Addressing Pain: Regional Nerve Blocks

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1. Introduction

Providing adequate pain control for equine patients in the perioperative and postoperative period should be part of any practitioner's surgical plan involving dental extraction and/or sinus surgery. The vast majority of extraction techniques in common use today can be performed standing with good perioperative analgesia/anesthesia delivered intravenously and analgesia provided by regional nerve blocks. This greatly reduces the risk to the horse from general anesthesia, bleeding during surgery, and recovery time. Many same-day surgeries can be performed stall-side or with only a 24-hour stay at an equine hospital. In addition, postoperative pain control can improve the quality of patient recovery. Most equine owners have become quite savvy regarding pain control for their horses and will frequently want to discuss this issue with the practitioner.

There are many ways to provide analgesia and anesthesia for the horse intravenously or intramuscularly. These topics have been thoroughly covered in the 2010 Vet Clinics of North America: Equine Practice—Pain Therapy in Horses. In the words of Dr. Goodrich, “Pain that is controlled results in a nondepressed horse that maintains a good appetite and has a normal functioning immune system, which results in normal tissue healing.”

The author highly recommends reading this issue of Vet Clinics to catch up on the most recently reported literature on preoperative, intraoperative, and postoperative pain control strategies, using a multimodal approach to achieve maximal results.

One facet of a good pain control plan is regional nerve blocks. Regional nerve blocks are the key to being able to perform dental extractions in the standing horse under a constant rate intravenous infusion of an anesthetic agent. Before the common use of regional nerve blocks in performing standing extractions, the surgeon's success relied more on the nature of the horse, very high doses of intravenous anesthetics, and uncomplicated or non-surgical extraction procedures. With the use of regional nerve blocks, now most horses can have productive noninvasive and invasive dental procedures standing. General anesthesia is still necessary for intractable patients, surgeries requiring computed tomography, and extractions or maxillofacial surgeries requiring precise, delicate surgical techniques. When placing a nerve block, achieving effectiveness while reducing risk is paramount. The following descriptions give step-by-step directions to performing nerve blocks associated with extractions.
2. Materials and Methods

Local Anesthetic
- Major procedures: bupivacaine 5% solution; onset of action, 10 to 20 minutes; duration of action, 180 to 480 minutes.
- Minor procedures: lidocaine 2% solution; onset of action, 1 to 3 minutes; duration of action, 60 to 120 minutes.

Give all regional anesthetics slowly (over 1 minute) and chose volume to match site (avoid placing too much in a restricted space).

Equipment Needed
- Clippers.
- Betadine and saline-soaked gauze for prep tray.
- Sterile gloves.
- Tuohy Epidural Needles (spinal needles used historically); 2.0-inch length; 22 gauge; 3.5-inch length; 22 gauge; 6.0-inch length; 20 gauge.
- Hypodermic needle; 1.0-inch length; 25 gauge; 1.5-inch length; 24 gauge.
- Extension set 6-inch Luer lock.
- Syringe; 20-cc Luer lock; 12-cc Luer lock; 3-cc.
- Loss-of-Resistance Syringe.
- Peripheral nerve stimulator.
- Insulated peripheral nerve block needle; 6-inch length and 20 gauge.
- Conducting gel.

General Preparation
- Heavily sedate the horse.
- Locate injection site.
- Surgically prepare the injection site.
- Fill syringes with local anesthetic and flood extension lines if used.
- Don sterile gloves and work in sterile manner for injection.

Inferior Alveolar Nerve Block (Mandibular Nerve Block)
The nerve stimulator technique was developed by Dr. Rawlinson and Dr. Campoy.

The inferior alveolar nerve block anesthetizes the inferior alveolar nerve as it branches away from the mandibular nerve and travels into the mandibular foramen and the mandibular canal. This block will provide analgesia to the ipsilateral mandible and mandibular teeth in addition to all soft tissue structures innervated by the mental nerves (see below). The mandibular foramen is located rostrally on the medial aspect of the coronoid process at the level of the ipsilateral mandibular occlusal surface.

Locate the mandibular foramen at the intersection of the following two lines:

(1) Lay a straight edge along the occlusal surface of the mandibular cheek teeth. The most caudal portion of the commissure of the lips usually corresponds to this surface, and the line is drawn parallel to the facial crest. Mark with a Sharpie the portion of this plane over the masseter muscle.
(2) Lay the straight edge from the lateral canthus of the ipsilateral eye to the most ventral aspect of the mandibular ramus and mark with a Sharpie the plane over the masseter and the intersection point with the preceding plane.

The procedure will be described for use with a nerve stimulator and with spinal needles during the lecture series.

