

Canine diskospondylitis: Its etiology, diagnosis, and treatment

Various pathogenic processes can cause bacteria or fungi to infiltrate and multiply in intervertebral disks. Find out how to diagnose this potentially painful and crippling problem and what therapy can eradicate the infection.

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DISKOSPONDYLITIS is an infection of the intervertebral disk with concurrent osteomyelitis of contiguous vertebrae.^{1,2} It occasionally affects dogs, causing clinical signs that vary from depression and weight loss to paralysis. Early diagnosis and appropriate therapy are essential to a successful outcome.^{3,4} This article reviews the pathogenesis, diagnosis, and treatment of diskospondylitis.

Etiology and pathogenesis

Hematogenous spread of bacteria or fungi is the most common cause of diskospondylitis. *Staphylococcus intermedius* is the bacterial species that most often causes diskospondylitis in dogs. Other frequently documented bacterial pathogens include *Streptococcus* species, *Brucella canis*, and *Escherichia coli*.⁵ Less frequently isolated bacteria are *Pasteurella*, *Proteus*, *Corynebacterium*, *Actinomyces*, *Nocardia*, *Bacteroides*, and *Mycobacterium* species. The fungi *Aspergillus* and *Paecilomyces* species have also been cultured.⁶ Vertebral infections caused by grass awn migration (*see below*) are often associated with mixed bacterial infections. *Actinomyces* species are common isolates in cases of grass awn migration. Other organisms such as *Streptococcus* species, *Staphylococcus* species, *Bacteroides* species, *Proteus mirabilis*, *Pasteurella* species, and *Pseudomonas* species frequently accompany *Actinomyces* species in these infections.^{6,7}

The infection may originate from many sources, with the urinary tract being most common.² Most dogs in which staphylococci are cultured in urine also have bacteremia, suggesting that the urinary tract infection could be a result of the bacteremia. A role for primary urinary tract infections as a cause of diskospondylitis is more evident in cases of gram-negative sepsis. If *E. coli* is isolated in blood culture and involvement of the urinary tract is identified, the bacteremia can be attributed to a gram-negative genitourinary infection, since *E. coli* is the most commonly isolated organism from urinary tract infections.

Bacterial endocarditis is also suspected to be a primary source of intervertebral disk infections in some dogs. This is a rare cause of diskospondylitis, and the clinicopathologic syndrome associated with endocarditis is usually more severe than that associated with diskospondylitis alone.²

Dental disease has also been implicated in the pathogenesis of hematogenous bacterial diskospondylitis. A wide variety of bacteria constitute the normal gingival flora in dogs. In people, transient bacteremia occurs spontaneously during mastication. In one study of diskospondylitis in dogs, moderate to severe periodontal disease observed in the dogs was implicated as a possible source of infection.⁸

Factors such as immunosuppression, spinal trauma, and foreign body migration appear to play important roles in the pathogenesis of diskospondylitis.

An immunologic study in Airedale terriers suggests that decreased serum concentrations of IgA in some dogs may impair their resistance to skin and intestinal microflora.⁸ The immunosuppressed condition of these dogs probably contributes to the penetration of bacteria into the body and its subsequent spread to the disks. It is not clear whether immunosuppression in the dogs in the study was a primary factor leading to disease or occurred subsequent to the infection. Immunosuppression may predispose German shepherds to diskospondylitis caused by *Aspergillus* species and basset hounds to infection caused by *Mycobacterium avium*, though specific immunologic abnormalities have not been identified.^{2,8,9}

Previous trauma to the cartilaginous end plates, vertebral bodies, and intervertebral disks may contribute to diskospondylitis development.⁶ Although trauma is not often a reported cause of diskospondylitis, the predominance of the disease in large-breed male dogs suggests that stresses placed on the vertebral column because of increased weight and activity may play a role.¹⁰ In dogs, the thoracic and lumbar vertebrae and the L7 to S1 disk space are recognized as the most common sites for diskospondylitis.⁸⁻¹¹ Some consideration must be given to the idea that venous and possibly arterial stasis occur at L7 to S1 as a result of vascular occlusion on an intermittent basis during normal movement in dogs. The lumbosacral junction is a concentrated area of stress because of the immobility of the pelvis. The stress of movement in these large-breed dogs could generate enough

force to cause microscopic bone fractures, as has been seen in people. Microfractures, localization of bacteria, and subsequent compromised vascularity of the vertebral end plates in this area could provide a medium for bacterial growth.^{8,11}

