Peer Reviewed

Alonso Guedes, DVM, MS, PhD, Diplomate ACVA
University of California–Davis

Epidural Analgesia & Anesthesia

Administration of drugs into the epidural space was first used more than 100 years ago when cocaine was administered epidurally to humans and dogs. With this route of administration, the drug is deposited close to the site of action, maximizing binding to specific receptors and reducing dose-related side effects. Dose requirement of general anesthetics may be reduced, resulting in better systemic homeostasis, and the analgesic effects may last well into the postoperative period.

GENERAL CONSIDERATIONS

Epidural administration involves injecting a drug or drug combination into the epidural space—the space between the vertebral canal and dura mater. With ***spinal administration***, the drug is injected into the subarachnoid space, mixing with cerebrospinal fluid.

The term ***epidural anesthesia*** describes the injection of a local anesthetic into the epidural space, whereas ***epidural analgesia*** refers to the epidural administration of analgesics. When used before surgery, epidural anesthesia or analgesia may reduce the inhalant anesthetic requirement. This is beneficial in all patients but even more so in debilitated and hemodynamically unstable patients. Preemptive analgesia is another important benefit.

RELEVANT ANATOMY

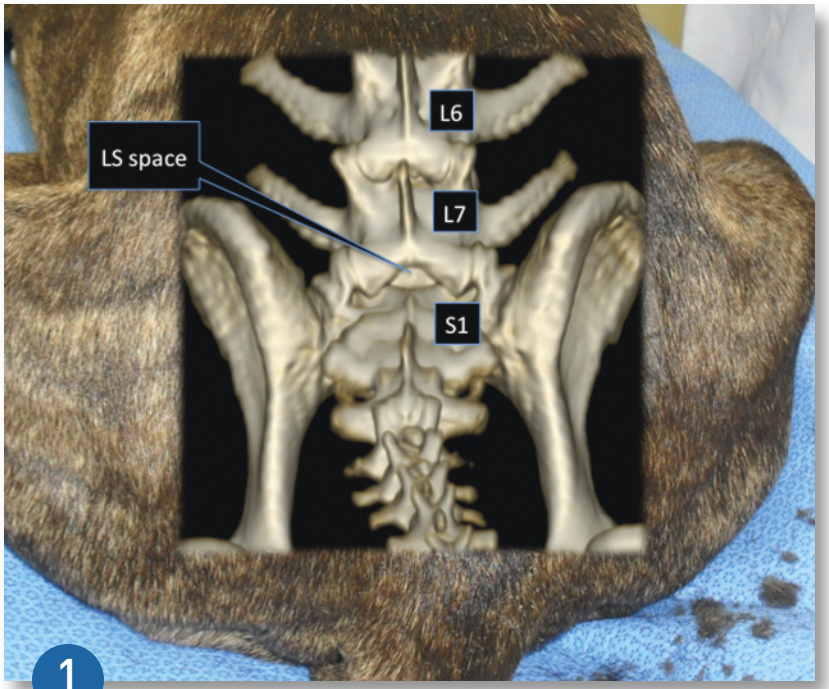
In dogs and cats, epidural procedures are usually performed at the lumbosacral space (**Figure 1**).

The spinal cord ends approximately at the level of the sixth and seventh lumbar intervertebral spaces (L6–L7) in medium- to large-breed dogs and at the level of the seventh lumbar and first sacral intervertebral spaces (L7–S1) in cats and small-breed dogs. Hence, cerebral spinal fluid may be encountered at the level of the lumbosacral space in cats and small-breed dogs.

The tissue planes, arrayed from superficial to deep, at the level of the lumbosacral space are:

AUTHOR INSIGHT

Epidural injections may be painful, so the procedure should be performed under general anesthesia or heavy sedation.



1 Relevant anatomy to perform epidural procedures

LS = lumbosacral

- Skin
- Subcutaneous tissue
- Supraspinous ligament
- Interspinous ligament
- Ligamentum flavum (yellow ligament)
- Epidural space.