Mental Nerve Block
The mental nerve block anesthetizes the rostral portion of the inferior alveolar nerve as it branches into the mental nerve at the level of the mental foramen. If the block is delivered to the rostral inferior alveolar nerve, then the ipsilateral canine and incisor teeth will be anesthetized in addition to the skin and lip rostral to the mental foramen. Only the mental nerve (skin and lip) will be anesthetized if the local anesthetic is not delivered through the mental foramen into the mandibular canal. The mental foramen is located on the lateral aspect of the mandible in the interalveolar space (the “bar”) at the level of the commissure of the lips halfway between the most dorsal and ventral aspect of the mandible. Dorsal elevation of the tendon of the depressor labii inferioris, which lies over the foramen, will assist with palpation.

Locate the position of the mental foramen.
- Clip, clean, and prep site.
- Use a 2-inch, 22-gauge needle for this block.
- Palpate the foramen. Introduce the needle roughly 1 cm rostral to the foramen at a 30 to 40 degree angle to the bone.
- The needle is passed into the foramen roughly 1 cm and digital pressure is applied to the mental foramen to stabilize the needle and prevent outflow of local anesthetic.
- The syringe is aspirated to ensure no direct placement in a vessel.
- Slowly deposit 5 to 10 mL of local anesthetic. If in the mandibular canal, avoid placing too much fluid (>10 mL) in the canal because this may result in nerve damage due to high pressure within the canal.
- Slowly remove the needle and apply pressure to the site for roughly 1 minute.

This block is NOT well tolerated by the horse due to the almost unavoidable direct needle contact with the nerve.

Maxillary Nerve Block (Extraperiorbital Fat Body Insertion Technique)
This technique was developed by Dr. Staszyk.

The maxillary nerve block anesthetizes the infraorbital nerve as it branches from the maxillary
nerve in the region of the pterygopalatine fossa. This nerve block will provide analgesia to all ipsilateral maxillary teeth and gingiva. The Extra-periorbital Fat Body Insertion (EFBI) technique aims to infuse anesthetic into the extraperiorbital fat body, which allows for diffusion of material into the region of the caudal infraorbital canal, maxillary foramen, pterygopalatine fossa housing the infraorbital nerve, and the maxillary nerve. By using this technique, the practitioner avoids close contact of the needle tip with significant regional vessels and nerves.

- Locate the entry point for a 3.5-inch, 22-gauge Tuohy needle.

  (1) Follow facial crest to most caudal aspect where crest starts to deviate dorsally to become part of the zygomatic arch. This point is usually located in the region of the middle third to caudal third of the eyeball, but different facial conformation and various size horses make the use of eyeball positioning less reliable.

  (2) Roughly 10 mm caudal to the point of dorsal deviation of the facial crest and parallel to the plane of the body of the facial crest marks the point of entry for the needle.

- Clip, clean, and prep the site.
- A small bleb of lidocaine can be placed subcutaneously at the point of entry of the Tuohy needle.
- Holding the Tuohy needle perpendicular to the skin the needle is advanced into the masseter muscle. As the needle passes through the multiple bodies of the masseter muscle, small changes in needle resistance will be felt.
- If at 10 to 20 mm of depth a bony structure is encountered, withdraw the needle and reposition the entry another 5 mm caudal. The bony structure is the dorsal portion of the maxillary tuber.
- At roughly 50- to 60-mm depth, a definitive “pop” will be encountered with the needle and the resistance to advancement of the needle will be much less after the “pop.” The increased resistance accounting for the “pop” is the thick fascial plane dividing the masseter muscle from the extraperiorbital fat body.
- A loss-of-resistance syringe filled will air can be used to help differentiate between muscle tissue and fat tissue if the practitioner has doubts about the location of the dividing fascial plane. Air passes easier into fat than into muscle; therefore, a small amount of air can be used to determine resistance within the masseter and loss of resistance within the fat body.
- Once the needle has passed through this fascial plane, it is advanced an additional 5 mm into the extraperiorbital fat body.
- When the needle is appropriately positioned, 10 to 20 mL of anesthetic material can be slowly injected into the site. Remember to aspirate before injection.
- Remove the needle and apply pressure to the entry point for 15 to 30 seconds.

Infraorbital Nerve Block

The infraorbital nerve block\textsuperscript{3,6} anesthetizes the infraorbital nerve as it exits the infraorbital foramen. This will provide analgesia to the ipsilateral canine, incisors, and the skin, lip, nostril, and face up to the level of the infraorbital foramen. It is debatable if this will provide any analgesia to the second and third premolar. If the block is placed into the infraorbital canal, the premolars and rostral molar teeth may also obtain adequate analgesia. The infraorbital foramen is located dorsal and rostral to the point of the facial crest on the maxillary bone.

