

Local and Regional Anesthesia Techniques: From Teeth Toes!

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Please note: The following descriptions are an overview only. They are an introduction, not a complete how-to. Please refer to additional reference materials with illustrations or seek the guidance of others with experience before performing the more complex techniques on patients.

I. Overview

- a. Local and regional anesthesia techniques can be an excellent addition to an analgesic plan
- b. Techniques can produce desensitization and analgesia to various structures
- c. Using these techniques can decrease the amount of inhalant anesthetic required for anesthesia, provide immediate relief of post-operative discomfort, and are relatively inexpensive to perform
- d. Techniques range in difficulty, from very easy to moderately difficult, but with a little practice can be easily incorporated into routine procedure
- e. Like everything else in medicine, there are complications that can occur with the use of these techniques

II. Pharmacology

- a. Local anesthetics (LA) refer to the class of drugs that prevent nerve cell depolarization and, therefore, stop the conduction of nerve impulses
- b. Prevent sodium from entering the nerve cell, then preventing the impulse
- c. Absence of transmission of the pain impulse from reaching the level of the spinal cord (if used locally) and subsequently the higher brain centers
- d. The potency of a LA is based on its lipid solubility and its duration of action is based on the LA's protein binding
- e. Cardiovascular and neurologic toxicity
 - i. Cats are more sensitive to LA's toxic effect than are dogs
 - ii. The dose should be calculated carefully to avoid approaching the toxic range
 - iii. Always aspirate before injection of the local anesthetic

III. Absorption

- a. Not well absorbed through the skin
- b. Better absorbed through mucus membranes
- c. Best used when deposited at the preferred site of action
- d. Topical preparations are available (i.e. EMLA cream) but require time to take effect and are variably effective
- e. Lidocaine patches are available for topical treatments
- f. Infiltration anesthesia is more effective and involves infusion local anesthetic in the area to be operated on
- g. Regional anesthesia is more specific in the placement around nerves themselves
- h. Sensations are lost in this order; pain, cold, warm, touch, and deep pressure
- i. Motor fibers are blocked prior to losing deep pressure sensation

IV. Vasoconstrictors

- a. All of the local anesthetics cause vasodilation in the area in which they are placed
- b. Drugs to induce vasoconstriction are often added to a local anesthetic block
 - i. Epinephrine can be added to delay the absorption of the LA which will increase the intensity of the block and prolong the duration of anesthesia
 - ii. The addition of epinephrine can increase the risk of cardiac arrhythmias and other potentially dangerous side-effects, and should be used on an individual basis

V. Infraorbital block

- a. The infraorbital block will desensitize the upper lip, nose, roof of the nasal cavity, gingiva and buccal mucosa rostral to the infraorbital canal as well as desensitize the innervation of the first incisor through the third premolar in both the canine and feline patients
- b. While blocking this nerve anesthetizes the aforementioned structures, it is important to note that local anesthetic placement in this area will not desensitize the palatal mucosa
- c. The infraorbital nerve is blocked at the level of its exiting the infraorbital canal
- d. The needle can be placed either intraorally or extraorally approximately 1 cm rostral to the palpable bony rim of the canal and advanced to the level of the infraorbital canal
- e. The canal and neurovascular bundle can be palpated dorsal to the distal root of the third premolar
- f. Digital pressure should be applied for 60 seconds after administration to prevent hematoma formation

VI. Maxillary block

- a. A maxillary block will desensitize the palatal mucosa, maxillary teeth in that quadrant, gingiva and buccal mucosa, nose, and upper lip
- b. Two described methods for performing a maxillary nerve block
 - i. The first is to desensitize the nerve at the level of the perpendicular portion of the palatine bone between the maxillary foramen and the foramen rotundum. The block is accomplished by inserting the needle ventral to the zygomatic arch and $\frac{1}{2}$ cm caudal to the lateral canthus of the eye at a 90 degree angle to the skin and advancing to the level of the pterygopalatine fossa
 - ii. The second method follows the initial steps of the infraorbital block, but using a one-and-one-half inch needle. The needle is advanced through the infraorbital canal until the needle exits the maxillary canal and is advanced to approximately half the distance of the zygomatic arch (depth is dependant on the animal's size). The LA is deposited in this region while applying digital pressure to the infraorbital canal. Attention should always be paid to advancing the needle parallel with the hard palate. By maintaining this parallel line of direction, inadvertent penetration into the globe is avoided. This is especially important in brachycephalic breeds and cats (who may have a minimum of 4mm of length of their infraorbital canal).

VII. Lacrimal, zygomatic, ophthalmic block

- a. The eye, orbit, conjunctiva, eyelids, and forehead skin can be desensitized by blocking the lacrimal, zygomatic, and ophthalmic nerves (ophthalmic division of the trigeminal nerve)
- b. Accomplished by inserting a needle at the lateral canthus of the eye just ventral to the zygomatic arch. The needle should be advanced medial to the ramus of the mandible in the direction of the contralateral ear until the orbital fissure is reached.

