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Diagnostic Imaging in the Degenerative Diseases of the Spine in Dogs

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REVIEW

Abstract

Spinal cord disorders in dogs, such as Intervertebral Disc Degeneration, Degenerative Myelopathy, and Degenerative Lumbosacral Stenosis, significantly impact canine health and quality of life. These conditions, varying in manifestation but common in their progressive deterioration, are influenced by factors such as breed, age, and gender, highlighting the complexity of spinal issues in canines. Advanced imaging technologies play a crucial role in diagnosing and managing these disorders. Conventional radiography is vital for initial assessments, while advancements in computed tomography (CT) have enhanced the resolution and accuracy of images, particularly of the spine's bony structures. Magnetic resonance imaging (MRI) remains the preferred modality for its superior ability to depict both bone and soft tissue details, essential for comprehensive evaluations. CT is invaluable for detailed visualization of bone abnormalities, fractures, and degenerative changes, aiding in accurate disease diagnosis and intervention planning. However, due to its limitations in soft tissue assessment, the selection of imaging modalities must be tailored to specific clinical needs. This concise overview emphasizes the importance of a comprehensive diagnostic approach in managing canine spinal disorders and suggests the potential for translational research to benefit both veterinary and human medicine.

Keywords: Canine disorders; degenerative diseases; diagnostic imaging.

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INTRODUCTION

Spinal cord disorders represent a significant challenge in veterinary medicine, often resulting with neurological disorders due to variety of causes including anatomical anomalies, infectious and inflammatory conditions, degenerative diseases, or injuries (Gouveia et al., 2023; Jiang et al., 2023). According to the comprehensive study by Da Costa and Moore (2010), a range of degenerative diseases prominently affects the canine population. These conditions, which significantly impair the quality of life of affected dogs, encompass a variety of structural and functional disorders within the skeletal and nervous systems. Among the primary conditions highlighted are Intervertebral Disc Degeneration, Degenerative Myelopathy, and Degenerative Lumbosacral Stenosis. Each of these conditions manifests differently but shares the common feature of progressive deterioration over time. These are closely followed by injuries like vertebral fractures or dislocations, spinal concussions, compressions, or lacerations, as well as cancer and fibrocartilaginous embolisms. Steroid-responsive meningitis-arteritis stands out as the most prevalent immune-mediated issue, with discospondylitis being the top infectious cause (Fuchs et al., 2023). Spinal cord ailments can result from a wide range of factors and are often linked with specific demographics (such as breed, age, and gender) and neuroanatomical sites. In humans, it ranks as the second leading reason for seeking medical care in the

United States (DiPiro et al., 2022). The likelihood of experiencing back pain at some point in one's life is around 70% to 85% (De Souza et al., 2019). Furthermore, research has explored the impact of environmental and lifestyle factors, including diet and physical activity levels, on the onset of various conditions in humans (Serio et al., 2023; Santos, 2022; Farhud, 2015). Significantly, spinal disorders present in dogs with a prevalence and impact comparable to that observed in humans, indicating a strong potential for translational research. Consequently, findings can be effectively utilized in both - clinical human and veterinary practice as well.

The most important and most commonly used imaging modalities are conventional radiography, computed tomography (CT) and magnetic resonance (MR).

Conventional spine radiographs remain valuable for initial assessments, detecting significant issues such as disc space narrowing (indicative of discopathy), osteophytes, degenerative sclerotization, scoliosis, spondylolisthesis, and other congenital anomalies. For mild cases of degenerative spinal diseases, radiography alone may be adequate as the sole imaging technique. Digitalization, including digital radiography and enhanced post-processing, has significantly enhanced the image quality of conventional radiography. Additionally, the advent of multidetector scanners and sophisticated multiplanar and three-dimensional reconstructions has allowed computed tomography to produce highly accurate and high-resolution images of the bony structures of the spine. Computed Tomography is a pivotal imaging tool in the examination of spinal disorders, offering detailed cross-sectional images of bone and soft tissues. This modality is particularly effective in identifying bone abnormalities, fractures, and degenerative changes within the spine. In contrast to radiography, CT imaging provides enhanced visualization of the bone structure, crucial for assessing degenerative diseases. This enhanced detail covers variations such as end plate irregularities and sclerosis, narrowing of the spinal canal, osteoarthritis of the facet joints, spondylolysis, and spondylolisthesis. CT can effectively display and categorize abnormalities such as the formation of osteophytes; enlargement of the articular processes; thinning of the articular cartilage; presence of the vacuum phenomenon in joints and discs; formation of synovial and subchondral cysts; and calcification within the joint capsule, vertebral end plates, and ligaments (Caetano et al., 2021). CT is utilized as an additional tool when a detailed analysis of bone structures is required, such as in cases of spinal stenosis. It is also recommended for patients who have contraindications to MR imaging. In the 90s, computed tomography was the main diagnostic tool for degenerative spine disease, but magnetic resonance imaging has largely taken over this role since then. MR imaging excels in detailing soft tissue variations using magnetic fields and radiofrequency waves to capture tissue responses. It provides high contrast resolution and is effective for imaging all spinal conditions. Initially used for screening, it often progresses to more targeted imaging based on earlier findings. MR imaging is the preferred imaging modality and is recommended for all patients experiencing persistent pain, radicular symptoms, or neurological impairments (Michelini et al., 2018). MRI enables a comprehensive evaluation of degenerative alterations in both the bone and soft tissue components of the disc-vertebral unit.

