Diskospondylitis is an infection of the intervertebral disk and the end plates of the adjacent vertebrae. This disease is fairly common in dogs and has been seen with many different bacterial infections and some fungal infections. Staphylococcal infections are the most common cause of diskospondylitis in dogs. Other common causes include infections with Streptococcus spp, Escherichia coli, and Brucella canis. Some of the less common organisms isolated include Klebsiella, Pseudomonas, Proteus, Actinomycetes, Pasteurella, Candida, and Mycobacterium spp. Fungal diseases such as infection with Aspergillus or Paecilomyces spp as well as unspecified fungal infections have also been reported as causes of diskospondylitis.

This condition is very uncommon in cats, and only few case reports are present in the literature, so this article focuses on diskospondylitis in dogs.

Diskospondylitis occurs most frequently in large-breed dogs, although dogs of any size or breed may be affected. The most common cause of diskospondylitis is hematogenous spread of the infectious organism. The infection may originate from many different sources, with urinary tract infections (UTIs) being the most common concurrent infection. Other potential primary sources of infection include endocarditis, dental or oral cavity infections, and respiratory infections. The disease has also been seen with foreign body migration (e.g., grass awns), penetrating wounds and abscesses, and iatrogenic causes (e.g., spinal surgery, epidural injection). However, the incidence of the disease appears to be low after spinal surgery because the disease is rarely reported in chondrodystrophic breeds (e.g., dachshunds), which have a higher incidence of spinal surgeries.

The neurologic signs are variable depending on the duration and severity of the lesion, complicating factors such as vertebral luxation or fracture, compression of the spinal cord, and location of the lesion. The clinical signs vary from subtle signs (e.g., mild spinal hyperesthesia) to severe neurologic dysfunction and paralysis, with moderate to severe spinal hyperesthesia being the most common presenting complaint.

A thorough history, physical examination, and neurologic examination are essential for accurate evaluation of these patients. The diagnosis is clinically confirmed by radiography, and positive microbial culture results further support the diagnosis.

Because treatment is most successful if initiated in the early stages and less complicated cases, an early diagnosis is important for the best possible outcome. It is also important to differentiate diskospondylitis from other diseases that may cause similar clinical signs in the patient. In most cases, medical treatment (i.e., antibiotics and restricted activity) is effective; however, in more severe cases, surgical intervention may be required.

**Diagnostic Criteria**

**Historical Information**

**Gender Predisposition**

Male dogs are more commonly affected than females (male:female ratio, 2:1).

**Age Predisposition**

Diskospondylitis can occur at any age, but in a recent study, the disease was more commonly seen in older dogs.

**Breed Predisposition**

The disease is more common in large- and giant-breed dogs. Great Danes, Labrador retrievers, and boxers seem to be overrepresented. However, the disease can occur in any breed.

**Owner Observations**

- Clinical signs are variable and reflect lesion localization and severity. Signs may include spinal hyperesthesia, ataxia, proprioceptive deficits, paresis, and paralysis.
- The disease is usually slowly progressive in nature, and the clinical signs vary depending on the type of infectious organism and presence of systemic disease. Initially, the clinical signs may be nonspecific and vague.
- Excessive activity or trauma may exacerbate the neurologic deficits or pain. This may be because of
the instability caused by diskospondylitis and a higher possibility of secondary problems such as luxation, subluxation, vertebral fractures, or intervertebral disk herniation in the affected area.

Other Historical Considerations/Predispositions
- A thorough history should be taken for any previous or current signs of infection, with UTIs being the most common. Other more common possibilities include but are not limited to oral cavity or dental infections, endocarditis, pyometra, prostatitis, and respiratory infections.
- Diskospondylitis caused by previous spinal surgery or epidural injections is uncommon based on the present literature.
- Foreign body migrations (i.e., grass awns) have been reported to cause diskospondylitis, but more commonly, a less localized spondylitis results. There have also been rare case reports suggesting migration of other foreign objects from the gastrointestinal tract or respiratory system as causes of diskospondylitis.
- Failure to respond favorably to previous treatments and duration of the clinical signs should be considered when establishing the diagnostic and treatment plan.

