Local and regional anesthetic and analgesic techniques in the dog and cat: Part II, infiltration and nerve blocks

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In part I of this article, the basic pharmacology of local anesthetics and the merits of topical anesthesia were discussed. In part II, infiltration analgesia and specific nerve blocks will be described, in order that the practitioner can provide further analgesia for patients during the perioperative period.

Infiltration anesthesia

Small wounds can be repaired after using infiltration anesthesia. Local anesthetic solutions are deposited around the area to be desensitized by multiple ID and/or SC injections. Lidocaine (0.5% to 2%) is often used; care should be taken to ensure that the toxic dose of 10 mg/kg BW is avoided. After the first needle insertion and deposition of solution, subsequent needle insertions can be made through desensitized tissue, so that the patient only feels the first needle insertion. Care should be taken not to contaminate needles with infected tissue when placing local anesthetic solution around abscesses. The volume of lidocaine to be used depends on the area, but generally 2 to 5 mg/kg BW of lidocaine may be used. If epinephrine is used with lidocaine, the total dose can be increased to 5 to 8 mg/kg BW. To decrease the concentration and, therefore, increase the volume, lidocaine can be diluted with sterile saline, but not sterile water. The total dose should be reduced by 30% to 40% in geriatric, sick, or cachectic dogs. Local anesthetics with epinephrine should not be injected into tissues supplied by end arteries, such as those of the ears or tail. The vasoconstrictor should also be avoided in dogs with thin skin. As well as occasioning the risk of severe vasoconstriction and tissue necrosis, epinephrine may also cause cardiac arrhythmias, especially if cardiac sensitizing anesthetics, such as halothane, are used concurrently. Avoid making subfascial and intra-arterial injections of epinephrine-containing solutions.

Intradermal lidocaine injections may cause initial discomfort, but this can be avoided if sodium bicarbonate is added to the lidocaine in a 1:9 ratio (bicarbonate:lidocaine).

Intra-articular analgesia

Bupivacaine used as a 0.25% or 0.5% solution has been used to fill the joint space following surgery. The intensity of analgesia may be improved by adding 0.1 mg/kg BW of morphine to the bupivacaine.

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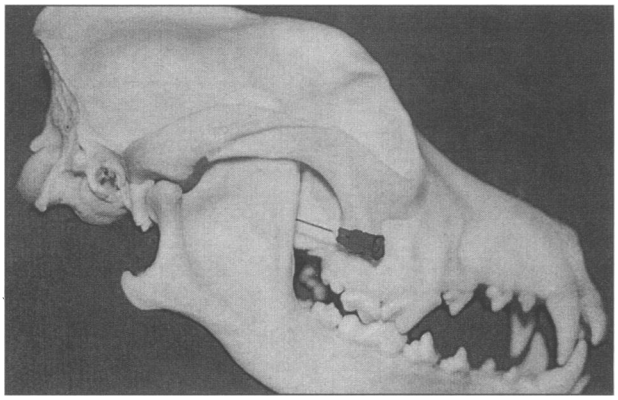

Figure 1. Photograph showing direction of needle for akinesia of the eyeball.

The head

Akinesia of the eyeball

This block can be used to prevent movement of the eye under anesthesia when peripheral muscle relaxation techniques are not available. Anesthesia of the ophthalmic nerves is a safer block to use than is retrobulbar anesthesia, since the latter involves the risk of direct subarachnoid injection causing respiratory arrest, or intravascular injection and systemic absorption. A 2.5-cm, 22-G needle is inserted ventral to the zygomatic arch below the lateral canthus of the eye, and towards the mandibular ramus. The point of the needle is walked off the rostral border of the ramus and directed in a mediodorsal direction towards the lacrimal, oculomotor, trochlear, and ophthalmic nerves emerging from the orbital fissure (Figure 1).

