

Relation of fibrocartilaginous embolism and acute and non-compressive nucleus pulposus extrusion with imaging tests – case report

[Relação de embolia fibrocartilaginosa e extrusão aguda e não-compressiva do núcleo pulposus com testes de imagem - relato de caso]

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ABSTRACT

Fibrocartilaginous embolism (FCEM) and acute, non-compressive nucleus pulposus extrusion (ANNPE) are non-compressive myelopathies that are difficult to differentiate. The definitive diagnosis is obtained only with histology, but the presumptive diagnosis is made through clinical signs and imaging tests. The aim of this study is to report the imaging tests performed for the diagnosis of a neurological clinical case and discuss the best diagnostic method. After attending the patient, complementary tests were requested. Radiography results showed no change. The computed tomography diagnostic impression indicated distal protrusion between C6-C7, T11-T12, T13-L1 followed by mild spinal cord compression defined by the presence of a ventral hyperattenuating region. Magnetic resonance (RMI), showed a slight T2W hypersignal, well delimited in the gray matter, lateralized to the right, over the cranial third of C7. Concluding that the magnetic resonance is the method that brought more information for the diagnosis, in which the others were not described medullary alterations pertinent to FCEM and ANNPE. With their fair prognosis, the absence of histological diagnosis of these diseases may be a limiting factor in this study and, in relation to the RMI alterations being very similar between FCEM and ANNPE it is not possible to diagnose fully accurately.

Keywords: computed tomography, magnetic resonance, dogs

RESUMO

A embolia fibrocartilaginosa (EFC) e a extrusão aguda não compressiva do núcleo pulposus (EANCNP) são mielopatias não compressivas de difícil diferenciação. O diagnóstico definitivo é obtido apenas com a histologia, mas o diagnóstico presuntivo é feito por meio de sinais clínicos e exames de imagem. O objetivo deste trabalho é relatar os exames de imagem realizados para o diagnóstico de um caso clínico neurológico e discutir o melhor método diagnóstico. Após o atendimento do paciente, foram solicitados exames complementares. Os resultados da radiografia não mostraram nenhuma alteração. A impressão diagnóstica da tomografia computadorizada indicou protrusão distal entre C6-C7, T11-T12, T13-L1, seguida de leve compressão medular definida pela presença de região hiperatenuante ventral. À ressonância magnética (RM), apresentava discreto hipersinal em T2W, bem delimitado na substância cinzenta, lateralizado à direita, sobre o terço cranial de C7. Concluiu-se que a ressonância magnética é o método que mais trouxe informações para o diagnóstico, os demais métodos não foram descritos alterações medulares pertinentes à EFC e à EANCNP. Com seu prognóstico favorável, a ausência de diagnóstico histológico dessas doenças pode ser um fator limitante neste estudo. Em relação às alterações do RM serem muito semelhantes entre EFC e EANCNP, não é possível diagnosticar com total precisão.

Palavras-chave: Tomografia Computadorizada; Ressonância Magnética; Cães

INTRODUCTION

Fibrocartilagenous embolism (FCE) and acute non-compressive nucleus pulposus extrusion (ANNPE) are usual in dogs and do not present with spinal cord compression. It has been increasingly diagnosed due to the increased use of magnetic resonance imaging (MRI) in veterinary medicine. Distinguishing FCE and ANNPE from other myelopathies is usually easy but differentiating the two diseases between them to determine which one is occurring can be quite challenging (Mari *et al.*, 2017; Risio, 2015).

The definitive diagnosis is only possible to be performed post-mortem by macroscopic and microscopic examination of the affected region (Gandini *et al.*, 2003; Mari *et al.*, 2017). But the presumptive diagnosis is based on typical clinical signs and imaging tests such as radiographs, computed tomography (CT) and MRI, the latter being considered the gold standard for the evaluation of myelopathies (Risio and Platt, 2010; Mari *et al.*, 2017; Ros *et al.*, 2017).

Fibrocartilagenous embolism is characterized by the embolization of fibrocartilagenous material in the spinal vasculature resulting in ischemic necrosis. This embolus is identical to the nucleus pulposus, histochemically and histologically, and it is still uncertain how this embolus reaches the vessels of the spinal cord (Cauzinille and Kornegay, 1996).

Acute, non-compressive extrusion of the nucleus pulposus refers to the extrusion of a hydrated nucleus pulposus due to an increase in intradiscal pressure, which normally occurs in healthy discs subjected to great force or trauma, leading to spinal cord contusion, not compression. The hydrated nucleus dissipates in the epidural space (Risio *et al.*, 2009, Gandini *et al.*, 2003, Mari *et al.*, 2017).