If the spinal cord is present at that particular level, then following the epidural space are the dura mater, arachnoid, cerebrospinal fluid, pia mater, and spinal cord. The epidural space is not empty; it is filled with variable amounts of adipose and conjunctive tissues and contains blood vessels.

WHAT YOU WILL NEED

Required

- Clippers
- Alcohol and chlorhexidine or povidone-iodine scrubs
- Sterile gloves
- Spinal needle (Quincke needle; 22- or 20-gauge; 1.5–3.5 inches, depending on patient size)

Optional

- 3- or 5-mL glass syringe
- Sterile water or saline

STEP BY STEP EPIDURAL ANALGESIA & ANESTHESIA

STEP 1

Position the patient in sternal or lateral recumbency with the hindlimbs pulled forward. Sternal recumbency facilitates locating the lumbosacral space and using the hanging-drop technique; however, it may worsen fracture sites in the pelvis, femur, or tibia. Thus, lateral recumbency might be preferred in those cases.

AUTHOR INSIGHT **To avoid causing more damage to fracture sites while the patient is in sternal recumbency, position the patient close to the edge of the table with the affected leg hanging freely off the side. An assistant should stabilize the patient to prevent it from falling off the table.**

CONTINUES

STEP 2

Clip the hair over the lumbosacral space and prepare the area as you would for surgery.

AUTHOR INSIGHT

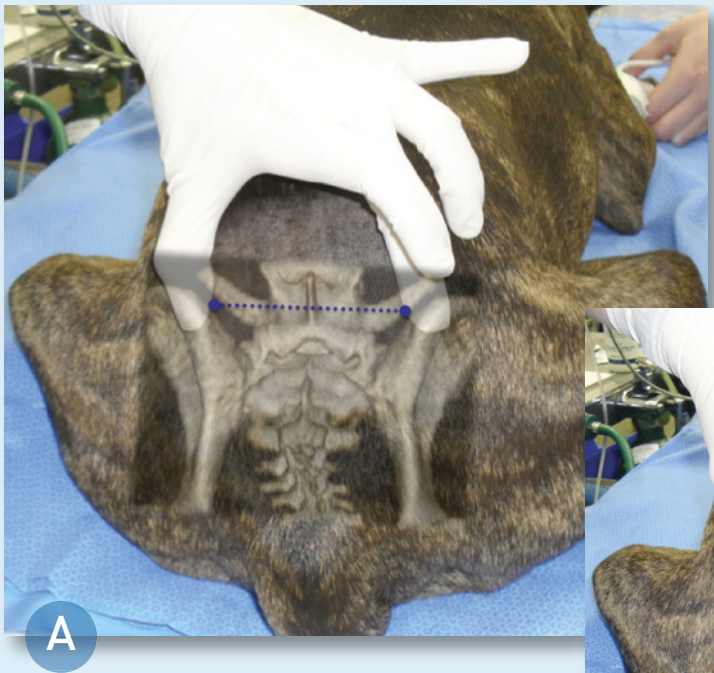
If there are signs of skin infection or inflammation over the lumbosacral area, do not perform the epidural procedure. Coagulation abnormalities and sepsis are additional contraindications for epidurals.

AUTHOR INSIGHT

The depression between L7 and S1 may not be obvious in overweight patients and in certain breeds, such as rottweilers. In these cases, insert the needle at midline just caudal from the imaginary line connecting the iliac prominences.

