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Potential Pitfalls of Select Perineural Nerve Blocks

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Take Home Message—Perineural anesthesia has been a mainstay of lameness diagnosis for decades. However, the more we learn about some of these techniques the more we may need to temper the interpretation of these blocks. Diffusion of anesthetic, depositing anesthetic into synovial structures, and variable regions of desensitization have all been found to occur with some perineural blocks. Knowing these potential risks is necessary to accurately interpret the results of perineural anesthesia.

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I. ANESTHETICS

The local anesthetics most frequently used are 2% lidocaine hydrochloride (xylocaine hydrochloride) and 2% mepivacaine hydrochloride (carbocaine). These solutions are potent and rapidly effective, but can be locally irritating. Since mepivacaine is longer lasting and less irritating than lidocaine it is used most frequently. Lidocaine is thought to last only 60 minutes with the maximum effect at 15 minutes. However, a recent study using force plate evaluations indicated that mepivacaine was also fully effective from 15 - 60 minutes after a palmar digital (PD) nerve block was performed. The effect of the block began to subside between 1-2 hours but gait characteristics persisted beyond 2 hours. This is very important to remember when performing multiple nerve blocks on any given horse over a prolonged period of time. Bupivacaine hydrochloride (marcaine) may be used if the goal is to provide a longer duration of analgesia (4-6 hours), such as following surgery. Combining local anesthetic with epinephrine may also prolong the duration of anesthesia (up to 6 hours). However, swelling is usually more severe and the potential to cause skin necrosis over the site of injection is a serious concern.

II. SKIN PREPARATION

Most perineural blocks do not require an antiseptic skin preparation. The only skin preparation necessary for most sites of regional anesthesia is scrubbing or wiping the area with 4 x 4 gauzes soaked in alcohol until clean. Exceptions to this include the low palmar and plantar (4-point) block, the high palmar (4-point) block, the lateral palmar block and the high plantar (4-point and dorsal branch lateral plantar nerve) blocks. These sites have the potential to enter synovial cavities and therefore an antiseptic skin preparation should be performed.

III. RESTRAINT

The type of physical restraint depends on the disposition of the horse and the skill of the veterinarian. Most blocks are performed out of the stocks, but in selected instances stocks can be helpful. When performing local anesthesia, the horse should be haltered and restrained by an attendant who is standing on the same side of the horse. Most perineural blocks of the distal limb can be performed with minimal restraint depending on the nature of the horse. However, twitch restraint is often very helpful especially with the more proximal blocks. When using local anesthesia in the hind limb, the practitioner should always be in a position so that minimal bodily harm will result if rapid movement occurs.

IV. ASSESSMENT OF RESPONSE TO BLOCKS

Skin sensation is often used to assess the success of perineural blocks in the distal limb. This can be performed with a blunt object such as a pen, hemostat, or needle cap. These objects should not be jabbed into the skin, but applied gently at first with a gradual increase in pressure. Most horses are receptive to this technique, and will quietly respond if the nerves are not totally desensitized. However, some horses are difficult to read and skin sensation may persist even with an effective block. This is especially true for blocks performed more proximally in the limb (above the fetlock). Other manipulative tests that previously caused pain (such as hoof tester examination, deep palpation, and flexion) may need to be repeated to accurately determine if the block worked. In general, the higher the perineural block, the less accurate skin sensation can be to evaluate the success of the block. This is because deeper tissues are targeted which may not desensitize the skin surface. For instance, the lateral palmar nerve block and the deep branch of the lateral plantar nerve (DBLPN) block target the proximal suspensory region and do not necessarily block the overlying skin.

1. Palmar Digital (PD) Block

Quantity of Local Anesthetic: 1-1.5 mL

Needle size: 5/8”, 25 gauge

Injection Technique: The injection is done with the foot elevated in most cases. Some prefer to stand with their back...
toward the animal's hind end while holding the hoof between their knees. Others prefer holding the pastern with one hand while injecting with the other, and assume either a lateral or frontal position in relation to the limb. The PD nerves should be anesthetized just distal to or at the proximal border of the collateral cartilages. Blocking the nerves at this location will reduce the risk of anesthetizing the dorsal branches of the PD nerve. If the PD block is performed 2-3 cm above the collateral cartilages, the pastern joint can be desensitized in addition to the foot. The PD nerve and neurovascular bundle are easily palpable at the level of the collateral cartilage just abaxial to the deep digital flexor tendon (DDFT). A 25-gauge, 5/8” needle is inserted in a proximal to distal direction over the nerve, and local anesthetic is injected perineurally.

