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CASE REPORT

Far lateral lumbar disc extrusion in a dachshund dog

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Abstract: A 6-year-old Dachshund was presented with acute, non-localized pain without neurological dysfunction. Radiography revealed multiple calcifications of intervertebral discs and narrowing of disc space in the thoracolumbar region. Computed tomography and magnetic resonance imaging revealed calcified disc-like material entrapped in the left extraforaminal area and showed a displaced nerve root. Fenestration and removal of the extruded disc material were performed in a routine manner. Histopathological examination showed degenerative disc materials with severe calcification both in the nucleus pulposus and around the annulus fibrosis. Based on imaging, surgical, and histopathologic results, the dog was diagnosed with far lateral lumbar disc extrusion.

Keywords: far lateral lumbar disc extrusion, extraforaminal disc extrusion, disc calcification, IVDD, dogs

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Intervertebral disc disease (IVDD) is the most common spinal and vertebral disorder in dogs [1]. There are 2 main types of IVDD: protrusion and extrusion. The protrusion type, also known as Hansen type II IVDD, is the result of fibroid degeneration, which induces thickening of the annulus fibrosis [2]. It is mainly observed in non-chondrodystrophic large-breed dogs, and progression of the disease is often chronic. In contrast, the extrusion type (Hansen type I IVDD) is more common in small, toy-breed dogs and is the result of chondroid degeneration, in which the gelatinous material in the nucleus pulposus is calcified producing reduced flexibility and compressibility, eventually resulting in sudden rupture of the disc [3]. Extrusion most commonly occurs in the thoracolumbar region, especially between T11 and L3 and is usually associated with acute clinical signs such as back pain, paraparesis, paraplegia, or urinary dysfunction [4]. Disc rupture can theoretically occur in any direction, but it mainly occurs dorsally due to the thinness of the annulus fibrosus [5]. In human medicine, disc extrusion is classified into 4 types depending on the rupture direction: central, lateral, foraminal, and far lateral (also known as extraforaminal) [6]. The majority of cases reported in dogs have focused on central and lateral IVDD, whereas there are few reports on foraminal and far lateral types. This case report describes a rare case of far lateral lumbar disc extrusion (FLLDE), also known as extraforaminal IVDD, in a dog. We believe that our case findings will considerably enrich the existing veterinary science associated with IVDD.

A 6-year-old male, castrated Dachshund dog, weighing 8 kg, was presented with acute, non-localized pain. The dog had a history of temporary limbic stiffness while running on the previous day; moreover, on the day of admission, he experienced discomfort in the left hindlimb. On physical examination, the dog exhibited severe back pain. Blood work, including a complete blood count and serum biochemistry analysis, showed no remarkable abnormalities. Neurological examination, including tests of cranial nerves, postural reactions, urination, and sensation, revealed no abnormalities.

Radiographs of thoracolumbar vertebra were recorded in a routine manner (Titan 2000M; Comed Medical Systems, Korea). On the lateral projection, distinct calcified disc materials were identified between the 10th thoracic vertebra (T10) and T11, between T12 and T13, and between the first lumbar vertebra (L1) and L2 (Fig. 1). The intervertebral disc space between L1 and L2

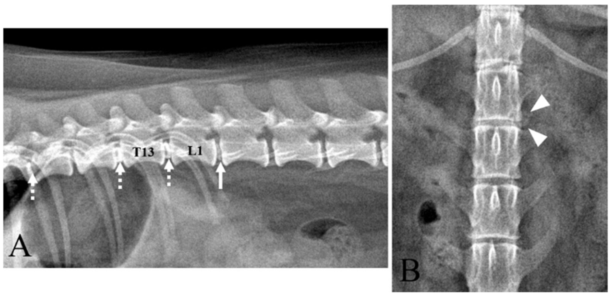

Fig. 1. Lateral (A) and ventrodorsal (B) radiographs of lumbar vertebrae. (A) On the lateral projection, multifocal ellipsoid radiopaque materials consistent with a calcified intervertebral disc are visible at the level of the intervertebral disc space (dashed arrows). Note the narrowing of intervertebral disc space and the collapsed calcified disc between L1 and L2 (arrow). (B) On the ventrodorsal projection, round-shaped radiopaque material is visible at the left side of the intervertebral disc space between L1 and L2, consistent with the far lateral disc space. L1, the first lumbar vertebra; L2, the second lumbar vertebra; T13, the 13th thoracic vertebra.