An infection in the paravertebral tissues and subsequent diskospondylitis and vertebral osteomyelitis are most commonly caused by foreign body migration, especially grass awns.⁴ These plant materials (*e.g.* wheat, barley, cheatgrass, foxtails) usually have barbed ends that allow them to move forward but not backward. Although the exact site of entry of grass awns is unknown, there are several theories. One proposed mechanism is that these plants may migrate to the region of the vertebrae after entering skin overlying the paravertebral structures or abdomen. Muscular contractions may assist in grass awn migration. Penetration of these grass awns through the bowel wall has also been suggested as a portal of entry; however, evidence such as mesenteric scarring has not been documented. Inhalation of the grass awn, with migration through the lungs or mediastinum and then along the crura of the diaphragm, has also been suggested as an entry point. The crura of the diaphragm insert on the ventral lumbar bodies of L2 to L4. Grass-awn-associated diskospondylitis and spondylitis occur most frequently at these vertebral bodies, which supports the inhalation theory of migration.⁶

In the vertebral column, infection first localizes in the cartilaginous end plate, probably in the slowly flowing venous channels.¹⁰ Nutrient capillaries that supply blood to the bone loop sharply at the epiphyseal plate before entering a system of sinusoidal veins connecting to the medullary cavity. Experimental studies suggest that the

metaphysis may be unable to withstand a bacterial insult in part because of the arrangement of this vascular network.⁵ The capillary loops at the epiphyseal plate are nonanastomosing branches of the nutrient artery, and obstruction by bacteria or microthrombi tends to result in small areas of avascular necrosis. Blood flow through the afferent capillary loop is slowed and turbulent because of the disproportionate diameters and numbers of vessels compared with those in the efferent loops. The afferent capillary loop also lacks phagocytic cells, while the efferent loop contains inactive phagocytic cells. This results in a decreased resistance to bacterial colonization in the necrotic area.⁴ The circumferential vessels surrounding the annulus fibrosus form numerous anastomoses with the vascular components of the vertebral bodies. Branches from these vessels penetrate the junction of annulus and nucleus pulposus. This communicating venous plexus may allow infection to spread to adjacent vertebrae (*Figure 1*). The disk space itself is the initiation point for infections only when direct inoculation with bacteria occurs.⁷ Once a vertebral infection is established, the spinal cord and nerve roots may become involved, leading to neurologic deficits (*Figure 2*).

Diagnosis

Signalment and clinical signs

Diskospondylitis primarily affects large- and giant-breed dogs, although dogs of any size may be affected.¹² Males are affected twice as often as females are. Affected dogs are most often middle-aged, and German shepherds and Great Danes are represented more frequently than are other breeds.¹⁰

The clinical presentation of



FIGURE 1

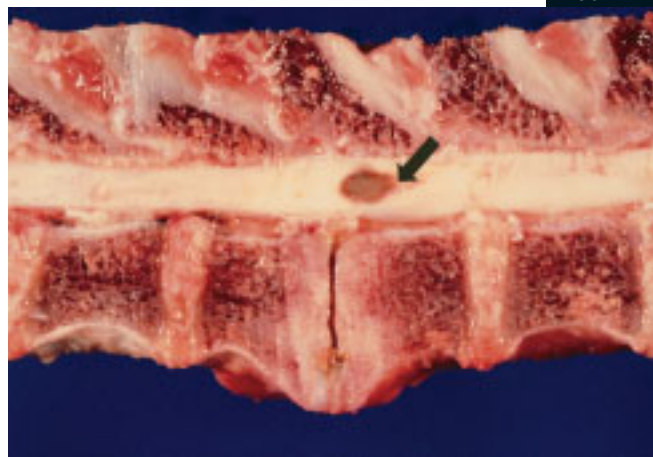


FIGURE 2

1. A histopathologic specimen of a vertebral space with diskospondylitis. There is an intense inflammatory reaction as well as symmetric erosion of the vertebral end plates. Note the proximity of the annulus fibrosus and the vertebral body (hematoxylin-eosin stain; 40 \times). (Photograph courtesy of Dr. Roy Pool.)