Physical Examination Findings
- The clinical signs are variable depending on the severity and location of the lesion.
- A thorough neurologic examination is essential. The neurologic signs vary from mild paraspinal hyperesthesia to severe neurologic deficits. Moderate to severe spinal hyperesthesia is the most common finding. Some of the more common neurologic deficits, when present, include ataxia, proprioceptive deficits, and ambulatory paresis. Severe neurologic signs are rare but include severe paresis, paralysis, and loss of deep pain sensation.
- Some dogs may also show systemic signs of disease such as fever, anorexia, or lethargy.
- The patient should be evaluated closely for any abnormalities in other organs or body systems. This is done to identify any potential source of systemic infection (bacteremia) such as UTI, prostatitis, or pyometra. Rectal examination, inspection of the oral cavity, and careful auscultation of the heart (to detect a cardiac murmur associated with endocarditis) should be included in the physical examination.

Laboratory Findings
- Hematologic and serum chemistry study findings are usually nonspecific and unremarkable. Evidence of infection such as an inflammatory leukogram or left shift may be present on the complete blood count. Depending on the presence of disease or infection in an organ, related abnormalities of the serum chemistry profile may also be present.
- Urinalysis and urine microbial culture and sensitivity should be performed on every patient suspected of having diskospondylitis. Based on one study, about 30% of the dogs with diskospondylitis have microbial growth in their urine cultures.
- Microbial culture and sensitivity (aerobic and anaerobic) testing of the blood are recommended. In the same study mentioned above, about 34% of the dogs had microbial growth in their blood cultures.
- Based on the same study, when blood and urine microbial cultures were combined, about 42% of dogs had positive growth. The study also showed that two or more infectious agents were identified in about 9% of the dogs.
- It is advised that all dogs with diskospondylitis be tested for brucellosis. Because of its zoonotic potential and public health concerns and to come up with the most appropriate antimicrobial selection, it is important to rule out this disease. In one study, nine of 68 dogs had a positive Brucella card test result. In another study, 14 of 145 dogs with diskospondylitis had B. canis infection. Serologic tests, such as the tube agglutination test or rapid slide agglutination test, may be used for screening. False-negative test results are rare, but false-positive results are relatively common with these tests. The agar gel immunodiffusion test is a more sensitive and specific test and should be used to confirm positive results on the screening tests. In some cases, positive microbial growth may be identified on urine or blood cultures. Sexually intact male dogs in the southeastern United States seem to be at higher risk.
Although meningitis is rare in patients with diskospondylitis, cerebrospinal fluid (CSF) should ideally be evaluated before myelography and in patients with clinical signs compatible with meningitis or myelitis.

Other Diagnostic Findings
- In most cases, the clinical diagnosis is made mainly by evaluation of the radiographs. Positive microbial cultures further support the radiographic diagnosis.
- Radiographs of the entire spine should be obtained because some patients may have more than one affected area.
- Radiographic changes may not be present up to 2 to 6 weeks after the onset of the infection; therefore, a dog may be clinically abnormal yet radiographically normal during this time.
- Some of the earliest radiographic signs are lysis of the vertebral end plates and narrowed disk space. The radiographic changes are usually a mixture of destructive and proliferative lesions.
- Based on some studies, the L7–S1 disk space is the most commonly affected region. Some of the other common areas include T13–L1, C6–C7, and the cranial lumbar area.
- Bony lysis may occasionally affect the vertebral bodies in addition to the end plates.
- In more chronic cases, the disk space may appear widened because of lysis of the end plates and adjacent bones.
- Other less common and later radiographic changes include vertebral fracture or luxation, vertebral collapse, scoliosis, and ankylosis.
- Ultrasonography is helpful for evaluation of the abdomen and heart to find the source of the infection and evaluate other organs.
- Myelography may be performed in patients with severe neurologic deficits to detect extradural spinal cord compression.
- Advanced imaging such as computed tomography (CT) and magnetic resonance imaging is very helpful in patients with subtle radiographic lesions, inconclusive or questionable radiographic findings, or severe neurologic deficits.
- Fine-needle aspiration of the disk space is another diagnostic option. The aspirate is used for microbial culture and sensitivity and cytology. This procedure may be guided by ultrasound or CT. This is a relatively safe method and is usually reserved for patients without any microbial growth on urine or blood samples, patients that do not respond well to the initial antimicrobial therapy, those with suspected vertebral neoplasia, or when the diagnosis is unclear.
- Surgical biopsy is reserved for cases with severe clinical signs in association with therapeutic failure, a high index of suspicion of neoplasia, or during decompressive surgical procedures.