Upper lip, nose, roof of nasal cavity, and skin as far caudal as the infraorbital foramen

Desensitization of this area requires the blocking of the infraorbital nerve. The needle is inserted into the infraorbital canal either through the skin or the mucous membrane in the area of the upper gum, approximately 1 cm rostral to the bony lip of the infraorbital foramen (Figure 2). Half to 1.0 mL of 2% lidocaine should be injected by using a 2.5- to 5-cm, 20- to 25-G, needle. Penetration of the infraorbital canal may be improved by

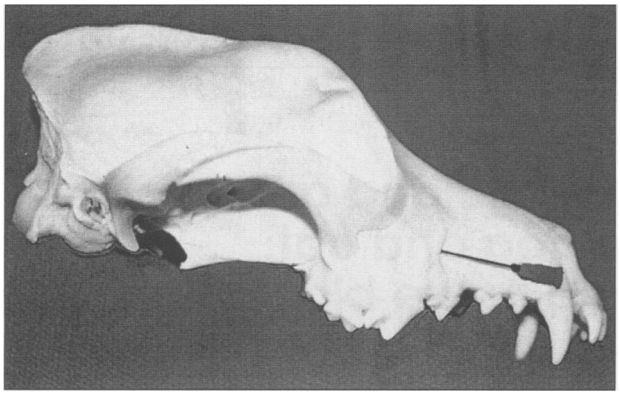

Figure 2. Photograph of direction of needle for infraorbital nerve block.

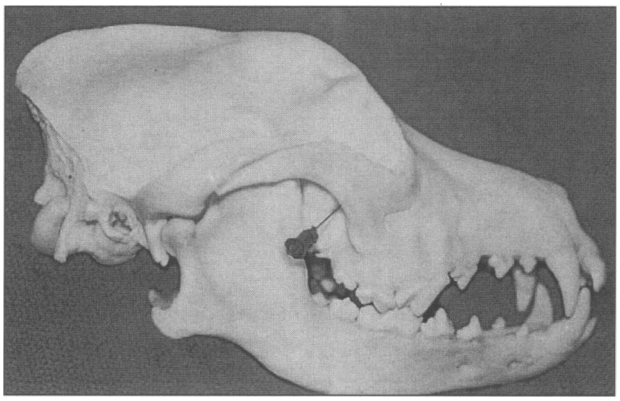

Figure 3. Photograph showing direction of needle for maxillary nerve block.

slightly curving the needle, so that it is not stopped by the medial wall of the canal.

Lower lip

The needle is directed rostral to the mental foramen at the level of the second premolar tooth in order to deposit 0.5 to 1.0 mL of drug around the mental nerves (from mandibular alveolar nerve).

Dental analgesia

Maxilla, upper teeth, nose, and upper lip

Local anesthetic is deposited around the maxillary nerve where it crosses parallel to the perpendicular part of the palatine bone between the round foramen and the maxillary foramen (Figure 3). The needle is directed 90° mesiad, ventral to the border of the zygomatic process, and approximately 0.5 cm caudal to the lateral canthus of the eye. Local anesthetic (0.25 to 1.0 mL) is deposited around the maxillary nerve.

Mandible and lower teeth

The inferior alveolar branch of the mandibular nerve is blocked as it enters the mandibular foramen by inserting a needle 0.5 to 1.0 cm rostral to the angular process of the mandible and advancing it 1 to 2 cm dorsad along the medial surface of the ramus of the mandible to the palpable mandibular foramen (Figure 4). The mandibular foramen can be palpated intraorally in dogs, and the needle point guided to the foramen.

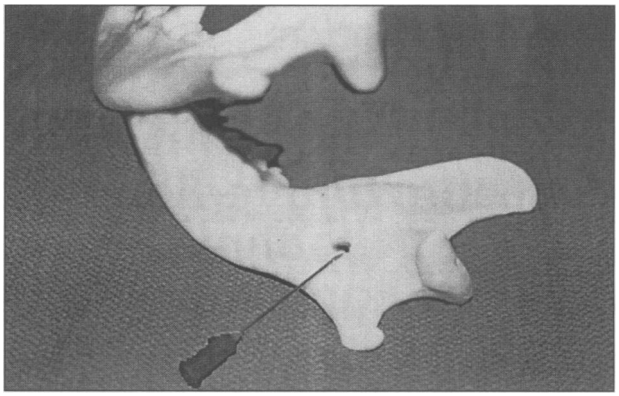

Figure 4. Photograph showing direction of needle for mandibular nerve block.

