

## MRI FINDINGS OF THE CERVICAL SPINE IN 3 BEAGLE DOGS

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### *Abstract*

*Degenerative disc disease is a condition of the spine caused by dehydration and degeneration of intervertebral discs being an inevitable process with increasing age of the animals. These changes can lead to clinical and pathological diseases characterized differently, such as Hansen type II (protrusion) and Hansen type I (extrusion) disc disease. Medical records of three Beagle dogs, aged 3-8 years, who were presented in the clinic of the Faculty of Veterinary Medicine of Bucharest with neurological features, were reviewed. Animals were evaluated by radiographic and MRI imaging. Radiographic examination was conducted in lateral incidence at the level of cervical segment. MRI images were obtained with a low field magnetic resonance of 0.3 Tesla, through: T1 SE (spin echo), T2 FSE (fast spin echo) and T1 sequences after the administration of contrast agent, dogs were positioned in lateral decubitus under inhalatory anesthesia. Radiographic examination revealed narrowing of the intervertebral space in two cases, at the level of C2-C3. MRI examination revealed intervertebral disc degeneration and dehydration at a total number of eight discs in the cervical segment from all three cases. Hansen type II (protrusion) compression on the spinal cord has been registered in one case at C3-C4 level, and in two cases was detected Hansen type I (extrusion) at C2-C3 level, with the movement of the disc fragments in the spine, confirmed by radiographic examination. Magnetic resonance imaging has provided a useful, safe, non-invasive evaluation of the cervical spinal cord.*

**Key words:** dog, extrusion, MRI, protrusion.

### INTRODUCTION

Intervertebral disc herniation is a spinal cord disease commonly found in dogs, with two types of degenerate intervertebral discs hernias, namely intervertebral disc extrusion or Hansen type I and intervertebral disc protrusions or Hansen type II (Hansen, 1952; Bergknut et al., 2013). Both types of disc disease are associated with different pathological and clinical features (Decker et al., 2016). Extrusion of the intervertebral disc is characterized by a sudden and unexpected herniation of the degenerated and/or calcified nucleus pulp by a rupture of the fibrous ring, followed by the migration of the disc material into the vertebral canal. The usual affection is found in young dogs belonging to the chondrodystrophic breeds and is accompanied by an acute onset of clinical signs, which may range from cervical hyperesthesia to paraplegia (Hansen, 1952, Smolders et al., 2013). Protrusion of the intervertebral disc is characterized by the slow, progressive and focal extension of the fibrous ring and the longitudinal dorsal ligament into the vertebral

canal. This type of disorder is common in older non-chondrodystrophic dogs, where clinical signs, such as paresis and limb ataxia, slowly settle (Hansen, 1952; Smolders et al., 2013).

In practice, it is very important to make an exact distinguish between the extrusion and protrusion of the disc before the treatment. Magnetic resonance imaging (MRI) is considered to be the best way to diagnose intervertebral disc disease in dogs because it is safe, non-invasive and offers high-resolution digital images in multiple planes. It also provides a good view of the parenchyma of the spinal cord and other vertebral structures (Hansen, 1952; Murthy et al., 2014).

The objectives of this study were to describe and establish the type of disc degenerative disease in 3 Beagle dogs evaluated by neurological, radiographic and magnetic resonance examination.

### MATERIALS AND METHODS

The medical records of **3 dogs** from the Beagle breed (case 1: 5 years old, female; case 2: 3

years old, male; case 3: 8 years, male) were reviewed at the clinic of the Faculty of Veterinary Medicine from Bucharest with neurological signs. The clinical evaluation was done according to the methodology described in the specialized textbooks (Vlăgioiu and Tudor, 2012). Radiographic images were obtained from latero-lateral incidence with an Optimus Bucky Diagnost (Philips, Germany) using a focal length of 100 cm. The MRI examination was done using a VET MR GRADE with a power of 0.3 Tesla (ESAOTE, Italy) using a permanent magnet and dedicated coils. The protocols used to obtain the images consist of T1 Spin Eco (SE) and T2 Fast Spin Eco (FSE) in three planes (sagittal, transversal and dorsal) with a slices thickness of 3 mm and postcontrast images obtained in T1 sequence after administration of the intravenous contrast substance (Multihance, 0.2 ml/kg). For the MRI examination, the animals were positioned in lateral/sterno-abdominal decubitus and were anaesthetized using premedication protocol composed of one of the following: Diazepam,

Butorphanol or Domitor, then induction with propofol (Propovet, IV), then intubated and maintained under general anesthesia with Isoflurane in 100% oxygen and adjusted in accordance with the depth of anesthesia, to obtain superior image quality and without motion artifacts.

## RESULTS AND DISCUSSIONS

Clinical examination by general examination methods revealed pain in the cervical segment, and after the neurological examination a disc degeneration at the C2-T2 level was suspected, but other pathologies such as myelopathy, vascular disease or a trauma at that level have not been excluded. Neurological signs were represented by: limb ataxia and low proprioception of the anterior limbs.

