BLOCK THAT PAIN: PAIN MANAGEMENT FOR THE DENTAL PATIENT

Mary L, Berg, BS, LATG, RVT, VTS (Dentistry), FVTE
Beyond the Crown Veterinary Education
Lawrence, KS

Pain management is more than the latest popular terminology. It is an important part of veterinary dentistry. Many of the procedures performed on animals are painful, and it is our duty as RVTs to ensure that our patients are as comfortable as possible. The delivery of local nerve blocks, prior to performing many dental procedures or oral surgery, is an effective way to create preemptive analgesia. Local nerve blocks can often be incorporated into a multimodal plan for pain control.

DEFINITION

The International Association for the Study of Pain defines pain as an unpleasant sensory or emotional experience associated with actual or potential tissue damage, or described in terms of such damage.

PATHOPHYSIOLOGY OF PAIN

In order to manage pain, it is important to have a basic understanding of the complex interactions coming together to create the pain response. This will allow for the formulation of a plan to control pain prior to a procedure, during surgery, and post-operatively. Nociception is defined as the processing of a noxious stimulus, resulting in the perception of pain by the brain. Nociception has three distinct physiological processes: transduction, transmission, and modulation.

Transduction is the translation of physical energy (noxious stimuli) into electrical activity at the peripheral nociceptor. These receptors are considered mechanosensitive, thermosensitive and chemosensitive.

Transmission transports these impulses along nerve fibers to the *dorsal root gangia* of the brain. These trigeminal afferent nerves are subdivided into two categories:
• A-delta or fast fibers, responsible for sharp, stabbing pain, as in a sudden tooth fracture
• C or slow fibers, responsible for dull, throbbing pain, as in trauma with internal hemorrhage and pressure.

Modulation is the synapse of the neurons in the *nucleus caudalis* in the medulla of the brain. This leads to the perception of pain. The goal of dental analgesia is to block this perception.

Consequences of Pain

Pain can be pathologic, if left untreated. Pain can cause increased risk of infection; delayed wound healing; reduced food and water intake; inability to move; altered sleep patterns; and altered behaviour patterns. Some or all of these consequences may prolong convalescence, and may predispose the patient to an adverse outcome.

PAIN RECOGNITION

Physiological signs of acute pain include increased respiration, increased blood pressure and heart rate, and peripheral vasoconstriction that presents itself as blanched membranes. The manifestations of pain can be different in dogs and cats. Dogs will often whine and whimper, become unusually timid or aggressive, have a fixed stare, or exhibit restless behavior. Cats may purr, growl, or groom when in pain. They may try to hide, appear to squint, and be resistant to movement. An animal in pain may not have an appetite, may have inappropriate urination, or they may stop grooming themselves.

PAIN ASSESSMENT

RVTs have the primary role in assessing a patient's pain level. In order to assess a patient's pain level, you need to know what is normal. If at all possible, become familiar with a patient's presenting physiological values and behaviors at admission. A thorough pain assessment should include both watching the patient from a distance, and completing an interactive assessment that encourages a response from the patient. One can watch the patient either in the exam room or in a kennel to obtain an assessment without interaction. Direct interactive assessment may be a gentle pressure in an effected area.

There are simple assessment scales available that can be used to record the pain level of the patient. These include a visual analog scale, and the numerical rating scale.
www.vasg.org/pdfs/CSU_Acute_Pain_Scale_Canine.pdf

STRATEGIES FOR PAIN MANAGEMENT

Pain can be controlled at each of the sites along the pain pathway. Different modalities of treatment can be combined, or used alone, to produce the desired effect in a specific area. Local and regional anesthetics and alpha-2 agonists will block the transmission of pain. Antiinflammatory drugs work at the site of transduction, and modulate the pain response. Opioids modulate pain perception both centrally and locally.

It has been documented that preventive analgesic protocol will decrease the total volume of required analgesics. If pain control is not started until after a patient is showing discomfort, a higher level of drugs will be needed to stop this increased sensitivity to noxious stimuli in the central nervous system. This is also known as "wind-up". A multi-modal approach to pain management before, during and after a procedure will reduce "wind-up," and result in a more comfortable patient. Combining pain medications and sedatives in the pre-anesthetic protocol will decrease the need for a high concentration of inhalation anesthetics. Providing antiinflammatory drugs at the beginning or end of a procedure will reduce the local pain response, due to tissue manipulation. Instructing clients to follow the prescribed dosing schedule of postoperative oral medication will help to eliminate the chance of overdosing a patient.

