Lameness caused by an extradural lumbosacral foraminal synovial cyst in three German Shepherd Dogs

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Keywords

Synovial cyst, foraminal stenosis, lumbosacral, lameness, dog

Summary

Three German Shepherd Dogs that were presented for investigation of chronic unilateral hindlimb lameness and pain in the lumbosacral region were diagnosed with an intraspinal, extradural synovial cyst and reactive fibrosis protruding into the foramen of the lumbosacral articulation using magnetic resonance imaging and histology. This extradural mass compressed the nerve root in the foramen and the cauda equina. During a dorsal laminectomy and unilateral partial foraminotomy, the cyst and the fibrotic tissue were removed with the aid of a 2.4 mm 30° arthroscope for visualization of the foramen. The fibrotic tissue surrounding the cysts was in all cases confluent with the annulus of the intervertebral disc. The histological examination confirmed the diagnosis of a synovial cyst in all three cases by finding inflamed synovial membrane in the samples from the wall of the cyst as well as reactive fibrosis and cartilaginous metaplasia in the surrounding tissue. The three patients improved after the surgery and were pain free during the follow-up evaluations.

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Introduction

Intraspinal cyst is the accepted terminology for degenerative non-meningeal extradural spinal cysts arising from periarticular joint tissue and, less commonly, the ligaments of the vertebral canal and intervertebral discs (1–7). Intraspinal synovial cysts arising from the joint capsule of the articular facets are a rare clinical entity. A true synovial cyst has a lining of synovial-like epithelial cells, whereas a ganglion cyst has a collagenous capsule surrounding myxoid material (2-4). Extradural cysts of the vertebral canal produce slowly progressive clinical signs compatible with a myelopathy or radiculopathy, but may occasionally be clinically silent. Intraspinal synovial cysts can occur either in the cervical or thoracolumbar region, with each location having a distinct clinical pattern in dogs (8, 9). Cervical synovial cysts are more common in the dog (8). Thoracolumbar and lumbosacral synovial cysts occur mainly in older large breed dogs (8, 9).

The purpose of this report is to describe three cases of histologically confirmed synovial cysts surrounded by an unusually large fibrotic reaction leading to a foraminal seventh lumbar (L7) nerve root entrapment.

Cases

Three German Shepherd Dogs were referred for the investigation and treatment of a chronic lameness of the right hindlimb (case 1: male, 8-years-old; case 2: female, 6-years-old; case 3: female, 5-years-old). The dogs showed reluctance to jump and exercise in addition to intermittent lameness of the right hindlimb. Case 3 was also licking the paw of the right hindlimb. Urination and defecation were reported to be normal, and the general health of the dogs was good.

The referring veterinarians had prescribed non-steroidal anti-inflammatory medication, which reduced the severity of clinical signs in all cases, but did not resolve the problem.

The findings of the clinical examination were very similar in all dogs: pain reaction during palpation of the dorsal lumbosacral area, a lack of any proprioceptive deficits and normal peripheral reflexes in the hind and forelimbs. The orthopaedic examination showed normal joints of the limbs without any swelling in any of the limbs, but mild muscle atrophy and lameness could be found in the right hindlimb. The remainder of the physical examination was unremarkable; the results of the preanaesthetic blood analyses were in the normal range.

On the plain radiographs, signs of degenerative changes of the lumbosacral spine, including ventral spondylosis and endplate sclerosis were visible in all three cases. An MRI scan of the lumbosacral spine was then performed.

Magnetic resonance imaging findings

The magnetic resonance imaging (MRI) examination of the lumbosacral area was performed in case 1 using a 1.5T scanner[a] and in cases 2 and 3 using a 0.25T scanner[b] while the dogs were under general anaesthesia.

Fast spin echo (FSE) T2 sagittal and transverse, spin echo (SE) T1 sagittal and transverse, three-diminsional (3D) hybrid contrast enhanced (HYCE) transverse, Turbo 3D T1 transverse and dorsal and gradient echo (GE) short tau inversion recovery (STIR) transverse scans were performed. No contrast agent was administered in case 1 and 2. In case 3, T1-weighted sequences were repeated after administration of an intravenous contrast agent[c].

