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ARTICLE #3

Block that pain: Dental pain management

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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. The trigeminal, or fifth, cranial nerve is primarily responsible for detecting and encoding noxious stimuli in the orofacial region.

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 fibres to the *dorsal root ganglia* of the brain. These trigeminal afferent nerves are subdivided into three categories:

- A-beta fibres transmit light touch, thought of as a "prepain" sensation
- A-delta or fast fibres, responsible for sharp, stabbing pain, as in a sudden tooth fracture
- C or slow fibres, responsible for dull, throbbing pain, as in trauma with internal hemorrhage and pressure. The majority of fibres in the dental pulp are C fibres

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 behaviour. 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 behaviours 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 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. Anti-inflammatory 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 a 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 anti-inflammatory 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 post-operative oral medication will help to eliminate the chance of overdosing a patient. It is important that clients administer pain medications "on the clock," rather than as needed, as it more difficult to treat pain after the fact than it is to prevent it.

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 two per cent and bupivacaine 0.5 per cent. 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. Bupivacaine 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 2.0 mg/kg. The total volume per injection site is 0.1ml for cats and small dogs, and up to 0.3 ml 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 analgesia can be increased by the addition of an opioid, such as buprenorphine, to the bupivacaine. The addition of a 0.003 mg/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.

Drug	Dose Canine and Feline
Bupivacaine	Up to 2 mg/kg total dose
Buprenorphine	~0.003 mg/kg combined with anesthetic agent. Mix immediately prior to use.
Dexmedetomidine	1-2 mcg/kg combined with anesthetic agent.

Regional blocks

Familiarity with skeletal landmarks is needed prior to performing a regional block. Examination of dog and cat skull models 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.

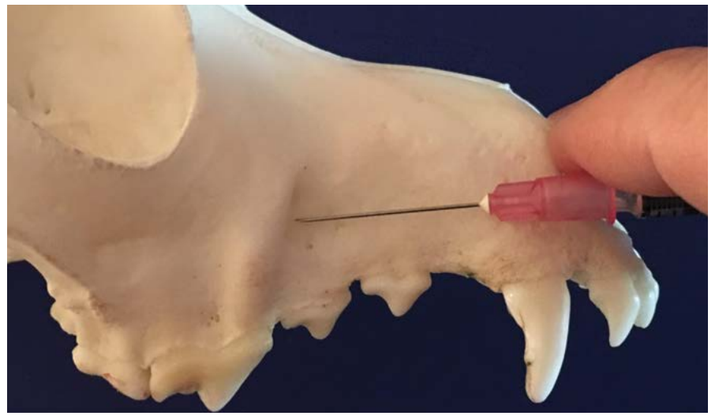

Photo 1: needle placement for the maxillary infraorbital nerve block.

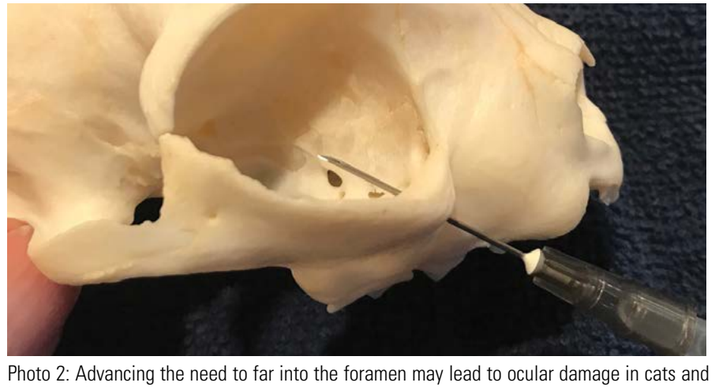

Photo 2: Advancing the need to far into the foramen may lead to ocular damage in cats and brachycephalic dogs.

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 3). In dogs, the maxillary nerve block is performed by inserting the needle just caudal to the last maxillary molar (Photo 4). Advance the needle dorsally to a level just beyond the root tips of the last molar, then aspirate and rotate the needle 360 degrees, to ensure the needle is not in a blood vessel, and slowly

Photo 3: Infraorbital neurovascular bundle

Photo 4: Needle place for the caudal maxillary nerve block

inject the agent. This technique is preferred over the infraorbital nerve block, for providing analgesia to the maxillary molars.

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 three 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

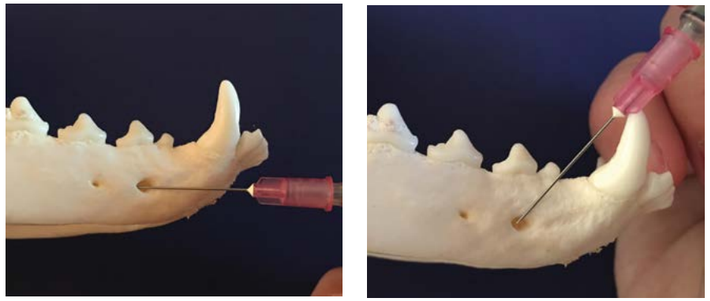

Photo 5 & 6 show different approaches to the middle mental foramen.

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.)

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 (Photo 7). The needle is inserted intraorally, on the lingual surface of the mandible, adjacent to the foramen. Aspiration and injection is as previously described.