INTERVERTEBRAL DISK DEGENERATION (IVDD)

Protrusion or extrusion of the intervertebral disc (IVD) can lead to compression of the spinal cord or spinal nerve roots, causing clinical manifestations of pain or neurological disorder of varying intensity. Such pathological occurrences are more common in dogs than in cats (Fenn i Olby, 2020; Morgan et al., 1993). Degenerative changes leading to disc prolapse include calcification and narrowing of the disc (Morgan et al., 1993;). A study conducted on Dachshunds aged between 1 and 5 years demonstrated a positive correlation between the frequency of disc calcification and age (Stigen, 1996).

Radiographic findings may include narrowing of the space between cranial or caudal joint surfaces, alteration in the shape of the intervertebral foramina, increased shadow intensity in their area, or the presence of calcified disc parts within the vertebral canal (Burk and Feeney, 2003). Plain radiography has a diagnostic accuracy for intervertebral disc protrusion of 50-75% in the thoracolumbar segment of the spine and 26% for the cervical segment. Myelography, with greater accuracy up to 97%, can depict extradural formations, with prolapsed disc parts that may be positioned in the ventral median line of the spinal canal, causing displacement of the contrast line (Burk and Feeney, 2003).

In rare cases, the extruded disc may penetrate the dura mater and lodge within the spinal cord, which can be detected on myelography as spinal cord swelling or extramedullary intradural pathological changes (Hay and Muir, 2000; Burk and Feeney, 2003). Disc extrusion can cause ascending-descending myelomalacia, visible as swelling of the spinal cord on myelography. In cases of chronic degeneration, there may be narrowing of the intervertebral space and sclerosis of the bodies of adjacent vertebrae. Following surgical fenestration of the disc, the width of the disc space may further narrow (Burk and Feeney, 2003).

Radiographic projections, including lateral and ventrodorsal, are commonly used in diagnosing suspected intervertebral disc extrusion (IVDE) cases. While general anesthesia is often recommended for clearer radiographs, sedation is frequently deemed sufficient for patient positioning in clinical practice. Radiographs serve as a

preliminary diagnostic tool in spinal assessments, but definitive techniques such as myelography, CT, or MRI should ideally use general anesthesia.

Key radiographic features of IVDE involve narrowed disc spaces, articular facets, and intervertebral foramen, along with the presence of mineralized disc material and vacuum phenomena (Lamb et al., 2002). Although mineralization signals disc degeneration, it does not necessarily indicate disc extrusion. Evidence shows that early calcification significantly predicts later disc herniation (Jensen et al., 2008) and is a risk factor for recurrence post-surgery (Brisson et al., 2011). However, studies indicate a lack of correlation between radiographically detected calcification and actual extrusion sites (Bos et al., 2012). Longitudinal studies have documented that disc naturally undergo cycles of calcification and decalcification, making it an unreliable sole diagnostic criterion (Da Costa et al., 2020).