In all three cases there was moderate right central protrusion and lateralization of the degenerated lumbosacral articulation disc extending into the lateral recess and intervertebral foramen. In the cranial aspect of the protruded disc, located ventral to the right intervertebral joint, there was an oval-rounded T2 hyperintense structure with a hypointense centre measuring approximately 3–5 mm in diameter extending into the intervertebral foramina (▶Figure 1). The structure had mild rim enhancement after contrast administration.

There was heterogeneous tissue surrounding this hyperintense structure with increased STIR signal. The L7 right nerve root could be outlined and appeared to be normal in diameter and signal intensity in cases 1 and 2, but the right L7 nerve root appeared thickened and had increased STIR-signal without abnormal contrast enhancement in case 3 (▶Figure 2).

The diagnostic imaging diagnosis in the three cases was signs of degenerative lumbosacral stenosis with right-sided disc herniation and an intraspinal cyst with surrounding tissue protruding in the right lumbosacral articulation foramen compressing the right L7 nerve root.

Surgical procedure

After premedication with methadone[d] (0.3 mg/kg) and acepromazine[e] (0.05 mg/kg SC), anaesthesia was induced with propofol[f] (4 mg/kg IV) and diazepam[g] (0.1 mg/kg IV), and maintained with isoflurane. A dorsal surgical approach was performed to the lamina and right facet of the lumbosacral articulation. The standard dorsal laminectomy with high speed drill and rongeurs revealed in all three cases an irregular soft tissue mass in the right ventral spinal

a Phillips Diamond Select Intera 1.5T: Burgess Diagnostics, Preston, UK
b Vet-MR Grande®: Esaote SpA, Genoa, Italy
c Gadodiamid 0.15 mmol/kg, Omniscan: GE Healthcare, Stockholm Sweden
d Metadon Recip 10mg/ml: Recip SA, Solna, Sweden
e Plegicil: Pharmaxim AB, Helsingborg, Sweden
f Propofol®-Lipuro: B. Braun Co, Tuttlingen, Germany
g Stesolid Novum: Actavis Group hf, Hafnarfjörður, Island

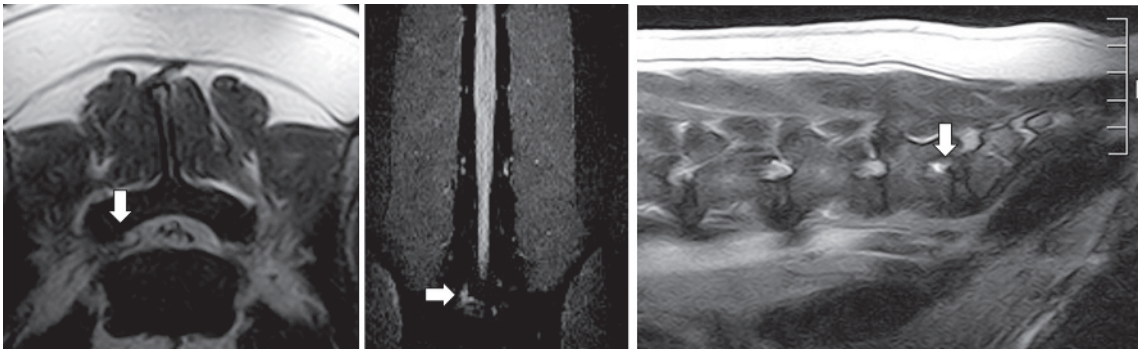

Figure 1 Three-dimensional hybrid contrast enhanced (HYCE) transverse, gradient echo short tau inversion (GE STIR) dorsal and fast spin echo (FSE) T2 sagital slices of case 2 showing the intraspinal cyst and the inflamed fibrotic tissue protruding into the right L7S1 foramen.

