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Case Report

Multimodal Diagnosis of Cervical Spinal Cord Compression in a Dog: The Role of Accessible Imaging in Complex Decision-Making

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Abstract: Intervertebral disc disease (IVDD) is a leading cause of spinal cord compression in dogs, frequently affecting the cervical region. This case report describes the diagnostic approach and imaging findings in a geriatric Shih-Tzu presenting cervical pain and progressive neurological signs, highlighting the importance of accessible diagnostic tools in clinical routine. Initial clinical evaluation and plain radiography suggested cervical disc involvement, revealing a narrowed intervertebral space at a single segment. Due to the persistence and worsening of clinical signs, myelography was performed in conjunction with cerebrospinal fluid (CSF) analysis, allowing for the exclusion of inflammatory or infectious central nervous system disorders. Myelography revealed two cervical regions with extradural compression. Subsequently, computed tomography (CT) demonstrated three affected cervical intervertebral spaces, including disc extrusion and protrusions with varying degrees of spinal cord compression. Although advanced imaging modalities offer greater diagnostic accuracy, this report demonstrates that contrast radiography and CSF analysis, when correctly indicated and interpreted, remain relevant and viable diagnostic tools in veterinary practice. Despite the confirmation of multifocal cervical IVDD, the owner opted against surgical treatment.

Keywords: Intervertebral Disc Disease; Myelography; Cerebrospinal Fluid; Cervical Spine; Diagnostic Imaging.

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1. Introduction

In dogs, the vertebral column is anatomically divided into five regions: cervical, thoracic, lumbar, sacral, and caudal [1]. Knowledge of these regions is fundamental for accurate anamnesis and functional neuroanatomy, aiding in the identification and localization of diseases affecting the spinal cord. Among these conditions, intervertebral disc disease (IVDD) stands out as the most prevalent neurological disorder in dogs, representing the primary cause of spinal pain and neurological deficits in this species [2]. Traditionally, IVDD is classified according to the Hansen system into Type I and Type II [3]. In Hansen Type I IVDD, chondroid degeneration of the intervertebral disc occurs, culminating in the acute extrusion of the nucleus pulposus into the vertebral canal; this is most frequently

observed in chondrodystrophic breeds. Conversely, Hansen Type II IVDD involves progressive fibroid degeneration of the disc with protrusion of the disc material, being more common in non-chondrodystrophic breeds [2, 4]. Recent advances in the understanding of IVDD pathophysiology have expanded this classification to include subtypes such as lateral lumbar disc extrusion, hydrated nucleus pulposus extrusion (HNPE), acute non-compressive nucleus pulposus extrusion (ANNPE), and intradural-intramedullary intervertebral disc extrusion, reflecting the diversity of clinical presentations and spinal cord compression patterns [5, 6].

Cervical IVDD accounts for approximately 15% of discopathies in dogs, being the second most common location after the thoracolumbar region. In most cases, one or more cervical intervertebral spaces are affected, and cervical pain is the predominant clinical sign [7, 8]. Other clinical signs include cervical rigidity, muscle spasms, pain on palpation, reluctance to flex or extend the head and neck, and variable neurological deficits such as muscle weakness, hemiparesis, tetraparesis, or tetraplegia, depending on the degree and extent of the spinal cord compression [7]. The main differential diagnoses for cervical disorders are described in Table 1.

Table 1. Differential diagnoses for IVDD.

Clinical Signs	Cervical IVDD
Pain only	Acute IVDH, nerve root compression, neoplasia, meningitis, fracture-luxation
Acute paresis	Acute IVDH, fracture-luxation, neoplasia, MUO
Chronic ataxia – paresis	Chronic IVDH, neoplasia, vertebral anomaly
Extra-spinal conditions	PNS lesions, HypoAC, metabolic lesions, cardiomyopathies, neuromuscular junction disorders

Adapted from Jeffery et al. [3]. Legend. IVDH, intervertebral disc herniation; PNS, peripheral nervous system; MUO, meningoencephalomyelitis of unknown origin; HypoAC, hypoadrenocorticism.

The diagnosis of IVDD is based on the correlation between clinical history, physical and neurological examination findings, and ancillary tests. Imaging modalities such as plain radiography, myelography, computed tomography (CT), and magnetic resonance imaging (MRI) are essential tools for diagnostic confirmation, assessment of lesion extent, and therapeutic planning. Laboratory tests, including complete blood count (CBC), biochemical profile, and cerebrospinal fluid (CSF) analysis, are crucial for excluding inflammatory, infectious, or neoplastic diseases that present with similar clinical signs [9]. In this context, the present case report aims to describe and characterize the clinical and imaging findings of cervical IVDD in a dog, emphasizing the contribution of accessible and widely available diagnostic methods in clinical routine, especially in settings with limited advanced diagnostic resources.

