

Intervertebral T3-T4 Disc Extrusions in Two German Shepherd Dogs

Isidro Mateo, Lic Vet, DECVN, Rocio Paniagua, Grado Vet, Ana Cloquell, Lic Vet, Fernando Vazquez, Lic Vet, PhD

ABSTRACT

Although intervertebral disc extrusions are extremely frequent in dogs, those affecting the cranial thoracic spine in large-breed dogs have not been reported. In this case report, the clinical, radiological, surgical, and histopathological findings in two German shepherd dogs with T3-T4 disc extrusions are reported. Clinical and imaging findings (acute onset and radiological evidence of lateralized disc material dispersed beyond the margins of the intervertebral disc space) allowed proper diagnosis of disc extrusion. Decompressive surgery via hemilaminectomy was performed in both patients with favorable outcomes. Intervertebral disc extrusions should be considered as a differential diagnosis of large-breed dogs with acute onset, upper-thoracic spinal cord disease. Imaging findings can aid in differentiating thoracic intervertebral disc extrusions from protrusions, thus leading to appropriate treatment. (*J Am Anim Hosp Assoc* 2019; 55:e553-03. DOI 10.5326/JAAHA-MS-6883)

Introduction

Degenerative intervertebral disc disease is one of the most common disorders affecting the canine spine, and it is frequently associated with neurological signs. Although disc degeneration can occur at any level, the cervical and thoracolumbar intervertebral discs are the most commonly affected and therefore most predisposed to be herniated.¹ Disc degeneration can lead to two types of disc herniation: extrusion and protrusion. Intervertebral disc extrusions (also known as Hansen Type I lesion) are associated with chondroid degeneration, which is typically observed in small-breed chondrodystrophic dogs.² It consists of a sudden herniation of the nucleus pulposus through the annulus fibrosus into the vertebral canal, with subsequent acute compression of the spinal cord.³ Intervertebral disc protrusion (Hansen Type II lesion) consists of focal extension of the annulus fibrosus and nucleus pulposus into the vertebral canal. This herniation is secondary to a partial rupture and weakening of the dorsal annulus fibrosus.² This pathology is usually associated with large-breed, nonchondrodystrophic dogs, producing chronic clinical signs of spinal cord dysfunction.³ Nevertheless, some studies have shown that 62–92% of nonchondrodystrophic dogs weighing >20 kg with

thoracolumbar degenerative disc disease experience nuclear extrusion as opposed to annular protrusion.^{4,5}

The upper-thoracic spine (intervertebral disc spaces T1-T2 to T9-T10) is rarely affected by disc extrusions, probably reflecting anatomical differences between the various sections of the spine.⁶ The cranial thoracic T1-T11 intervertebral discs are stabilized dorsally by the intercapital ligament that runs under the dorsal longitudinal ligament and connects contralateral rib heads, providing additional stability to this region, resulting in a low rate of disc herniation between T2 and T11. Movement around the cranial thoracic region is also limited by the musculature and ligaments associated with the ribs.⁷ All described disc herniations of the upper-thoracic spine in large-breed dogs were characterized as protrusions.^{6,8–10}

Because of the increased recognition of this pathology, some authors have concluded that evaluation of the complete thoracic spine should be performed in patients with clinical signs suggestive of thoracolumbar spinal cord disease in order to avoid a misdiagnosis of noncompressive myelopathy (particularly a degenerative myelopathy), specifically in German shepherd dogs, in which cranial thoracic

From Hospital Clínico Veterinario, Universidad Alfonso X el Sabio, Madrid, Spain.

Correspondence: isidro_mateo@yahoo.es (I.M.)

myelo-CT (myelographic computerized tomography)

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intervertebral disc herniations are more frequent and more severe than in other large-breed dogs.^{8,9}

In this report, we describe the clinical, radiological, surgical, and histopathological findings of intervertebral disc extrusions in the upper-thoracic spine (T3-T4 intervertebral discs) in two German shepherd dogs and their prognosis after surgical management.