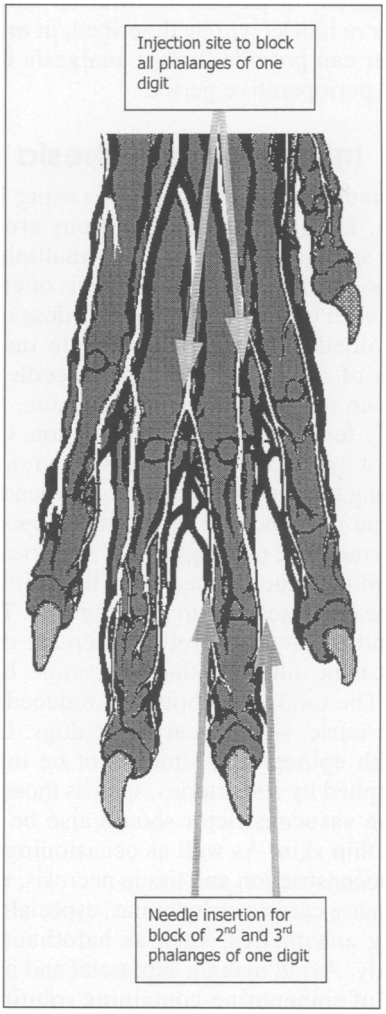

Figure 5. Diagram showing 2 areas for digital nerve block in the dog.

The limb

Digital nerve block

A 22- to 25-G needle is introduced percutaneously to the lateral sides of the digit to be blocked, or further proximally if the entire digit requires analgesia (Figure 5). Local anesthetic (0.2 to 1.0 mL), without adrenaline added, is introduced in each site. Avoid toxic doses of local anesthetic with multiple injections.

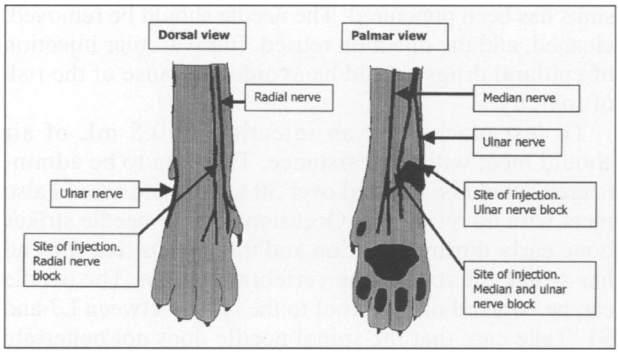

Figure 6. Diagram showing areas for injection of local anesthetic for analgesia of the feline paw (postoperative analgesia for a declaw procedure).

Block for feline onychectomy

Analgesia for declaw procedure in cats can be provided by blocking the nerves supplying the paw with 0.1 to 0.3 mL of 0.5% bupivacaine at each site indicated in the diagram (Figure 6). The toxic dose of bupivacaine (4 mg/kg BW) should not be exceeded.

Intravenous regional analgesia of a limb

This block can provide 60 to 90 min of analgesia to the extremity of either a fore- or a hind limb through the application of a tourniquet and the injection of a local anesthetic distal to the tourniquet. Analgesia is present distal to the level of the tourniquet. It is usually better to preplace an IV catheter in a superficial vein (cephalic or saphenous) distal to the tourniquet, as it may be difficult to identify a vein after limb exsanguination. Once the catheter is secured, the tourniquet is loosened, and the limb is exsanguinated by wrapping it with an Esmarch bandage or by holding it above the level of the heart for a few minutes. Care should be taken not to dislodge the catheter with the Esmarch bandage. The tourniquet is then tightened enough to obstruct arterial blood flow (a sphygmomanometer cuff can also be used and the pressure in the cuff increased to above systolic blood pressure). Once the tourniquet is secured, the Esmarch bandage (if used) can be removed. An injection of 2.5 to 5 mg/kg BW of 2% lidocaine is injected through the catheter with light pressure. Analgesia occurs in 5 to 10 min. The tourniquet should not be left in place longer than 90 min to avoid complications resulting from blood flow deprivation.

