Indian Journal of Animal Sciences **94** (11): 929–933, November 2024/Article
https://doi.org/10.56093/ijans.v94i11.153713

Breed, age, and gender correlations with discospondylitis in dogs: A radiological perspective

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Received: 11 July 2024; Accepted: 30 September 2024

ABSTRACT

This study presents 14 cases of discospondylitis (DS) of the thoracic, lumbar and lumbosacral spine in dogs, providing a detailed analysis of breed, gender, age distribution, and the localization of radiologically diagnosed changes. Utilizing radiography, computed tomography (CT), and myelography, the research targeted the identification of typical DS indicators such as erosions of vertebral end-plates, narrowing of intervertebral spaces, and adjacent lytic changes. The study confirmed a higher susceptibility of DS in large breeds, particularly mixed breeds and German Shepherds, aligning with existing literature that links the condition to increased spinal strain. Significant findings include a notable prevalence of DS in male dogs and a higher incidence in young to middle-aged dogs, especially those aged 3 to 6 years. The lumbar segments L4-L6 were most frequently affected. The study emphasizes the need for early and accurate diagnosis, highlighting the effectiveness of CT in detecting subtle changes not always visible on initial radiographs. Overall, the research underscores the importance of recognizing breed and age-related predispositions to improve diagnostic approaches and treatment outcomes for discospondylitis in dogs.

Keywords: Dogs, Osteomyelitis, Spine, Spondylitis

Several inflammatory conditions can impact the vertebrae. Vertebral osteomyelitis (VO), primarily involves septic inflammation of the vertebral bodies, leading to significant bone proliferation. The most common name in veterinary medicine for VO is spondylitis. However, with discospondylitis (DS), the inflammation extends to the intervertebral disk and the neighbouring end-plates. While both the conditions are severe and are associated with infections affecting the spinal column of dogs, discospondylitis is significantly more prevalent (Csébi *et al*. 2010). The origins of DS in dogs can be traced to factors such as the migrating foreign bodies, as well as fungal and bacterial infections (Csébi *et al*. 2010, Long *et al*. 2022).

The risk of developing DS increases with age, peaking in dogs older than 10 years (Van Hoof *et al* 2023). It is most frequently observed in large-breed dogs, with a higher prevalence in males (Long *et al*. 2022). Common symptoms include spinal pain in most affected dogs (Long *et al*. 2022, Pilkington *et al*. 2023) and fever in about 30% of cases (Forbes *et al.* 2019, Long *et al*. 2022). Risk factors encompass large breed, middle-aged dogs, intact male, recent corticosteroid therapy, or those who underwent recent surgery, including both spinal as well as surgeries at distant locations from spine (Canal *et al.* 2016, Pilkington *et al*. 2023).

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Clinical signs for DS in dogs can range from general discomfort to paraplegia. Affected animals might exhibit gastrointestinal symptoms like vomiting, lack of appetite, and neurological deficits ranging from unsteadiness to complete motor function loss, hyperesthesia, or general spinal pain (Gomes *et al*. 2022). The most frequent initial symptom is spinal pain, occurring in over 80% of cases, with its severity varying from one patient to another (Ruoff *et al*. 2018, De Freitas *et al*. 2022). Owners often notice increased lethargy in their pets, reluctance to run or jump, with symptoms generally worsening over time, though sudden onset is also possible. The inconsistency of spinal pain as a symptom makes it an unreliable marker for determining the resolution of the disease (Van Hoof *et al*. 2023).

About 30% of dogs show fever, weight loss, or other signs of systemic illness. Owing to the non-specific nature of these signs, differential diagnoses should include spinal tumors, intervertebral disc disease, spondylosis deformans, and vertebral physitis in younger animals (Ruoff *et al*. 2018). Physical examination results can differ based on the severity and location of the infections. Patients in early stages often display spinal hyperpathia, whereas those in later stages may experience more intense pain, partial paralysis, and possibly complete paralysis. While acute onset is rare, instances of non-ambulatory partial paralysis and complete paralysis have been observed (Riggs 2016). Despite the vital role of imaging in diagnosing discospondylitis, interpreting these images can be challenging in certain

scenarios.