Case Reports

A 7 yr old male German shepherd dog was referred to the Hospital Clínico Veterinario – Universidad Alfonso X el Sabio for an acute onset nonambulatory paraparesis of 48 hr duration without response to treatment with meloxicam (0.1 mg/kg/24 hr³). No previous history of pelvic limb weakness was noticed by the owners. Physical examination was normal. Neurological examination revealed nonambulatory paraparesis with short-strided gait of the thoracic limbs. Severe truncal ataxia was evident when the gait was evaluated with support. Proprioceptive deficits were detected in both pelvic limbs, with normal spinal reflexes in all limbs. Neurological signs were consistent with a focal lesion affecting C6-T2 or upper-thoracic spinal cord segments. Lumbar myelography with 0.3 mL/kg of iohexol^b, followed by post-myelographic computerized tomography (myelo-CT) revealed dorsal deviation and attenuation of the ventral contrast column over the T3-T4 intervertebral disc (Figure 1A). On myelo-CT transverse images, clear lateralization to the right of the isoattenuating lesion originating from the T3-T4 intervertebral disc was evident (Figure 1B). The disc material obliterated the right T3-T4 intervertebral foramen and was dispersed over the vertebral body of T4 (Figure 1C). The spinal cord was severely compressed.

A right-sided T3-T4 hemilaminectomy was performed. Extruded disc material was removed and submitted for histopathological evaluation. The protruded dorsal annulus fibrosus was incised and removed. Tramadol (1 mg/kg/8 hr^c) and cephalexin (22 mg/kg/12 hr^d) were added to meloxicam for 1 wk. The dog's neurological status progressively improved; he was ambulatory 1 wk after surgery and remained mildly paraparetic 1 mo later. Histopathological examination of the extruded disc revealed numerous chondrocyte-like cells linearly arranged and immersed in a homogeneous extracellular hyaline matrix (Figure 2A). This matrix presented numerous clefts and cracks and occasional notochordal cells (Figure 2B). These findings were consistent with the diagnosis of extruded degenerated nucleus pulposus.

A 10 yr old male German shepherd dog was referred with acute onset paraplegia progressive over 24 hr. The owners reported chronic forelimb lameness as a result of elbow dysplasia and osteoarthritis. Physical examination was normal. Neurological examination revealed paraplegia with short-strided gait of the

