

Peripheral Nerve Block Techniques

Epidural, Brachial Plexus, Forefoot, & Stifle

Janet A. Welch, DVM, Diplomate ACVS, Auburn University

OVERVIEW

Effective peripheral nerve blocks provide excellent anesthesia and analgesia.

Local anesthetics inhibit propagation of painful impulses along peripheral nerves by blocking the rapid influx of sodium that is required to initiate an action potential. Local anesthetics can reduce the amount of inhalation anesthetic needed to perform a procedure and can mitigate the "wind-up" response of the CNS to noxious stimuli. The duration of effect varies with the type of local anesthetic. Shorter-acting agents provide 1 hour of anesthesia, and longer-acting agents provide up to 6 hours. The duration of analgesia, or reduced sensation of pain, may be longer. Opioid analgesics, such as morphine, can be administered locally along with lidocaine or bupivacaine to augment the duration of analgesia. In addition to the CNS, opioid receptors are present in the periphery if tissues are inflamed.

Local anesthetic agents can be administered as topical, infiltrative, intraarticular or peripheral nerve blocks. Topical administration involves deposition of the agent on intact mucous membranes or skin. Infiltrative anesthesia involves injection into the subcutaneous tissues around an incision or wound or at the site of catheter placement.

Intraarticular blocks target sensory nerve endings in the synovium. Peripheral nerve blocks are performed by injecting local anesthetic in the immediate vicinity of a peripheral nerve or nerve plexus. Common peripheral nerve blocks in small animal patients include epidural, brachial plexus, dental, and forefoot blocks. Intraarticular stifle blocks are also used. This article presents all but the dental block, which will be covered in an article in a future issue. Local anesthetic blocks can be given to heavily sedated or anesthetized animals. Greatest efficacy is obtained when local blocks are given before surgery is begun.

CNS=central nervous system

LOCAL ANESTHETIC AGENTS

The local anesthetic agents most commonly used in veterinary practice are lidocaine and bupivacaine. Lidocaine has a rapid onset of action and duration of approximately 1 to 2 hours. It is available in 1% or 2% solution (10 or 20 mg/ml). In awake or sedated animals, warming the solution to body temperature before administering can reduce the stinging sensation associated with lidocaine administration. Local anesthetics do not need to be refrigerated. Bupivacaine has a slower onset time (peak effect occurs within 30 minutes) and duration of 4 to 6 hours. It is available in 0.25% or 0.5% solution (2.5 or 5 mg/ml). Ropivacaine is relatively new. It is similar in duration to bupivacaine but induces less motor blockade and has reduced potential for cardiotoxicity with overdosage. With all local anesthetics, the priority of nerve fibers paralyzed depends on the amount of myelination and size: The smaller sensory and autonomic fibers are anesthetized first, followed by larger motor and proprioceptive axons.

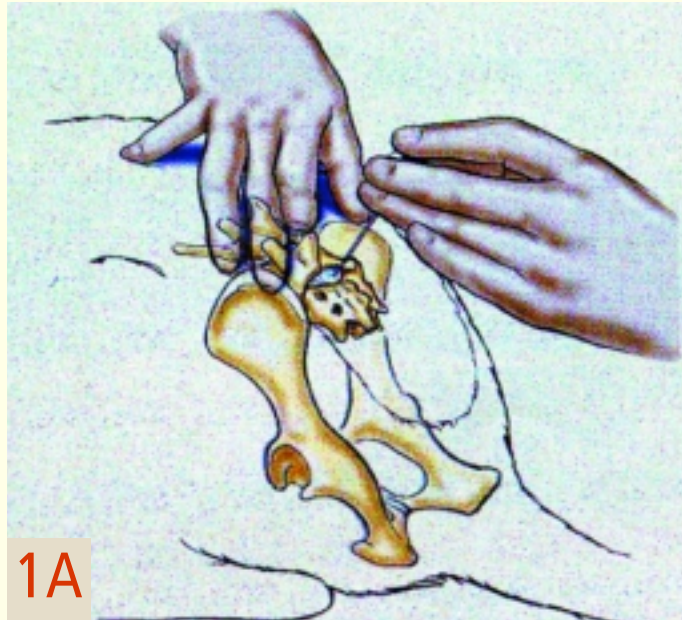
Systemic toxicity of these agents is most likely to occur if the drug is inadvertently administered intravenously. Toxic signs are manifested in the CNS and cardiac muscle. Initial CNS signs are stimulation, restlessness, and seizures, which are followed by depression. The myocardial effect is decreased excitability, conduction rate, and contractility. Hypotension can also occur. Toxic signs are not seen when dosage recommendations are followed. For dogs, the intravenous convulsant dose of lidocaine is 20.8 ± 4 mg/kg and that of bupivacaine is 4.31 ± 0.36 mg/kg. When used for most regional nerve blocks, the maximum dose of bupivacaine is 2 mg/kg and lidocaine is 2 to 4 mg/kg. When lidocaine and bupivacaine are used together, the maximum dose is 1.5 mg/kg of each drug. The dose is lower for epidural administration—1 ml/4.5 kg (1 ml/10 lb)—for either lidocaine or bupivacaine.