VIII. Mental block

- a. The lower lip can be desensitized by blocking the mental nerve at the level of the middle mental foramen
- b. At the level of the mesial root of the second premolar tooth, the needle can be inserted just rostral to the middle mental foramen. The foramen can be palpated in certain animals
- c. This block is effective in blocking the first premolar through first incisor of that quadrant in the canine and the canine tooth through first incisor in the cat

IX. Mandibular block

- a. The mandibular block will desensitize the mandibular molars, premolars, canine teeth, incisors, gingiva, mucosa and skin of the chin and lower lip by blocking the inferior alveolar branch of the mandibular nerve
- b. The nerve is blocked at the site of entry of the mandibular nerve into the mandibular canal at the level of the mandibular foramen
- c. Two methods described for performing the mandibular block
 - i. The first is to insert the needle at the lower angle of the jaw around 1.5 cm rostral to the angular process. The needle is then advanced dorsally along the medial surface of the ramus of the mandible to the palpable lip of the mandibular foramen. The needle can be palpated over the foramen with the aid of a mouth gag
 - ii. The second method involves inserting the needle orally, with the aid of a mouth gag, along the medial surface of the mandible immediately caudal to the third mandibular molar and directed toward the angle of the ramus. The needle is advanced half the distance between these two landmarks and may be palpated over the mandibular foramen.

X. Distal radial, ulnar, median block

- a. The distal radial, ulnar, and median nerve blocks will desensitize the forelimb from the carpus distally
- b. The block is an infiltrative block
- c. The superficial branches of the radial nerve are blocked on the dorsomedial aspect of the limb approximately $\frac{1}{2}$ cm proximal to the carpus. The dorsal branch of the ulnar nerve is blocked on the mediopalmar aspect of the carpus. The palmar branch of the ulnar nerve and the median nerve are blocked on the palmar aspect of the carpus. At all three sites, the needle is inserted subcutaneously in the area of the nerves and the LA infiltrated at the site.

XI. Brachial plexus block

- a. The radial, median, ulnar, musculocutaneous, and axillary nerves can all be desensitized
- b. The brachial plexus block, using LA, will also block motor activity to the limb
- c. The block will desensitize everything from the elbow distally
- d. Performing the block requires the use of a 3 inch or longer, depending on the animal's size, needle. The needle should be inserted medial to the shoulder joint parallel to the vertebral column. The needle should be angled

toward the costochondral junction of the ribs. Once the needle is inserted to its maximum depth, the LA should then be injected slowly as the needle is slowly removed

- e. The block can be performed with the aid of an insulated needle and a nerve stimulator. The nerve stimulator will ensure proper deposition of the LA
- f. One complication of the brachial plexus block is inadvertently entering the pleural cavity and possibly inducing a pneumothorax

XII. Bier block

- a. The BIER block provides intravenous regional anesthesia of a distal limb with the use of a tourniquet
- b. A BIER block will block nerve endings in peripheral tissues
- c. A tourniquet is placed tightly enough to occlude blood flow into the limb. Once the tourniquet is placed, LA is administered into a superficial vein distal to the tourniquet. The limb will be desensitized for the duration the tourniquet is in place. Once the tourniquet is removed, the drug will be taken up into systemic circulation and residual anesthesia will remain for up to 30 minutes
- d. Because the drugs will be taken into systemic circulation, epinephrine should not be used when performing a BIER block
- e. Due to complications associated with tourniquet usage, close monitoring of the time the tourniquet is on the limb should be a priority

XIII. Intra-articular block

- a. The block provides analgesia without significant adverse reactions
- b. The block is performed by injecting LA directly into the joint, typically as the joint is closed in surgery
- c. There is recent literature that suggests LA may cause cartilage cells to die
- d. If the joint is thought to be septic, the block should not be performed

XIV. Intercostal block

- a. The intercostals nerves can be blocked to reduce the amount of other analgesics needed to treat thoracotomy pain or thoracic trauma pain
- b. A minimum of two intercostals spaces cranial to and caudal to the site of injury should be blocked
- c. The needle should be inserted at the caudal border of the rib near the level of the intervertebral foramen
- d. The needle should be in the muscular tissue before the LA is administered
- e. A pneumothorax can occur following this block if the pleural cavity is entered and the lungs injured

XV. Lumbosacral epidural anesthesia

- a. Provide an excellent addition to an analgesic plan
- b. Performing an epidural with a local anesthetic can produce paralysis of the hind limbs
- c. Epidural morphine can provide analgesia approximately 30 minutes following injection and can last anywhere from 10 to 24 hours
- d. The preservatives used in morphine prepared for systemic administration can be toxic to the spinal cord; therefore the preservative free preparations are best for epidurals
- e. An epidural injection is performed following identification of specific landmarks and a sterile prep of the area
- f. The spinal cord ends at the vertebral body of L6 in dogs and at S1 in cats
- g. The dorsal iliac wings of the ilium should be palpated bilaterally
- h. The spinous process of the seventh lumbar vertebra and the median sacral crest should also be palpated
- i. Once the landmarks are identified, a beveled spinal needle with a stylet can be placed on the skin on midline over the identified lumbosacral (LS) space
- j. The LS space can be palpated just caudal to the wings of the ilium and the dorsal spinous process of the seventh lumbar vertebra
- k. The needle should be inserted at a 90° angle to the skin's surface
- l. There is an initial loss of resistance when passing through the skin. A more important, second loss of resistance ("pop") is felt when the needle passes through the ligamentum flavum
- m. Passing through the ligamentum flavum corresponds to the needle entering the epidural space
- n. The stylet can then be removed and the needle examined for flow of blood or cerebrospinal fluid. If blood is present, proceeding with the epidural should be reconsidered
- o. If CSF is present, the dose of the drug (depending on the drug to be administered) should be reconsidered
- p. A loss of resistance test can be performed to confirm accurate needle placement in the epidural space by injecting air or sterile saline, with no resistance being a positive test