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Lumbosacral Epidural Anaesthesia in a Dog and its Complication – A Case Report

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Abstract

In this report, we present a rarely described case of anaesthetic complication in a 2-year-old intact female Shih Tzu, including clinical findings, magnetic resonance imaging results, and outcome. The dog was admitted to the hospital with paraplegia and lumbosacral pain, which we attributed to iatrogenic trauma resulting from epidural injection and accidental dural sac puncture.

Keywords: local anaesthesia, small animals, paralysis, neolasia.

The discovery of anaesthesia is one of the most important milestones in the history of medicine. Modern anaesthesiology, like other medical disciplines in veterinary and human medicine, is based on the principles of evidence-based medicine. Completed as well as ongoing research and analysis of the information obtained have determined the direction, procedures, and principles of veterinary anaesthesiology. Local anaesthetic techniques have used and continue to use appropriate anatomical landmarks on the patient's body to determine the injection site. For example, bony prominences, tendons, or pulsations of arteries.

The requirements for the technique of local epidural anaesthesiaare paralysis of sensory nerves in the area where the procedure is to be performed and muscle relaxation. In addition, the use of epidural anaesthesia-analgesia (EAA) reduces the amount of surgical stimulation perceived by the patient; this reduction in painful stimulation decreases the depth of general anaesthesia required and reduces the amount of analgesia required for stable anaesthesia. It also reduces the side effects of general anaesthesia. In addition to stable intraoperative anaesthesia, EAA provides good postoperative patient comfort, directly reducing the need for systemic analgesics and thus length of hospital stay. In addition, EAA is reported to improve wound healing and attenuate cancer progression (Ferreira 2018).

Complications of epidural anaesthesia are generally poorly reported in the veterinary literature. Concomitant clinical signs include tenderness of the puncture site, lameness, muscle weakness, and difficulty with urination and defecation. The most commonly reported complication is puncture of a vessel or the dural sac. Iatrogenic trauma to the spinal cord and cauda equina can also be caused by epidural injections. In a study by Zapata *et al.* (2020), the dural sac ended caudal to the lumbosacral junction (LS) in nearly 3/4 of the dogs in the < 10 kg category, so accidental subarachnoid puncture during lumbosacral EAA is very likely in this body weight range (Zapata *et al.* 2020). The main complications that may occur when performing epidural anaesthesia are ineffective or partial blockade (frequent), haematoma or abscess formation, nerve injury, and incorrect intrathecal injections (2–4%). From a systemic point of view, respiratory depression (when an excessive volume of local anaesthetic is used, which may migrate cranially to the point of blocking the nerves controlling diaphragmatic activity), bradycardia and hypotension (sympathetic blockade), and neurologic symptoms (coma, muscle twitching, and convulsions) may be noted. Cases of pruritus, lack of hair regrowth, myoclonus, and urinary retention have been

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reported (Valverde 2008, Kalchofner Guerrero *et al.* 2014, Peterson *et al.* 2014, Steagall *et al.* 2017).

Case History and Observations

A 2-year-old intact female Shih Tzu was referred to our hospital for diagnostic imaging with paraplegia and pain on palpation of the lumbosacral region. The dog underwent ovariohysterectomy under epidural and general anaesthesia three days prior to admission.

On admission, the dog was bright, alert, and responsive, BCS 4/9. Neurologic examination revealed signs of L4-S3 myelopathy with severe pain in the lumbosacral region. Blood tests results (haematology, biochemistry, SNAP4DX, IDEX) and urinalysis were all within normal range (Table I).

According to the history, the dog was paraplegic on the day of surgery and EAA, and it was expected to improve the next day. Since this was not the case, the dog was referred for magnetic resonance imaging. On neurologic examination, the patellar reflex and deep pain perception were intact, but the flexor reflex on both pelvic limbs was diminished. The thoracic limbs were neurologically intact. Radiographs of the lumbosacral region showed no pathologic changes. Magnetic resonance imaging (MRI) showed intradural and extradural masses in the lumbosacral region, which were assumed hematomas (Fig. 1).

Treatment and Discussion

The dog was treated with robenacoxib (1mg/kg p.o. once daily) for pain management and ceftriaxone (25 mg/kg p.o. twice daily) for possible bacterial contamination. On day 14, the dog was fully ambulatory, had no neurologic deficits, and no obvious pain on palpation. However, the owners stated that the dog was painful and vocalising during defecation. This time, a repeat MRI scan showed intramedullary changes and scar tissue formation at the same site as the previously reported epidural