The clinical signs of both diseases usually have sudden onset, with its subsequent stabilization occurring within 24 hours, becoming then, non-progressive. The definition of FCE and ANNPE is given according to the affected region and lesion's extension, which in its turn is usually asymmetric. The prognosis is closely linked to the extension of the lesion (Risio and Platt, 2010; Mari *et al.*, 2017).

The analysis of cerebrospinal fluid is important in ruling out other acute and focal myelopathies. In cases of FCE and ANNPE it rarely presents alterations (Risio and Platt, 2010).

The aim of this essay is to report the imaging tests performed for the diagnosis of a neurological clinical case treated at the veterinary clinic of Pontificia Universidade Católica de Campinas (PUC Campinas) and to discuss the best method.

To carry out this work, a literature review was carried out in the following databases: Elsevier open science, Pubmed, Scientific Electronic Library Online (Scielo), as well as in books, scientific journals, and scientific articles.

It was also carried out the report of a clinical case of a canine mixed breed female of 9 years old, presenting neurological symptoms in which radiographic examination was performed at the veterinary clinic that was attended and for other examinations, reports of examinations carried out by specialized veterinarians.

A 9 year old female of the canine species, mixed breed medium size, was attended at the veterinary clinic of the Pontifical Catholic University (PUC Campinas) Campus II on 04/20/2021. The main complaint was spastic paralysis of the four limbs. During anamnesis, the tutor reported that she found the animal in lateral decubitus, in which she remained during the consultation, presenting rigid limbs performing only head movements, with significant tremor, no vocalization, no convulsion or opisthotonos. The tutor also mentioned the animal's habit of jumping a lot and climbing in high places, not being able to rule out a fall or trauma, although they cannot confirm any event. On physical examination, the patient showed no sign of fracture. A neurological examination was performed, which indicated spinal cord injury in the cervical region and impairment of the most evident neuromotor lesions on the right side.

Then, radiographic examination of this segment was requested, in which there were no changes in the anatomical axis, intervertebral spaces and preserved intervertebral foramina. Computed tomography examination was requested and

while awaiting the results, prednisone therapy was instituted.

Computed tomography (CT) was performed on 04/26/2021 of the C3-L7 segment in continuous 1mm-thick tomographic sections before and after administration of contrast in the subarachnoid space, in which a slight elevation of the ventral column of contrast was visualized between C6-C7, mild cervical and lumbar spondylosis. In the pre-contrast images, a suggestive hyperattenuating and ill-defined region could be observed located on the ventral aspect of the segment at the level of the intervertebral space between T11-T12, T12-T13 (most evident) and T13-L1. The diagnostic impression indicated distal protrusion between C6-C7, T11-T12, T13-L1 accompanied by mild spinal cord compression.

The analysis of the cerebrospinal fluid showed no cytological changes, it was colorless, with a clear appearance.

Based on the neurological examination, the alterations described in the CT report were not consistent with the patient's evolution, therefore, it was decided to continue the investigation with the performance of high-field magnetic resonance imaging of the cervicothoracic and multiplanar thoracolumbar segments (sagittal, transverse, dorsal and radial) and multisequential with T1W-weighted images (pre and post gadolinium-based contrast), T2W, T2, STIR and T2-myelogram. Evidencing the discs with varying degrees of dehydration, which was more evident in C6-C7. The spinal cord showed a slight T2W hypersignal, well delimited in the gray matter, lateralized to the right, over the cranial third of C7. In this region, there was a slight enhancement after contrast administration. Multiple non-compressive bulges along the thoracic spine. A suggested diagnostic impression was vascular injury (fibrocartilaginous embolism) in the spinal cord over the cranial third of C7, with a less likely differential diagnosis of acute, non-compressive nucleus pulposus extrusion.

On 05/26/2021, the patient returned and was in the prednisone weaning phase, in which the animal was already able to remain in external recumbency, improved tail movement and limb flexion.

DISCUSSION

The patient's clinical signs are consistent with those mentioned in the literature, including the asymmetry of the lesion, which in this case, the most affected side was right and non-progressive (Risio and Platt, 2010; Mari *et al.*, 2017).

Radiography is an important screening test, and the absence of alterations also helps in the treatment, since both FCE and ANNPE do not normally show alterations, as well as in contrasted tests. Although myelography is an option to exclude other diagnoses, it was decided not to perform it due to sedation and application of contrast that would already be performed later in the computed tomography (Risio and Platt, 2010; Hecht and Costa, 2015).