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How to Perform the Blocks: Epidural, Brachial Plexus, Forefoot,

EPIDURAL BLOCK

An epidural analgesic should be considered for animals undergoing orthopedic hindlimb surgery, perineal or anal surgery, or mid- to lower abdominal surgery. Epidural injections of local anesthetics can provide anesthesia of the caudal half of the body or can be used to provide analgesia extending up to the forelimbs. Contraindications include lumbosacral trauma, pyoderma over the lumbosacral space, or coagulopathy. Urine retention is a potential concern with epidural morphine. In dogs and cats, the epidural block is injected at the L7–S1 space. The spinal cord usually ends at the last lumbar vertebra (L7) in dogs, whereas the spinal cord ends at the first sacral vertebra in cats. Position the patient in sternal (**Figure 1A**) or lateral (**Figure 1B**) recumbency. Sternal positioning facilitates the hanging-drop technique, and lateral recumbency is useful for animals with fractures. If lateral recumbency is chosen, the limb on which the procedure is to be done is positioned down. Gloves are worn for the sterile preparation, which extends from the lower lumbar region to the tail.



WHAT YOU WILL NEED

- Spinal needle

The length and size of the spinal needle depends on the size of the patient:

< 5 kg: 1-inch × 25-g

5–10 kg: 1.5-inch × 22-g

11–45 kg: 2.5-inch × 22-g

> 45 kg: 3.5-inch × 22-g

- Sterile syringes

1. Palpate the lumbosacral space with one hand on the cranial edge of the iliac wings and the index finger locating the L7–S1 space. The dorsal spinous process of L7 is located at the midpoint between the cranial edges of the iliac wings. Palpate the L7–S1 space from a cranial and a caudal direction to confirm its location. In overweight dogs, increased pressure is needed to locate the space. If the patient is in lateral recumbency, it is helpful for an assistant to press against the lower abdomen.
2. Insert a spinal needle into the L7–S1 space. Direct the bevel of the needle cranially, and hold it perpendicular to the skin. Pass the needle through the skin and connective tissues to reach the epidural space. Passage through the ligamentum flavum can often be discerned by a “pop” or sudden loss of resistance. If this is the case, the needle is advanced no further, so that its tip remains just beneath the ligament. If there is not a distinct “pop,” advance the needle to the floor of the vertebral canal, and then move it back very slightly (~ 1 mm). This places the needle in the epidural space. (The author has used this technique exclusively in dogs with no evidence of damage to the cauda equina.) Remove the stylet. If CSF is seen in the spinal needle, the needle is in the subarachnoid versus the epidural space. The solution to be injected can be decreased by 50%, or the spinal needle can be replaced. In cats, the injection is assumed to be in the subarachnoid space and a reduced dose (50%) is always used.
3. Inject a test solution of 0.5 to 1 ml of sterile saline, or immediately inject the analgesic agent. There should be minimal resistance. If resistance is felt or if blood is seen in the hub, withdraw the needle and repeat the procedure. Inject the solution slowly over 1 minute.
4. *Hanging-drop technique:* Place patient in sternal position. Find L7–S1 space as described above. Insert needle through skin; then remove stylet. Place stylet on a sterile field (such as the sterile glove packaging). Instill a few drops of anesthetic solution into hub of spinal needle. Slowly advance needle. Once it has penetrated the ligamentum flavum, fluid will typically flow