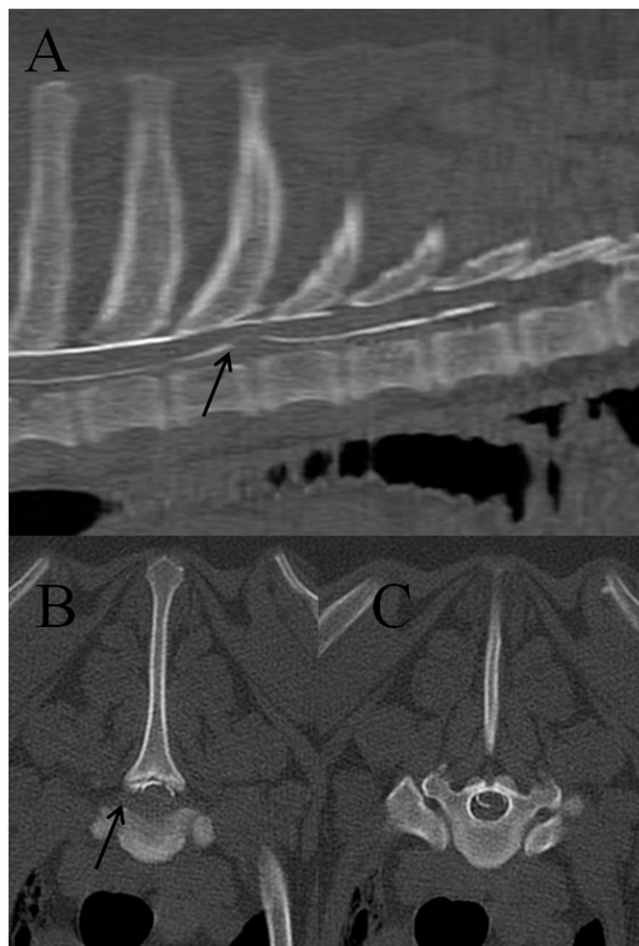
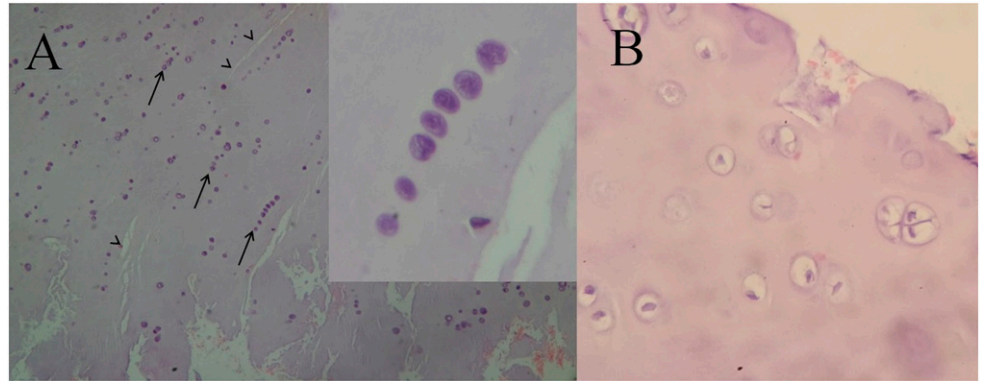


FIGURE 1 Sagittal reconstruction (A) and transverse myelo-CT images obtained at T3-T4 intervertebral disc (B) and T4 vertebral body (C). Note dorsal deviation of the ventral contrast column at the T3-T4 intervertebral disc (arrow in A). Right lateralization of the isoattenuating mass through the intervertebral foramen (arrow in B) is also evident. Also note dispersed intervertebral disc material beyond the borders of the intervertebral disc space (C). Severe spinal cord compression can be observed in all images. myelo-CT, myelographic computerized tomography.

thoracic limbs. Postural reactions were normal in both thoracic limbs, and spinal reflexes were normal in all limbs. A C6-T2 or upper-thoracic spinal cord lesion was suspected. Lumbar myelography revealed a ventral extradural compression at the level of the caudal aspect of the T3 vertebral body (Figure 3). Myelo-CT confirmed the lesion as originating at the T3-T4 intervertebral disc compressing the spinal cord laterally on the left side. Calcification of the dorsal longitudinal ligament was also evident along the complete thoracic spine, with minimal spinal cord involvement. Generalized spondylosis and T13-L1 intervertebral disc protrusion was also seen.

FIGURE 2 (A) Chondrocyte-like cells immersed in an acidophilic extracellular matrix. Note clefts on the matrix (arrowheads) and linear arrangement of these chondrocyte-like cells (arrows and inset). (B) Extruded material showing dispersed notochordal cells in a hyaline matrix.



A T3-T4 left hemilaminectomy was performed with similar results as the previous case, and identical medical treatment was provided. The dog experienced slower clinical improvement; he was ambulatory 15 days after surgery but remained ambulatory paraparetic at 4 mo. Histopathological analysis of the resected tissue showed similar findings as in the previous case.