2. A gross specimen of a vertebral space with bacterial diskospondylitis. There is lysis of the vertebral end plates and spondylosis formation on the ventral aspect of the space. The spinal cord contains an area of hemorrhage and swelling caused by instability (arrow). (Photograph courtesy of Dr. William Maslin.)

diskospondylitis varies, but signs usually progress over a long period. The duration of signs observed by clients most commonly ranges from several days to several weeks, but some affected dogs have a longer course of disease lasting up to or longer than one year.^{7,12} Signs can vary from those of systemic infection (*e.g.* depression, anorexia, fever, weight loss) to those of musculoskeletal dysfunction (*e.g.* hyperesthesia, lameness, abnormal or stilted gait, reluctance to ambulate). Neurologic signs are those of extradural compression, paresis and ataxia, or paralysis and depend on the vertebral site and severity of the lesion. Hyperesthesia along the spinal column is often seen first and may be the only sign observed, although some dogs do not exhibit pain or discomfort. In a study of 32 dogs, 22 showed hyperesthesia as a clinical sign.¹² Neurologic dys-

function can develop over time with bone proliferation or occur suddenly with rupture of the intervertebral disk. Hemiparesis or hemiplegia can result from nerve root involvement in patients with vertebral infection.^{5,10}

History and physical examination

You may discover a possible source of bacteremia (*e.g.* pyometra, prostatitis, pneumonia, bacterial endocarditis) based on a patient's history and physical examination findings. Dogs with involvement of other body systems are considered to have complicated diskospondylitis.³ Consider a vertebral infection in any patient with paravertebral hyperesthesia, especially in adult large-sized dogs. Palpate the spine for any evidence of pain, and perform a thorough neurologic exam. In the absence of obvious spinal disease, clinical signs such as fever of unknown origin or recurrent

genitourinary infections may justify a spinal radiographic examination to rule out diskospondylitis.⁶ The physical examination should also include examination of the ear canals, skin, and teeth; rectal palpation of the prostate in males; and thoracic auscultation to detect a heart murmur associated with bacterial endocarditis.⁷

Radiography

Diskospondylitis, vertebral osteomyelitis, vertebral phsitis, spondylosis deformans, and vertebral neoplasia alter the shape and radiopacity of affected vertebrae in different ways.¹³ The radiographic appearance of diskospondylitis only subtly differs from the appearance of these other vertebral diseases (*Table 1*). The lumbosacral disk space (L7 to S1) is the intervertebral disk space most commonly infected (*Figure 3*). Other common sites include the cra-

TABLE 1 Radiographic Signs of Vertebral Diseases

Disease	Radiographic Signs
Diskospondylitis	<p>Bony lysis of one or both vertebral end plates and, occasionally, the vertebral bodies</p> <p>Bone proliferation on and within infected vertebrae including ventral osseous proliferation bridging the affected disk space</p> <p>Narrowing of the affected disk space</p> <p>Reactive sclerosis in both vertebral bodies of affected disk space</p>
Vertebral osteomyelitis	<p>Irregular and poorly marginated bony lysis affecting the vertebral body or other vertebral regions</p> <p>Irregularly shaped periosteal reaction</p>
Vertebral physisitis	<p>Lucent widening of the caudal vertebral physis and loss of definition of physal margins</p> <p>Physal collapse and sclerosis and remodeling of the ventrocaudal portion of the vertebra</p>
Spondylosis deformans	<p>Bony exostoses on the ventrolateral portion of the spine</p> <p>Osteophyte formation at areas of ligament attachment to the vertebrae</p> <p>Bridging of the affected disk space with osteophytes</p> <p>No bony lysis or sclerotic vertebral end plates</p>
Vertebral neoplasia	<p>Usually resides in one vertebra</p> <p>Destruction of cortical bone or collapse of the adjacent disk space evident</p> <p>Bone production may be evident</p>