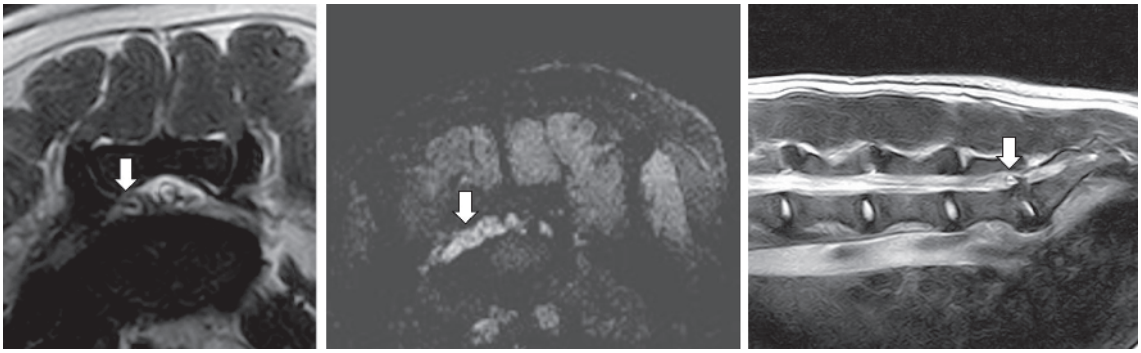

Figure 2 Three-dimensional hybrid contrast enhanced (HYCE), gradient echo short tau inversion (GE STIR) transverse and fast spin echo (FSE) T2 sagital slices of case 3 showing the intraspinal cyst and the inflamed fibrotic tissue protruding into the right L7S1 foramen.

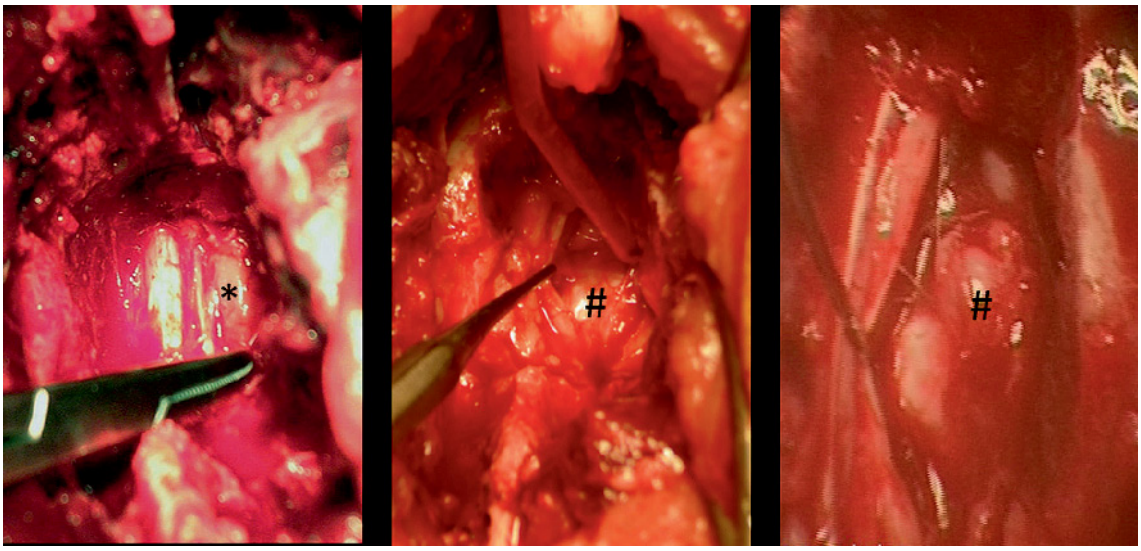

Figure 3
Intra-operative view after the dorsal laminectomy at the lumbosacral junction. **A)** The cyst is visible in case 1 (*). **B)** In case 2 and **C)** case 3, a fibrotic mass was visible in the right ventral spinal canal containing the cyst (#).

