were given the nerve block approximately 15 to 20 minutes before surgery began. Use of a bupivacaine-lidocaine mixture has been advocated for cats only undergoing onychectomy, which results in a shorter onset of action as well as a longer duration of analgesia,<sup>9</sup> compared with use of bupivacaine alone. This combination has not been scientifically determined to be more effective than bupivacaine alone.

The most likely reason we did not detect a difference in the discomfort scores was that the IM administration of buprenorphine may have masked the beneficial effects of the nerve block, which could not be detected clinically. Therefore, discomfort postoperatively was minimal in control limbs; addition of a nerve block would not have resulted in a further decrease in discomfort scores. Buprenorphine has been found to be more effective than other analgesics for pain relief in cats undergoing onychectomies.<sup>7</sup> In our study, acepromazine was also given to cats, which can potentiate the analgesic effects of buprenorphine as well as decrease anxiety in cats, potentially making it more difficult to assess signs of pain.<sup>10</sup> A difference in discomfort scores may have been detected if a systemic analgesic had not been administered. However, this would not have been ethical, and the purpose of our study was to evaluate the use of a multimodal analgesic protocol.

Significant differences in complication scores between control limbs and limbs receiving nerve blocks were not detected 24 or 168 hours after surgery. Complication scores measured for both feet were low, most likely because 1 experienced veterinary surgeon performed all procedures. The complication scores that were evaluated were a reflection of complications associated with onychectomy. We did not look at potential complications (such as infection, local irritation, and swelling) specifically associated with the nerve block. Those additional variables could have been evaluated as complications specifically related to the nerve block. Although these variables were not included, evidence of complications near the injection sites was not detected. Similar results were reported by Ringwood and Smith<sup>9</sup> in cats ( $n > 30$ ) receiving nerve blocks.

A limitation of the study reported here was the subjective nature of the assessment of pain. Evaluation of pain in cats can be challenging.<sup>11,12</sup> Optimally, objective and subjective variables would be used for a study in which pain was assessed. A numerical rating scale was used to evaluate pain in our study. Variables were chosen to be as objective as possible. Use of objective measurements of physiologic variables, such as catecholamine concentrations, heart rate, respiratory rate, and blood pressure, could not have been used because of the study design. Each cat received a nerve block in 1 forelimb, and the contralateral limb was used as a control; therefore, it would not have been possible to determine if an increase in those physiologic variables

was associated with the control limb or the limb receiving the nerve block. Additionally, results of 1 study<sup>13</sup> indicate that observation by and interaction with a trained observer may be used to determine pain in cats.

During assessment of discomfort, pain was assessed by manually applying pressure to the feet. This observation could have been made more objective by use of a device that delivered a desired and consistent amount of pressure, which may have decreased the variability of the subjective measure of pressure applied by each observer. The variable, lameness, was determined by observation. Gordon et al<sup>b</sup> evaluated use of pressure platform analysis in cats undergoing onychectomies using 3 analgesic protocols. In that study, use of pressure platform analysis provided objective data for peak vertical force and vertical impulse in cats pre- and postoperatively. The authors concluded that this technique may be useful for evaluating pain in cats after onychectomies.<sup>b</sup>

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b. Gordon WJ, Romans C, Evans R, et al. Objective evaluation of the efficacy of bupivacaine, butorphanol, and fentanyl patch after onychectomy using force platform gait analysis (abstr), in *Proceedings. 31st Annu Conf Vet Orthop Soc 2004*;27.

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## Appendix 1

Scoring system used for assessment of signs of discomfort after forelimb onychectomy in cats (n = 20) receiving buprenorphine (0.01 mg/kg [0.004 mg/lb], IM) in which 1 forelimb received bupivacaine (1 mg/kg [0.45 mg/lb] of a 0.75% solution) administered as a 4-point regional nerve block; the other forelimb was used as a control.

Variable	Score
Foot reaction	0 = Not bothering feet 1 = Shaking feet 2 = Licking feet 3 = Chewing feet
Lameness	0 = None 1 = Mild 2 = Marked 3 = Touching toe 4 = Not weight bearing
Signs of pain	0 = None 1 = Resists firm touching 2 = Resists moderate touching 3 = Resists mild touching 4 = Severe, resists any touching

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## Appendix 2

Scoring system used for assessment of complications after forelimb onychectomy in cats (n = 20) receiving buprenorphine (0.01 mg/kg, IM) in which 1 forelimb received bupivacaine (1 mg/kg of a 0.75% solution) administered as a 4-point regional nerve block; the other forelimb was used as a control.

Variable	Score
Swelling	0 = None 1 = Mild 2 = Moderate 3 = Severe
Hemorrhage	0 = None 1 = Mild 2 = Moderate 3 = Severe
Infection	0 = None 1 = Mild (1 digit) 2 = Moderate (> 1 digit) 3 = Severe (> 1 digit)