Numerous imaging methods are utilized to detect areas of discospondylitis, encompassing radiography, computed tomography (CT), MRI, myelography, epidurography, ultrasonography, and nuclear scintigraphy. Additionally, fluoroscopy and CT are instrumental in facilitating percutaneous image-guided aspirations of the affected discs. However, radiography is the most commonly used diagnostic method in veterinary medicine due to its ready availability in most practices (Ruoff *et al.* 2018). Firstly, it is widely available in most veterinary clinics, ensuring easier access for diagnosis. Secondly, the procedure and interpretation of radiographic images are relatively quick, allowing for a faster assessment. Additionally, the process itself is rapid, minimizing the time required for the procedure and reducing the stress for the animal. This paper concentrates on cases of VO and DS, describing its common clinical characteristics, pathophysiology and diagnostic methods.

MATERIALS AND METHODS

Radiographic records were reviewed for diagnoses of 'discospondylitis' over a period of 36 months, from 2013 to 2016, at the Department of Radiology and Physical Therapy, University of Sarajevo-Veterinary Faculty, Bosnia and Herzegovina. The dogs included in the study were primarily presented for diagnostic evaluations due to suspected discospondylitis. Dogs were referred to the clinic for standard diagnostic procedures based on clinical symptoms of spinal disease. The dogs were maintained under standard veterinary care, with feeding practices adhering to commonly accepted guidelines for their respective breeds.

For the purpose of this study, radiographs and CT images that exhibited characteristics such as loss of definition of end-plate margins, narrowing of the intervertebral disc (IVD) space, lytic bone changes adjacent to the IVD space, and sclerosis at the margins of bone lysis were included (DS group). The study involved 14 dogs of various breeds (Mixed breed, German Shepherd, Dalmatian, Labrador Retriever, and Irish Setter),of different gender and age. According to age, dogs were categorized into three age groups (1-2 years, 3-6 years, and 7-10 years). Additionally, the localization of radiologically diagnosed changes was assessed for each breed, covering T1-T12, T13-L3, L4-L6, and L7-S1. Native radiography was conducted for all dogs, with left lateral (LL) and ventrodorsal (VD) projections for detailed visualization. Contrast studies, including myelography and epidurography using a positive contrast agent (iohexol) under general anesthesia, following standard procedures, were employed in cases where native radiography was insufficient (n=3). In cases where a precise diagnosis was challenging, computed tomography (CT) was applied for a comprehensive view of the lumbosacral region (n=7). A comprehensive view of the lumbosacral region was obtained using a spiral CT device with sedated patients positioned for accurate scanning.

To examine the significance of association of occurrence of DS in the studied population of dogs (n=194) with regard to their gender, size, age and localization of the spinal changes, the two-tailed Fisher's exact test was used (Altman 1991). The tested associations were considered statistically significant at $p<0.05$. Statistical analyses were performed using the MedCalc® Statistical Software version 23.0.2 (2024 MedCalc Software Ltd, Ostend, Belgium).

RESULTS AND DISCUSSION

As shown in Table1, the majority of DS cases were diagnosed in mixed-breed dogs and German Shepherds. In terms of gender distribution, almost all diagnosed cases were males, constituting 85.72% of the total 14 cases, with only two cases recorded in Irish Setter females. The observed dominance of male dogs in DS cases was statistically significant ($p= 0.025$).

As for the breed distribution of DS cases between large (Mixed Breed, German Shepherd, Dalmatian, Labrador Retriever, and Irish Setter) and small breeds (Dachshunds, Pekingese, Yorkshire Terriers, Cocker Spaniels, Schnauzers, Maltese, Poodles, Shih Tzus, and Beagles), occurrence of the disease was highly significantly predominant in large breeds ($p=0.002$), where all the 14 DS cases were observed, while DS was not observed in small breeds.

In terms of age, 4 out of 14 DS cases were diagnosed in dogs aged between 1-2 years, while the majority significantly higher number of dogs diagnosed with DS were recorded in dogs aged 3-6 years (n= 8; $p=0.024$). Only two cases of DS were observed in dogs aged 7-10 years. No cases were recorded in dogs older than 10 years (Table 1).

As shown in Table 2, the majority of DS was predominantly diagnosed in the L4-L6 segment of the lumbar spine ($p=0.039$) when compared to other spinal segments.