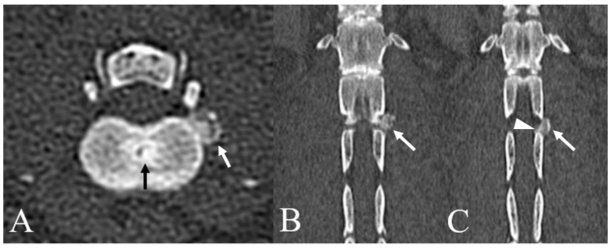

Fig. 2. Pre-contrast transverse (A) and dorsal reconstructed (B, C) computed tomographic images with a bone window at the lumbar vertebral region. (A) Hyperattenuating round, bony material (5 mm diameter; white arrows) is identified at the extraforaminal region between L1 and L2. Note the hypoattenuating round defect with sclerotic margin visible in the center of the intervertebral disc, consistent with the nucleus pulposus (black arrow). At the level of the intervertebral foramen, the distal portion of the material shows continuity into the vertebral canal (white arrowhead). (B) Level of intervertebral disc space; (C) level of intervertebral foramen.

was distinctly narrowed, and a collapsed calcified disc was visible. Round, calcified, radiopaque material (5 mm in diameter) was seen on the ventrodorsal projection at the left side of the intervertebral disc space between L1 and L2.

Computed tomography (CT) was performed (BRIVO CT385; GE healthcare system, USA) in ventral recumbency using a pre-contrast bone algorithm with 100 kVp, 200 mAs, and 0.125 mm slice thickness without gantry tilting. In the transverse images, round-shaped hyperattenuating discoid material with a calcified rim was noted on the left side at the level of the intervertebral foramen between L1 and L2 (Fig. 2A). In the dorsal reconstructed CT images (Fig. 2B and C), some of the radiopaque material showed continuity with the vertebral canal. A round defect with a sclerotic bone margin was present in the central portion of the intervertebral disc. The remaining intervertebral disc showed multifocal calcifications on radiographs.

Magnetic resonance imaging (MRI) was performed under general anesthesia using a 1.5 Tesla system (Signa HDxt; GE healthcare system). Anesthesia was induced with propofol (6 mg/kg, IV; Provive 1%; Myungmoon Pharmaceutical Co., Korea) and was maintained with 1.5% isoflurane (Foran solution; Choongwae Pharma Corporation, Korea) in 100% oxygen via endotracheal intubation. The dog was positioned in dorsal recumbency on the 8-channel phased-array spine coil. The parameters of the MRI scan are summarized in Table 1.

On T2-weighted sagittal images, multiple thoracolumbar disc degenerations and dehydrations were visible (Fig. 3A). Although mild protrusions were detected multifocally, no evidence of spinal cord compression or myelopathy was observed. On the transverse plane, round hypointense material was identified on the left far lateral area between L1 and L2. A widening of space for nerve root fat was identified, implying entrapment of hypointense material in the space. There was no evidence of inflammatory changes around the vertebra, intervertebral disc, or paraspinal muscles. Based on the multimodal imaging results, the presence of extraforaminal calcified disc material, mineralized neurogenic tumor, and osseous vertebral tumor were considered indicative of

Table 1. Parameters of the magnetic resonance imaging sequences

Parameters (unit)	T1W transverse	T1W sagittal	T2W transverse	T2W sagittal	T2W 3D Cube
Sequence	FSE	FSE	FSE	FSE	3D-FSE
FOV (cm)	12 × 12	25 × 25	12 × 12	25 × 25	16 × 16
Slice thickness (mm)	1.5	3	1.5	3	1.6
Interslice gap (mm)	1.8	3.3	1.8	3.3	2
Relaxation time (ms)	494	532	5,008	3,500	2,600
Echo time (ms)	12	12	87	105	114
Matrix	288 × 224	352 × 224	288 × 224	352 × 256	256 × 256
Nex	2	2	2	2	4

T1W, T1-weight image; T2W, T2-weighted image; 3D, 3-dimensional; FSE, fast spin echo; FOV, field of view.