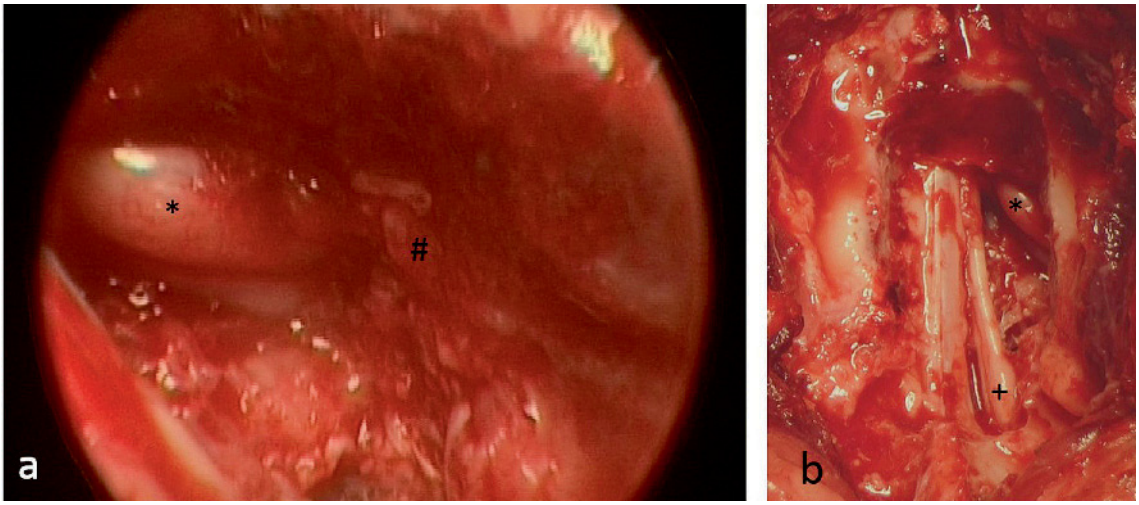

Figure 4
A) Intra-operative view using the 2.4 mm arthroscope showing the enlarged seventh lumbar nerve root (*) and the foramen still filled with fibrotic tissue (#). **B)** Intra-operative view of case 3 with the first sacral nerve (+) after removing the compressing tissue.

canal protruding into the right lumbosacral articulation foramen and pushing the cauda equina including the S1 nerve to the left side. In case 1, a cyst filled with clear fluid could be identified, and in cases 2 and 3, the cyst was embedded in the dense fibrotic tissue (▶Figure 3). No direct connection of the cysts to the facet joint could be detected.

The laminectomy was extended to the right side by removing a part of the facet of L7. Care was taken to leave the base of the facet wide enough to prevent a fracture. The fibrotic proliferation could not be lifted up from the disc and was removed using sharp dissection and arthroscopy rongeurs. The fibrotic tissue was strongly adherent and confluent with the annulus fibrosus, which was partly removed on the right side. The surgery was assisted by video-endoscopy using a 2.4 mm 30° arthroscope in cases 2 and 3 for better visualization of the foramen and documentation.

A sample was taken from the cyst wall and the fibrotic tissue in all three cases for histopathology. The foramen was further cleared of proliferative tissue and caudally enlarged using a 1 mm-size Kerrison rongeur (▶Figure 4). After the L7 and the first sacral (S1) nerves were free of compression and the foramen opened and patent for careful probing, an autologous fat graft was used to cover the exposed nervous tissue and the surgical approach was closed routinely.

Postoperative analgesia consisted of methadone (0.3 mg/kg every 2 to 4 hours). A transdermal fentanyl patch[h] was applied for discharge together with carprofen[i] (4 mg/kg every 24 hours for 10–20 days).

The postoperative period was uneventful in all cases; case 2 developed diarrhoea seven days postoperatively which resolved by changing the non-steroidal anti-inflammatory drug medication. The lameness and signs of lumbar pain improved within several days, and the clinical situation remained improved with patients free of

h Durogesic® 100µg: Jansen AG, Oberriet, Switzerland
i Rimadyl®: Zoetis, Florham Park, NJ, USA

clinical signs during the follow-up of three to six months.

Histopathology

The histopathological features of tissue samples harvested during surgery were reported by the laboratory[j] as follows (►Figure 5).

Case 1

A small fragment of dense fibrocollagenous connective tissue adjacent to which was evidence of myxoid connective tissue proliferation in which there were lymphocytes, plasma cells and siderophages. A cavity was lined by epithelioid cells. This piece of connective tissue would be consistent with a synovial cyst wall in which there was evidence to suggest previous haemorrhage. There were moderate numbers of lymphocytes and plasma cells suggesting chronic inflammation.

- **Histopathological diagnosis:** Chronically inflamed synovial membrane.