nial lumbar area, T13 to L1, and C6 to C7. Involvement of multiple disk spaces is seen occasionally. The thoracic spine is predisposed to involvement of multiple disk spaces.^{3,10} Infection usually spreads to adjacent disks by diffusing through the multiple holes in the vertebral end plates.^{7,10} Studies involving more than 25 dogs from a variety of sources documented multiple lesions in 18% to 28% of patients.³ It is important to note that the diagnostic lesions seen on spinal radiographs may not appear until two to six weeks after the

onset of infection; thus, dogs may have clinical signs and be radiographically normal.^{3,7,10}

The earliest and hallmark radiographic sign of diskospondylitis is lysis of the vertebral end plates (*Figures 4A & 4B*). The lesion is typically a mixed destructive and proliferative lesion centered on the affected disk space. Diskospondylitis lesions originate as symmetric lysis of the vertebral end plates with reactive sclerosis in both vertebral bodies and subsequent symmetric spondylosis. Bony lysis occasionally affects the vertebral

bodies in addition to the cartilaginous end plates. The disk space may be narrowed as a result of disk destruction. As the infection progresses, end plate erosion becomes more evident, and the disk space appears widened because of lysis of adjacent bone (*Figure 5*). Late radiographic findings may include vertebral collapse or fracture, scoliosis, and bony ankylosis.^{6,8,13,14}

Other diagnostic imaging

Other types of diagnostic imaging may be beneficial in diagnosing diskospondylitis if radiography is not definitive.

Myelography may be helpful when a patient has marked neurologic abnormalities and you are considering decompressive surgery. Myelographic findings consistent with extradural spinal cord compression include attenuation and dorsal deviation of the ventral contrast column over the affected disk space or vertebrae.^{7,12}

Computed tomography (CT) may identify subtle end plate erosion and soft tissue swelling or abscess around the vertebrae. In human and veterinary patients with diskospondylitis, CT shows destruction of the vertebral end plate, with irregularities or multiple hypoattenuating holes visible on transverse views. If the infection has extended into the vertebral canal, a soft tissue density is seen in the epidural space. CT performed after a myelographic examination clearly defines compression of the cord or nerve roots by granulation tissue, abscess, or bone impingement. CT is most useful when the results of a survey radiographic examination are normal or inconclusive.⁷

Magnetic resonance imaging (MRI) provides useful information when survey and contrast radiography are not definitive. It allows evaluation of