The present study showed discospondylitis characterized

Table 1. Breed and age distribution of dogs with discospondylitis (DS)

Breed	Age:1-2 years (%)	Age: 3-6 years (%)	Age: 7-10 years (%)	Total (%)
Mixed breed (n=4)	14.28	0.00	14.28	28.57
German Shepherd (n=4)	0.00	28.57	0.00	28.57
Dalmatian (n=2)	14.28	0.00	0.00	14.28
Labrador Retriever (n=2)	0.00	14.28	0.00	14.28
Irish Setter (n=2)	0.00	14.28	0.00	14.28
Total (n=14)	28.57	57.12	14.28	100.00

Table 2. Localization and frequency of discospondylitis (DS) in examined dog breeds

Breed	Localization T1-T12 (%)	Localization T13-L3 (%)	Localization L4-L6 (%)	Localization L7-S1 (%)	Total (%)
Mixed breed (n=4)	0.00	0.00	28.57	0.00	28.57
German Shepherd (n=4)	14.28	0.00	0.00	14.28	28.57
Dalmatian (n=2)	0.00	0.00	14.28	0.00	14.28
Labrador Retriever (n=2)	0.00	14.28	0.00	0.00	14.28
Irish Setter (n=2)	0.00	0.00	14.28	0.00	14.28
Total (n=14)	14.28	14.28	57.14	14.28	100.00

by the destruction of vertebral endplates. Irregularly shaped bone proliferations with complete disc and vertebral body destruction were also observed. Figs. 1-5 illustrate specific features of discospondylitis, including narrowed intervertebral spaces, bone proliferations on ventral and dorsal edges of vertebral bodies, and extradural compression of contrast medium.

Radiographs are useful as the initial diagnostic method, and often, a diagnosis can be established solely using this imaging technique. Early stages of infection are typically indicated on radiographs by slight irregularities on the vertebral end plates' surfaces. The disc space may be narrowed due to the destruction of the discs. In human patients, radiographic changes can emerge anywhere from 2 weeks to several months following the start of the infection (Thomas 2000). Therefore, early in the disease's progression, radiographs may appear normal. Although Thomas (2000) have reported that the most common site for discospondylitis is L7-Sl, however any disc space can be affected and multiple disc spaces can be involved, our study showed that the L4-L6 intervertebral disc was the most frequently affected site.

In human patients, computed tomography (CT) is more effective than radiography at detecting subtle erosion of the vertebral end plate, swelling and abscess in the paravertebral soft tissues. In both human and veterinary patients suffering from discospondylitis, CT imaging reveals end plate destruction characterized by irregularities or multiple hypoattenuating holes, which are apparent in

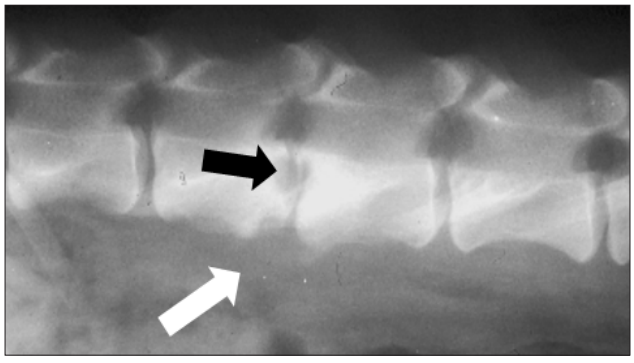

Fig. 1. Left lateral projection radiographs revealed a narrowing of the intervertebral space between L3 and L4 (black arrow) in a 3-year-old Labrador retriever. Advanced osteolytic processes and interdigitating exostosis are observed on the endplates of L3 and L4 vertebrae (white arrow).

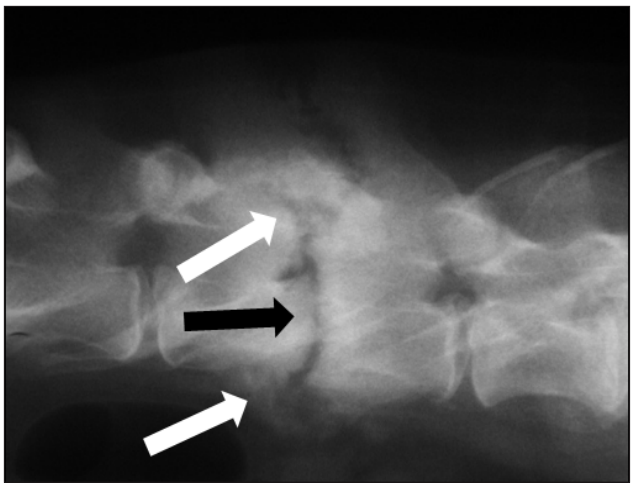

Fig. 2. Radiograph of the lumbar spine segment in a 7-10-year old mixed breed dog, demonstrating proliferation of inflammatory reactive bone tissue on the ventral edges of L4 and L5 vertebral bodies (lower white arrow), dorsally towards spinal processes and osteophytosis at intervertebral joint (upper white arrow). Destruction of newly formed tissue, collapse of the L4-L5 intervertebral space, and shortening of the L5 vertebra are visible (black arrow).