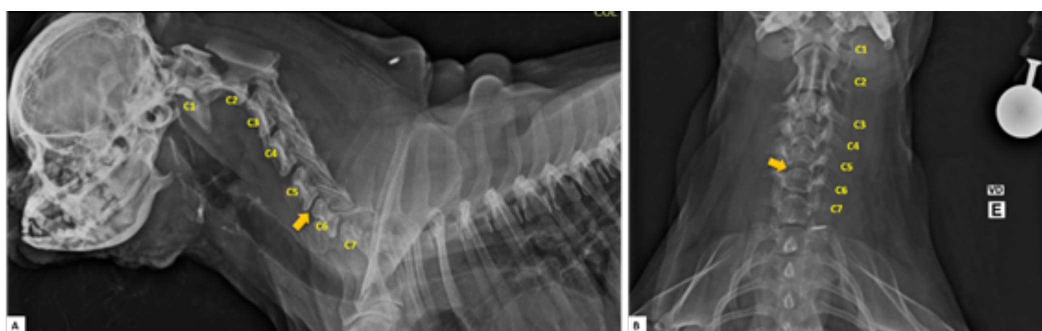
2. Case Report

An 11-year-old neutered male Shih Tzu, weighing 7.8 kg, was presented at a veterinary clinic in Palotina, PR, initially with a chief complaint of cutaneous pruritus. During the anamnesis, the owner reported a prior history of spinal column alterations without a definitive diagnosis. In subsequent evaluations, despite clinical improvement in the dermatological condition, physical examination revealed overt pain upon palpation of the cervical region, particularly at the cranial intervertebral spaces. Based on this finding, thoracic radiography was requested, which showed no relevant abnormalities and was considered within normal limits. Based on the suspicion of neurologically induced pain, clinical treatment with gabapentin and prednisolone was initiated.

Upon re-evaluation, the owner reported clinical worsening, characterized by severe cervical pain when lifting the head abruptly. Physical and neurological examinations revealed a stiff gait associated with mild thoracic limb spasticity, suggesting a cervical neurological impairment. Given the progression of clinical signs, cervical spine imaging was pursued as a complementary diagnostic step.

Initially, plain radiographs of the cervical spine were obtained without sedation in right lateral and ventrodorsal projections. The primary radiographic finding was a narrowed intervertebral space at C5–C6 (Figure 1). Other intervertebral spaces, as well as intervertebral foramina, vertebral bodies, spinous, transverse, and articular processes, were preserved, with no other relevant musculoskeletal alterations observed. The radiographic findings were suggestive of disc involvement (Figure 1). However, due to the limited availability of advanced imaging methods such as CT or MRI in the immediate geographic region, and the logistical challenge of transporting a geriatric patient in pain over 100 km to the nearest imaging center, myelography was proposed as the next diagnostic step. This invasive procedure was justified by the need for a more assertive diagnosis to guide immediate clinical management within the hospital's available infrastructure. Myelography was then performed under general anesthesia.

Figure 1. A. Plain radiograph of the cervical region, right lateral projection. B. Plain radiograph of the cervical region, ventrodorsal projection. A narrowed intervertebral space is observed at C5-C6 (arrows).