CSF = cerebrospinal fluid

& Intraarticular Stifle

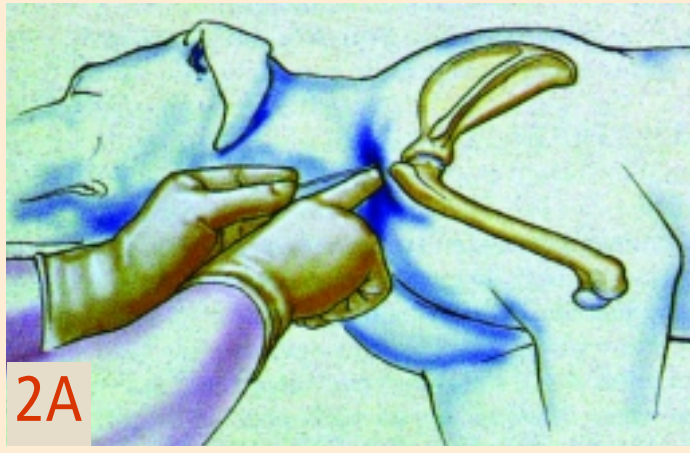


from hub into the epidural space. The remaining solution is then slowly injected into the epidural space.

Drugs and Dosages

- **Bupivacaine 0.5%.** Dose: 1 ml/4.5 kg to a maximum of 6 ml (up to 8 ml in giant-sized dogs). In cats, reduce volume by 50%.
- **Preservative-free morphine (1.0 mg/ml).** Dose: 0.2 mg/kg (equivalent to 1 ml/4.5 kg). In cats, reduce volume by 50%. If spinal fluid is encountered, decrease solution to be injected by 50% or re-place the needle.
- **Morphine/bupivacaine epidural combination.** Doses are as listed above. Bupivacaine is kept to a maximum of 6 ml. Morphine is calculated according to weight. Use two separate syringes, and give the morphine first to avoid excessive cranial advancement of bupivacaine with risk for paralyzing the muscles of respiration. This combination has been shown to provide longer-lasting analgesia than morphine alone.

Lower dosages are required in obese animals. The spinal cord is the same size as it would be in the animal's lean state.



BRACHIAL PLEXUS BLOCK

A brachial plexus block can provide analgesia from the elbow to the foot. The site of injection is at the level of the greater tubercle (Figures 2A and 2B). The area is aseptically prepared and sterile gloves are worn.

1. Insert a spinal needle medial to the greater tubercle and as close to the rib cage as possible without penetrating the thoracic inlet. Hold the spinal needle parallel to the vertebral column. Extend the needle to the level of the first intercostal space. Remove the stylet and aspirate. If blood appears in the needle, remove and re-place it.
2. Inject local anesthetic while withdrawing the needle 75% of the distance inserted.
3. While staying parallel to the spine, reinsert the needle two more times, approximately 30 degrees dorsal and 30 degrees ventral.
4. Aspirate for blood after each insertion; then inject while withdrawing.

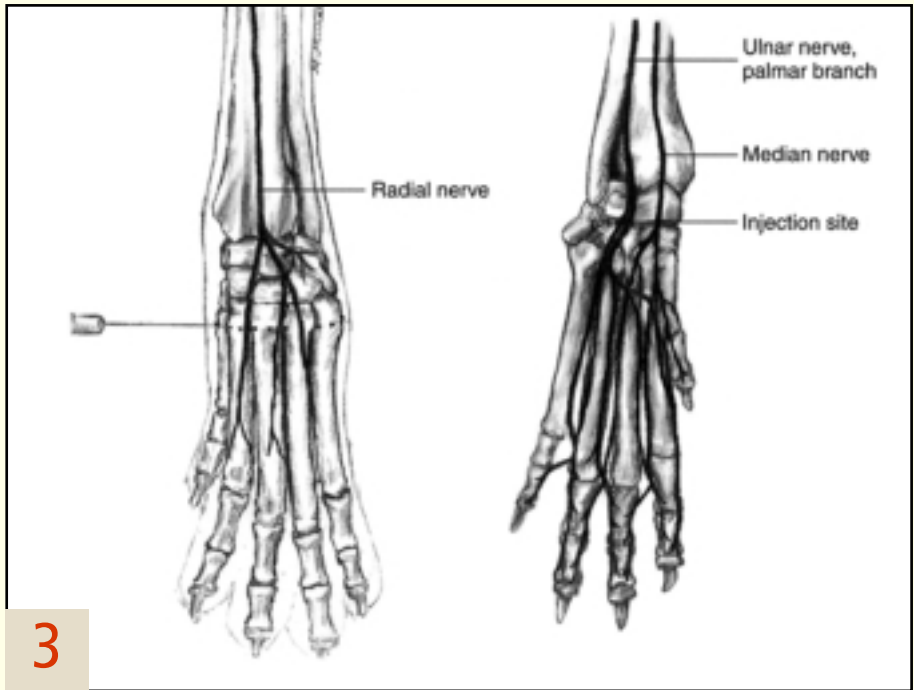
Drugs and Dosages (Without Epinephrine)