Table I. Results of blood examinations

CBC	Value	Reference	Biochemistry	Value	Reference
RBCs	6.6	5.65–8.87×10^{12}/L	ALT	86	10–125 U/L
Hgb	15.9	13.1–20.5 g/dL	Amylase	526	226–1063U/L
PCV	47	37.3–61.7 %	ALP	117	23–212 U/L
Reticulocytes	1	0–1.5 %	AST	13.3	13–15U/L
Absolute reticulocyte count	80	10–110 K/mcL	CK	156	52–368U/L
MCV	68.1	61.6–73.5 fL	GGT	3	0–8 U/L
MCH	24.1	21.2–25.9 pg	LDH	201	0–236U/L
MCHC	34	32.0–37.9×10 g/L	Bilirubin	3.2	0–5.1 mcmol/L
Platelets	415	211–621× 10^9/L	Calcium	2.5	2.3–2.9 mmol/L
MPV	7.2	6.1–10.1 fL	Chloride	117	110–124 mmol/L
WBCs	8.4	5.05–16.76×10^9/L	Cholesterol	5.3	3.5–7.2mmol/L
Neutrophils	83.8	%	Creatinine	102	44–159 mcmol/L
Lymphocytes	11.6	%	Glucose	5.3	3.89–7.95 mmol/L
Monocytes	4.0	%	Magnesium	0.8	0.7–1.0mmol/L
Eosinophils	0.5	%	Phosphorus	1.2	0.9–1.7mmol/L
Basophils	0.1	%	Potassium	4.4	3.9–5.1mmol/L
Neutrophils	9.9	2.95–11.64×10^9/L	Total protein	66	52–82 g/L
Lymphocytes	4.46	1.05–5.10×10^9/L	albumin	28	22–39 g/L
Monocytes	1.1	0.16–1.12×10^9/L	globulin	31	27–44g/L
Eosinophils	0.2	0.05–1.23×10^9/L	Sodium	144	142–152mmol/L
Basophils	0.04	0.00–0.10×10^9/L	Urea nitrogen	5.6	2.5–9.6 mmol/L

Plate 1. Spinal needle inserted epidurally in a dog.

and intradural lesions (Fig. 1). Colonoscopy and abdominal ultrasonography revealed no lesion in the gastrointestinal tract or other organs that could be responsible for the pain described. We recommended continued cage rest and short walks, and the dog recovered completely within 4 weeks.

The terms epidural and extradural refer to the space outside the *dura mater*. The terms intrathecal, subarachnoid, and spinal refer to the space between the *pia mater* and arachnoid membrane. Epiduralanesthesia refers to the sensory, motor, and autonomic blockade produced by epidural administration of local anesthetics while epidural analgesia refers to epidural administration of analgesics, such as opioids (Steagall *et al*. 2017).

Epidural anaesthesia-analgesia is a powerful tool in small animal clinical practise (Plate 1). It undoubtedly offers advantages such as alleviating perioperative pain, improving postoperative recovery and wound healing, and limiting the spread of tumours. While initially challenging, the technique of epidural anesthesia-analgesia is easily repeatable, requires minimal equipment, and takes a little time to perform. As with any invasive procedure, albeit minimal, there is risk associated with this procedure. There are a number of reported complications, but most of them are minor and rare, and they should not preclude its use in orthopaedic and soft tissue surgery (Ferreira *loc cit*.).The advantage is its proximity to the spinal cord receptors involved in the modulation and transmission of the nociceptive signal. Epidural anaesthesia-analgesia is usually indicated for surgery caudal to the diaphragm, as it promotes perioperative analgesia, reduces the metabolic and endocrine response to surgical stress, accelerates recovery from anaesthesia, and reduces the need for general anaesthetics and opioids and thus minimising their adverse effects (Cima *et al*. 2020, Viscasillas *et al*. 2022).

Ovariohysterectomy is a very common surgical procedure in veterinary medicine, electivein most cases, and the animals are usually young and healthy. Ovariohysterectomy was used as a model for somatic and visceral pain since both components are involved in the surgerical procedure. The abdominal wall at the level of the surgical incision for ovariohysterectomy is innervated by lumbar nerve roots, and the ovaries and uterus are innervated by the autonomic nervous system. Many analgesic protocols are described to manage pain during ovariohysterectomy. In recent years, loco-regional anaesthetic techniques have been introduced in veterinary anaesthesia, including epidural techniques. The success of epidural analgesia depends on the proper positioning of the needle tip inside the epidural space and adequate spread of the local anaesthetic. In addition, based on canine cadaver studies, there is still no clear answer about which approach and drug volume are the best. Based on these facts, physicians performing loco-regional anaesthetic techniques should be aware of the varying success rates and potential complications that may occur. Authors believe that the epidural technique´s learning curve can be steeper since just one injection is needed. Furthermore, several recognised methods (such as hanging drop, ultrasonography, neurostimulation, etc.) have been described to assess the correct position of the tip of the needle in the epidural space, which is essential (Cicirelli *et al*. 2022, Viscasillas *et al*. 2022).