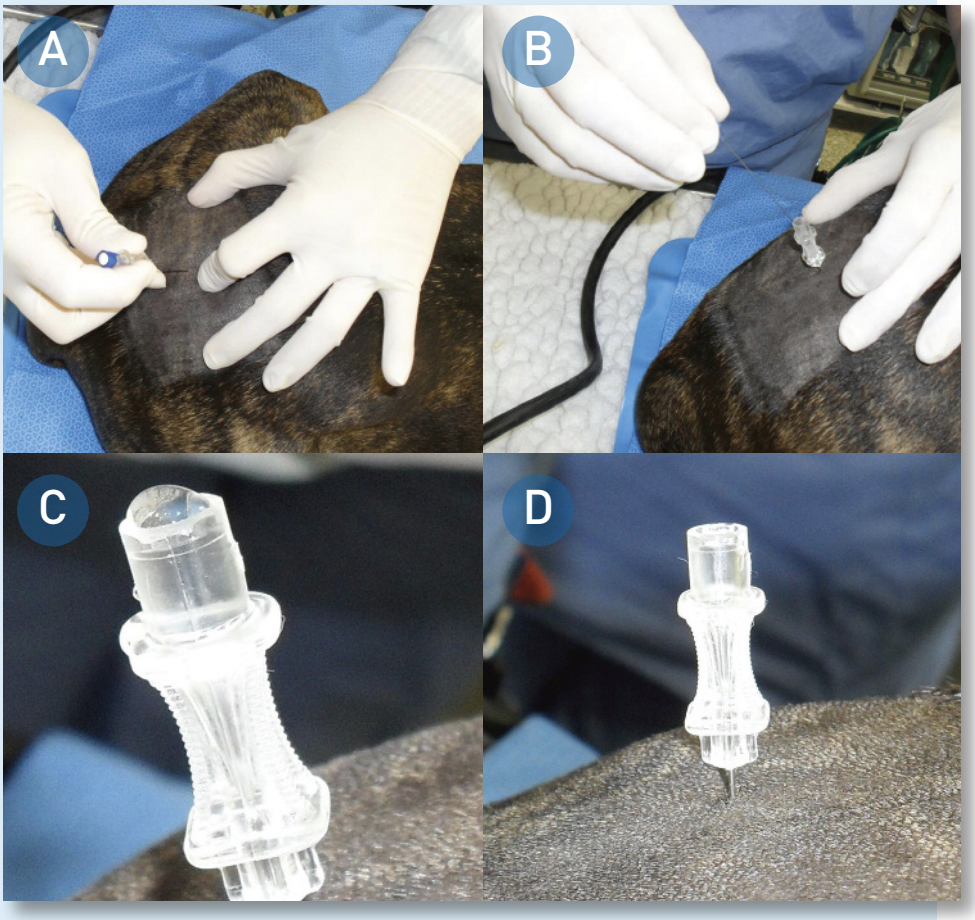
STEP 3

Wearing sterile gloves, palpate the iliac prominences (with thumb and middle finger) and draw an imaginary line between them. The lumbosacral space is located just caudal to this line (**A**). Then palpate the lumbosacral space with the index finger; this space can be felt as a depression just caudal to an imaginary line connecting the iliac prominences (**A and B**).



STEP 4

Insert the spinal needle perpendicular to the skin, directly on midline, and advance it until it passes into the subcutaneous tissue but before it punctures the ligamentum flavum (**A**). Remove the stylet (**B**) and fill the hub of the needle with preservative-free saline, sterile water, or the anesthetic solution; this is called the hanging-drop technique (**C**). For the hanging-drop technique, the stylet needs to be removed before entering the epidural space, but it must be in the needle while penetrating the skin to prevent accidental transplantation of dermal tissue into the epidural space. Carefully advance the needle; a "pop" may be felt when it passes through the ligamentum flavum and reaches the epidural space. The negative pressure in the epidural space draws the solution from the hub of the needle (positive hanging-drop sign), indicating proper epidural placement (**D**).



AUTHOR INSIGHT

In small patients in which the epidural space is small and little negative pressure is present, the solution may not be sucked in from the hub of the needle. Instead, only a slight depression on the meniscus may be noticed as the epidural space is entered. It is critical to slowly advance the needle while carefully observing the meniscus of the hanging drop. Occasionally, the needle may become blocked with tissue because it is advanced without the stylet; this results in a negative hanging-drop sign. In such cases, remove the needle and clear it by reintroducing the stylet. The lack-of-resistance test (see Step 6, page 66) can be used instead.