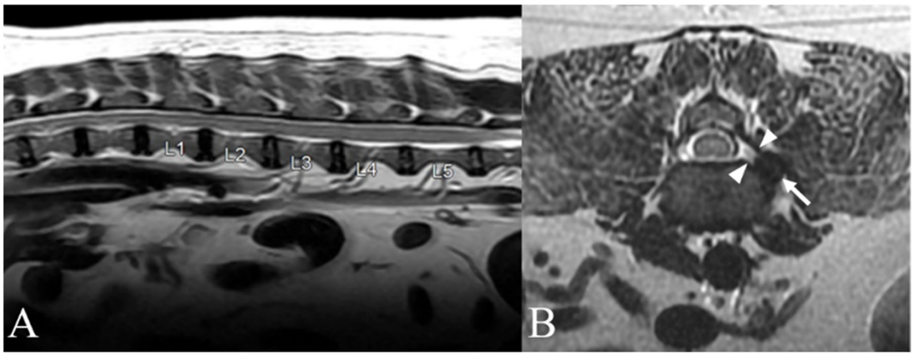

Fig. 3. Magnetic resonance imaging findings on mid-sagittal (A) and transverse (B) images. (A) On the mid-sagittal image, degenerative hypointense intervertebral discs are identified in the lumbar (L) vertebral region. No remarkable disc extrusion or spinal cord compression is visible. (B) On the transverse plane, hypointense round material consistent with a calcified disc is clearly visible in the left extraforaminal region (arrow). Note the widening of perineural space due to entrapment of disc material (arrowheads).

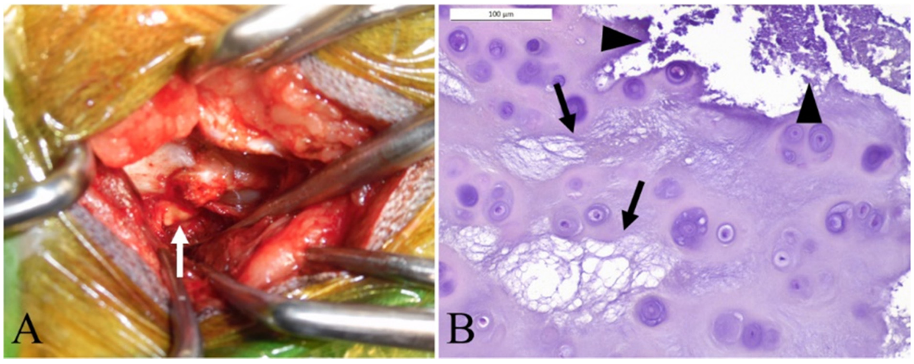

Fig. 4. Intraoperative image (A) and histopathologic results (B). (A) During surgery, reddish-colored, irregular-shaped, calcified disc material is attached to the annulus fibrosus (white arrow). The material is identified below the articular joint. (B) The histopathologic results show variously sized chondrocytes along with vacuolar degeneration (arrows) and multifocal calcification (arrowheads). Based on intraoperative and histopathological results, no remarkable inflammatory or neoplastic changes were identified. hematoxylin & eosin staining; magnification: × 400

possible differential diagnoses.

Fenestration to relieve back pain was performed in a routine manner. The left side dorsolateral approach for fenestration was used in the intervertebral disc space between L1 and L2. By using a periosteal elevator, we elevated the epaxial muscles and exposed the articular facets. We retracted muscular attachments to the accessory process to expose the dorsolateral aspect of the annulus fibrosus. During the surgery, reddish irregularly shaped disc-like materials were detected; these were attached to the annulus fibrosus located below the articular process (Fig. 4A). The material was removed using a No. 10 blade and no evidence of bleeding was observed after removal. In the histopathological results, basophilic chondrocytes with multifocal calcification and chondroid degeneration were identified in cartilaginous material, features consistent with the intervertebral disc (Fig. 4B). The disc material showed no remarkable inflammatory and neoplastic changes. Severe calcification was observed in the nucleus pulposus and around the annulus fibrosis. The dog was finally diagnosed with FLLDE, a rare subtype of intervertebral disc extrusion.

The dog recovered after surgery without any events. Seven days after surgery, the neurological examination showed no remarkable findings and a complete loss of back pain. A month after discharge, physical and neurological examinations showed no abnormalities.

IVDD is the most common type of spinal cord disease in dogs. Traditionally, cases of IVDD are classified as either a Hansen type I extrusion or Hansen type II protrusion. [1] Protrusions are mainly chronic, while an extrusion type is more clinically significant because it is frequently accompanied by spinal cord injury due to acute disc rupture. [4] Disc extrusion usually occurs in the chondrodystrophic breeds and is associated with disc degeneration. In chondrodystrophic breeds, disc degeneration and calcification occur at a relatively young age and induce reduced flexibility and compressibility, which could result in acute disc rupture. [3] Because the dorsolateral aspect of annulus fibrosis is thinner than the ventral aspect in dogs, disc extrusion occurs mainly in the dorsal or dorsolateral direction [2]. Among the 4 types of disc extrusion mentioned above, the central and lateral types are occasionally grouped as paramedian disc extrusions, and in these cases, disc ruptures often occur in the dorsal direction in the vertebral canal. Foraminal and extraforaminal disc extrusions are defined as the rupture of disc material in an unusual direction and which mainly result in compression of the nerve root rather than the spinal cord.