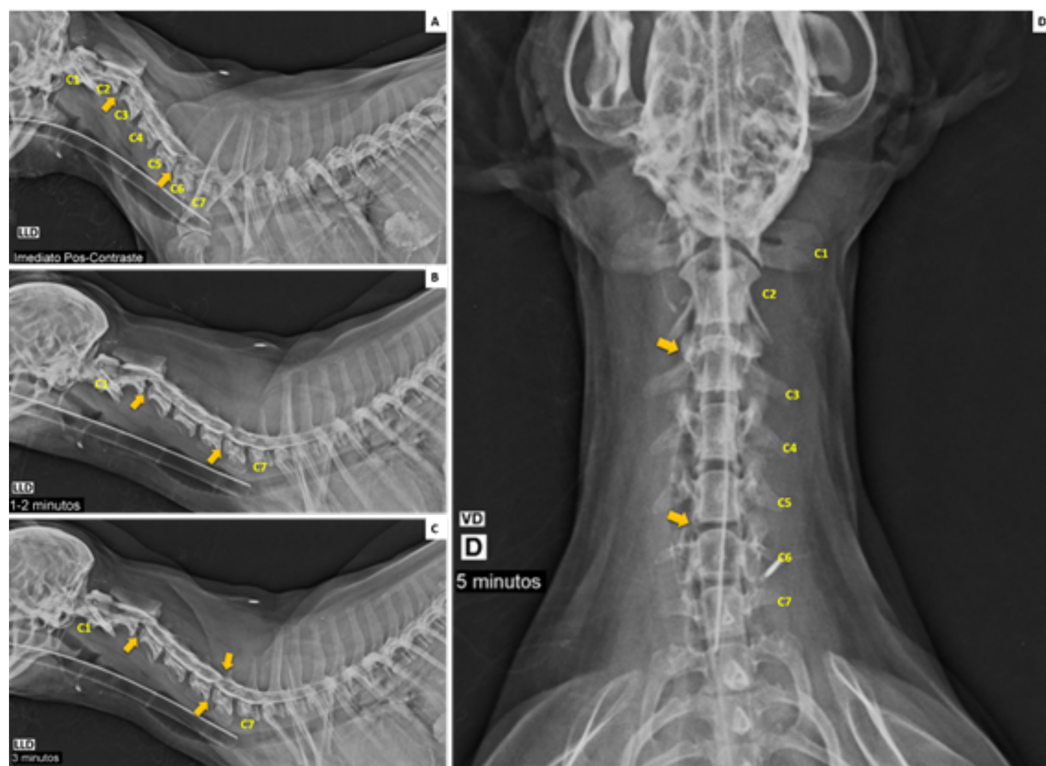
The patient was sedated, and prior to contrast medium administration, approximately 3 mL of cerebrospinal fluid (CSF) was collected via cisterna magna puncture for laboratory analysis. The collection was performed immediately after anesthesia induction and prior to the administration of the contrast medium for myelography to avoid iatrogenic chemical meningitis or pleocytosis affecting the results. CSF analysis revealed a clear, colorless fluid with density and pH within expected ranges, normal to slightly increased total protein concentration, normal cellularity, and absence of pleocytosis—findings consistent with an extradural compressive lesion, which aided in excluding inflammatory, infectious, or neoplastic central nervous system processes.

Subsequently, 1.5 mL of a non-ionic water-soluble iodinated contrast medium (iohexol, 300 mg I/mL) was administered into the subarachnoid space. Myelographic radiographs were obtained in lateral projection immediately after administration, with repetitions at two and three minutes, followed by a ventrodorsal projection at five minutes. Myelographic findings revealed abnormalities at two cervical levels (Figure 2). At C2–C3, the lateral projection showed interruption of the ventral contrast column and thinning of the dorsal column, while the ventrodorsal projection identified a widening (swelling) of the contrast column. At the C5–C6 level, the lateral projection demonstrated interruption of both ventral and dorsal contrast columns, and the ventrodorsal projection revealed thinning of the lateral columns. These findings were compatible with extradural masses at two cervical segments, with intervertebral disc disease as the primary differential diagnosis.

To better characterize the type of disc lesion, its extent, and the degree of spinal cord compression, Computed tomography (CT) was performed at a partner diagnostic center using a helical protocol with 2.0 mm thickness (Figure 3). Images were reconstructed using a bone algorithm to enhance the detection of mineralized disc material. Due to the owner's financial constraints and the fact that the patient had already undergone myelog-

raphy, intravenous contrast-enhanced CT was not performed. Although raw technical parameters were not provided by the teleradiology service, the image quality allowed for clear identification of the compressive sites.

Figure 2. A to C. Contrast radiographs (myelography) immediately after contrast, at 2 minutes, and at 5 minutes, respectively; cervical region, right lateral projection. In D, contrast radiograph (myelography) at 5 minutes, cervical region, ventrodorsal projection. Interruption of the ventral column and thinning of the dorsal contrast column are observed between C2-C3 and C5-C6 (arrows).



The examination revealed multiple hyperattenuating regions within the cervical vertebral canal. At the C5–C6 intervertebral space, material was located ventral to the left lateral aspect of the vertebral canal, occupying approximately 40% of its area, compatible with disc extrusion and moderate spinal cord compression. At the C2–C3 level (more prominently) and C6–C7, hyperattenuating areas were identified at the ventral aspect of the vertebral canal, corresponding to approximately 10–30% of the canal area, compatible with disc protrusion and mild spinal cord compression. Thus, CT enabled the identification of three affected cervical segments, expanding upon the findings observed in previous imaging exams.

