

Surgical Treatment of Compressive Hydrated Nucleus Pulposus Extrusion in Dogs

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Abstract

A small animal hospital received a presentation of a female 8-year-old neutered Maltese Bichon Frise for evaluation of acute paraplegia. The results of diagnostic imaging, such as simple spinal radiographs and CT angiography, did not indicate the presence of an intervertebral disc extrusion or any other abnormalities. A speciality hospital's emergency department was recommended for the dog's MRI. The characteristics of an extrusion of hydrated nucleus pulposus. During hemilaminectomy, a mixture of white gelatinous and somewhat hard material was discovered. Both cytology and histology supported a nucleus pulposus that had partially deteriorated. It was determined that the lumbar spine had compressive HNPE. Five days after surgery, the dog was given the all-clear. The owner reported normal ambulation and no indications of neurologic impairments during the most recent follow-up, which was conducted by phone interview.

Keywords: Orthogonal radiographs; Congenital abnormalities; Haematoxylin; Eosinophilic

Introduction

The most frequent cause of acute paralysis in chondrodystrophic dogs visiting small animal emergency clinics is intervertebral disc disease (IVDD). Intervertebral disc extrusions (IVDEs) and protrusions are typically included in IVDD. The hydrated nucleus pulposus extrusion is one of five types of IVDEs that can be further subcategorized (HNPE). 2 Just four cases of HNPE have been recorded at T13-L1.3-11, with most occurrences affecting the cervical spine. Just 3.6% of dogs with chondrodystrophies require further imaging, such as myelography, CT-myelography, or MRI. CT is deemed adequate as the first-line imaging modality in these breeds. 12 Contrarily, MRI reduces the likelihood of false-negative IVDE diagnosis results while also avoiding the dangers of myelography.

Cases presented

A female Maltese Bichon Frise (a cross between a Bichon Frise and a Maltese dog) aged 8 and weighing 11 kg was brought to the emergency department at Ludwig-Maximilians University. A tiny animal hospital had first examined the dog that day to determine whether or not it had [1-7] acute paraplegia. IVDE was a possibility. The tests included a complete blood count (CBC), serum biochemistry, orthogonal radiographs, and a spine-specific CT angiography. Serum biochemistry and the CBC were unremarkable. The dog was sent for an MRI scan because diagnostic imaging did not indicate an IVDE or show any other abnormalities.

Materials and Methods

The broad examination didn't stand out. A Grade 2 modified Frankel score on a neurological examination indicated paraplegia, and the lesion was considered to be localised at the T3-L3 spinal cord region with lateralization to the right side. The dog had retained urine. Before referral, radiographs and a CT scan were examined. The radiographs didn't show any alterations that would support IVDE. The test was conducted using a helical multiple slice CT (Somatom Scope, Siemens Medizintechnik/Healthineers). All series were run at 110 kV/130 mAs with a 1 mm slice thickness. The high-frequency image reconstruction algorithm's "B80s" convolution kernel has a window level of 300 and a window width of 2300. The low-frequency image reconstruction algorithm's "B31s" convolution kernel has a window level of 46

and a window width of 320 for the soft tissue window. In soft tissue reconstruction, attenuation was measured, and a mean attenuation of 41 Hounsfield units (HU) with a range of 10 HU was found. Acute IVDE symptoms were not visible on the CT scan. Sagittal, transverse, and dorsal T2-weighted [T2w], transverse pre- and postcontrast T1w and subtraction, transverse T2*w, and transverse short tau inversion recovery (STIR) MRIs using the advanced standard protocol (1.5T) were done. The intervertebral disc space was shown to have a wide-based ventral extrudal compressive homo- to heterogeneous IVDE on MRI, with a modest right-sided lateralization tapering off in a cranial and caudal direction. On T2w pictures, the material displayed a hyperintense signal with iso-hypointense foci. On T1w images, the material displayed an iso-hypointense signal. On T2*w images and STIR images, the material displayed a hyperintense signal. Reduced nucleus pulposus volume and partially degraded nucleus pulposus were visible in the afflicted disc region. The hyperintense signal connected to the subarachnoid and epidural spaces was lost. The contrast enhancement in the extruded material was variable. In the transverse planes, the degree of spinal cord compression accounted for 51%. A compressive, lateralized HNPE at the second to third lumbar intervertebral disc space was suspected based on imaging results.

Distinctive diagnosis

IVDE is the most frequent cause of acute paraplegia in chondrodystrophic dogs. Acute non-compressive nucleus pulposus extrusion (ANNPE), infection, trauma, degenerative disease, haemorrhage, ischemic injury (fibrocartilaginous embolic myelopathy (FCEM)), congenital abnormalities, and neoplasia are a few more possible aetiologies. The major differential diagnosis for this instance was HNPE based on the results of the MRI.

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Received: 05-May-2023, Manuscript No: jvmh-23-90919, **Editor assigned:** 08-May-2023, PreQC No: jvmh-23-90919 (PQ), **Reviewed:** 22-May-2023, QC No: jvmh-23-90919, **Revised:** 25-May-2023, Manuscript No: jvmh-23-90919 (R), **Published:** 31-May-2023, DOI: 10.4172/jvmh.1000181

Citation: Meyer-Lindenberg (2023) Surgical Treatment of Compressive Hydrated Nucleus Pulposus Extrusion in Dogs. J Vet Med Health 7: 181.