The myelographic characteristics observed in cases of IVDE typically indicate extradural compression. To aid in distinguishing IVDE from intervertebral disc protrusion (IVDP), diagnostic criteria have been proposed, including: (1) observable thinning and deviation of the contrast columns, (2) variable degrees of thinning in the contrast columns or their discontinuity, (3) diffuse thinning of the contrast columns extending beyond the boundaries of the affected disc, and (4) an uneven distribution of contrast column thinning either cranial or caudal to the affected disc (Macias et al., 2002). Evaluating ventrodorsal and/or oblique views is crucial for identifying axial deviation of the contrast and determining the lateralization of the lesion, guiding the surgical approach (Brisson , 2010). While some studies have suggested a correlation between extensive intramedullary patterns and poor outcomes, this association was not supported by another investigation (Da Costa et al., 2020). Evidence of extensive swelling of the spinal cord with contrast medium infiltration has been linked to myelomalacia. False negative results can occur in myelography for IVDE cases, particularly those involving lateral or foraminal extrusions, necessitating the use of CT or MRI (Bersan et al., 2015).

CT is very important in the diagnostic assessment of suspected IVD in dogs (Robertson and Thrall, 2011) Three techniques are used for IVD diagnosis via CT: non-contrast CT, intravenous contrast CT (CT-angiography), and subarachnoid contrast CT (CT-myelography). CT-myelography requires less contrast medium volume (approximately 25 to 50%) compared to conventional myelography, thus enhancing safety. These CT modalities allow reformatting of transverse images into different planes, particularly with multidetector CTs enabling multiplanar reformatting (Ricciardi et al., 2018. CT offers advantages over MRI, being more accessible, cost-effective, and faster, often feasible under sedation. While most IVD cases can be diagnosed with non-contrast CT, MRI or CT-myelography may be necessary for some cases. Median examination times vary, with helical CT at 4 minutes, conventional CT at 8 minutes, and myelography at 32 minutes (Hecht et al., 2009), although newer systems with more slices significantly reduce scanning times, often below a minute.

Non-contrast CT is the focus of most IVDD investigations. In CT images, normal intervertebral discs appear uniformly soft, without distinction between the nucleus pulposus and annulus fibrosus (da Costa et al., 2020). The spinal cord, cerebrospinal fluid, and meninges have similar densities, forming the thecal sac. Epidural fat surrounds the thecal sac, appearing darker gray due to lower density than soft tissue, aiding in its margin discrimination. Calcified disc material is visible in non-enhanced CT due to its higher density compared to adjacent soft tissues and fat (Olby et al., 2000).

MRI is widely regarded as the preferred diagnostic imaging modality for IVDD in both human and veterinary patients. MR imaging features of IVDE involve extradural compression of the spinal cord, typically centered over or near the intervertebral disc space. This mass effect, caused by extruded material, leads to compression and/or displacement of the spinal cord, visible on T2-weighted (T2W) images as displacement or loss of the hyperintense signal associated with subarachnoid and epidural spaces. Extruded nucleus pulposus is usually identified as a hypointense mass within the epidural space on both T1-weighted (T1W) and T2W images. It can be dispersed if not linked to the affected intervertebral space and spread throughout the epidural space, or non-dispersed if it remains in contact with the affected intervertebral disc.

Epidural hemorrhage associated with IVDE can exhibit various signal intensities, including signal void, emphasizing that IVDE diagnosis shouldn't rely solely on one signal intensity pattern. The degree of spinal cord compression can be categorized using morphologic compression scales, often based on the percentage reduction in spinal cord diameter, graded as mild, moderate, or severe.

Paravertebral muscle signal changes were seen in 36% of dogs with IVDE, characterized by hyperintense edematous patterns on T2W and iso- or hypointense on T1W sequences. In dogs with acute thoracolumbar disc extrusion, areas of spinal cord hyperintensity on T2W images can be observed, correlating with the severity of neurologic signs at presentation.

DEGENERATIVE MYELOPATHY (DM)

DM in dogs, a neurodegenerative disorder first recognized in 1973, by Averill, begins with general proprioceptive ataxia and upper motor neuron spastic paresis in the pelvic limbs during late adulthood. The condition inevitably progresses to paraplegia, often leading to euthanasia due to respiratory dysfunction. Ante-mortem diagnosis continues to be a diagnosis of exclusion, necessitating the distinction from other myelopathies such as intervertebral disc extrusion and spinal neoplasia (Bouché et al., 2023). Computed Tomography and Magnetic Resonance Imaging, as well as electromyography (EM) and cerebrospinal fluid examination (CSF), are not specific enough to definitively diagnose DM. As such, these diagnostic methods can only provide indicative results (Fiszdon et al., 2020).