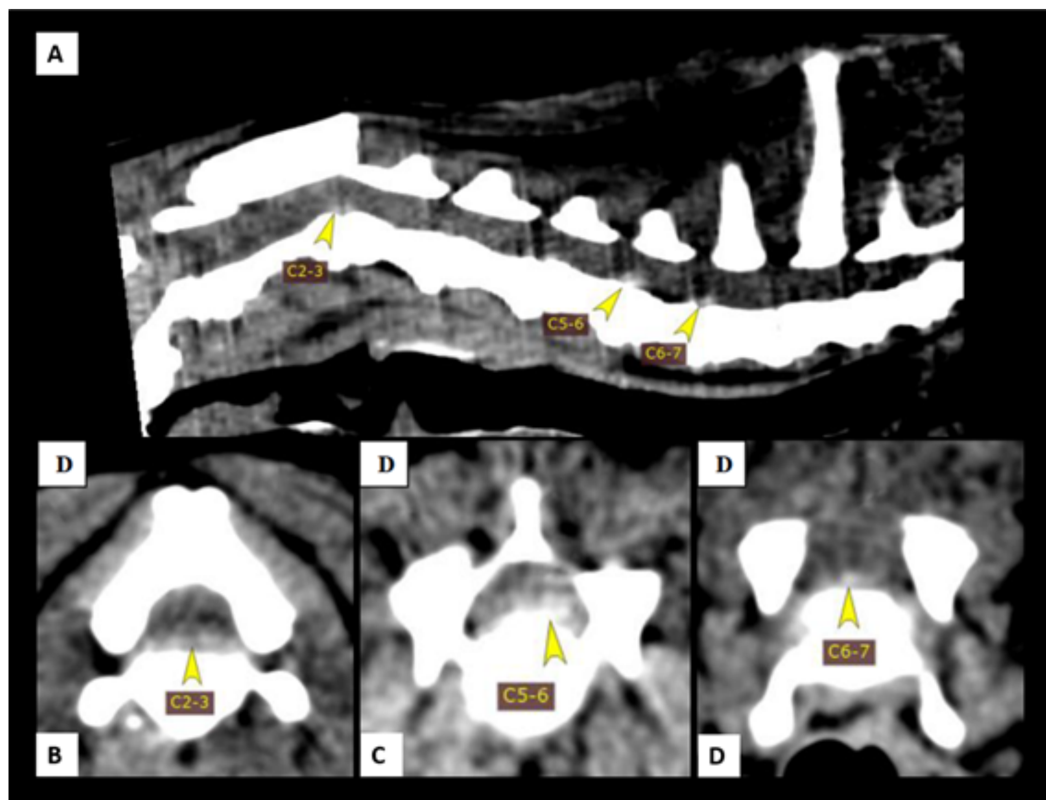
Based on the correlation between clinical signs, plain radiography, myelography, CSF analysis, and CT findings, a diagnosis of multifocal cervical intervertebral disc disease was established, characterized by disc extrusion at C5–C6 and disc protrusion at C2–C3 and C6–C7. Despite the diagnostic confirmation and the availability of surgical treatment as a therapeutic option, the owner declined surgical intervention. Clinical management alternatives and patient monitoring were subsequently discussed.

3. Discussion

Following the identification of cervical pain and proper neuroanatomical localization, ancillary tests constitute a fundamental subsequent diagnostic step. They provide information regarding the nature, extent, and severity of spinal cord lesions, while also

aiding in the exclusion of differential diagnoses and guiding clinical or surgical management. The correlation between clinical findings and imaging results is essential in the approach to compressive spinal cord diseases, especially in suspected cases of intervertebral disc disease (IVDD) [10].

Figure 3. A to C. Contrast radiographs (myelography) immediately after contrast, at 2 minutes, and at 5 minutes, respectively; cervical region, right lateral projection. In D, contrast radiograph (myelography) at 5 minutes, cervical region, ventrodorsal projection. Interruption of the ventral column and thinning of the dorsal contrast column are observed between C2-C3 and C5-C6 (arrows).



Plain radiography is widely used as an initial screening tool because it is accessible, rapid, and cost-effective, allowing for the exclusion of conditions such as discospondylitis, fractures, luxations, or overt neoplastic processes. In cases of IVDD, this exam may reveal suggestive findings such as narrowed intervertebral spaces, disc mineralization, or alterations in the articular processes, as observed in the present report. However, as highlighted by Lamb and reiterated in the most recent international consensus on IVDD [10, 11], plain radiography exhibits low sensitivity and specificity for diagnostic confirmation, as it does not allow for direct evaluation of the spinal cord or precise characterization of the involved disc material.