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Results and Discussion

Treatment

Surgery was advised due to the severity of the spinal cord compression and the heterogeneous appearance of the herniated material, which indicated at least partially hard disc material. The canine was positioned in a sternal recumbency while a right-sided hemilaminectomy (L2-3) was carried out utilising a dorsal technique. Surgery results supported the IVDE diagnosis. The material was recognised as a mixture of white gelatinous and partially hard material (cartilaginous look). The cord appeared to be sufficiently decompressed over the length of the hemilaminectomy, and all visible material had been removed. The collection of specimens was done for histopathologic and cytologic analysis. A urinary catheter was inserted after the wound was usually stitched up. Regardless of the breed, MRI provides more information than CT contrast for the examination of intervertebral disc extrusion. Several stages of hydrated nucleus pulposus extrusion (HNPE), with varied quantities of hydrated nucleus pulposus and spinal cord compression, may take place. Compressive HNPE may require surgical intervention.

Achievement and follow-up

The dog underwent successful surgery, and postoperative care included the administration of fentanyl-ketamine-lidocaine CRI solution (2 ml/kg/day intravenous (IV)), a fentanyl transdermal skin patch, gabapentin (10 mg/kg q8h orally), phenoxybenzamine. The day following surgery, physiotherapy (a five-step procedure) was started. Two days after surgery, the urine catheter was withdrawn, and the urinary bladder was manually expressed until the patient could once again urinate on command. On day 5 after surgery, the dog was able to walk and urinate on his own and was released. His neurological condition continued to improve. The dog no longer displayed cognitive impairments and appeared at ease when the owner was re-interviewed two months after the operation. Due to the dog's clinically normal condition and the remote location, follow-up visits for additional testing were rejected. Haematoxylin and eosin was used to stain cytological smears made from extruded intervertebral disc tissue that was obtained during surgery (H&E). Prior to paraffin embedding, the excised material was fixed in a 10% neutral buffered formalin solution. The Masson's trichrome and H&E stains were used. The cytopreparations showed lakes of eosinophilic amorphous acellular material that resembled chondroid matrix, as well as an abundant background of basophilic matrix and red blood cells. There were also numerous groups of amorphous, basophilic chondroid material with nucleated cells. These cells resembled chondrocytes or notochordal cells because of their loosely defined borders, intense chromophilia, and occasionally indented nuclei. In the dense amorphous extracellular matrix, the histology revealed fragments of the nucleus pulposus with irregularly shaped nests and islets containing two to four notochordal cells. These fragments stained basophilic to slightly eosinophilic in H&E and diffusely blue on Masson's trichrome stains, covering up to 70%–75% of the area of the sections. Moreover, several rows of chondrocytes with a linear and parallel orientation that matched the inner annulus fibrosus were found. Nuclear pyknosis and necrosis of notochordal cells were examples of degenerative alterations, as well as infrequent tears and clefts of the inner annulus fibrosus that were occasionally bordered by fibrin. No indication of inflammatory cells could be found. These results supported the ejection of the nucleus pulposus, which had largely deteriorated. An animal hospital for small animals received a dog with acute paraplegia. The most plausible

diagnosis was IVDE based on the chondrodystrophic breed and neurological evaluation. Thoracolumbar spine radiographs and a CT scan were taken, but the CT scan was unable to make a diagnosis. In one investigation, the use of CT as the initial imaging modality for canines exhibiting thoracolumbar myelopathy was supported. 17.4% of non-chondrodystrophic breeds required additional imaging, compared to 3.6% of Dachshunds and 13.6% of breeds beyond regular business hours. However, a CT scan is conducted knowing that more imaging may be needed if no lesion is seen. 13 The usefulness of CT for the evaluation of HNPE was examined in a different investigation. With a sensitivity of 91% and specificity of 100%, CT angiography showed a lesion in all but one case to distinguish between HNPE and Hansen type I IVDE. 8 In contrast-enhanced CT, HNPE was not seen in the described chondrodystrophic dog. Comparing CT-myelography to non-contrast CT, CT angiography, and myelography, it was found to have a greater diagnostic sensitivity¹⁵; nevertheless, the dangers of myelography are still present. 13 As opposed to non-contrast CT, MRI has a 10% higher sensitivity and a considerably lower chance of producing false-negative results for diagnosing thoracolumbar IVDE. HNPE favours the cervical area in particular. 3-11 De Decker and Fenn¹⁶ and their personal experience indicate that HNPE happens in the thoracolumbar spine. A study that recently described thoracolumbar HNPE in 21 dogs¹⁴ provided support for this finding, and the case presented contributes to the knowledge of the relatively few cases that have been documented thus far. Until until 2022, there was no histology proof that HNPE existed in the canine thoracolumbar spine. Histological support in one dog was observed in a recent investigation. 14 In-depth cytological and histological evidence for this syndrome is also presented in this case report.

Statement of Ethics

The data in this publication were collected as part of usual care for the dog, thus there are no ethical concerns. There was no animal experimentation done on the dog. These studies do not need ethics approval or general approval under German law, according to the relevant authorities.

Authorities to the Work

This study was designed and carried out by Matthias Kornmayer. Both cytology and histology benefited from the work of Sonja Fiedler and Marco Rosati. Before submission, the manuscript was reviewed by Andrea Meyer-Lindenberg.

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