

Anatomical Basis of Epidural Anaesthesia in Large and Small Animals

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Introduction

Epidural anaesthesia is a widely used regional anaesthetic technique in veterinary medicine. It refers to the administration of anesthetic or analgesic medication into the epidural space surrounding the spinal cord. This technique is used to provide pain relief and muscle relaxation for various procedure including surgeries, particularly those involving hindquarters, abdomen and thorax. The procedure involves injecting local anaesthetic to the epidural space, located outside dura mater surrounding spinal cord. While basic principle is same, the techniques, drug dosages, site of administration vary from species to species because of anatomy and size difference. Use of this method can reduce the need of general anaesthesia and systemic analgesics, contributing to safer anaesthetic protocols and improved patient comfort.

Basic anatomy of the vertebral column and spinal cord

The vertebral column is made of a series of vertebrae grouped into cervical, thoracic, lumbar, sacral and coccygeal parts. The number of each group of vertebrae is different in each species. The centre of the

vertebral column serves as the vertebral canal in where the spinal cord is located.

Spinal cord is surrounded by 3 protective membranes (from outer to inner): (i) Duramater (ii) Arachnoid and (iii) Piamater

Epidural space

Between the Duramater and the bony vertebral canal lies the epidural space. The epidural space contains fat, blood vessels (including the epidural venous plexus) and spinal nerve roots. It's a crucial area for administering epidural anesthesia and analgesia, as it allows for the diffusion of medications to the spinal nerve.

Epidural sites and landmarks in large animals

In large animals such as cattle, buffalo, horses and small ruminants, epidural anesthesia is commonly performed at caudal locations to limit the area affected while ensuring effective pain control.

1. Cattle: - The most common epidural site is the

1. Sacrococcygeal epidural space (S5-Co1) -sacrococcygeal epidural block
2. The first intercoccygeal (Co1-Co2) space

The injection site can be located by Tail movement method, which causes the movement at the articulation between vertebrae helping to identify the correct space or by palpating at the tail elevation or at the space between the vertebrae. The site is accessed by inserting the needle perpendicular to the skin surface at the midline between the sacrum and the first coccygeal vertebra.

2. Horse: - Epidural anaesthesia in horse is more challenging due to anatomical differences and their large body mass. The preferred site in horse is

1. First intercoccygeal space (Co1-Co2)
2. Lumbar epidurals rarely used because of the increased risk of complications.
3. Sacrococcygeal space

3. Buffalo: -Similar to cattle but the muscle and fat variation has to be noted

The commonly preferred site is:

sacrococcygeal (S5-Co1) or Co1-Co2

4. Sheep and Goat: -Commonly preferred site are

1. Lumbosacral (L7-S1) – for extensive block
2. Sacrococcygeal space (Co1-Co2)

Note: Tail elevation helps identify joints. Injection to Lumbosacral site may cause temporary hindlimb weakness.

Epidural Sites and Landmarks in Small Animals

In small animals like dogs and cats, epidural anesthesia is usually given at the lumbosacral space. This helps provide pain relief during surgeries involving the pelvis, back legs, tail or the area around the anus.

1. Dogs: - The most common spot for epidural is the lumbosacral space (between the last lumbar bone L7 and the first sacral bone S1). To find this spot, you can feel for: The iliac bones (hip bones) on both sides, the bony bump of L7, and A small dip between L7 and S1.

2. Cats: - In cats, the same lumbosacral space (L7–S1) is used. But extra care is needed because in cats, the spinal cord can go further back, up to the third sacral bone (S3). So, if the needle goes too deep, it might accidentally enter the spinal fluid space (which is not safe). The needle should be inserted slowly and carefully, paying close attention to the depth.

Comparative Anatomical Consideration

Anatomical variations between species significantly affect the technique, drug volume and safety of epidural anesthesia.

• Vertebral Anatomy Differences

Large animals like cattle and horses have wider vertebral spaces, especially in the sacrococcygeal region, making caudal epidural access easier. In contrast, small animals like dogs and cats require lumbosacral (L7–S1) access, which has a deeper and narrower space, especially in obese or deep-chested breeds. Ruminants have a shallower epidural space, while small animals need more precision due to difference in the extent of spinal cord.

• Complication Risks

Spinal cord termination varies: dogs (L6–L7), cats (up to S3), cattle/horses (S1–S2). Deeper needle placement in cats can risk dural puncture. Drug spread is also influenced by fat content, tissue density and positioning, possibly leading to uneven or failed anesthesia.

• Species-Specific Considerations

Drug volume differs: 0.2–0.3 mL/kg in small animals vs. 5–10 mL in large animals. Duration of action depends on body condition and space depth. Continuous epidural via catheter is more feasible in large animals, less so in small ones due to anatomical constraints.

Conclusion

Epidural anaesthesia is a powerful and versatile tool in veterinary medicine. It provides effective, targeted pain relief and

enhances animal welfare by minimizing the need for systemic anaesthesia and improving recovery. The key to its successful application lies in a thorough understanding of species-specific anatomy, allowing the clinician to select the correct site and technique.

Future advancements in this field, such as ultrasound-guided placement and the development of new drug formulations, will continue to improve the safety and efficacy of epidural anaesthesia. As a result, this technique will remain a cornerstone of effective and compassionate pain management in veterinary practice, ensuring better outcomes for patients of all sizes.

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