PRE-ANESTHETIC DRUGS:

Many drugs aid in pre-anesthetic, systemic pain control. These include hydromorphone, butorphanol, morphine, and medetomidine. All of these drugs work differently in the brain. The drug of choice is determined by many factors, including:

- Patient's condition: age, body score, underlying medical conditions
- Cost: some drugs are prohibitively expensive to use in large patients
- Procedure: full mouth extractions are more painful than a single tooth extraction
- Hospital protocols: use the recommended protocol for your clinic

It is not within the scope of this paper to cover each of the possible pre-anesthetic drug combinations. Every patient should be evaluated to determine the best choice for that individual.

DURING THE PROCEDURE

Regional and local anesthetic blocks are used in dentistry to control pain at the site of the procedure. In the past, the drugs of choice for this procedure were lidocaine hydrochloride 2% combined with bupivacaine 0.5%. Lidocaine provides a quick onset of action of about two minutes, but has a duration of only one to two hours, while bupivacaine has a delayed onset of four to eight minutes, but has a duration of four to ten hours. Studies have shown that the combination of these drugs actually **decreases** the duration of the block. It is now recommended that bupivacaine be used alone. The delay in onset can be negated by appropriate timing of the injection after a thorough oral examination followed by administration of the blocks prior to performing painful procedures. When using local anesthetics, the

patient must be monitored very closely. Bupivicaine can cause cardiac depression, seizures, and respiratory distress, if given at too great a dose, or administered intravenously. The recommended total dosing for bupivacaine is 2.0mg/kg. The total volume per injection site is 0.1ml for cats and small dogs, and up to 0.3ml for very large dogs. If a patient's mouth is to be blocked in more than one region, caution must be taken not to exceed the maximum total dosage.

The duration of the block can be increased by the addition of an opioid, such as buprenorphine, to the bupivacaine. The addition of a 0.003 /kg to the dose of bupivacaine is all that is needed to extend the length of the block.

While no studies in dogs have been published, the addition of dexmedetomidine combined with the local anesthetic agents has been shown to have a significantly prolonged action in humans and rats. Dexmedetomidine enhances the anesthetic action, via the alpha-2 A receptors. A suggested dexmedetomidine dose of 1-2 mcg/kg, added to the anesthetic drug while monitoring the patient's heart rate, ECG, blood pressure and SpO_2, and providing supplementary oxygen, is recommended.

REGIONAL BLOCKS

Familiarity with skeletal landmarks is needed prior to performing a regional block. Examination of a dog and cat skull model is helpful. It is imperative to avoid injecting the local anesthetic into a blood vessel, to limit any cardiotoxic effects.

If a regional nerve block cannot be performed, individual teeth can be blocked using a field block. A field block is performed by infiltrating the surrounding tissue with the analgesic agent.

MATERIALS

The materials needed for intraoral regional blocks are the drug of choice, a 1mL syringe, and assorted needles, depending upon the site to be blocked. Generally, a 25g X 5/8" needle is used for most blocks. However, patients with long or large faces may require the use of a 1½" needle. The procedure is described below.

WARNING

Although some experts advocate the insertion of the needle deep into the foramen, the techniques described in this text will involve a less invasive technique, which will decrease the likelihood of nerve damage while performing nerve blocks.

MAXILLARY INFRAORBITAL NERVE BLOCK

The maxillary infraorbital nerve block will affect the bone, soft tissues, canines and incisors. The infraorbital foramen is readily palpated in the maxilla, just distal to the third premolar. (Photo 1)It is imperative to keep the syringe and needle parallel to the palate, and not advance the needle too far into the foramen, especially in cats. (Photo 2) The infraorbital foramen is located within 4mm of the medial canthus of the eye. Caution must be used to avoid any ocular injury.