A tentative diagnosis of DM is often made when there is no clinically significant compressive myelopathy, as determined by computed tomography/myelography or magnetic resonance imaging (MRI). MRI is particularly valuable for detecting early intramedullary spinal cord neoplasia and signs of extradural compressive myelopathy. Imaging may also show disk protrusions that can complicate the diagnosis of DM. The clinician must rely on clinical experience to assess the speed of disease progression, the presence of paraspinal hyperesthesia, and the degree of spinal cord compression to explain the severity of the myelopathy (Coates, 2000).

Studies suggest that physical rehabilitation, may extend survival and delay symptom progression in affected dogs. Neurodiagnostic methods used to evaluate spinal cord disease encompass CSF analysis, electrodiagnostic testing, and various spinal cord imaging techniques (Coates and Wininger, 2010) While the initial reports primarily involved German Shepherd dogs (GSD), other breeds were such as Boxers, and Pembroke Welsh Corgis are included (Shelton et al., 2012). A presumptive diagnosis of degenerative myelopathy is commonly established when there is an absence of clinically significant compressive myelopathy, as verified through myelography or magnetic resonance imaging.Studies utilizing computed tomography and myelography in dogs diagnosed with or suspected of having DM have also highlighted the presence of other spinal cord disorders such as stenosis, atrophy, and focal attenuation of the subarachnoid space. MRI proves particularly valuable in detecting early intramedullary spinal cord neoplasia's and signs of extradural compressive myelopathy. However, imaging can also reveal disc protrusions that may complicate the diagnosis of DM. Clinicians rely on their experience to assess the progression speed of the disease, the presence of paraspinal hyperesthesia, and the degree of spinal cord compression, which are critical in determining the severity of the myelopathy (Coates andWininger, 2010).

CSF analysis is instrumental in excluding conditions like meningitis and can also serve as a means to identify potential biomarkers. Importantly, in cases of DM, no cytological or protein abnormalities are typically observed in the CSF of affected dogs.

DEGENERATIVE LUMBOSACRAL STENOSIS (DLSS)

DLSS is a syndrome linked to degeneration at the lumbosacral junction, resulting in low back pain and possible neurologic dysfunction from cauda equina compression (DeRisio et al., 2000). Originally termed "degenerative lumbosacral stenosis" by Chamber in 1989, DLSS is primarily influenced by intervertebral disc degeneration but lacks definitive characteristics for diagnosis (Worth et al., 2019). Diagnoses are often made presumptively based on clinical signs, advanced imaging, and by excluding other causes of cauda equina compression (Meij et al., 2010). A diagnosis of DLSS in dogs should be made based on detecting dysfunction related to the cauda equina and/or pain that can be induced by movement or manipulation of the LS junction. This diagnosis should also be supported by advanced imaging findings and after ruling out other possible diagnoses. It is crucial to maintain a high level of suspicion for this condition and employ suitable manipulative tests to enhance the detection of DLSS in dogs (Worth et al., 2019).

The condition manifests through bulging of the annulus fibrosus and narrowing at the L7-S1 intervertebral disc, which can compress nerve roots of the cauda equina due to a combination of disc prolapse and hypertrophy, fibrosis, or osteophytosis associated with the L7-S1 articulations (Meij et al., 2010).

CT abnormalities in dogs with DLSS include the disappearance of epidural fat, enhanced soft-tissue opacity in the intervertebral foramen, bulging of the intervertebral discs, vertebral canal stenosis, and hypertrophy of the articular processes. In non-contrast CT scans, epidural fat normally envelopes the nerve roots and the dural sac; however, in conditions of stenosis and compression, this fat diminishes, causing the compressive soft tissues to blend indistinctly with the surrounding nerves. The application of intravenous contrast in CT scans of the LS region has been found to improve the detection rates of ventral and lateral compressions. Conversely, the combination of subarachnoid contrast (myelography) with CT is discouraged for LS evaluations due to the introduction of blooming and beam hardening artifacts that complicate the diagnostic interpretation. Additionally, research indicates that the extent of lumbosacral compression revealed by MRI does not correlate with the severity of clinical symptoms observed in affected dogs. MRI often identifies ventral compression resulting from degeneration and protrusion of intervertebral discs. This protrusion is typically indicated by a loss of the normal bright hyperintense signal from

the intervertebral disc. Additionally, dorsal compression can be seen, attributed to thickening of the joint capsule, formation of osteophytes, and hypertrophy of the ligamentum flavum. Foraminal stenosis plays a critical role in the pathology of degenerative lumbosacral stenosis, necessitating detailed examination of the parasagittal and transverse images. Transverse images are crucial for measuring the dorsoventral diameter of the foramina, while parasagittal images assess the craniocaudal diameter. Both CT and MRI show a high degree of consistency in detecting LS disease, yet their correlations with surgical findings are notably low. Furthermore, neither CT nor MRI findings correlate with the clinical outcomes. It is also vital to note that clinically asymptomatic dogs may display imaging characteristics indicative of LS diseases without manifesting any clinical symptoms (da Costa and Samii, 2010).