Epidural administration of local anaesthetics can be effective in a variety of surgical procedures such as caesarean section, orthopaedic surgery, and soft tissue surgery. However, human studies indicate that the incidence of complications with peripheral nerve blocks techniques is lower than with epidural blocks,

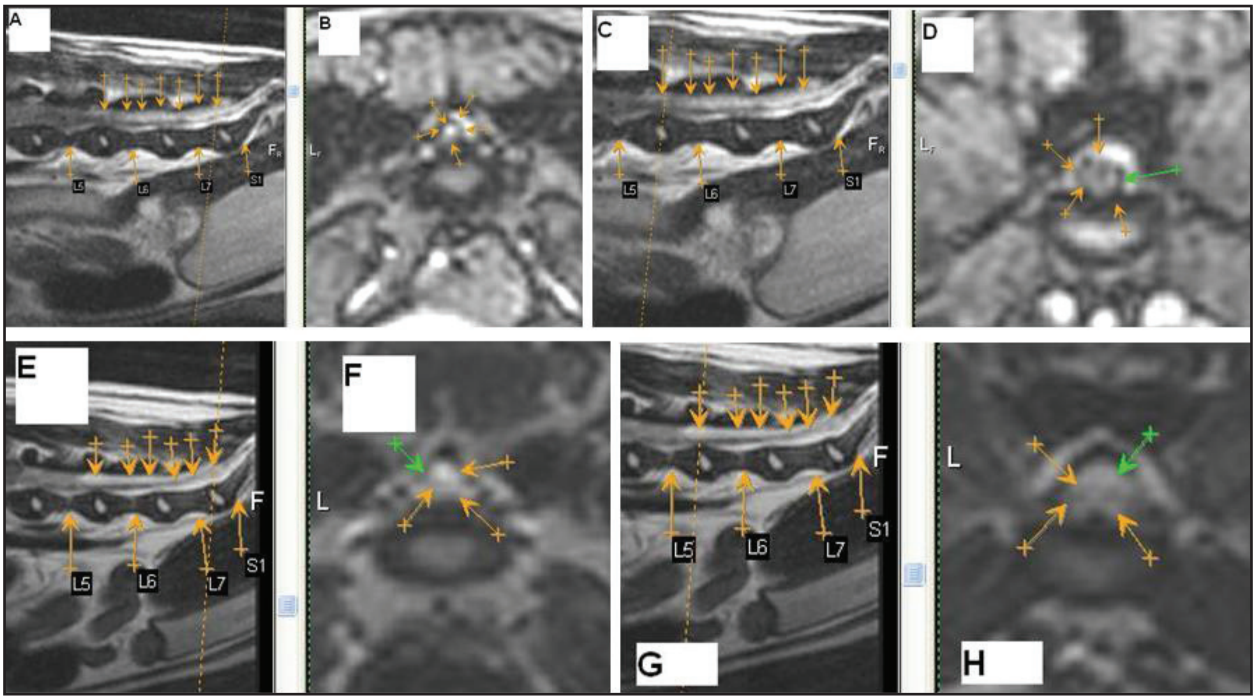

Fig 1. MRI of the lumbosacral region of a dog with chronic pain after epidural injection

A,C) T2W sagittal; and, **B)** T2*axial image (L7-S1 level);

D) T2* axial image (L5-L6 level) at 3 days after epidural injection shows regions of hypointensity (arrows) both within and outside the *dura mater* at the L5-L7 vertebrae;

E,G) T2-sagittal; and **F)** T2-weighted axial image (L7-S1 level), **H)** T2-weighted axial image (L5-L6 level) 4 weeks after epidural injection showing changes within the *dura mater* consistent with scar tissue.

MR images were obtained using 1.0 Tesla, Siemens, 3.0 mm slices.

according to a systematic review and meta-analysis (Fowler *et al.* 2008). Analgesia from peripheral nerve block (PNB) or epidural anaesthesia was comparable, but the adverse event profile was better in the PNB group, with less hypotension, less urinary retention, and greater patient satisfaction. The authors conclude that lumbar epidural anaesthesia should not be used routinely and that PNB is more appropriate for multimodal analgesia (Gurney and Leece 2014). However, in veterinary medicine the benefits of this technique often outweigh the risks. Clinicians should be aware of potential complications such as technical failure, contamination, hematoma, accidental intrathecal injection, respiratory depression, sympathetic blockade, bradycardia, hypotension, neurologic deficits, delayed hair growth, pruritus, and urinary retention. For example, an epidural abscess and lumbosacral discospondylitis have been reported in a dog most likely due to colonic perforation or faecal contamination (Steagall *et al.* 2017).

Summary

Epidural anaesthesia is most commonly performed in the lumbosacral region in dogs. The area of blockade is limited to the region caudal to the umbilical scar, as it only allows anaesthesia of the lumbosacral plexus (L3 to S1). Other epidural puncture sites have been suggested, such as T11 to L1, L6 to S1, and sacrococcygeal. Occasionally, it is necessary to anaesthetize the cranial abdominal region, which is supplied by sensitive nerves from the thoracic vertebra T8 to the lumbar vertebra L3. However, neuraxial anaesthesia of the cranial and mid-abdomen region remains challenging. In addition, the technique of epidural space puncture between L1 and L2 has been well described. Other options include transverse abdominal plane block, which allows anaesthesia of the skin and abdominal muscles during mastectomy, but its efficacy in intra-abdominal procedures is unknown (Cima *loc cit*.).

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