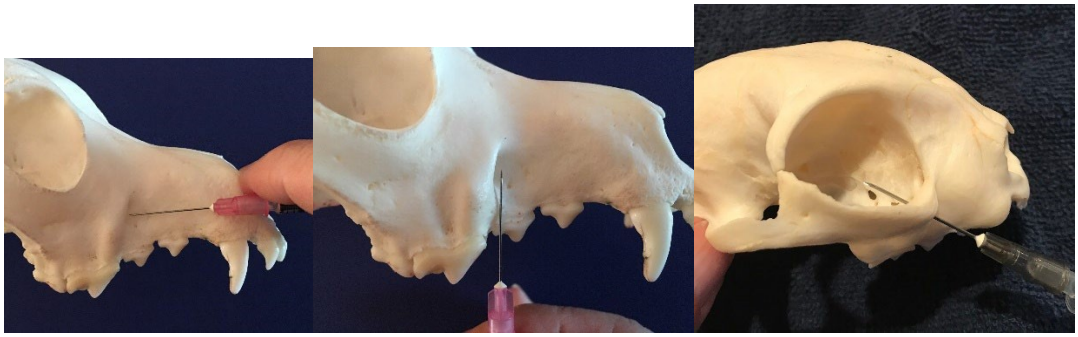

Photo 1 & 2: Needle placement for the maxillary infraorbital nerve block .
Photo 3: Advancing the need to far into the formamen may lead to ocular damage in cats and brachycephalic dogs.

CAUDAL MAXILLARY NERVE BLOCK

The caudal maxillary nerve block will affect the bone, teeth, and soft tissue rostral to the first maxillary molar on the injected side. The landmarks are caudal to the maxillary second molar. The infraorbital neurovascular bundle is affected by this block. (Photo 4) In dogs, the maxillary nerve block is performed by inserting the needle just caudal to the last maxillary molar. (Photo 5) Advance the needle dorsally to a level just beyond the root tips of the last molar, then aspirate twice and slowly inject the agent. This technique is preferred over the infraorbital nerve block, for providing analgesia to the maxillary molars. An alternative method to place the caudal maxillary block is shown in photos 6 to 8.

Photo 4: Nerve bundle

Photo 5: Needle place for the caudal maxillary nerve block

Photos 6-8: Alternative method for the caudal maxillary block.

In cats, the caudal maxillary nerve block is performed at the base of the 'V' notch or divot near the soft palate juncture, palpable just medial to the caudal root tips of the maxillary fourth premolar. Aspirate at least two times, and inject slowly.

MIDDLE MENTAL NERVE BLOCK IN CATS

The middle mental foramen is very small and difficult to locate in cats, making this block hard to place. In cats, the labial frenulum landmark is used as a guide, but the foramen is rarely palpable. The author rarely places this block due to limitation of effectiveness and difficulty of placement.

MIDDLE MENTAL NERVE BLOCK IN DOGS

The middle mental nerve block will affect the bone, teeth, and soft tissue rostral to the second mandibular premolar (canine tooth in cats) on the injected side. The foramen is situated just caudal to the mandibular labial frenulum. It is ventral to the mesial root of the second premolar, and generally can be palpated in dogs. Dental radiography can aid in the location of the foramen. The bevel of the needle is passed just over the opening of the foramen and the anesthetic is injected as described above. (Caution must be taken to avoid actually threading the needle into the middle mental foramen. It is a very narrow opening and contains neurovascular structures that must not be macerated.) Photos 9 & 10 show different approaches to the middle mental foramen.

Photo 9 & 10 show different approaches to the middle mental foramen.

MANDIBULAR NERVE BLOCK

The mandibular (inferior alveolar) nerve block will affect all bone, teeth, and soft tissue of the injected mandible. It can be performed either extraorally or intraorally. The notch of the caudal ventral mandible is palpated just cranial to the angular process for extra-oral insertion. The needle is inserted at the lingual aspect of the ventral mandible, and advanced dorsally to the midpoint between the ventral and dorsal borders of the mandible. The needle may be palpated from the inside of the mouth. Injection is as previously described.

The intraoral technique requires palpation of the mandibular foramen. It is located on the lingual aspect of the mandible, two-thirds of the distance from the last molar to the mandibular angular process (see diagram above). The needle is inserted intraorally, on the lingual surface of the mandible, adjacent to the

foramen. Aspiration and injection is as previously described. Photo 11 & 12: Proper needle placement at the entrance of the inferior alveolar foramen.