Brachial plexus block

This block provides analgesia for the forelimb distal to the elbow. The procedure is performed best in well-sedated or anesthetized dogs. A 7.5-cm, 20- or 22-G spinal needle is inserted medial to the shoulder joint and parallel with the vertebral column towards the costochondral junctions (Figure 7). The distal end of the needle should lie just caudal to the spine of the scapula. The clinician should check that the lumen of the needle is not within a blood vessel, through aspiration of the needle with a syringe. Two mg/kg BW of 0.5% bupivacaine is administered, half of the volume is injected once the needle point is caudal to the spine of the scapula, and the remainder as the needle is withdrawn (aspirating prior to each injection). It may take up to

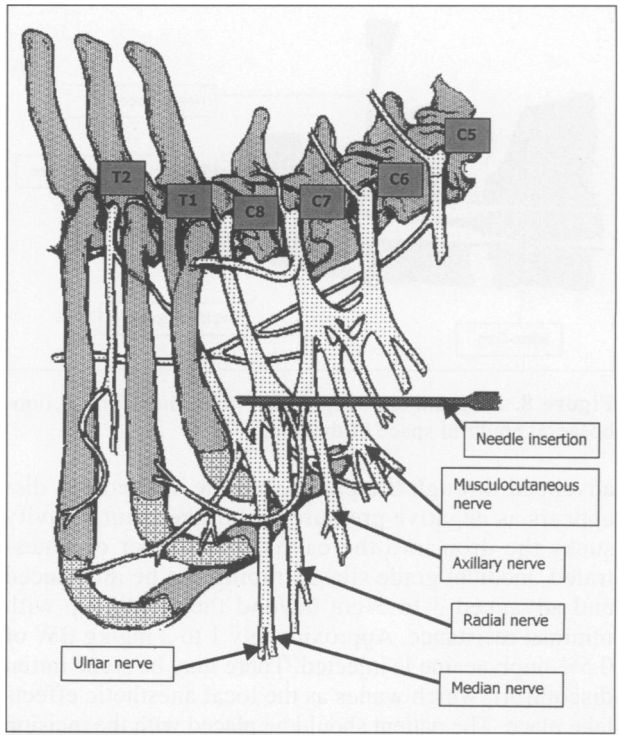

Figure 7. Diagram showing needle direction for brachial plexus nerve block in the dog.

15 min for the block to become evident. To increase the volume of the injectant, the bupivacaine can be diluted by adding saline in an amount equivalent to one third of the initial volume of bupivacaine.

The thorax

Intercostal nerve block

This block is often used for relieving pain after a lateral thoracotomy, pleural drainage, or rib fractures. Two adjacent intercostal nerves, cranial and caudal to the incision or wound (4 sites in total), are blocked. The caudal border of the rib close to the intervertebral foramen is located and 0.25 to 1.0 mL of 0.5% bupivacaine is injected. The volume selected depends on the size of patient, as the toxic dose of 4 mg/kg BW of bupivacaine should not be exceeded. The block is best performed as the surgeon is closing a lateral thoracotomy site, since the nerves are better visualized at this time.

Pleural analgesia

Administration of local analgesic through a catheter into the pleural cavity can provide analgesia for pain arising from lateral and sternal thoracotomies, rib fractures, and chest wall metastases.

Percutaneous placement of a catheter in the pleural cavity is required, or a preplaced chest drain can be used. Percutaneous placement requires confirmation of entry into the pleural cavity, through detection of negative pressure. The animal should be sedated and the caudal border of the rib should be infiltrated with local analgesic in order to facilitate catheter insertion. A Huber point (Touhy) needle is inserted with a meniscus of sterile saline in the hub of the needle. The needle is

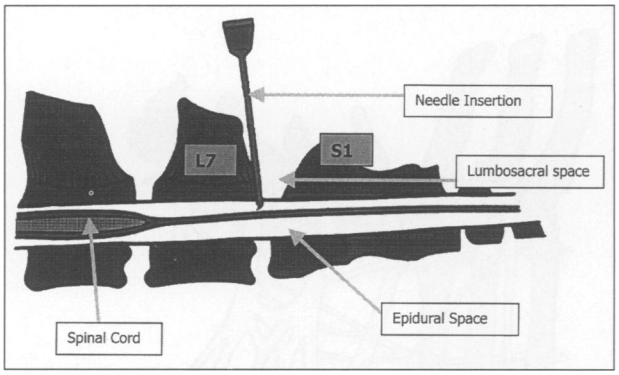

Figure 8. Diagram showing needle placement in the lumbosacral epidural space of the dog.