Bupivacaine 0.5%: 2 mg/kg
Lidocaine 2%: 2 to 4 mg/kg

WHAT YOU WILL NEED

- **Spinal needles**
 If < 5 kg, use a 25-g needle. For all other weights, use a 22-g needle and choose a length that permits injection at the level of the first intercostal space.
- **Sterile syringe**
- **Nerve stimulators, optional** (see Reference 1)

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FOREFOOT BLOCK
Dorsal and Palmar Aspects

The forefoot block is useful for declaws or for any surgery or injury distal to the carpus.

WHAT YOU WILL NEED

- 25-g hypodermic needle

1. Insert the needle just distal to the carpus at the proximal–medial aspect of the metacarpus.
2. Aspirate and inject a small amount of local anesthetic to produce a small bleb.
3. Insert and repeat injections, continuing across the dorsum of the foot to the lateral aspect.
4. On the palmar aspect of the foot, find the depression just distal to the accessory carpal pad.
5. Aspirate and inject a small amount of local

anesthetic, ensuring a continuous infiltration from the medial to lateral aspect of the paw.

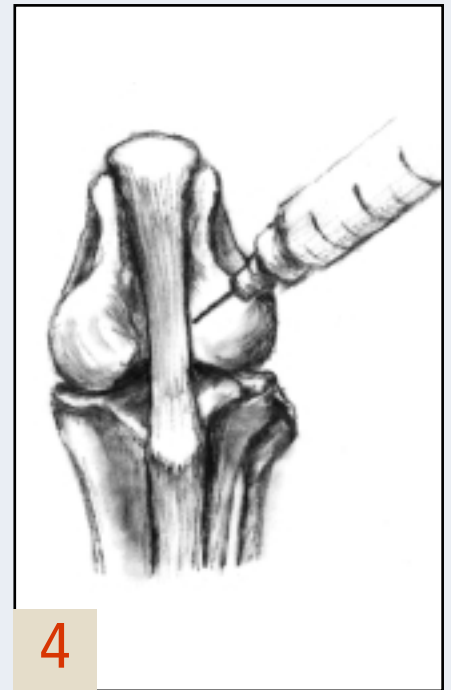
Drugs and Dosages

A combination of lidocaine 2% (1.5 mg/kg) and bupivacaine 0.5% (1.5 mg/kg) for dogs and cats. The total dose is split among all areas to be injected. This dose may be diluted to obtain additional volume.

PROCEDURE PEARL

Greatest efficacy is obtained when local blocks are given prior to the onset of surgery.

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INTRAARTICULAR STIFLE BLOCK

This intraarticular block may be used to provide analgesia for arthrotomy or arthroscopy procedures of the stifle joint. The analgesic solution can be administered immediately after intubation and before complete surgical preparation of the limb.

WHAT YOU WILL NEED

- 22-g 1- to 1.5-inch needle

1. Aseptically prepare the stifle joint.
2. Flex the stifle, and insert the needle just lateral to the patellar tendon. Alternatively, the needle can be placed through the patella tendon.
3. Aspirate to ensure that joint fluid is present, and inject.

Drugs and Dosages

Bupivacaine 0.5%: 1 to 2 mg/kg
Morphine 0.1 mg/kg: Can be injected after surgery to provide analgesia but not anesthesia. ■

See Aids & Resources, back page, for references, contacts, and appendices.