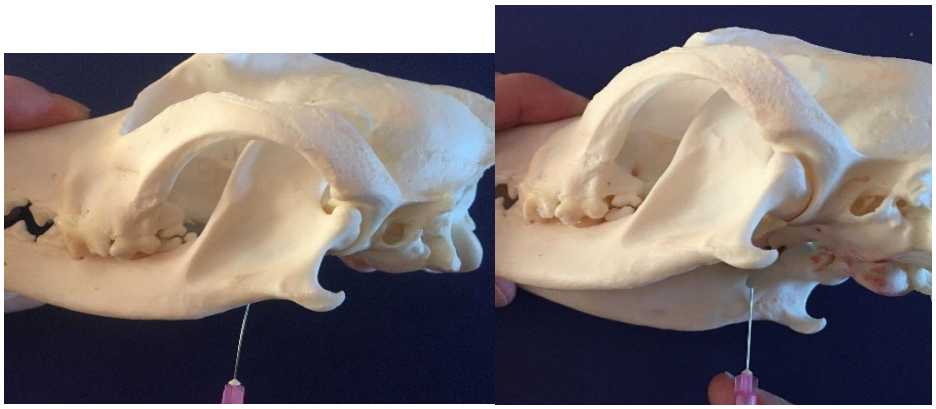

Photo 11 & 12: Proper needle placement at the entrance of the inferior alveolar foramen.

POST-OPERATIVE PAIN CONTROL

Upon recovery from anesthesia, it is important to keep patients comfortable, and slowly encourage a return to normal eating habits as soon as they are awake and walking. The shortterm use of a canned diet, or moistened dry kibble, will decrease mechanical trauma to the oral surgical site, and may be easier to chew. (To avoid dietary upset due to a change from dry to canned food, it is recommended that dry kibble be soaked until it is soft, to allow the patient to be maintained on its same diet.)

Many drugs are available for post-operative pain management. The most commonly used medications are non-steroidal anti-inflammatory drugs (NSAIDS) and opioids. An excellent reference for veterinary drugs and dosages is *Plumb's Veterinary Drug Handbook, 6th Edition*; Plumb, Donald, 2008 Wiley-Blackwell Publishing (www.wiley.com)

Non-steroidal anti-inflammatory drugs: NSAIDS are used to treat pain and extreme sensitivity associated with inflammation. Most NSAIDS used in veterinary medicine are Cox-2 selective. The breakdown of arachidonic acid by cyclooxygenase (Cox) enzymes, released at the site of surgery, produces prostaglandins. Further production is created by the development of cytokines and growth factors at the site. Prostaglandins are a component of the inflammatory cascade, and contribute to the sensitization of neurons to noxious stimuli. Inhibition of Cox enzymes will limit prostaglandin production, so that painful inflammation is reduced.

CONCLUSION

In conclusion, dental nerve blocks are inexpensive to perform, easy to master, and have a significant impact on patient comfort. They can be an invaluable part of a balanced anesthetic protocol, when combined with other analgesic modalities. A multimodal approach to dental analgesia is desired. The duration and extent of the oral procedure will help to determine the desired drug protocol. The goal is to have a patient that is comfortable, eats well and heals quickly.

References:

1. Small Animal Regional Anesthesia and Analgesia, ed. Luis Campoy and Matt Read, Wiley Blackwell, Ames, IA.
2. Local Analgesic and Anesthetic Blocks, Kraus, B. H., Iowa State University
3. Local Blocks for Everyday Practice, Shafford, H.L., Veterinary Anesthesia Specialist, LLC
4. Pain Management for the Veterinary Technicians and Nurses, M.E. Goldberg, N. Schaffran, Wiley Blackwell, 2014
5. Pain Management for the Small Animal Practitioner, 2nd ed., W.J. Tranquili, K.A. Grimm, L.A. Lamont, Teton New Media, 2004.
6. Regional Anesthesia for Dentistry and Oral Surgery, G.C. Lantz, J Vet Dent 20(3); 181-186, 2003
7. Small Animal Dental Procedures for Veterinary Technicians and Nurses, Chapter 4: Anesthesia and the Dental Patient, Wiley-Blackwell, 2013.
8. Veterinary Pain Management 3rd ed, J.S. Gaynor, Muir, WW., Elsevier, 2015
9. Veterinary Dentistry A Team Approach 2nd ed., S. E. Holmstrom, 2013
10. Effects of Buprenorphine Added to Bupivacaine Infraorbital Nerve Blocks on Isoflurane Minimum Alveolar Concentration Using a Model for Acute Dental/Oral Surgical Pain in Dogs, L.B.C. Snyder, C. J. Snyder, S. Hetzel, J Vet Dent 2016, Vol. 33(2) 90-96