Case 2

In the preparations we saw compact cell fibrosis. Furthermore at the periphery of one preparation there was fibrocartilage, which could have originated from a ligament attachment or an intervertebral disk. A synovial membrane was identified, which was highly inflamed and proliferative. The inflammation consisted mainly of lymphocytes and plasma cells. Overall the biopsy exhibited a chronic proliferative synovitis. This could be part of a synovial cyst. There were no obvious signs of a Hansen Type 2 prolapse identified.

- **Histopathological diagnosis:** Chronic proliferative synovitis.

Case 3

In the preparations, compact collagen connective tissue of uniform character was seen bordering strings of well-differentiated osteoid tissue. In a preparation, the collagenous connective tissue became a looser collagen connective tissue with some cartilage metaplasia. There was no inflammatory reaction or neoplasia found in that image. In a third preparation was the more cell-rich collagen connective tissue, which was adjacent to a cavity lined with a uniform epithelium resembling synovial membrane (►Figure 5). A moderate sub-epithelial lymphoplasmocellular inflammatory reaction was seen here. Together, along with some necrosis in the epithelium, fragments of fibrin and a few necrotic materials were found in the lumen. Furthermore, there were islands of cartilage metaplasia in the cyst lumen. The inflammation was considered to be of an older nature. This histological picture suggested an inflamed bursa or inflamed synovial membrane.

- **Histopathological diagnosis:** Chronic synovitis.

Discussion

Reports of canine thoracolumbar intraspinal cysts appear to be associated with

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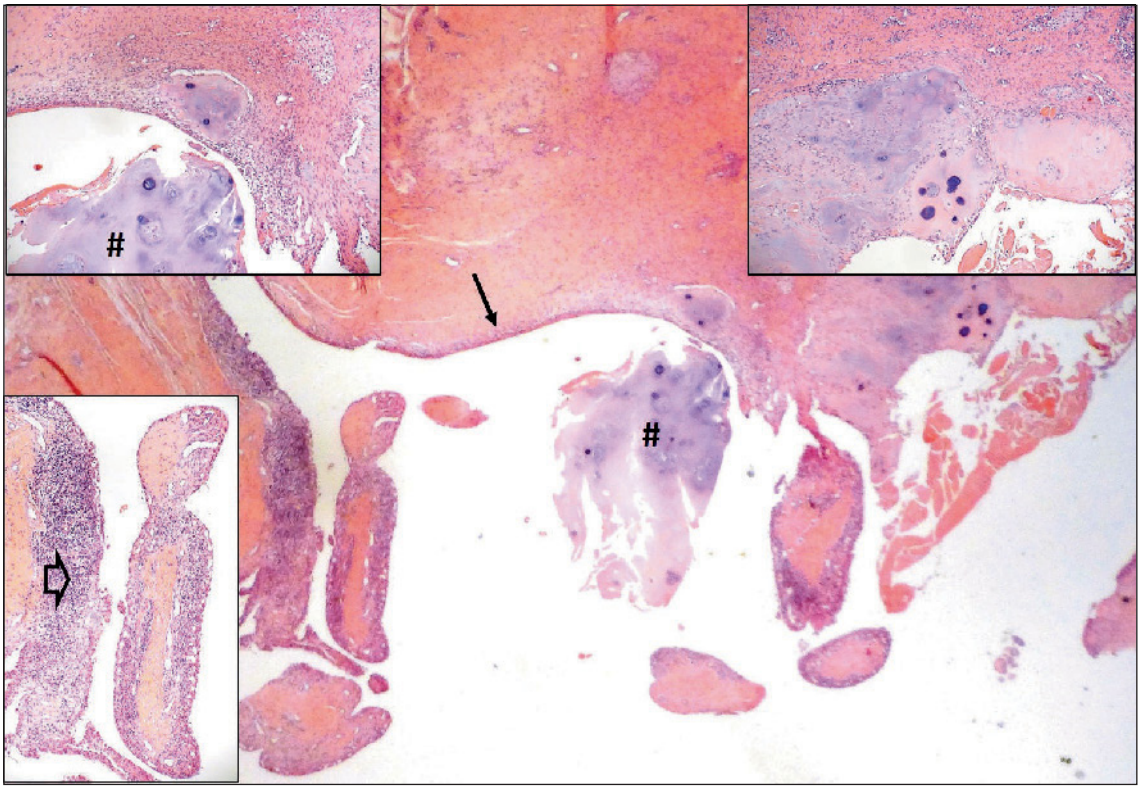