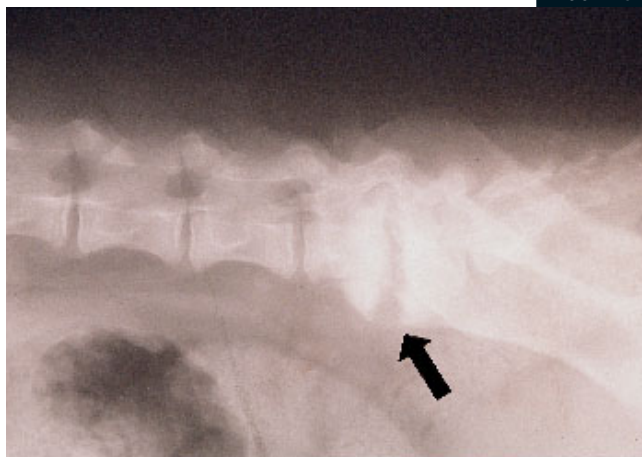


FIGURE 3

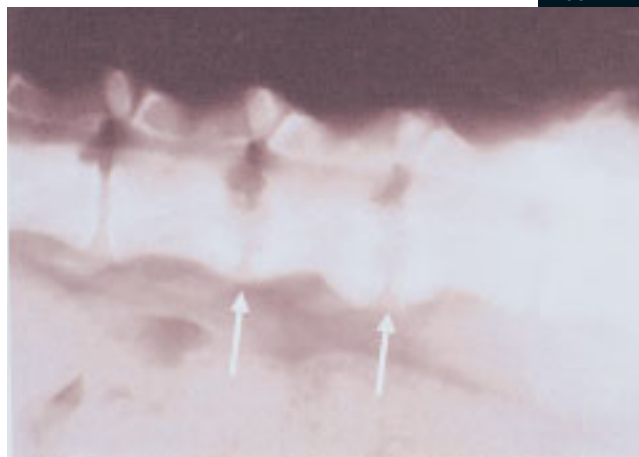


FIGURE 4A

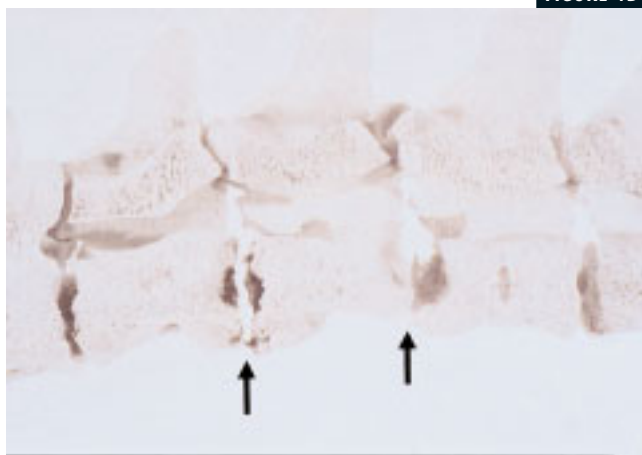


FIGURE 4B

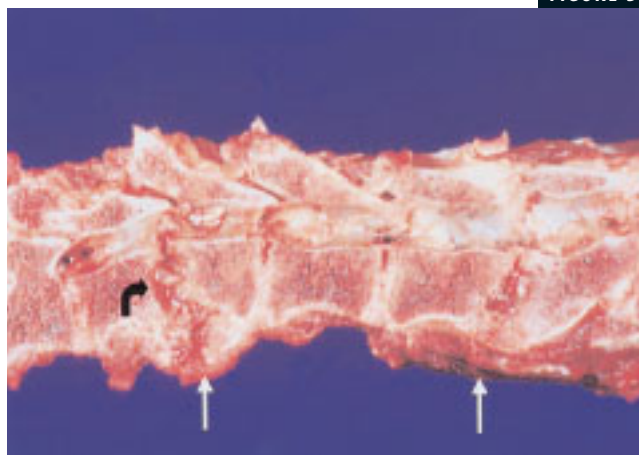


FIGURE 5

large areas of the vertebral column on a single set of images, identifies infected tissue earlier than radiography, and best determines the full extent of infection. Less advanced lesions of diskospondylitis may be missed on survey radiographs, but extension of the infection into the vertebral canal may be apparent on MRI. MRI results of increased T2-decreased T1 signal intensity and nonuniform contrast enhancement of the disk space, surrounding soft tissues, and adjacent vertebral end plates in question often suggest an inflammatory or infectious process of the vertebral column.^{2,7,15}

Nuclear scintigraphy (radionuclide bone scanning) typically identifies

abnormalities before bone lysis is evident on survey radiographs, and certain types of scans (gallium) are a good way to document successful treatment. These scans are not specific for infection and must be used in conjunction with other diagnostic testing.^{7,14}

Microbiology

Blood culture

In cases of suspected diskospondylitis, obtain blood samples aseptically from the jugular vein for both aerobic and anaerobic bacterial culture. Multiple cultures can be done to ensure isolation of the causative

3. Diskospondylitis occurs commonly in the lumbosacral intervertebral disk space. In this lateral radiograph of the spine, lysis and bony proliferation are evident at the lumbosacral junction (*arrow*).

4A & 4B. Diskospondylitis affecting multiple disk spaces in the lumbar region. In *Figure 4A*, symmetric lysis and reactive sclerosis of the vertebral end plates is evident radiographically in both affected disk spaces (*arrows*). In *Figure 4B*, a dried bone specimen of the same dog shows bony destruction of the end plates and spondylosis (*arrows*). (Photographs courtesy of Dr. Roy Pool.)