Discussion

Many studies have shown the existence of intervertebral disc disease in large-breed dogs, with the upper-thoracic spine being occasionally affected.^{4-6,8-10} Proper neurological examination will help avoid misdiagnosis as clinical signs can be suggestive of upper-thoracic spinal cord dysfunction. Short-strided gait in the thoracic limbs is a lower-motor neuron sign, and therefore, a lesion affecting C6-T2 spinal cord segments was considered in both cases. Nevertheless, with a C6-T2 lesion, it is unusual to observe nonambulatory paraparesis or paraplegia with normal postural reactions on the thoracic limbs, which would be more probable with a T3-L3 spinal cord lesion. With a lesion affecting the T3-L3 spinal cord segments, the short-strided thoracic limbs may reflect a cranial thoracic lesion that



FIGURE 3 Myelographic image of second patient. Note that the extradural compression was beyond the borders of the intervertebral disc space (arrow).

causes discomfort or a loss of the upper motor neuron and general proprioceptive systems that control axial muscles at a thoracic level.¹¹

Both cases were German shepherd dogs. This is not surprising as this breed represents 52.4% of the dogs with lesions in the upper-thoracic spine, most frequently at the T2-T3 and T4-T5 intervertebral discs.⁶ German shepherd dogs also have an increased risk for compression and herniation of the T3-T4 intervertebral disc, as occurred in these two cases.⁸ Nevertheless, all the described large-breed dogs with disc herniations in the upper-thoracic spine had protrusions instead of the extrusions observed in our patients. Both types of disc herniation are distinct clinical entities with different pathophysiology and prognosis. Therefore, their differentiation is required for proper treatment.

Our patients showed some radiological findings that were used to propose a preliminary diagnosis of disc extrusion instead of protrusion, which would be the expected diagnosis in a large-breed dog with upper-thoracic disc disease. These findings were (1) lateralized herniated disc, (2) single disc herniation, and (3) herniated disc material not confined to the intervertebral disc space.¹¹⁻¹³ Decompressive surgery was pursued by means of hemilaminectomy due to the severity of spinal cord compression. Other surgical approaches such as lateral corpectomy or stabilization techniques were not considered because the disc material was suspected of being extruded. Hemilaminectomy was also the treatment of choice in three German shepherd dogs with T2-T3 disc protrusions.⁹ Laminectomy has also been described as a decompressive procedure in a German shepherd dog with T3-T4 disc protrusion, but this technique was not considered in these cases because of the lateralized position of the extruded disc and concerns about postoperative stability.¹⁰ Neither of our patients showed immediate postoperative deterioration of their neurological status, as occurred in previously described surgical cases, which is probably a result of the acute and severe nature of the lesions.⁹ Prognosis was considered favorable as both patients regained ambulatory status.

Histopathological analysis of the resected tissue showed degenerative changes expected to be found in a chondrodystrophic dog. These changes were replacement of notochordal cells by chondrocyte-like cells and disaggregation of notochordal cells, resulting in small cell clusters or single notochordal cells and fragmented extracellular matrix with clefts.¹ Moreover, no evidence of fibrinoid metamorphosis was observed, a classical change observed in a nonchondrodystrophic dog. Nevertheless, some recent studies suggest that degenerative changes in chondrodystrophic and nonchondrodystrophic dogs are more similar than previously assumed, and nonchondrodystrophic dogs such as German shepherds may have chondrodystrophic degenerative changes at an old age.^{1,2}

Conclusion

Intervertebral disc extrusion should be considered during the differential diagnosis of large-breed dogs with an acute onset upper-thoracic spinal cord dysfunction, particularly in German shepherd dogs. Established MRI guidelines to differentiate between disc extrusions and protrusions can be applied with myelo-CT. Their use, together with clinical evaluation, allows for proper diagnosis and treatment. Prognosis in large-breed dogs with upper-thoracic intervertebral disc extrusions is favorable after surgical treatment. ■

FOOTNOTES

- ^a Metacam; Boehringer Ingelheim Vetmedica GmbH, Ingelheim, Germany
^b Omnipaque; GE Healthcare, Madrid, Spain
^c Tramadol Normon; Laboratorios Normon S.A., Madrid, Spain
^d Tsefalen; ICF Srl Industria Chimica Fine, Cremona, Italy

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