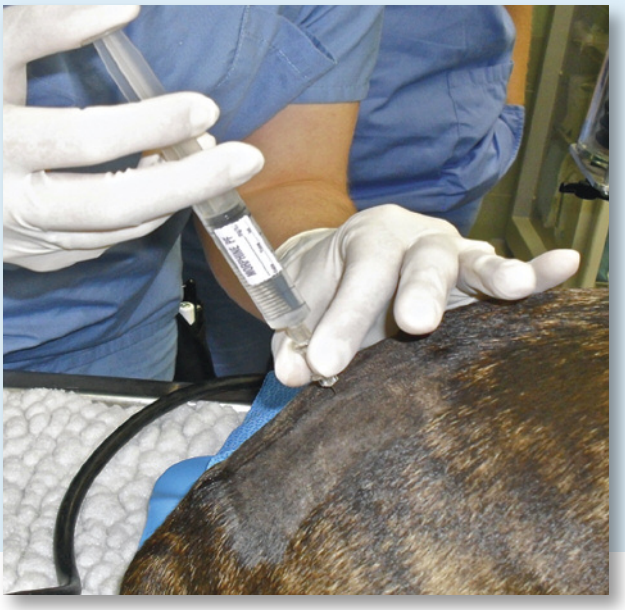
VIEW A HANDOUT on **Drug Protocols for Single Epidural Injections in Dogs & Cats** on page 68.

CONTINUES

STEP 5

Once the needle is in the epidural space, connect the syringe with the epidural drug solution, aspirate (to assure that the tip of the needle is not in a blood vessel or the subarachnoid space), and slowly inject the drug over a period of 60 seconds. Avoid rapid injections because they may result in a patchy block or cause trauma to epidural tissues.

If a blood vessel is punctured, remove the needle and repeat the technique using a new one. If cerebrospinal fluid is drawn back, remove the needle and repeat the technique, or administer 50% of the intended volume into the subarachnoid space (this is no longer epidural but spinal anesthesia/analgesia).



STEP 6

If the hanging-drop technique fails, the epidural space can be identified by the loss-of-resistance test by using a 3- or 5-mL glass syringe containing 1 mL of air. The advantage of using a glass syringe is that there is negligible resistance from the glass plunge in a glass barrel. Upon injection, resistance should not exist if the needle is in the epidural space. Alternatively, a 3-mL plastic syringe may be used, but the inherent resistance associated with the rubber plunge sliding against the plastic barrel must be considered.

AUTHOR INSIGHT

Observation of lack of compression of a small (0.5-mL) air bubble left in the syringe helps confirm that there is no resistance to injection and the needle is correctly positioned in the epidural space. Changes in respiratory pattern during the injection is another indication that the needle is correctly positioned.