5. A gross specimen of a spine with diskospondylitis affecting multiple sites. Destruction of the cartilaginous end plates and vertebral body is evident (*curved arrow*). The affected disk spaces are narrowed. Infected tissue, necrosis, and spondylosis are evident on the vertebral bodies (*straight arrows*).

organism. More than one culture is ideal but rarely done by clinicians, which may account for the low percentage of isolated bacteria in practice. Bacterial blood culture results are positive in about 40% to 75% of affected patients.^{12,16}

Urine culture

Since urinary tract infections often accompany diskospondylitis, always culture the urine. Sometimes the bacteria in the blood are also shed in the urine and can cause a positive culture result. Blood and urine culture often reveal the same organism. Obtain the urine sample by cystocentesis. Urine culture results have been reported to be positive in about 25% to 40% of affected dogs.^{6,16} Ideally, obtain culture results before initiating antibiotic therapy. Fungal isolates can also be obtained by culturing the urine sediment. *Aspergillus terreus* is most often isolated, either by urine cultures or swabs of tissue from the affected disk space.¹⁷ In addition to culture, urine sediment can be microscopically examined for evidence of fungal hyphae.^{17,18}

Needle aspiration and biopsy

Percutaneous needle aspiration of the disk space is a safe procedure to obtain tissue for cultures and cytologic examination. The procedure requires general anesthesia and sterile preparation of the skin overlying the entry site. Guide a spinal needle into the disk by using CT or fluoroscopy. Introduce a small amount of sterile saline solution, and immediately aspirate several times to obtain tissue material. Percutaneous needle aspiration is indicated for patients that do not respond to initial antibiotic therapy, in cases of suspected neoplasia, or when the diagnosis is unclear. If culture results by needle aspiration are negative, surgical biopsy can be con-

sidered.^{6,7} Reserve surgical biopsy for cases with extenuating circumstances, such as therapeutic failures.⁶

Brucella canis culture and serologic testing

Test dogs with radiographic evidence of diskospondylitis for *Brucella canis*. Most dogs with concurrent *B. canis* infection are intact males, though it has been reported in intact females.¹⁸ Because of the zoonotic potential of *B. canis*, it is advisable to test all dogs with signs of diskospondylitis. The principal abnormalities associated with brucellosis are disorders of the reproductive tract; however, other organ systems may be affected. *Brucella canis*-associated diskospondylitis has been reported in dogs, but details regarding signalment, clinical abnormalities, diagnostic criteria, and treatment are similar to those in dogs with diskospondylitis caused by other organisms. *Brucella canis* can be isolated from the blood and urine through culture. *Brucella canis* has also been isolated from bone at the time of decompressive surgery. Demonstration of the organism by blood culture is considered definitive. The test is rarely done because *B. canis* is hard to isolate.¹⁸

Serologic tests, such as the rapid-slide agglutination and tube agglutination tests, can be used for screening. False negative results are rare with both tests (1%),⁶ but false positive results are common with both tests. The agar gel immunodiffusion test is a more sensitive and specific serodiagnostic test for brucellosis and should be done to confirm positive results on other serologic tests.^{6,18}

Pathology and histopathology

The vertebral lesions of diskospondylitis on necropsy consist of moderate to extensive necrosis of articular cartilage end plates and un-

derlying bone. These granulomatous lesions may or may not be invading the subarachnoid space and the leptomeninges of the spinal cord.¹⁶ On histopathologic study of biopsy samples or tissues collected at necropsy, increased numbers of plasma cells are seen, and marked sclerosis of the lesion site is noted. Large foci of inflammatory cells and necrotic debris are present, and increased osteoclastic activity with bone resorption is also seen.¹⁶