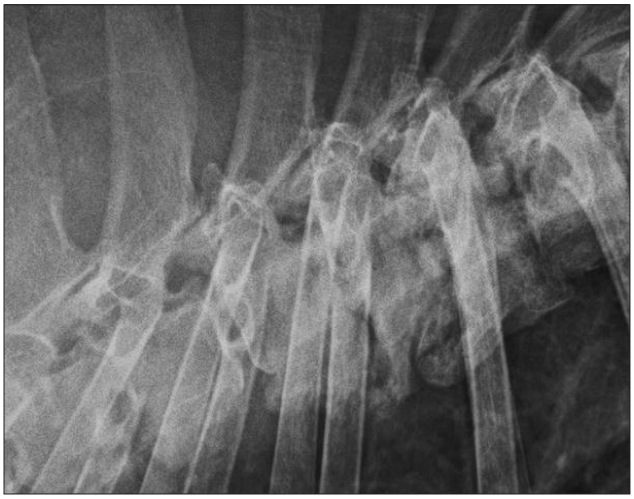

Fig. 3. Radiograph showing narrowed thoracic intervertebral disc spaces and irregularity at the vertebral end-plates in a 6-year-old German Shepherd. There are visible lytic changes on adjacent vertebrae and sclerosis around these regions, which are indicative of the inflammatory process affecting the intervertebral discs and adjacent vertebral bodies.

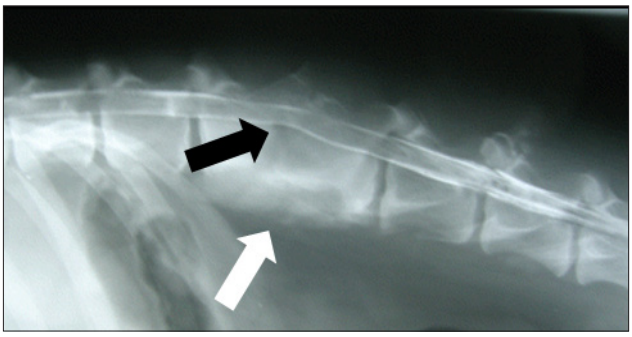

Fig. 4. Profile myelogram of the lumbar spine in a 3-year-old Labrador retriever shows extradural compression of the contrast medium at the level of L2-L3 vertebrae (black arrow). As a typical sign of discospondylitis, bone proliferations with osteolysis and fusion of L2 and L3 are observed below the vertebral bodies (white arrow).

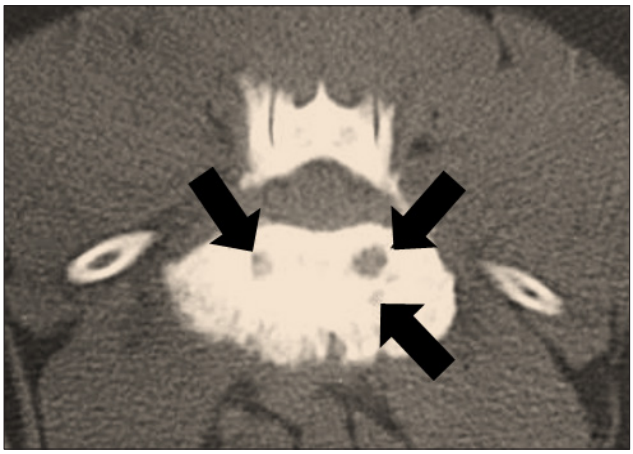

Fig. 5. Tomogram of the cross-section of the spine at the level of the intervertebral space L4-L5 (soft tissue window) in an 8-year-old mixed breed dog clearly shows limited osteolytic foci (arrows) affecting the intervertebral disc and joint surfaces.

transverse view scans (Thomas 2000).

