

MAGNETIC RESONANCE IMAGING OF INTERVERTEBRAL DISC DISEASE ON CERVICAL SPINE IN DOGS - 12 CASES

Marius-Mihai BĂDULESCU, Alexandru-Gabriel NEAGU, Raluca Mihaela TURBATU, Ruxandra Georgiana PAVEL, Niculae TUDOR, Constantin VLĂGIOIU

University of Agronomic Sciences and Veterinary Medicine of Bucharest, Faculty of Veterinary Medicine, 105 Splaiul Independentei Street, 050097, District 5, Bucharest, Romania

Corresponding author email: marius.badulescu@fmvb.usamv.ro

Abstract

Intervertebral disc disease (IVDD) results from the degeneration and dehydration of intervertebral discs, a natural process that occurs as animals age. These degenerative changes can lead to various clinical and pathological issues, including disc extrusions and protrusions. A review of the medical records of 12 dogs presented at the Faculty of Veterinary Medicine in Bucharest with neurological deficits was conducted. The animals underwent magnetic resonance imaging (MRI) for evaluation. The MRI results identified intervertebral disc disease, with 5 cases classified as Hansen Type I (extrusion) and 7 cases as Hansen Type II (protrusion), all causing spinal cord compression. MRI proved to be a valuable, safe, and non-invasive method for assessing the spinal cord in the cervical segment.

Key words: discopathy, dog, imaging diagnosis, MRI.

INTRODUCTION

Discopathy is among the most prevalent spinal conditions in dogs, characterized by the dehydration and degeneration of intervertebral discs. It is typically observed in older dogs or those from chondrodystrophic breeds (da Costa et al., 2012; da Costa et al., 2020). The condition is characterized by two forms of evolution, represented by an acute form, called intervertebral disc extrusion (Hansen type I), and a chronic form, or intervertebral disc protrusion (Hansen type II) (Bergknut et al., 2013).

In the case of disc extrusion, a herniation of the calcified nucleus pulposus occurs through the annulus fibrous ring and it penetrates the vertebral canal. This condition occurs predominantly in chondrodystrophic breeds, with young dogs being more affected, and was clinically manifested by acute hyperesthesia up to paraplegia (Smolders et al., 2013; da Costa et al., 2020; Argent et al., 2022). Disc protrusion is the slow, progressive, focal extension of the annulus fibrosus and dorsal ligament into the spinal canal.

The condition is often seen in non-chondrodystrophic breeds, particularly geriatric dogs, and clinically manifests as slow-onset hind limb paresis and ataxia (Smolders et al., 2013).

Radiographic examination and myelography were the most used methods for the diagnosis of disc diseases (da Costa et al., 2020). With the evolution of technology and the increasing use of magnetic resonance imaging (MRI), the exact differentiation between extrusion and protrusion has been facilitated, a decisive factor in the application of appropriate therapy. MRI diagnosis is considered a modern and non-invasive diagnostic method that, in addition to differentiating the two conditions, also provides important data regarding the integrity of the spinal cord, and the other structures at the vertebral level (Kranenburg et al., 2013; Murthy et al., 2014). This study aimed to identify and localize disc diseases in dogs of different breeds.

MATERIALS AND METHODS

The study was conducted at the University Veterinary Emergency Hospital "Prof. Dr. Alin Bîrțoiu" from Bucharest, on a number of 12 dogs (French Bulldog, Pekingese, Beagle, Shih-Tzu, Crossbreed, German Shepherd), which present neurological signs specific to intervertebral discopathy. The criteria for inclusion in the study following clinical examinations were: the presence of pain in the cervical spine with sudden onset, the presence of tetraplegia, and proprioceptive deficits.

Patients were examined by clinical and neurological examination, followed by recommendations for further investigations.

The MRI scan was carried out using a VET MR GANDE machine with a 0.3 Tesla strength, utilizing a permanent magnet and specialized coils. T1 Spin Echo and T2 Fast Spin Echo sequences were applied in sagittal and transverse planes, with a slice thickness between 2.5 to 3 mm. Contrast medium (Clariscan) images were captured following intravenous administration at a dosage of 0.2 ml/kg. The animals were positioned in sternal and left-lateral recumbency during the procedure

The animals were scanned under general anesthesia. Premedication consisted of Butorphanol at 0.2 mg/kg IV, with Propofol administered intravenously at 3-5 mg/kg for induction. Following intubation, anesthesia was sustained with Isoflurane and 100% oxygen. Spontaneous or intermittent positive-pressure ventilation (IPPV) was managed via a volume-cycled ventilator, delivering 12-15 breaths per minute to maintain an end-tidal CO₂ level between 35-45 mm Hg. Initially, oxygen was supplied at 2 L/min, with the vaporizer adjusted to achieve an end-tidal isoflurane concentration of 2.0% within 10 minutes of induction. Once the target was met, the oxygen flow rate was reduced to (500 + 10/kg) L/min, while the isoflurane concentration remained steady at 1.5 vol.% throughout the procedure (Tudor et al., 2019; Pavel et al., 2021).