**Pitfalls:**
1. Blocking too high in the pastern
2. Using too much anesthetic – diffusion decreases specificity
3. Assuming that the PD block only desensitizes the palmar aspect of the foot

**2. Basissemoidal (High PD) Block**

**Quantity of Local Anesthetic:** 1.5-2 mL

**Needle size:** 5/8”, 25 gauge

**Injection Technique:** This block is performed similarly to the PD block only it is more proximal on the limb at the base of the proximal sesamoid bones (often referred to as a high PD block). The PD nerves can be palpated at this location and 1.5 – 2.0 mL of anesthetic is deposited directly over the nerves. The basissemoidal block will desensitize the dorsal branch and the PD nerve at a more proximal location in the pastern. This block will desensitize the palmar/plantar soft tissue structures of the pastern, the proximal interphalangeal (PIP) joint, and all structures of the foot. Because it is performed at the base of the sesamoid bones, it is possible but unlikely to desensitize any of the fetlock joint.

**Pitfalls:**
1. Using too much anesthetic – diffusion decreases specificity
2. Difficulty in palpating the PD nerves - they are not as superficial in this location compared to more distally

**3. Low Palmar/Plantar or Four-Point Block**

**Quantity of Local Anesthetic:** 2-3 mLs/site

**Needle size:** 5/8 or 1”, 22-25 gauge

**Injection Technique:** The low palmar or low volar block is often referred to as the low 4-point block because both the palmar and palmar metacarpal/metatarsal nerves are anesthetized at the distal aspect of the metacarpus/metatarsus. The lateral and medial palmar/plantar nerves lie between the suspensory ligament and the deep digital flexor tendon. These nerves are relatively deep but can be reached in most cases with a 5/8” 25-gauge needle (a 1”, 22-gauge needle may also be used), after which 2-3 mL of local anesthetic is deposited. It is best to perform these blocks 1 cm proximal to the distal ends of the splint bones to avoid injection into the digital flexor tendon sheath. The medial and lateral palmar metacarpal/metatarsal nerves innervate the deep structures of the fetlock and course parallel and axial to the second and fourth metacarpal/metatarsal bones. A 5/8” 25-gauge needle or a 1”, 22-gauge needle is used to inject 2-3 mL of anesthetic around these nerves as they emerge distal to the ends of the second and fourth metacarpal/metatarsal bones. However, because the palmar/plantar pouches of the fetlock joint can be inadvertently entered at this location, these nerves can also be anesthetized more proximally.

**Pitfalls:**
1. Inadvertent injection of the fetlock joint or digital flexor tendon sheath
2. Proximal diffusion of anesthetic that may desensitize the body of the suspensory or other more proximal structures
3. Difficulty in assessing whether the palmar metacarpal/metatarsal nerves are desensitized

**4. High Palmar or High Four-Point Block**

**Quantity of Local Anesthetic:** 3-4 mLs/site

**Needle size:** 5/8”, 25 gauge and 1.5”, 22 gauge

**Injection Technique:** The high 4-point or high palmar block is analogous to the low 4-point block because the same four nerves are anesthetized in the proximal aspect of the metacarpus just below the carpometacarpal joint. However, the high palmar block is more difficult to perform because the soft tissue structures are more closely confined to the metacarpus and the palmar metacarpal nerves are located deeper within the axial borders of the second and fourth metacarpal bones. The proximal palmar nerves are anesthetized in the groove between the suspensory ligament and the DDFT. A 5/8”, 25-gauge needle is inserted through the heavy fascia and 3-4 mL of anesthetic is deposited. Blocking just the palmar nerves will not completely desensitize the deep structures of the metacarpus. The palmar metacarpal nerves run parallel and axial to the second and fourth metacarpal bones and each can be desensitized by infiltration of 3-4 mL of local anesthetic along the axial surfaces of the metacarpal bones. A 1.5 inch needle is directed toward the palmar metacarpus along the axial borders of the splint bones until bone is contacted. The needle is withdrawn slightly and aspirated to be certain that the needle is not within the carpometacarpal joint before the anesthetic is deposited. Blocking the palmar metacarpal nerves is usually performed with the limb held while anesthesia of the palmar nerves is often easier with the limb weight-bearing. These four nerve blocks will effectively desensitize the deep structures of the metacarpus and the origin of the suspensory ligament.