Summary of Diagnostic Criteria
- The typical patient is a large- or giant-breed male dog. The disease is usually chronic and progressive in nature.
- The initial clinical diagnosis is based on history, clinical signs, and radiographic findings. Positive microbial cultures and response to antimicrobial medications further support the diagnosis.
- Other body systems and organs, such as the urogenital organs, heart, and oral cavity, should be evaluated for any evidence of infection.
- Serology is used to rule out brucellosis.

Diagnostic Differentials
- Intervertebral disk disease, central nervous system (CNS) infectious disease and noninfectious inflammatory disease (e.g., granulomatous meningoencephalitis), CNS neoplasia, and vertebral instability or subluxation may all have clinical signs similar to diskospondylitis.
- Vertebral neoplasia and osteomyelitis.

TREATMENT RECOMMENDATIONS

Initial Treatment
Patients with diskospondylitis are usually treated medically. The mainstays of treatment include antimicrobials and restricted activity.
- Antimicrobial selection should be based on the microbial culture and sensitivity results (urine; blood; and in selected cases, fine-needle aspiration of the disk) or serology (brucellosis). If no microbial growth is present or if performing these tests is not an option, treatment should be initiated based on the most likely infectious organisms causing the disease.
- Until urine and other culture or sensitivity and serology results (e.g., for Brucella) are available, the patient may be treated empirically for the most common cause of infection, coagulase-positive Staphylococcus spp. If an organism is not identified, empirical therapy may be continued as long as the patient is responding well to treatment. First-generation cephalosporins or β-lactamase–resistant penicillins are the most commonly used drugs in these cases.
- Fluoroquinolones appear to be effective for dogs infected with B. canis and achieve high concentration in the bone. A combination of tetracyclines and aminoglycosides has also been recommended for treatment of diskospondylitis caused by B. canis.
- Proper antibiotic therapy directed toward the causative agent for an appropriate amount of time is essential in treatment.
Some of the routinely used antimicrobials against the more common causative agents are listed in Table 1.

Castration is recommended in intact males diagnosed with brucellosis.

Patients with significant neurologic deficits, severe radiographic changes, or systemic signs of disease (e.g., anorexia, lethargy, fever) may benefit from a few days of hospitalization with IV antibiotics and supportive care (e.g., IV fluids, pain medications) before they start oral antibiotics. Patients should be evaluated daily for any changes in their clinical and neurologic signs.

Alternative/Optional Treatments/Therapy

- If the patient does not respond favorably to the initial treatment, the antimicrobial selection may need to be altered. If previous blood and urine microbial cultures and Brucella test results are all negative (or if they were not performed), repeat urine and blood microbial cultures and potentially fine-needle aspiration of the disk may be helpful in identifying the causative organism and selecting the most effective antimicrobial medication.

Supportive Treatment

- Analgesics should be used in patients with hyperesthesia. Standard doses of opioids, NSAIDs, or a combination of both are the most commonly used analgesics in these patients.

- Complete restricted activity (cage rest) is an important component of therapy. Depending on the individual case, surgical options include decompression, distraction and stabilization, and surgical biopsy.

- In cases with foreign body migration (e.g., grass awns), the foreign material should ideally be removed.

In cases with severe neurologic deficits, significant worsening of the neurologic signs, or evidence of instability or extradural spinal compression, surgery may be indicated. Depending on the individual case, surgical options include decompression, distraction and stabilization, and surgical biopsy.