To rule out other conditions, an analysis of the cerebrospinal fluid was carried out, in which its result was consistent with the literature, presenting rarely changes in these cases, and when it does present, they are non-specific abnormalities such as xanthochromia, mild to moderate pleocytosis and increased protein concentration (Hecht and Costa, 2015; Risio, 2015; Risio and Platt, 2010).

Tomography was performed as a second diagnostic option because it is more available and less expensive (Costa *et al.*, 2020). Computed tomography helps to exclude other acute myelopathies and may suggest spinal cord edema. (Risio and Platt, 2010). Although in the present essay, CT presented divergences with MRI, not being possible to obtain the diagnosis. A plausible explanation to this would be the limitations of CT when compared to MRI, including the contrast variation being greater in MRI than in CT, the fact that MRI can be obtained in different planes, while CT can only be acquired parallel to the gantry and, most importantly for this case, the spinal cord itself is not directly visualized by simple CT, and compression is usually inferred through loss of epidural space (Costa *et al.*, 2020; D'anjou, 2014).

Magnetic resonance (RMI) imaging has been described as the gold standard for these conditions and this is related to its ability to distinguish multiple anatomical structures of the spinal canal such as the spinal cord, synovial

joints, nerve roots, among others (Costa *et al.*, 2020, Mary *et al.*, 2017).

MRI showed T2W hypersignal that is present in cases of FCE and ANNPE, but there was an absence of the signs inherent to the nucleus pulposus. Based on the MRI criteria for acute disc extrusion as a T2-weighted focal intramedullary hyperintensity over a narrow intervertebral disc and residual nucleus pulposus volume, extradural material compatible with hydrated nucleus pulposus not causing spinal cord compression, a directional pattern non-longitudinal T2W IH originating from an intervertebral disc with a cleft in the dorsal part of the annulus fibrosus, on T1-weighted isointense images are commonly found and there is no evidence of image enhancement after contrast application, however images have also been reported hypointense on T1 showing enhancement on post-contrast T1. In thromboembolism, the presence of a focal intramedullary lesion, well demarcated, hyperintense (longitudinal T2W) and iso or hypointense T1-weighted, mainly affecting the gray matter and the absence of relevant results with ANNPE, stands out. Knowing this and based only on MRI, the main differential diagnosis would be FCE, followed by ANNPE (Risio *et al.*, 2009; Risio, 2015; Hecht and Costa, 2015; Mary *et al.*, 2017).

However, in cases of antemortem ham diagnosis, it is known that the prevalence of FCE in the intervertebral spaces of C1-C5 is less common, occurring more in the L4-S3 and T3-L3 segments, respectively. While for ANNPE the most predisposed portions are the cervical and thoracolumbar, particularly the spaces between T12 and L2. A suspicion for this segment to be the most affected would be the strong biomechanical forces that act in this region, especially during vigorous exercise and trauma. (Chang *et al.*, 2007; Risio, 2015). Adding the lesion location and the patient's jumping history, the most likely diagnosis analyzing these factors would be ANNPE.

MRI scans performed 24-72 hours after the onset of symptoms may reveal no hyperintensity

changes on MRI. The use of diffusion-weighted magnetic resonance imaging has been cited to increase the specificity and sensitivity of early-stage diagnosis, especially in cases of FCE (Risio *et al.*, 2009; Risio, 2015). On the other hand, in the articles and books consulted, no information was found regarding the performance of tests with longer intervals after the onset of clinical signs, whether this affects, positively or negatively, the diagnosis, therefore, it is not possible to say that the time elapsed between the onset of clinical signs and MRI, that is, 27 days, may have impaired the accuracy of the diagnosis.

On return after 36 days, there was a positive evolution of the patient's clinical condition. Mari *et al.* (2017) report that dogs with a presumptive diagnosis of FCE have a greater chance of recovery than animals with ANNPE.

It is also not possible to rule out other diseases of the intervertebral disc due to changes in the computed tomography exam in the intervertebral spaces T11-T12, T13-L1, the study site in this report being C6-C7.

CONCLUSION

We can conclude with the report that magnetic resonance imaging is the diagnostic method that brought more information to this report, although it is not the definitive one. Due to the favorable prognosis of these conditions, there is a lack of histological diagnosis of these diseases, which may be a limiting factor for their study. Computed tomography was not of great value in the reported case, although its use is greatly encouraged, as contrast-enhanced CT can replace MRI in some cases of intervertebral disc disease and provides more information than radiography. The differentiation between FCE and ANNPE proved to be extremely complicated only with the magnetic resonance data, and the issues evaluated such as history, epidemiology and clinical signs are also of great value, showing the importance of performing a good clinical care for a good interpretation of the imaging tests. It cannot be ruled out that the interval between the onset of clinical signs and the MRI may have affected the result.

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