In the face of persistent or progressive clinical signs, contrast-enhanced radiography of the spinal column (myelography) remains a relevant and widely applicable intermediate diagnostic method in veterinary routine. Myelography enables indirect visualization of the spinal cord by analyzing contrast columns within the subarachnoid space, allowing for the identification of deviations, interruptions, or thinning consistent with extradural compressions, such as those observed in disc extrusion or protrusion [12, 13]. In this case, myelography identified two cervical regions consistent with spinal cord compression, demonstrating higher sensitivity compared to plain radiography and reinforcing its diagnostic value in settings with limited access to advanced imaging. It is important to note that the cranial compression at C2-C3 likely created a 'stop effect', partially obstructing

the flow of contrast medium and masking the more caudal lesion at C6-C7 during the myelographic exam. This highlights a significant limitation of myelography in multifocal cases.

Associated with myelography, cerebrospinal fluid (CSF) analysis constitutes an important ancillary test, primarily to rule out inflammatory, infectious, or neoplastic diseases of the central nervous system. Although CSF examination is not specific for IVDD, alterations such as a slight increase in protein concentration without significant pleocytosis may be associated with mechanical spinal cord compression and disruption of the blood-brain barrier, findings consistent with compressive disc lesions [14, 15]. Studies also indicate that the presence of inflammatory changes in the CSF may be related to the severity of the spinal cord injury, granting the exam potential prognostic value when interpreted alongside clinical and imaging findings [16, 17].

When available, advanced imaging modalities such as computed tomography (CT) and magnetic resonance imaging (MRI) offer greater diagnostic accuracy and are recommended whenever possible. Computed tomography, particularly effective in detecting mineralized disc material, allows for a detailed evaluation of the location, lateralization, and extent of spinal cord compression in transverse slices, surpassing myelography in sensitivity for the anatomical characterization of the lesion [18, 19]. In this study, images were reconstructed using a bone algorithm to enhance the detection of mineralized disc material. Although raw technical parameters such as kVp and mAs were not available due to the teleradiology service format, the image quality allowed for clear identification of the compressive sites. In the described case, CT revealed three affected cervical regions, expanding upon the findings previously identified by myelography and evidencing disc extrusion and protrusions at different levels.

The 2022 international consensus on IVDD in dogs reinforces that MRI is considered the gold standard for the definitive diagnosis of IVDD, as it allows for detailed evaluation of the intervertebral disc, spinal cord, and adjacent soft tissues, in addition to more accurately differentiating between disc extrusion and protrusion [11]. The coexistence of disc extrusions at C5-C6 and protrusions at C2-C3 and C6-C7 suggests an acute-on-chronic clinical progression. While CT identified these areas, the authors acknowledge that MRI remains the gold standard for definitive differentiation. In the absence of MRI, these classifications were based on tomographic density and breed predisposition.

Furthermore, the correlation between imaging and functional neuroanatomy suggests that the C5-C6 extrusion was the primary driver of the neurological deficits (40% compression), while the cranial pain localized at C1-C3 was consistent with the protrusion at C2-C3. However, the same consensus recognizes that financial, logistical, and structural limitations frequently restrict access to MRI in clinical practice, making techniques such as myelography and CT valid and clinically relevant alternatives. Performing multiple anesthetic procedures on an 11-year-old patient presented ethical challenges, but each step was necessary for diagnostic progression. In a follow-up evaluation in May 2023, the patient showed significant clinical improvement under medical management. The owner reported the absence of pain crises and increased stability, demonstrating that the multimodal diagnosis was essential to define the best therapeutic path for the patient's reality.

4. Conclusion

In conclusion, while accessible imaging tools remain valuable for initial screening in resource-limited settings, they may provide an incomplete diagnosis. This case demonstrates that advanced imaging (CT or MRI) is essential for accurate multifocal identification and precise surgical or clinical planning, even when conservative management is the final choice.