The radiographic examination revealed the narrowing of the C2-C3 intervertebral space in cases 1 and 3 (Figure 1), suspecting a disc herniation, and in case 2 there were no radiographic changes.

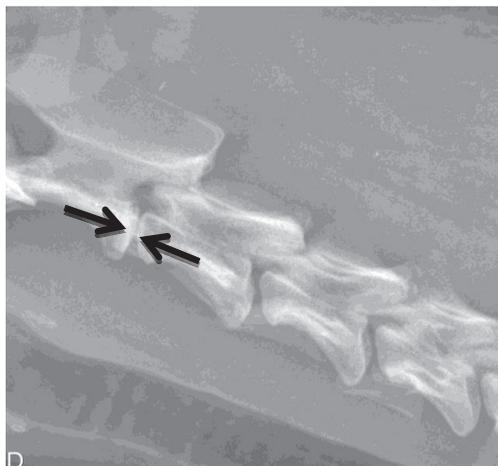


Figure 1 – Latero-lateral incidence of the cervical spine in case 3: collapse of intervertebral space at the level of C2-C3 (arrows) is observed

The magnetic resonance imaging examination revealed the following aspects: degeneration and dehydration of the intervertebral disc at a total of 8 discs in the cervical segment in all the three cases (case 1: 4 discs, case 2: 1 disc, case 3: 3 discs), from which one case (case 2) had disc protrusion (Hansen type II) at the C3-C4 intervertebral space with compression on the spinal cord (Figure 2), and in cases 1 and 3 disc

extrusion was revealed (Hansen type I) at the C2-C3 level, as follows: median, right paramedian (case 1) with the caudal migration of the disc fragment in the vertebral canal (Figure 4 and 5), respectively (case 3) left paramedian disc extrusion (Figure 3). The results of the MRI examination confirm the radiography suspicion of disc herniation at the C2-C3 level.

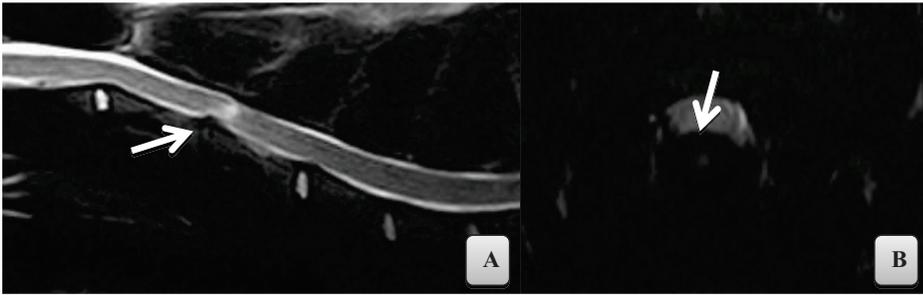


Figure 2 – Images in sagittal T2 (A) and transverse T2 (B) planes, at the C3-C4 intervertebral space, case 2: can be observed the hypointensity of the degenerate disc, dehydrated, but also moderate dorsal compression (A) respectively median compression of the meninges and spinal cord without breaking the fibrous ring (B). Light diffuse hiperintensity area caused by compression (arrows).

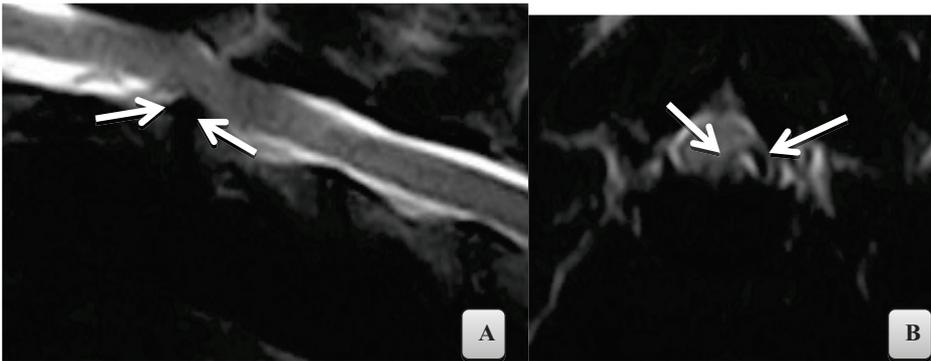


Figure 3 - Images in sagittal T2 (A) and transverse T2 (B) planes, at the C2-C3 intervertebral space, case 3: can be observed the hypointensity of the degenerate, dehydrated disc (A), but also a heterogeneous area, well-defined iso/hypointensity, left paramedian (B) compressing the spinal cord (arrows).