FLLDE accounts for only 4% of all disc herniation in humans and occurs most commonly between L4–L5 or L3–L4. The far lateral space, which includes the dorsal root ganglion, is defined as the area between the cranial articular facet and the annulus fibrosus. Because the dorsal root ganglion contains a large number of neurons, compression by the extruded disc material can cause various clinical symptoms. Severe radiculopathy and acute non-specific pain could be due to direct contact of the nucleus pulposus or annular fragments with the dorsal root ganglion. Because of the small size of the neural foramen, even small far-laterally herniated disc fragments can produce severe symptoms. Since spinal cord compression is less frequently encountered than typical IVDD, paraparesis and paraplegia rarely occur. In the present case, the dog displayed severe non-specific pain without any abnormalities in gait or postural reactions, suspected to be due to the radiculopathy.

Diagnosis of FLLDE is challenging, as the extraforaminal zone is generally not visible on MRI in daily veterinary practice. According to the author's experience, a spinal MRI scan is generally performed to initially produce a sagittal image in which FLLDE may not be clearly visible. Therefore, spinal cord compression may not be seen on a sagittal image, causing radiologists to possibly miss it. Even in humans, it is reported that about one-third of FLLDEs are initially misdiagnosed, often as a retroperitoneal mass, metastatic tumor, or peripheral nerve sheath tumor [7-9]. In the case of multiple IVDD, FLLDE can be overlooked and other aspects can be diagnosed as the main cause; this leads to a poor prognosis due to delayed diagnosis. To minimize such misdiagnosis, it is important to confirm the symmetricity of the annulus fibrosis on the transverse plane, because most FLLDEs attach to the annulus fibrosus producing a distortion of the disc contour [6,10]. In contrast to that in humans, the spinal nerve is too small to be clearly visible in dogs; thus, on MRI, fat suppression sequences may be helpful to identify inflammatory reactions around the nerve root, caused by extruded disc material. In general, CT is not the gold standard procedure for diagnosing and evaluating disc extrusion in dogs, but it was very useful in the present case for diagnosing FLLDE because it showed a wide range of anatomical structures and multiplanar reconstructions. On the CT scan, the extraforaminal disc material has continuity into the vertebral canal on the dorsal reconstructed images, suggesting that the extraforaminal mass may be extruded disc material. As in the present case, a previously reported dog had calcified disc material in the extraforaminal zone [11]; therefore, CT is expected to play a complementary role, with MRI, in the diagnosis of FLLDE.

In human medicine, various prognoses of FLLDE have been reported. Since FLLDE does not directly compress the spinal cord, the post-operative prognosis is good [8]. However, FLLDE can be easily overlooked on MRI examination, and the prognosis could be worse than typical IVDD because of the associated difficulty in diagnosis. In addition, FLLDE generally occurs in older groups that have concurrent degenerative changes such as lumbosacral stenosis, leading to a poor prognosis in human [10]. However, IVDD occurs at a relatively young age in chondrodystrophic dog breeds in which concomitant degenerative changes are expected to be relatively rare. Although multiple disc degeneration was clearly identified *in situ*, no additional degenerative changes were observed in the present case.

A case of FLLDE is very rare and, to our best knowledge, only one case report has been previously published in veterinary medicine [11]. Prognosis of that case was excellent, and the authors believed that if the diagnosis of FLLDE is made accurately in a short time, the prognosis is expected to be better than that of typical IVDD. In fact, in the present and the previous case, the dog recovered immediately after the surgery with back pain signs completely disappeared. In human medicine, all 19 patients diagnosed with FLLDE showed excellent prognosis and loss of leg pain following surgery [12]. Another study reported that 71% of patients diagnosed with FLLDE improved with conservative treatment [8]. Though in the present case surgical removal was performed to relieve severe back pain, further investigations regarding the prognosis and treatment of FLLDE in dogs are necessary.