DLSS predominantly affects medium to large, middle-aged to older dogs, with a higher predisposition in breeds like the German Shepherd and Belgian Malinois, particularly those involved in strenuous activities (Steffen et al., 2007; Worth et al., 2019).

Currently, there is no consensus on the optimal treatment for DLSS. Conservative management for mild cases includes analgesics, anti-inflammatory drugs, and lifestyle modifications to mitigate symptoms (Jeffery et al., 2014). In cases where conservative measures fail, surgical intervention might be considered, although the lack of robust evidence makes the decision challenging (Jeffery et al., 2014). The efficacy of various treatments, including intradiscal injections and physical rehabilitation strategies like core muscle strengthening, remains under investigation.

EXTRADURAL SYNOVIAL CYSTS

Degenerative changes in various spinal structures can lead to diverse intra (extradural)- and perispinal cystic lesions containing serous, proteinaceous, or haemorrhagic contents. Spinal extradural synovial cysts and ganglion cysts, originating from the articular facets and adjacent connective tissues, are rare. Histologically, synovial cysts are distinguished by a lining of synovial-like epithelial cells, whereas ganglion cysts possess a collagenous capsule or fibrous wall that encases myxoid material (Dickinson, et al., 2001). From a clinical perspective, the distinction between these two types of cysts often has no bearing on the treatment approach, leading some experts to group them together under the term "intraspinal cysts".

Most spinal synovial cysts have been documented in humans, predominantly affecting the lumbar spine. In veterinary literature, similar cases have been identified in the cervical region of giant breed dogs (Dickinson et al., 2001) and at the thoracolumbar junction in a Siberian husky (Perez et al., 2000). However, nderstanding their radiological features, which may include rim enhancement (Wybier 2001), and associated findings is crucial for distinguishing degenerative cysts from those caused by other factors such as neoplastic, infectious, traumatic, or congenital/developmental origins (da Costa et al., 2020). While some of these cysts may be incidental, others can cause symptoms resembling herniated discs or contribute to spinal canal stenosis. Treatment options range from conservative measures to minimally invasive percutaneous and surgical approaches, including intracystic steroid injection, with some cysts showing potential for spontaneous regression (Tamura et al., 2015).

The nomenclature of degenerative lumbar spine cysts remains somewhat ambiguous in medical literature. Various categorization strategies based on factors like location, attachment or communication with specific spinal structures, and pathological characteristics have been employed. Terms used for defining these cysts include facet joint cysts, ligamentum flavum cysts, disc cysts, ganglion cysts of the posterior longitudinal ligament, and cysts associated with Baastrup's disease (da Costa et al., 2020; da Costa, 2010). Pathologically, degenerative cysts are broadly classified into synovium-lined synovial cysts and ganglion cysts (neocysts; pseudocysts) with a non-synovial connective tissue lining. Some authors propose an absence of joint connection as an additional criterion for identifying the latter type of cysts. Further pathological characterization may be based on associated findings like haemorrhage or concomitant granulomatous reaction, which could aid in distinguishing these cysts (da Costa et al., 2020).

Frequent observations of spinal radiographic include degenerative alterations and remodeling of the articular facets across various segments of the cervical vertebral column. These degenerative changes might be evident in both lateral and ventrodorsal views. Some studies show the enlarged and remodeled facets being most prominently visible in the ventrodorsal views (Dickinson et al., 2001). Notably, ventrodorsal views also may show a perceived narrowing of the vertebral spinal canal due to bony outgrowth from the articular facets. Myelography can reveale axial deviation and narrowing of the lateral contrast columns. Areas of axial deviation typically could coincide with locations of articular degeneration; however, the compressive lesions may be situated medially to the joints and exhibited a soft tissue density. CT images could also demonstrate a diminution of all contrast columns with visible compression and potential atrophy of the spinal cord (Dickinson, et al., 2001).