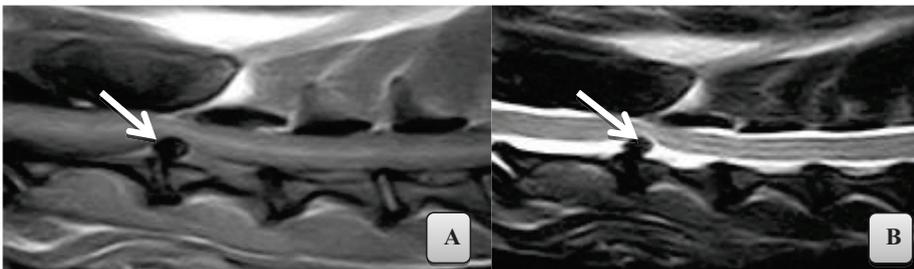


Figure 4 - Images in sagittal T1 (A) and T2 (B) planes, at the C2-C3 intervertebral space, case 1: can be observed the hypointensity of the degenerate, dehydrated disc, but also a heterogeneous area, well-defined hypointensity (disc material), slightly migrated caudally, compressing the spinal cord (arrows).

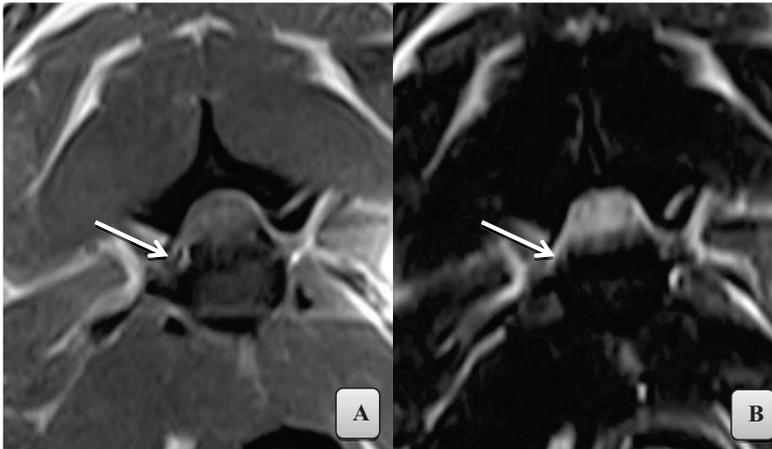


Figure 5 - Images in transverse T1 (A) and T2 (B) planes, at the C2-C3 intervertebral space, case 1: can be observed a slightly heterogeneous area, median, right paramedian, which disrupts the medullary parenchyma causing a medullary compression (arrows).

In the literature (Hansen, 1951, 1952), it is assumed that the disc degenerations in the condrodystrophic (CD) and non-condrodystrophic (NCD) breeds appears different depending on the age and the speed at which the degenerative changes spread, considering there are two different degenerative processes.

Further studies have supported this hypothesis, showing that there are important differences between the disc degeneration processes recorded in the CD breeds compared to those encountered in NCD breeds (Bergknut, 2013). In this paper are presented the imaging, radiographic and MRI aspects of three chondrodystrophic (Beagle) dogs (3-8 years old). Intervertebral disc disease is a common cause of back pain and neurological deficits in dogs and in individuals with present disc calcifications that increases the risk of intervertebral disc disease (Lappalainen A., and Col. 2001).

The clinical manifestations expressed by the animals that we evaluated were in agreement with previous data stating that intervertebral disc herniation caused different degrees of myelopathy, including pain, paralysis, or permanent paralysis, and the Beagle breed was most affected by the cervical intervertebral disc herniation (34.8%) (Itoh H., et al., 2008). It has also been shown that disc extrusion commonly affects small dogs in the cervical segment at C2-C3 and large at C6-C7 (Cherrone et al. 2004) or even C5-C6 and C6-C7 (Ryan and Col. 2008, Hillman et al., 2009, Costa Costa et

al., 2012). In our report, disc changes have been identified at C2-C3 (case 1 and 3) and C3-C4 level (case 2), in concordance with previous studies.

In a study by Kranenburg et al. (2013), type I hernia has been reported to frequently affect the cervical segment (17/49), followed by the thoracolumbar segment (31/49) and the lumbosacral segment (1/49), while type II hernia frequently affects the lumbosacral segment (16/25), followed by thoracolumbar segment (5/25) and cervical segment (4/25), concluding that the cervical segment presents an increased risk of developing a type I disc disease and a low risk for a type II disc disease (Kranenburg et al., 2013).

Risk of occurrence and the development of intervertebral disc degeneration and their associated disorders is higher in chondrodystrophic breeds, suggesting that besides the potential genetic component, some external factors such as physical activity and the environment in which the animals live (Lappalainen A., and Column 2001).

## CONCLUSIONS

In the presence of cervical pain, a neurological examination accompanied by a detailed imaging examination is needed to identify the presence of spinal cord injuries. Because cervical pain can have multiple causes, including intervertebral disc disease, magnetic

resonance imaging (MRI) is a useful method in confirming structural and positional alterations of intervertebral discs, thus excluding other pathologies and helping to guide the physician in choosing the appropriate therapy.

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