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References

1. König HE, Liebich HG. Veterinary anatomy of domestic mammals: textbook and colour atlas. 7th ed. Stuttgart: Thieme; 2021.
2. Brisson BA. Intervertebral disc disease in dogs. Vet Clin North Am Small Anim Pract. 2010 Jan;40(1):829-858. doi:10.1016/j.cvsm.2010.06.001.
3. Jeffery ND, Levine JM, Olby NJ, Stein VM. Intervertebral disk degeneration in dogs: consequences, diagnosis, treatment, and future directions. J Vet Intern Med. 2013 Nov-Dec;27(6):1318-1333. doi:10.1111/jvim.12183.
4. Thrall DE. Textbook of veterinary diagnostic radiology. 7th ed. St. Louis: Elsevier; 2022.
5. Beltran E, Dennis R, Doyle V, de Stefani A, Holloway L, De Risio L. Clinical and magnetic resonance imaging features of canine compressive cervical myelopathy with suspected hydrated nucleus pulposus extrusion. J Small Anim Pract. 2012;53(2):101-107. doi:10.1111/j.1748-5827.2011.01166.x.
6. Casado D, Fernandes R, Lourinho F, Gonçalves R, Clark R, Violini F, Carrera I. Magnetic resonance imaging features of canine intradural/extramedullary intervertebral disc extrusion in seven cases. Front Vet Sci. 2022 Sep 14;9:1003042. doi:10.3389/fvets.2022.1003042.
7. Braund KG. Intervertebral disk disease. In: Bojrab MJ, Smeak DD, Bloomberg MS, editors. Disease mechanisms in small animal surgery. 2nd ed. Philadelphia: Lea & Febiger; 1993. p. 960-970.
8. Janssens LAA. The treatment of canine cervical disc disease by means of acupuncture: a review of thirty-two cases. J Small Anim Pract. 1985 Aug;26(4):203-212. doi:10.1111/j.1748-5827.1985.tb02102.x.
9. Toombs JP, Bauer MS. Intervertebral disc disease. In: Slatter D, editor. Textbook of small animal surgery. 2nd ed. Philadelphia: Saunders; 1992. p. 1063-1080.
10. Lamb CR, Nicholls A, Targett MP, Mannion P. Accuracy of survey radiographic diagnosis of intervertebral disc protrusion in dogs. Vet Radiol Ultrasound. 2002 Mar-Apr;43(2):222-228. doi:10.1111/j.1740-8261.2002.tb00994.x.
11. Olby NJ, Moore SA, Brisson B, Fenn J, Flegel T, Kortz G, Lewis MJ, Tipold A. ACVIM consensus statement on diagnosis and management of acute canine thoracolumbar intervertebral disc extrusion. J Vet Intern Med. 2022;36(5):1570-1596. doi:10.1111/jvim.16480.
12. Robertson ID, Thrall DE. Imaging diagnosis—spinal diseases. In: Thrall DE, editor. Textbook of veterinary diagnostic radiology. 6th ed. St. Louis: Elsevier; 2011. p. 208-229.
13. Bos AS, Brisson BA, Nykamp SG, Poma R, Foster RA. Accuracy, intermethod agreement, and inter-reviewer agreement for use of magnetic resonance imaging and myelography in small-breed dogs with naturally occurring first-time intervertebral disk extrusion. J Am Vet Med Assoc. 2012 Apr 15;240(8):969-977. doi:10.2460/javma.240.8.969.
14. Chrisman CL. Cerebrospinal fluid analysis. Vet Clin North Am Small Anim Pract. 1992 Jul;22(4):781-810. doi:10.1016/S0195-5616(92)50077-8.
15. Levine GJ, Cook JR, Kerwin SC, Mankin JM, Griffin JF, Fosgate GT, Levine JM. Relationships between cerebrospinal fluid characteristics, injury severity, and functional outcome in dogs with and without intervertebral disk herniation. Vet Clin Pathol. 2014 Jun;43(3):437-446. doi:10.1111/vcp.12165.
16. Di Terlizzi R, Platt SR. The function, composition and analysis of cerebrospinal fluid in companion animals: part II—analysis. Vet J. 2009;180(1):15-32. doi:10.1016/j.tvjl.2007.11.024.
17. Israel SK, Levine JM, Kerwin SC, Levine GJ, Fosgate GT. The relative sensitivity of computed tomography and myelography for identification of thoracolumbar intervertebral disk herniations in dogs. Vet Radiol Ultrasound. 2009 May-Jun;50(3):247-252. doi:10.1111/j.1740-8261.2009.01528.x.
18. Newcomb B, Arble J, Rochat M, Pechman R, Payton M. Comparison of computed tomography and myelography to a reference standard of computed tomographic myelography for evaluation of dogs with intervertebral disc disease. Vet Surg. 2012 Apr;41(2):207-214. doi:10.1111/j.1532-950X.2011.00911.x.