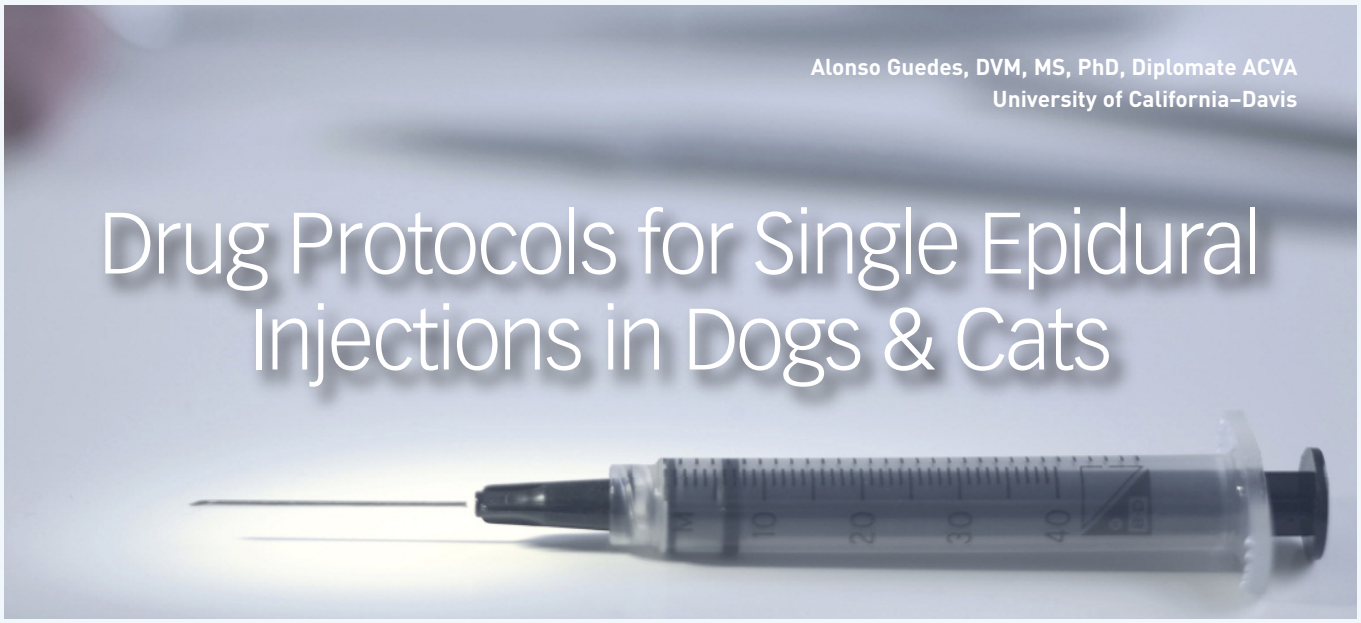
Acknowledgment

The author thanks Jason Peters and Richard Larson, Diagnostic Imaging Services, University of California–Davis Veterinary Medical Teaching Hospital, for their assistance with the photos and illustrations.

See Aids & Resources, back page, for references & suggested reading.

Alonso Guedes, DVM, MS, PhD, Diplomate ACVA
University of California–Davis

Drug Protocols for Single Epidural Injections in Dogs & Cats



Drug*	Dose (mg/kg)†	Onset (min)	Duration (h)	Species
Local anesthetics				
Lidocaine 2%	2–4	5	1–1.5	Dog, cat
Bupivacaine 0.5%	0.5–1	20–30	4–6	Dog, cat
Lidocaine 2% + bupivacaine 0.5%	2 + 0.5	5	4–6	Dog
Opioids				
Morphine‡	0.1–0.2	45–60	6–24	Dog, cat
Hydromorphone	0.1–0.2	20	6–8	Dog, cat
Oxymorphone	0.05–0.1	20–40	10–15	Dog, cat
Fentanyl	0.002–0.01	15–20	3–5	Dog
Fentanyl + morphine	0.002 + 0.1	15–20	6–24	Dog
Alpha-2 agonists				
Xylazine	0.02–0.2	30–45	2–3	Dog, cat
Medetomidine	0.002–0.015	30	2–4	Dog, cat
Combinations				
Bupivacaine 0.5% + morphine	0.5 + 0.1	20–30	18–24	Dog, cat
Lidocaine 2% + morphine	2 + 0.1	5	4–24	Dog, cat
Xylazine + morphine	0.02 + 0.1	30	6–10	Dog, cat
Medetomidine + morphine	0.005 + 0.1	20–30	10–16	Dog, cat

* Preservative-free drugs are preferred. Combinations of bupivacaine and morphine more consistently provide analgesia of long duration compared with single-drug administration. Local anesthetics affect autonomic, sensory, and motor neurons, whereas opioids affect only sensory neurons. Alpha-2 agonists, especially xylazine, may affect all neuron types to some degree and may produce systemic effects due to systemic absorption.

† The doses are calculated (in mg) and the volume adjusted to approximately 0.22 mL/kg by adding sterile water or physiologic saline if necessary. In large dogs, a maximum volume of 6 mL is adequate for procedures involving the pelvis, perineum, or hindlimbs.

‡ Morphine may cause urinary retention. Patient should have the bladder expressed at the end of surgery and should be observed for adequate voiding at least for the following 24 hours. Urinary retention may be managed with careful bladder expression, placement of a urinary catheter, or systemic administration of an opioid antagonist, such as naloxone.