Calcification of intervertebral discs is frequently observed on radiographs of chondrodystrophic breeds, especially Dachshunds. Based on the previous study [11], the calcified discs are degenerative changes; it is also known that the greater the calcification, the more likely that disc rupture will occur. Also, as the number of affected discs increases, dogs become more predisposed to IVDD and disc rupture [13]. In the present case, the calcified disc material in the extraforaminal area is considered to be related to severe calcification and the possibility of sudden rupture of the intervertebral disc. A degenerative, calcified nucleus pulposus can herniate from mild trauma and exercise in humans, and in the present case, the calcified nucleus pulposus may have migrated transforaminally due to exercise [14]. Hence, chondrodystrophic breed dogs, whose radiographs frequently display calcified intervertebral discs, could be predisposed to FLLDE; this knowledge is necessary when educating owners of these breeds about the potential need for exercise restriction.

This case report described a case of FLLDE with a rare manifestation of intervertebral disc extrusion. Because definite spinal cord compression may not be seen on a sagittal image, careful interpretations should be performed to avoid misdiagnosis as neurogenic or metastatic tumors. When a chondrodystrophic breed dog (such as a Dachshund) shows disc calcification, decreased intervertebral disc volume, and severe back pain, FLLDE should be considered as a differential diagnosis.

References

1. Mai W. Normal MRI spinal anatomy, degenerative disc disease, and disc herniation. In: Diagnostic MRI in Dogs and Cats. pp. 413–446, CRC Press, New York, 2018.
2. Dewey CW, da Costa RC. Myelopathies: disorders of the spinal cord. In: Practical Guide to Canine and Feline Neurology. 3rd ed. pp. 329–404, Wiley Blackwell, Hoboken, 2015.
3. Widmer WR, Thrall DE. The canine and feline vertebrae. In: Thrall DE. Textbook of Veterinary Diagnostic Radiology. 6th ed. pp. 172–193, Elsevier Health Sciences, London, 2013.
4. Davies JV, Liebel FX. Spine: intervertebral disc disease and 'wobbler syndrome'. In: Kirberger RM, McEvoy FJ (eds.). BSAVA Manual of Canine and Feline Musculoskeletal Imaging. 2nd ed. pp. 365–372, British Small Animal Veterinary Association, Quedgeley, 2016.
5. Heblinski N, Schmökel H. Our approach to intervertebral disc disease in dogs: a review of the current literature. J Vet Sci Med Diagn 2018;7:1.
6. Fardon DF, Milette PC; Combined Task Forces of the North American Spine Society, American Society of Spine Radiology, and American Society of Neuroradiology. Nomenclature and classification of lumbar disc pathology. Recommendations of the Combined task Forces of the North American Spine Society, American Society of Spine Radiology, and American Society of Neuroradiology. Spine (Phila Pa 1976) 2001;26: E93-E113.
7. Chun SW, Park YS, Heo W, Baek K, Moon JI. Extraforaminal extrusion of intervertebral disc misdiagnosed as neurogenic tumor: a case report. Investig Magn Reson Imaging 2017;21:109-113.
8. Epstein NE. Foraminal and far lateral lumbar disc herniations: surgical alternatives and outcome measures. Spinal Cord 2002;40:491-500.
9. Sharma MS, Morris JM, Pichelmann MA, Spinner RJ. L5-S1 extraforaminal intraneural disc herniation mimicking a malignant peripheral nerve sheath tumor. Spine J 2012;12:e7-e12.
10. Park HW, Park KS, Park MS, Kim SM, Chung SY, Lee DS. The comparisons of surgical outcomes and clinical characteristics between the far lateral lumbar disc herniations and the paramedian lumbar disc herniations. Korean J Spine 2013;10:155-159.
11. Fadda A, Lang J, Forterre F. Far lateral lumbar disc extrusion: MRI findings and surgical treatment. Vet Comp Orthop Traumatol 2013;26:318-322.
12. Samini F, Bahadorkhan G, Ehsaei MR, Kheradmand H. Intraforaminal and extraforaminal far lateral lumbar disc herniation (a review of 63 cases). Med J Islam Repub Iran 2008;22:63-67.
13. Rohdin C, Jeserevic J, Viitmaa R, Cizinauskas S. Prevalence of radiographic detectable intervertebral disc calcifications in Dachshunds surgically treated for disc extrusion. Acta Vet Scand 2010;52:24.
14. Park SM, Kim ES, Sung DH. Cervical radiculopathy caused by neural foraminal migration of a herniated calcified intervertebral disk in childhood: a case report. Arch Phys Med Rehabil 2005;86:2214-2217.