Treatment

Medical treatment

Diskospondylitis is usually treated medically, although surgical treatment is performed in extensive cases. The key to successful treatment of diskospondylitis is proper antibiotic therapy directed at the causative organism for an appropriate amount of time (Table 2). Since many of these patients are immunosuppressed, bactericidal antibiotics are preferred.⁷ Until blood and urine culture and sensitivity results are available, you can treat an animal empirically, assuming the infection is due to the most commonly isolated organism in patients with diskospondylitis, coagulase-positive *Staphylococcus* species.^{2,3} If an organism is not cultured, you can continue empiric therapy if the animal is responding well. Antibiotics effective for this purpose are first-generation cephalosporins or β -lactamase-resistant penicillins (e.g. cloxacillin sodium, oxacillin sodium, amoxicillin trihydrate-clavulanate potassium). Clindamycin is also effective against coagulase-positive *Staphylococcus* species. A trimethoprim and sulfonamide combination or chloramphenicol is less effective, but these drugs are also less expensive and can sometimes be effective.^{2,6,7}

Treat patients with fever, neurologic deficits, or rapidly progressing signs with intravenous antimicrobials for three to five days, followed by a course of oral antibiotics. Initial oral antibiotics are appropriate for animals with mild clinical signs and slowly progressing disease.⁷ Continue therapy for at least six weeks; therapy may need to be continued for up to six months in some cases. Antibiotic treatment usually results in improvement within four or five days. Clinical signs such as spinal hyperesthesia and fever may resolve within five days of treatment, but neurologic signs typically take longer to resolve.⁷ If there is no improvement after seven to 10 days of treatment, reevaluate the case.⁶ Corticosteroids are contraindicated in animals with vertebral infections. Administering nonsteroidal anti-inflammatory drugs to provide analgesia, along with cage rest, is useful in controlling signs of pain and lameness in these cases.³

A combination of tetracyclines and aminoglycosides has been recommended to treat diskospondylitis caused by *B. canis*.^{7,18} These dogs have also been treated with a tetracycline hydrochloride-streptomycin sulfate combination and with fluoroquinolones.^{7,18} The tetracycline and streptomycin combination is currently recommended for treating canine brucellosis, with a 94% success rate reported in one study.¹⁸ Fluoroquinolones achieve high therapeutic concentrations in neutrophils, macrophages, and the prostate gland, where *Brucella* species organisms are concentrated. In addition, fluoroquinolones have good penetration into bone and have been advocated for use in osteomyelitis, which makes them an adequate alternative in diskospondylitis treatment. Unfortunately, there is a high rate of recurrence of brucellosis after treatment,

TABLE 2 Common Causative Organisms of Diskospondylitis and Effective Antibiotics

Organism	Antibiotic	Dosage
<i>Staphylococcus</i> species	Cephalexin	20–30 mg/kg PO t.i.d.
	Cefazolin	20 mg/kg IV, IM, SC q.i.d.
	Cloxacillin	10 mg/kg IV, IM, PO q.i.d.
	Oxacillin	15–25 mg/kg PO t.i.d. to q.i.d.
	Amoxicillin-clavulanate	12.5–25 mg/kg PO b.i.d. to t.i.d.
<i>Streptococcus</i> species	Amoxicillin	20 mg/kg PO b.i.d.
<i>Brucella canis</i>	Enrofloxacin	10–20 mg/kg PO once a day
	Doxycycline	25 mg/kg PO b.i.d.
<i>Actinomyces</i> species	Penicillin G	100,000 U/kg IV, IM, SC q.i.d.
<i>Aspergillus</i> species	Ketoconazole	10 mg/kg PO b.i.d. (dog) 50 mg/kg PO b.i.d. (cat)
	Fluconazole	5 mg/kg PO b.i.d. (dog) 50 mg/kg PO b.i.d. (cat)
<i>Escherichia coli</i>	Enrofloxacin	10–20 mg/kg PO once a day
	Cefazolin	20 mg/kg IV, IM, SC q.i.d.
	Cephalexin	20–30 mg/kg PO t.i.d.
	Amoxicillin-clavulanate	12.5–25 mg/kg PO b.i.d. to t.i.d.
	Chloramphenicol	22 mg/kg PO, IV, SQ t.i.d.