DEFORMING SPONDYLOSIS (DS)

DS is the most common form of degenerative spinal disease, characterized by partial or complete ossous bridge between vertebral bodies (Furukawa et al., 2022; Morgan and Bailey, 2000; Morgan, 1967; Morgan et al., 1967). These bone proliferations often occur on the ventral and lateral surfaces of the vertebral bodies, and much less frequently on the dorsal surfaces, rarely compressing the spinal cord and nerve roots. Therefore, spondylosis is almost never clinically manifest, except for the occurrence of pain in the areas of bridged vertebrae. Spondylotic changes can become extensive. If these bony bridges continuously span multiple vertebrae, then we speak of so-called diffuse idiopathic sceletal hyperostosis (DISH).

Through a detailed clinical examination of these patients, stiffness can be detected in the affected area of the spine. Spondylosis primarily affects older medium-sized and large dogs, but autopsies can reveal changes in individuals as young as six months old (Lee et al., 2020). The direction of spondylotic changes can vary; ossification may start from one vertebra and develop towards another, begin simultaneously on two adjacent vertebrae and meet in the middle, start in between two vertebrae and progress in both directions, or develop through a combination of these variations. In severe cases, spondylosis can result in complete spinal fusion. This may lead to certain mechanical difficulties in movement, but spondylosis usually progresses without clinical signs. In some instances, as a secondary complication, narrowing of the intervertebral space may occur, but most cases do not lead to disc prolapse. Conversely, spondylosis can develop as a secondary condition to chronic disc prolapse, and distinguishing between these two conditions can be based on the extent of the spondylotic changes. If only one intervertebral space is affected and there is no evidence of spondylotic changes elsewhere, it likely indicates primary disc degeneration with secondary spondylosis development. If diffuse spondylotic changes in the spine are evident with only one narrowed intervertebral disc space, it generally indicates primary deforming spondylosis and a secondary consequence of disc degeneration. If clinical signs of these changes appear, myelography is needed to determine disc prolapse (Burk and Feeney, 2003).

Radiologically, spondylosis deformans is identified by the formation of osteophytes at the vertebral endplates, varying from minor bony outgrowths to complete bridging between adjacent vertebrae. When the lesions, such as bridging in spondylosis deformans, are pronounced, they can be readily diagnosed through radiographs alone. However, when the lesions are subtle, diagnosing them may be more subjective. Magnetic resonance imaging is recognized as the most effective imaging method for diagnosing discospondylitis in dogs, cats, and humans, especially during the initial stages of the disease. This is because MRI can detect changes indicative of infection before any bony destruction becomes apparent (Gomes et al., 2020). CT, on the other hand, may detect bone lesions earlier in the disease progression than radiography (Ruoff et al., 2018). Besides identifying characteristic bone lesions, CT can also reveal associated skeletal abnormalities such as disseminated idiopathic skeletal hyperostosis or vertebral malformations. Recent studies suggest that vertebral malformations are commonly associated with discospondylitis in screw-tailed brachycephalic dogs (Grapes et al., 2021).

CONCLUSIONS

Spinal cord disorders pose significant challenges in veterinary medicine, leading to neurological issues due to various causes such as anatomical anomalies, infectious and inflammatory conditions, degenerative diseases, or injuries. These conditions significantly impair the quality of life of affected dogs, encompassing a range of structural and functional disorders within the skeletal and nervous systems. Among these, Intervertebral Disc Degeneration, Degenerative Myelopathy, and Degenerative Lumbosacral Stenosis are prevalent, each manifesting with progressive deterioration over time. These conditions are closely followed by injuries like vertebral fractures and spinal concussions, as well as cancer and fibrocartilaginous embolisms. Steroid-responsive meningitis-arteritis and discospondylitis stand out as prevalent immune-mediated and infectious causes, respectively. The research emphasizes the parallel in prevalence and impact of spinal disorders in dogs and humans, suggesting a strong potential for translational research, benefiting both clinical human and veterinary practices. Imaging plays a crucial role in diagnosing and managing these disorders, with MRI being superior due to its detailed soft tissue imaging capabilities. However, CT and conventional radiography remain valuable, especially for initial assessments and cases where MRI is contraindicated. As we continue to improve our understanding and technology in imaging, the diagnosis and treatment of spinal disorders will likely advance, offering better outcomes for dogs afflicted with these conditions.

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Conflicts of Interest

The authors declare that they do not have any conflict of interest.

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