RESULTS AND DISCUSSIONS

Patients included in the study belonged to chondrodystrophic breeds (2 cases - French Bulldog, 3 cases - Pekingese, 1 case - Beagle, 2 cases - Shih-Tzu) and non-chondrodystrophic (3 cases - Crossbreed, 1 case - German Shepherd), of different ages and both sexes. The clinical examination followed changes in head and gait. In the case of patients with disc extrusion, acute pain in the cervical segment was also found. By correlating the clinical examination with the anamnesis, regarding the onset of the conditions, symptoms, and evolution, it was found that in most cases no changes were detected, except for the pain manifested when moving the head and neck, as well as when walking.

Neurological examination revealed a normal or altered pain status and normal behaviour, gait

evaluation revealed tetraparesis, and proprioceptive deficits varied according to the degree of spinal cord compression. Spinal reflexes, cranial nerve, perianal reflex and panniculus assessments were all normal. As a result, the neuroanatomical localization was identified at the C1-C7 spinal segment. Based on the VITAMIND acronym, the considered etiologies included inflammatory, degenerative and traumatic causes. After the neurological evaluation, both radiographic and MRI examinations of the C1-C7 cervical segment were recommended. The radiographs of this region showed no detectable abnormalities in the vertebrae, intervertebral spaces, or vertebral canal.

During the MRI examination, the following aspects were identified: 5 cases presented disc extrusion (Hansen type I) - 3 cases with disc extrusion present on the C2-C3 segment (Figure 1), and 2 cases at the level of the C3-C4 segment (Figures 2 and 3), respectively 7 cases of disc protrusion (Hansen type II) - one case of protrusion on the C3-C4 segment (Figure 4), 2 cases at the level of the C5-C6 segment and 4 cases that presented C6-C7 location.

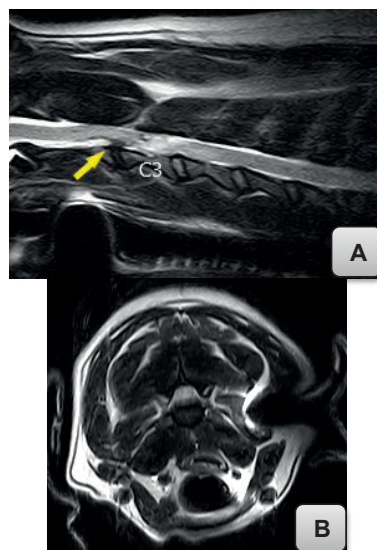


Figure 1. Sagittal plane images - T2 sequences (A) and transverse plane images - T2 sequences (B), at the C2-C3 intervertebral space, demonstrate an irregular distribution of disc material within the vertebral canal, visible as a T2 hypointense signal, resulting in significant dorsal spinal cord compression (A and B). Additionally, a diffuse T2 hyperintense area at C3 indicates secondary edema due to the compression

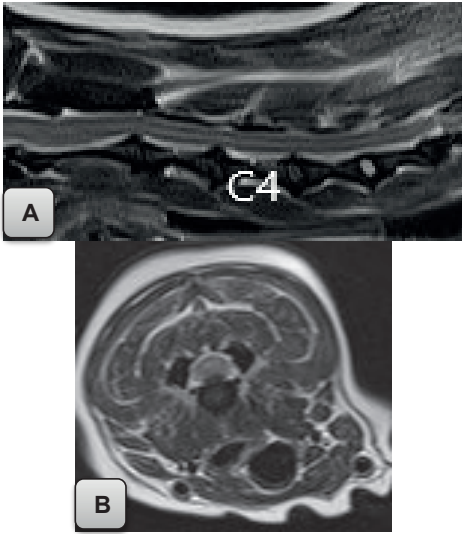


Figure 2. Sagittal T2 sequence images (A) and transverse T2 sequence images (B), at the C3-C4 intervertebral space, reveal a focal, well-defined disc material within the vertebral canal, appearing as a T2 hypointense signal, causing significant dorsal compression of the spinal cord (A and B)

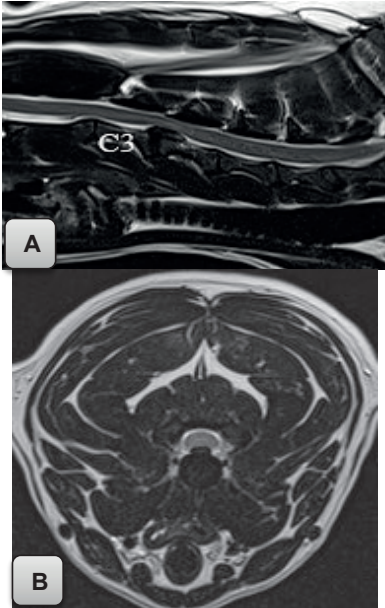


Figure 4. Sagittal T2 sequence images (A) and transverse T2 sequence images (B), at the C3-C4 intervertebral space, display a mild to moderate disc protrusion, resulting in mild to moderate compression of the spinal cord (A and B)