Figure 5
Histological preparation of case 3. Cell-rich collagen connective tissue can be seen adjacent to a cavity lined with a uniform epithelium resembling synovial membrane (black arrow). There is a moderate sub-epithelial lymphoplasmocellular inflammatory reaction (arrow head). In the cyst lumen are islands of cartilage metaplasia (#).

degenerative spinal changes (4, 8–13). All dogs within this category had the common finding of vertebral column degenerative disease, for example, articular facet arthritis and ventral spondylosis (4, 8). The mechanism of formation of thoracolumbar and lumbosacral synovial cysts is not fully clear, but a connection to chronic facet joint arthritis is postulated (4, 8). In spinal segments with high biomechanical loading, such as with the caudal cervical vertebrae and the lumbosacral articulation, there is an increased risk of chronic disc degeneration and facet joint osteoarthritis with herniation of synovial tissue and leakage of synovial fluid from the joints (4).

In humans, discal cysts are surrounded by a wall consisting of dense fibrous tissue, containing a serosanguinous or serous discharge, and the absence of disc material or a specific cell layer lining on histological examination (16). Canine discal cysts are ventrally located, and they are non-meningeal extradural lesions that communicate with the intervertebral disc through a ruptured annulus fibrosus and consist of nucleus pulposus material (4, 15-17). It has been proposed to call such compressive lesions 'hydrated nucleus pulposus extrusions' rather than discal cysts (4).

Computed tomography or MRI reveals in cases with an intraspinal cyst a rounded dorsolateral extradural cystic mass that may contain peripheral calcification and enhancement after contrast administration (11, 14). In our cases, the cystic structure was lateral in the spinal canal and surrounded by partially inflamed soft tissue confluent with the annulus of the intervertebral disc extending into the right lumbosacral articulation foramen.

A layer of synovial epithelium was histologically found in the cyst wall of the presented cases here, thus confirming the diagnosis of intraspinal cyst originating from the facet joint. There was lymphoplasmacellular infiltration in the synovial membrane indicating chronic inflammation. The surrounding fibrotic tissue was partially very dense and had islands of cartilage metaplasia suggesting also chronic inflammation. A connection from the inflammatory tissue to the annulus fibrosus could not be ruled out in the examined tissue samples. It can be speculated, that the location of a cyst with synovial membrane in the fibrotic proliferation in the ventrolateral spinal canal and intervertebral foramen is a late stage of a degenerative lumbosacral disease. A synovial cyst from the facet joint could have been incorporated into the inflammatory fibrotic reaction caused by leaking synovial fluid from the facet joint or the cyst itself. The histological picture suggested a chronic tissue reaction developing parallel to the degenerative changes of the lumbosacral disk. German Shepherd Dogs have been reported to be predisposed to degenerative lumbosacral disease, normally a chronic progressive problem (18, 19). This may be caused in the German Shepherd Dog by breed related anatomical variations of the lumbosacral facet joint orientation, accentuated by the frequent use of these animals as service dogs (18-20).

Treatment of symptomatic extramedullary spinal cysts usually involves surgical intervention and the long-term outcome appears to be favourable. The cysts are removed via dorsal laminectomy of the lumbosacral articulation. In our cases, the fibrotic tissue compressing the L7 nerve root in the foramen made a unilaterally larger laminectomy necessary to be able to approach the foramen. To minimize the negative mechanical effect of the surgery, care was taken to not weaken the base of the cranial facet. The foramen was only enlarged caudally. The use of a 2.4 mm 30° arthroscope allowed a good view of the L7 foramen and nerve root and reduced the size of the laminectomy. Leaving both lumbosacral articulation facet joints functional made the decision possible to not stabilize the lumbosacral articulation vertebra using implants (20). A free fat graft as used in these cases is recommended and regularly used by the authors to prevent adhesion formation after a laminectomy (21). The symptoms improved after the decompressive surgery which released the entrapped nerve roots L7 and S1 from the chronic pressure by the fibrotic mass, and the patients were free of clinical signs after two to four weeks.