advanced through the pleura and the saline drop disappears as negative pressure within the pleural cavity sucks the drop into the cavity. A catheter of fenestrated, medical grade silastic tubing can be introduced and advanced 3 to 5 cm beyond the needle tip with minimal resistance. Approximately 1 to 2 mg/kg BW of 0.5% bupivacaine is injected. There may be some initial discomfort, which wanes as the local anesthetic effects take place. The patient should be placed with the incision site down, so that local anesthetic pools over the incision site. Dogs with a sternal thoracotomy should be placed in sternal recumbency for 10 minutes to allow the drug to have maximum effect. Care should be taken to ensure that the intrapleural catheter is not left open to the atmosphere or a pneumothorax may be created. Strict adherence to sterile technique is important to prevent complications such as infection. The technique is not recommended for patients with pleural effusions, pleuritis, or excessive bleeding into the chest cavity.

Lumbosacral epidural

This procedure is relatively easy to perform in sedated or anesthetized cats and dogs. The technique can be used alone to allow a procedure to be performed or it can be used to provide further analgesia during general anesthesia. There are a number of drugs and drug combinations that can be used, depending on the desired results.

The technique — The cranial points of the ilium are palpated with the thumb and middle finger of the nondependent hand, allowing the index finger to locate the exact site of needle insertion. The lumbosacral junction is located just caudal to the last lumbar vertebra (L7) and is felt as a depression. A 2.5- to 7.5-cm, spinal needle is inserted perpendicular to the line of the dorsum (Figure 8). Penetration of the dura mater and entry into the epidural space may be detected as a popping sensation. Further insertion of the needle will meet resistance as the needle meets the bony floor of the spinal canal. The hub of the needle should be observed for blood or cerebrospinal fluid. Since the dural sac terminates further caudally in cats and small or young dogs, the clinician may observe cerebrospinal fluid escaping from the needle, in which case the epidural injection should be either abandoned or retried, or a quarter to a third of the originally calculated dose of the drug administered. The observation of blood means that the ventral venous sinus has been punctured. The needle should be removed, cleaned, and the injection retried. Intravascular injection of epidural drugs should be avoided because of the risk of toxicity.

To test placement, an injection of 0.5 mL of air should meet with no resistance. The drug to be administered should be injected over 30 to 60 s and should also meet with no resistance. Occasionally, the needle strikes bone early during insertion and this means that the end has struck the roof of the vertebral column. The needle can be 'walked off' the roof to the space between L7 and S1. Take care that the spinal needle does not penetrate the lumbar disc and enter the colon, as this can cause abscess formation upon withdrawal of the needle. The 7-cm spinal needle should only be used in large dogs and by experienced clinicians.

Catheters can also be placed for long term administration of epidural analgesics. The commercial packs that are available from medical suppliers contain Touhy needles, which are suitable for medium- to large-sized dogs. The Touhy needle should be inserted at an angle of 20° to the vertical in a cranial direction in order to keep the lumen free for insertion of a flexible catheter. The needle is then removed and the catheter taped securely and aseptically in place. Contraindications to epidural techniques include distorted anatomy, blood coagulation defects, septicemia, and skin infections over the puncture site.

Drugs used in the epidural space — Local anesthetics can be used alone or mixed with opioids for more effective analgesia. Lidocaine 2%, mepivacaine 2%, bupivacaine 0.5%, or ropivacaine 0.75% can be used at a dose of 1.0 mL/5 kg BW for analgesia up to the thoracolumbar area. Duration of analgesic effects depends on the drug used. The range is 1 h with lidocaine to 4 h with bupivacaine or ropivacaine. Side effects with use of local anesthetics in the epidural space depend on the cranial extent of block. If the block extends to the level of the thoracolumbar area, hypotension may be observed, since the lumbar sympathetic outflow of the autonomic nervous sytem is blocked. More cranial extension of the block (overdose) causes respiratory insufficiency, respiratory paralysis, and convulsions.

Morphine sulphate or, preferably, morphine without preservative, can be added at a dose of 0.1 mg/kg BW to the local anesthetic solution, or when used alone, made up to a total volume of 1.0 mL/10 kg BW by adding sterile saline. Hydromorphone (0.1 mg/kg) or oxymorphone (0.1 mg/kg) can be used in place of morphine. Analgesia provided by opioids can last up to 24 h with morphine and 8 h with oxymorphone. Opioids alone in the epidural space do not cause hypotension but, rarely, may cause intense pruritus or urinary incontinence.

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