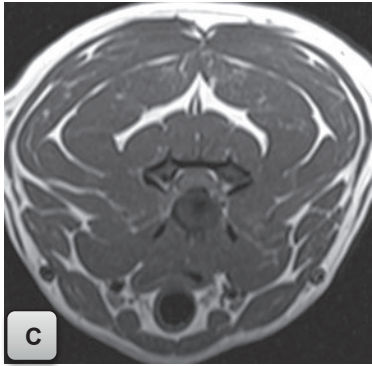
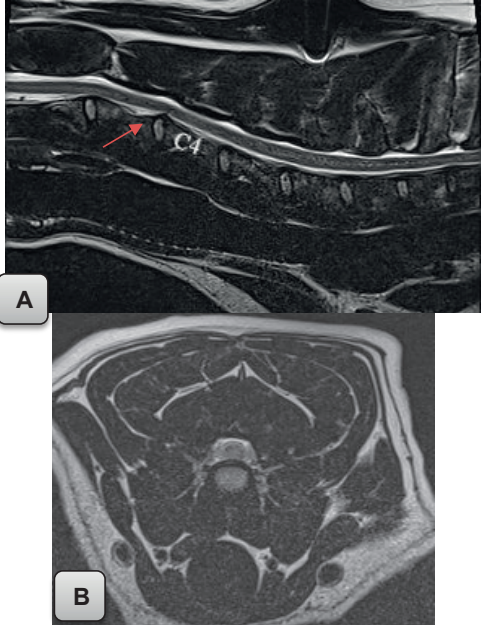


Figure 3. Sagittal T2 sequence images (A), transverse T2 sequence images (B) and transversal T1 sequence images (C), at the C3-C4 intervertebral space, showing a focal, well-delimited disc material migrated caudally in the vertebral canal as a T2 and T1 hypointensity signal with severe dorsal compression of the spinal cord (A, B and C)



Literature data show differences in the occurrence of disc degeneration in dogs depending on the type of breed, with chondrodystrophic breeds being more predisposed to this condition (Bergknut, 2013; Da Costa et al., 2020). Our study carried out on a smaller number of cases (n=12), highlights the presence of these changes in both categories of dogs (66.57% in chondrodystrophic breeds and 33.33% in non-chondrodystrophic breeds).

Chondrodystrophic patients were between 2 and 9 years old, with an average age of 5.6 years, while non-chondrodystrophic breeds ranged from 3 to 8 years, with a mean age of 6 years. A study by Kranenburg et al. (2013) found no significant age differences among the evaluated subjects, reporting an average age of 6.5 years for chondrodystrophic breeds and 6.6 years for non-chondrodystrophic breeds. More recently, Argent et al. (2022) identified disc disease in patients aged 1 to 17 years, with an average age of 8.41 years, a variation likely due to the larger sample size in the study, which included 119 dogs.

IVDD is a common cause of cervical spine pain and neurological issues in dogs (Lappalainen et al., 2001), with the severity of clinical symptoms varying based on the type and location of the condition (Kranenburg et al., 2013).

In this study, disc extrusion was predominantly recorded in the C2-C3 segment (3 cases), similar to those previously published (da Costa et al., 2020; Neagu et al., 2018). Kranenburg et al. (2013), highlight that the cervical spine segment, was the most affected region in the case of disc extrusion, being found in 17 out of 49 cases, resulting an increased risk of Hansen disc herniation type I in the cervical segment.

In addition, it was found that the location of the disc extrusion in the C2-C3 segment affects small dogs, while the location of C5-C6 and C6-C7 is more frequent in large dogs (Cherrone et al., 2004; Hakozaki et al., 2015; da Costa et al., 2020).

Regarding disc protrusion, in the present study, it was identified at the C6-C7 level, followed by C5-C6 and C3-C4, consistent with previous studies by Hakozaki (2015).

The clinical manifestations expressed by the animals taken in the study confirm the results of other studies, where, secondary to intervertebral disc damage, neurological signs such as ataxia,

and delayed proprioception in the forelimbs, which can evolve into paresis or paralysis, appeared (Itoh et al., 2008; Neagu et al., 2018).

CONCLUSIONS

The presence of symptoms such as cervical pain, delayed proprioception in the front limbs, ataxia, and paralysis of the hind limbs can be signs of a spinal condition, where an appropriate therapeutic protocol can be established based on the neurological and imaging diagnosis.

To confirm the suspected neurological diagnosis, the imaging examination (MRI) remains the easiest, non-invasive diagnostic method to confirm the structural changes of the intervertebral discs, being able to exclude other pathologies with similar manifestations.

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