**Pitfalls:**
1. Inadvertent injection of the distal outpouchings of the carpometacarpal joint (and therefore the

5. Lateral Palmar Block (Lateral Approach)

**Injection Technique:** At the proximal end of the fourth metacarpus, the lateral palmar nerve gives off its deep branch that branches to the origin of the suspensory ligament and divides into the lateral and medial palmar metacarpal nerves. The lateral palmar nerve can be anesthetized just below the accessory carpal bone (lateral approach) or axial to the accessory carpal bone in a more proximal location (medial approach). This block desensitizes the origin of the suspensory ligament and other deep structures of the palmar metacarpus. With the lateral approach, the nerve is anesthetized with 3-5 mL of anesthetic administered through a 1”, 22-gauge needle midway between the distal border of the accessory carpal bone and the proximal end of the fourth metacarpal bone. The needle is directed in a palmarolateral-to-dorsomedial direction and must penetrate the 2-3 mm thickness of the flexor retinaculum of the carpus. This block may be performed with the horse standing or with the carpus slightly flexed.

**Pitfalls:**
1. Inadvertent injection into the carpal sheath or middle carpal joint
2. Difficulty in injecting - needle has not penetrated the fascia below accessory carpal bone
3. Difficulty in assessing success of the block. Best done by palpating the absence of pain in the suspensory ligament

6. Lateral Palmar Block (Medial Approach)

**Injection Technique:** With the medial approach, the lateral palmar nerve is blocked medial to the accessory carpal bone. This medial technique is thought to reduce the risk of inadvertent injection into the carpal sheath. The site of injection is a longitudinal groove in the fascia palpable over the medial aspect of the accessory carpal bone, palmar to the insertion of the flexor retinaculum that forms the palmaromedial aspect of the carpal canal. With the limb weight-bearing, a 25-gauge 5/8” or 22-gauge 1” needle is inserted into the distal third of the groove in a mediolateral direction perpendicular to the limb and 2-4 mL of anesthetic injected.

**Pitfalls:**
1. Difficulty in injecting – needle in fascia or up against the medial aspect of accessory carpal bone
2. Difficulty in assessing success of the block. Best done by palpating the absence of pain in the suspensory ligament
3. May cause desensitization of entire palmar carpus

7. High Plantar (Sub-Tarsal) Blocks

**Injection Technique:** The high plantar block anesthetizes the medial and lateral plantar metatarsal nerves just below the tarsus analogous to the high palmar block of the forelimb. The plantar metatarsal nerves can be blocked using a 1.5”, 20-gauge needle inserted axial to the second and fourth metatarsal bones and directed dorsally toward the plantar aspect of the metatarsus. Three to 5 mLs of local anesthetic is injected into the region of the origin of the suspensory ligament. Inadvertent administration of anesthetic into the tarsal sheath or the tarsometatarsal joint can occur when performing anesthesia of the plantar metatarsal nerves. The medial and lateral plantar nerves can be anesthetized by placing 3-5 mL of anesthetic through the heavy fascia adjacent to the dorsal surface of the DDFT in the proximal metatarsal region using a 25-gauge, 5/8” needle. The high plantar block will effectively desensitize the second and fourth metatarsal bones, the suspensory ligament and its origin, and the flexor tendons in the metatarsal region. One study concluded that the high plantar nerve block cannot be used to differentiate between flexor tendon and suspensory ligament lesions as horses with both conditions improved after the block.

**Pitfalls:**
1. Inadvertent injection into the tarsal sheath or tarsometatarsal joint
2. Difficulty in performing the blocks because of the anatomic configuration of the splint bones and the resentment of the horse
3. Difficulty in assessing the success of the block

8. Deep Branch of the Lateral Plantar Nerve (DBLPN) Block

**Injection Technique:** The deep branch of the lateral plantar nerve (DBLPN) innervates the proximal suspensory in the hind limb and is removed to treat some horses with hind limb proximal suspensory desmitis. Two different techniques have been described. With the first approach, a 23-gauge 1-inch (2.5 cm) needle is inserted 15 mm distal to the head of the fourth metatarsus and directed perpendicular to the skin between the
axial border of fourth metatarsus and the SDFT to a depth of approximately 25 mm. Alternatively, an 18-20- (stated as 20-23 above) gauge 1.5 inch (3.8 cm) needle is inserted 20 mm distal and plantar to the head of the fourth metatarsus and directed proximodorsally and axial to the bone. The needle is advanced to a depth of 1-2 cm and 5-7 mL of anesthetic is deposited. It is usually best to hold the limb to perform either of these techniques. The single injection technique for the DBLPN is thought to provide a reliable method for perineural analgesia of the deep branch of the lateral plantar nerve (and therefore the proximal suspensory region) with minimal risk of inadvertently desensitizing other tarsal structures.

Pitfalls:
1. Difficulty in injecting – needle in origin of suspensory or overlying fascia. Most likely the needle is too deep
2. Difficulty in assessing success of the block – best done by palpating absence of pain in the suspensory ligament
3. Inadvertent desensitization of distal tarsal joints
4. Unpredictable diffusion of anesthetic

SUGGESTED READING