This study utilized native radiography, myelography, and CT scans to diagnose discospondylitis. Pathological changes leading to discospondylitis diagnosis primarily involved prominent proliferations of inflammatory reactive bone tissue with parallel osteolytic destruction of newly formed bone structures, shortening of lumbar vertebrae, narrowing or collapsing intervertebral spaces, and consequent compression of the spinal cord. The comprehensive evaluation of intervertebral discs with inflammatory processes implicates the collapse of the intervertebral space in chronic discospondylitis, diagnosed through native radiography and myelography. CT scans provided clear evidence of the destructive inflammatory process on the intervertebral disc and adjacent bone structures.

Typical radiographic findings associated with discospondylitis involve the erosion of vertebral end plates and adjacent vertebral bodies, resulting in a collapse of the intervertebral disk space (as shown in Fig. 1). Additionally, there was variable bone sclerosis around the eroded regions and osseous proliferation near the intervertebral disk spaces. It's important to note that since radiographic signs of discospondylitis may not appear immediately, the absence of abnormalities in initial vertebral column radiographs does not rule out the possibility of discospondylitis. Therefore, further imaging methods such as MRI, CT scans, or follow-up radiographs (Fig. 4) over several days to weeks are often necessary to establish a definite diagnosis.

The breed, gender, and age diversity of discospondylitis, as well as its localization in the thoracic, lumbar and lumbosacral segments of the dogs' spine are presented in Tables 1, 2 and 3. This study revealed that discospondylitis was most frequently diagnosed in mixed breeds (Fig. 2 and Fig. 5.) and German Shepherds (Fig. 3.). This finding is in accordance with other studies, which report a higher prevalence in large breeds such as the Great Dane, German Shepherd, and Labrador (Van Hoof *et al*. 2023). The common factor in these breeds, including the German Shepherd from present study, supports the hypothesis that the extra strain on the spine of larger dogs may contribute to the development of discospondylitis (Riggs 2016). This correlation suggests that not only purebred large breeds are at risk but mixed breeds that may share similar size and physical characteristics are also significantly affected.

This study showed that males are more prone to discospondylitis (Table 3). According to some authors, there is a sex predilection in the occurrence of discospondylitis, with male dogs being more frequently affected than females (Thomas 2000, Burkert *et al*. 2005), while some studies report a ratio of 2:1 (Thomas 2000, Riggs 2016). This disparity suggests a potential gender-based vulnerability in the development of this condition. This research indicates that discospondylitis predominantly affects dogs in the young to middle-aged category, particularly those aged between 3 to 6 years (57%) as detailed in Table 1. These findings are consistent with other studies suggesting a similar age predilection (Tipold and Stein 2010). Discospondylitis affecting the thoracic, lumbar, and lumbosacral spine was not diagnosed in dogs older than 10 years. Additionally, data from present study indicates that out of 14 diagnosed cases, 12 (85.72%) occurred in dogs aged 6 years or younger, underscoring the greater susceptibility of younger dogs to this condition. In terms of spinal localization of inflammatory changes, the most common finding was in the L4-L6 segment (57%), with 14.28% of discospondylitis diagnosed in the T1-T12,

Table 3. Breed and gender of dogs with discospondylitis (DS)

Breed	Males (%)	Females (%)	Total (%)
Mixed breed (n=4)	28.57	0.00	28.57
German Shepherd (n=4)	28.57	0.00	28.57
Dalmatian (n=2)	14.28	0.00	14.28
Labrador Retriever (n=2)	14.28	0.00	14.28
Irish Setter (n=2)	0.00	14.28	14.28
Total (n=14)	85.72	14.28	100.00

T13-L3 and L7-S1 segments each (Table 2). Present study showed no discospondylitis affecting cervical spine.

This study provides insights into the prevalence and characteristics of discospondylitis of the thoracic, lumbar and lumbosacral spine in dogs. L4-L6 intervertebral segment was identified as the most frequently affected location, which aligns with the general vulnerability of the lumbar region. The present study highlights a notable gender predilection, with male dogs being more commonly affected, consistent with previous literature. Furthermore, the disease predominantly impacts young to middle-aged dogs, with 85.72% of cases diagnosed in dogs aged up to 6 years. This age-related vulnerability stresses the importance of vigilant monitoring and early diagnostic interventions in younger dogs to manage and mitigate the progression of discospondylitis effectively.

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