### Table 1

<table>
<thead>
<tr>
<th>Organism</th>
<th>Antimicrobial Drug</th>
<th>Dosage</th>
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</thead>
<tbody>
<tr>
<td><em>Staphylococcus</em> spp</td>
<td>Cephalexin</td>
<td>20–30 mg/kg PO tid</td>
</tr>
<tr>
<td></td>
<td>Amoxicillin–clavulanate</td>
<td>12.5–25 mg/kg PO bid–tid</td>
</tr>
<tr>
<td></td>
<td>Oxacillin</td>
<td>15–25 mg/kg PO tid–qid</td>
</tr>
<tr>
<td></td>
<td>Cefazolin</td>
<td>20–25 mg/kg IV, IM, or SC qid</td>
</tr>
<tr>
<td><em>Streptococcus</em> spp</td>
<td>Amoxicillin</td>
<td>20–22 mg/kg PO bid–tid</td>
</tr>
<tr>
<td></td>
<td>Amoxicillin–clavulanate</td>
<td>12.5–25 mg/kg PO bid–tid</td>
</tr>
<tr>
<td><em>Brucella canis</em></td>
<td>Enrofloxacin</td>
<td>10–20 mg/kg PO sid</td>
</tr>
<tr>
<td></td>
<td>Doxycycline</td>
<td>20–25 mg/kg PO bid</td>
</tr>
<tr>
<td></td>
<td>Tetracycline</td>
<td>10–20 mg/kg PO tid</td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>Enrofloxacin</td>
<td>10–20 mg/kg PO or IV sid</td>
</tr>
<tr>
<td></td>
<td>Amoxicillin–clavulanate</td>
<td>12.5–25 mg/kg PO bid–tid</td>
</tr>
<tr>
<td></td>
<td>Cephalexin</td>
<td>20–30 mg/kg PO tid</td>
</tr>
<tr>
<td></td>
<td>Cefazolin</td>
<td>20–25 mg/kg IV, IM, or SC qid</td>
</tr>
<tr>
<td></td>
<td>Chloramphenicol</td>
<td>22 mg/kg PO, IV, or SC tid</td>
</tr>
<tr>
<td><em>Actinomyces</em> spp</td>
<td>Penicillin G</td>
<td>100,000 U/kg IV, IM, or SC qid</td>
</tr>
<tr>
<td><em>Aspergillus</em> spp</td>
<td>Ketoconazole</td>
<td>10 mg/kg PO bid</td>
</tr>
<tr>
<td></td>
<td>Fluconazole</td>
<td>5 mg/kg PO bid</td>
</tr>
</tbody>
</table>

**Patient Monitoring**
- Patients should be monitored for any changes in their neurologic and overall health status. If the neurologic signs worsen, additional diagnostic tests or more aggressive treatment, such as surgery, may be required.

**Home Management**
- Owners should be familiar with the potential side effects of the medications their pet is receiving.
- Owners should understand the importance of restricted activity and cage rest.
- Owners should be familiar with signs to monitor (e.g., pain, increased ataxia or paresis, paralysis) to assess the progression of the disease. They should be instructed to contact the veterinarian if the neurologic signs worsen.
- Physical therapy may be indicated for some patients. This is more important in severely paretic or recumbent animals.

**Milestones/Recovery Time Frames**
- The mean duration of antimicrobial administration was about 54 weeks in a recent study. However, the recommended length of treatment is variable in the current literature. The patient should be treated for at least 6 weeks, but longer treatment is required in many cases. Most clinicians recommend continuing therapy for a few weeks after complete resolution of the clinical signs. In some cases, therapy may need to be continued for months. Premature discontinuation of antibiotics may result in relapse of the clinical signs.
- It is recommended to recheck radiographs of the affected vertebrae every 4 to 8 weeks until evidence of bony lysis has disappeared or vertebral fusion has occurred. This may not occur for several months. If the infection continues to worsen, the lysis of the end plates becomes more evident and the disk space appears widened because of lysis of adjacent vertebrae. Vertebral or disk space collapse, fracture, and luxation may also be present in some cases.
- The recovery for patients with uncomplicated and mild cases is usually quicker and more complete. Patients with more severe cases may take longer to improve and may not make a full recovery.
- Diskospondylitis caused by fungal diseases tends to require longer treatment. However, the duration of treatment depends on the patient’s response to therapy, physical and neurologic examination results, and follow-up radiographic examinations. Complete resolution may be difficult in some cases. Prognosis is usually poor.
- Because of the intracellular nature of *B. canis*, complete resolution of infection is difficult, and there is a high rate of recurrence.

**Treatment Contraindications**
- Use of corticosteroids or any immunosuppressive drug is contraindicated.
- Underdosing or an inappropriately short duration of antibiotic treatment may predispose the patient to a relapse of the clinical signs or development of more resistant infections.

**PROGNOSIS**

**Favorable Criteria**
- Absent or mild neurologic deficits.
- Positive response to treatment.
- No systemic disease.
- Early detection of the disease (duration <2 weeks).

**Unfavorable Criteria**
- Severe neurologic deficits, especially severe non-ambulatory paresis or paralysis. Lack of deep pain sensation is a very poor prognostic indicator.
- Worsening of the clinical signs despite appropriate treatment.
- Brucellosis as a cause of diskospondylitis.
- Patients that have infections caused by *Aspergillus* spp and with other fungal infections often have a poor outcome.
- Evidence of fracture, subluxation, or instability present on imaging.
- Patients that require surgical intervention generally have a less favorable prognosis. However, the prognosis is variable depending on the neurologic status and severity of the vertebral lesions.

**RECOMMENDED READING**