- Locate the position of the infraorbital foramen at the intersection of two lines.

  (1) Draw an imaginary line from the lateral canthus of the eye down the maxilla parallel to the facial crest.

  (2) Draw a second imaginary line 1 to 2 cm rostral to the point of the facial crest that is perpendicular to the facial crest.

  (3) The infraorbital foramen will be located beneath the ventral margin of the levator labii superioris muscle. Move this muscle dorsally to palpate the foramen ridge clearly.

- Clip, clean, and prep the site.
- Use a 3.5-inch, 22-gauge Tuohy needle for this block.
- Introduce the needle as flush to the maxillary bone as possible roughly 0.5 cm rostral to the foramen. Keep the angle of the needle parallel to the facial crest to avoid hitting the walls of the infraorbital canal.
- The needle can be advanced to the desired length up to 2.5 inches to achieve necessary analgesia. It is the author’s opinion that the needle should only be advanced 1 cm to avoid damage to the neurovascular bundle in the canal. If more caudal analgesia is necessary, the author recommends using the maxillary nerve block described by Dr. Staszyk.
- Once the needle is in the canal, digital pressure is applied to prevent outflow of the local anesthetic.
- The syringe is aspirated to ensure no direct placement in a vessel.
- Slowly inject 5 to 10 mL of local anesthetic into the canal. Avoid placing too much fluid
(>10 mL) in the canal because this may result in nerve damage due to high pressure.

- Slowly remove the needle and apply pressure to the site for roughly 1 minute.

This block is not well tolerated by the horse because of the almost unavoidable direct needle contact with the nerve.

3. Discussion

The choice of local anesthetic agent depends mostly on the duration of action the practitioner hopes to achieve. Because the use of narcotics is less desirable in the horse due to decreased gastric motility and the risk of colic, it is desirable to use a local anesthetic that will work for as long as possible to help provide postoperative analgesia. Local nerve blocks should be performed before performing surgery or extracting teeth, and, depending on the length of surgery, providing a second block before recovery can be beneficial after surgery. The following is a passage from *Lumb and Jones’ Veterinary Anesthesia and Analgesia*, “The mechanism of action is the same for all local anesthetics, that is, interruption of the propagation of impulses along peripheral nerves preventing noxious stimulation from being transferred and causing complete analgesia in tissues. These agents bind to sodium channels and prevent depolarization. When used operatively, they can decrease the response to painful surgical stimuli and decrease the amount of general anesthesia needed to maintain a desirable plane of anesthesia. If a local block is being performed not only to decrease surgical stimulation but also to assist with recovery and to provide continued analgesia during the postoperative period, bupivacaine should be used based on its extended time of action (6 to 8 hours).” The author has found bupivacaine to be an excellent local anesthetic for maxillofacial and dental procedures. Though its onset of action is longer than other local anesthetics (10 to 20 minutes), the lag time can be minimized by placing the block before any surgical preparation and adding 3 to 5 mL of lidocaine to the syringe. In addition, research is starting to reveal the benefit of combining an alpha-2 agonist with local anesthetics to increase the duration of the block. Combining dexmedetomidine with the local anesthetic could potentially double its duration of action, though no clinical trials in horses have been performed yet to prove the theory.

The risk of complications that can arise during nerve blocks is significant. Needle-on-nerve contact, as in the case of the mental nerve block, can result in an explosive response from the horse no matter how sedate. Practitioners should be prepared to deal with this type of response and keep themselves, their staff, and laymen in safe positions. The remainder of the discussion will focus on additional complications encountered with performing regional nerve blocks. Reasoning for introducing the Tuohy needle and nerve stimulation for the inferior alveolar nerve block will also be discussed. Local analgesia will be briefly reviewed as it is a key in properly anesthetizing regions of the oral cavity for specific oral surgical procedures.

References and Footnotes


Marcaine, Hospira, Lake Forest, IL 60045.

Lidocaine hydrochloride 2%, Hospira, Lake Forest, IL 60045.

Tuohy Epidural Needle, GPC Medical Limited, New Delhi, India.

Loss-of-Resistance Syringe, BBraun, Bethlehem, PA 18018.

Stimuplex DIG RC, BBraun, Bethlehem, PA 18018 (less expensive models available from other companies).

Stimuplex A insulated needles with 30 degree bevel, 20 gauge × 6 inches, BBraun, Bethlehem, PA 18018.

Dexmedetomidine 100 µg/mL, Macleods Pharma, India.