Conflict of interest and financial support

No funding or financial support was received. We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

References

1. Shima Y, Rothman SL, Yasura K, et al. Degenerative intraspinal cyst of the cervical spine: case report and literature review. Spine 2002; 27: 18–22.
2. Kao CC, Uihlein A, Bickel WH, et al. Lumbar intraspinal extradural ganglion cyst. Neurosurgery 1968; 29: 168–172.
3. Kao CC, Winkler SS, Turner JH. Synovial cyst of spinal facet. Case report. J Neurosurg 1974; 41: 372–376.
4. Lowrie ML, Pratt SR, Garosi LS. Extramedullary spinal cysts in dogs. Vet Surg 2014; 43: 650–662.
5. Kornberg M. Nerve root compression by a ganglion cyst of the lumbar anulus fibrosus. A case report. Spine 1995; 20: 1633–1635.
6. Marshman LA, Benjamin JC, David KM, et al. "Disc cysts" and "posterior longitudinal ligament ganglion cysts": synonymous entities? Report of three cases and literature review. Neurosurgery 2005; 57: 818–823.
7. Ayberk G, Ozveren F, Gök B, et al. Lumbar synovial cysts: experience with nine cases. Neurol Med Chir (Tokyo) 2008; 48: 298–303.
8. Dickinson PJ, Sturges BK, Berry WL, et al. Extradural spinal synovial cysts in nine dogs. J Small Anim Pract 2001; 42: 502–509.
9. Sale CS, Smith KC. Extradural spinal juxtafacet (synovial) cysts in three dogs. J Small Anim Pract 2007; 48: 116–119.
10. Perez B, Rollan E, Ramiro F, et al. Intraspinal synovial cyst in a dog. J Am Anim Hosp Assoc 2000; 36: 235–238.
11. Forterre F, Kaiser S, Garner M, et al. Synovial cysts associated with cauda equina syndrome in two dogs. Vet Surg 2006; 35: 30–33.
12. Bley T, Lang J, Jaggy A, et al. Lumbar spinal 'juxtaarticular' cyst in a Gordon setter. J Vet Med A Physiol Pathol Clin Med 2007; 54: 494–498.
13. Webb AA, Pharr JW, Lew LJ, et al. MR imaging findings in a dog with lumbar ganglion cysts. Vet Radiol Ultrasound 2001; 42: 9–13.
14. Levitski RE, Chauvet AE, Lipsitz D, et al. Cervical myelopathy associated with extradural synovial cysts in 4 dogs. J Vet Intern Med 1999; 13: 181–186.
15. Kono K, Nakamura H, Inoue Y, et al. Intraspinal extradural cysts communicating with adjacent herniated disks: imaging characteristics and possible pathogenesis. Am J Neuroradiol 1999; 20: 1373–1377.
16. Chiba K, Toyama Y, Matsumoto M, et al. Intraspinal cyst communicating with the intervertebral disc in the lumbar spine: discal cyst. Spine 2001; 26: 2112–2118.

17. Konar M, Lang J, Flühmann G, et al. Ventral intraspinal cysts associated with the intervertebral disc: magnetic resonance imaging observations in seven dogs. Vet Surg 2008; 37: 94–101.
18. Amort KH, Ondreka N, Rudorf H, et al. MR-imaging of lumbosacral intervertebral disc degerenation in clinicall sounf german shepherd dogs compared to other breeds. Vet Radiol Ultrasound 2012; 53: 289–295.
19. Rossi F, Seiler G, Busato A, et al. Magnetic resonance imaging of articular process joint geometry and inervertebral disc degeneration in the caudal lumbar spine (L5-S1) of dogs with clinical signs of cauda equina compression. Vet Radiol Ultrasound 2004; 45: 381–387.
20. Suwankong N, Meij BP, Voorhout G, et al. Review and retrospective analysis of degenerative lumbosacral stenosis in 156 dogs treated by dorsal laminectomy. Vet Comp Orthop Traumatol 2008; 21: 285–293.
21. Quist JJ, Dhert WJA, Meij BP, et al. The prevention of peridural adhesions, a comparative long-term histomorphometrical study using a biodegradable barrier and a fat graft. J Bone Jt Surg 1998; 80-B: 520–526.