probably because of the intracellular location of the bacteria.^{2,6,7,18} Neuter dogs with diskospondylitis caused by *B. canis* to reduce the risk of spread to other animals and people. In addition to reducing sexual transmission of the disease, castration causes regression of gonadal steroid-dependent tissues that act as reservoirs for the organism. Castration resolves or prevents clinical abnormalities associated with brucellosis, such as epididymitis, orchitis, and scrotal dermatitis. Also, castration may reduce the risk of family member infection by genital secretion. Counsel clients on the zoonotic potential of *Brucella canis* and the health risks, particularly in pregnant women, children, or immunocompromised individuals.^{6,7,18}

Continue antibiotic therapy for a minimum of six weeks.³ Perform vertebral radiographic examinations every two to four weeks during treatment to monitor progression or re-

gression of lesions. Monitoring these lesions radiographically allows you to make decisions about the length of treatment and the antibiotic employed in treating the disease.¹⁹ Keep in mind that radiographic monitoring has some limitations. It could take two to four weeks after the infection resolves to see radiographic improvement. And extensive bony remodeling can mask active areas of bony lysis. So it is prudent to extend therapy for four to six weeks after radiographic resolution of bony lysis.⁶ Obtain additional spinal radiographs four to six weeks after stopping the antibiotic therapy to confirm resolution of the bony lysis.

Although surgical removal of grass awns, combined with antibiotic therapy, is recommended in cases of grass-awn-associated diskospondylitis, grass awn removal is not always practical. Finding the grass awn is difficult, and finding one does not

mean there are not others present. A strictly medical approach is much less invasive and has proved effective in most cases. *Actinomyces* species is a frequently isolated organism and can be treated with penicillin. Some species of *Actinomyces* may form cell-wall-deficient L-phase variants and are reported to respond poorly to ampicillin-type products. Other antimicrobials that can be used are clindamycin, chloramphenicol in conjunction with erythromycin, and minocycline hydrochloride. Antimi-

The goal of surgical biopsy is to obtain tissue for culture, which will help you determine a proper course of therapy.

Hemilaminectomy may be used to reduce spinal cord compression. Hemilaminectomy is preferred over dorsal laminectomy since it is less likely to destabilize the spine.^{7,19}

In rare cases of diskospondylitis unresponsive to medical treatment, intradiskal débridement can be performed to remove infected and devitalized tissue. Spinal stabilization

response to initial medical treatment. Even if an etiologic diagnosis is not made, most dogs with diskospondylitis and minimal neurologic deficits respond well to appropriate antibiotic therapy. Recurrence is always possible, especially in immunocompromised patients. The prognosis for patients with marked neurologic deficits is guarded, but sometimes these dogs respond favorably to treatment, so it is still recommended. Diskospondylitis due to *B. canis* often responds to antibiotic therapy, but recurrence is

common, and affected animals may require periodic treatment because of relapse. Fungal infections may respond to therapy, but recur-

rence is common, and the prognosis is guarded.⁷

Patients with only spinal hyperesthesia or hyperesthesia in combination with ambulatory paresis have a fair to excellent prognosis.^{7,19} Patients with either of the above problems that do not respond to an initial course of medication have a guarded to favorable prognosis for responding to either a different medication or intradiskal débridement.¹⁹ If patients have an acute onset of neurologic signs, evidence of extradural compression, or nonambulatory paraparesis or tetraparesis, they have a guarded prognosis when treated surgically.^{10,19} If these patients have evidence of spinal instability, the prognosis is guarded to poor.¹⁹

A medical approach to grass-awn-associated diskospondylitis is effective in most cases and is much less invasive.

crobiotics that are not often effective in these cases include aminoglycosides, metronidazole, cephalexin, and oxacillin.⁶

Fungal causes of diskospondylitis are rare but present a therapeutic challenge. Limited success has been achieved by using itraconazole, but clients must be informed that this drug is expensive and may have to be given for prolonged periods. Like bacterial diskospondylitis, the duration of treatment is based on the results of follow-up radiographic examinations.^{3,20}

Surgical treatment

Surgical treatment is rarely required, since most animals with diskospondylitis are treated successfully with appropriate medical therapy. Indications for surgery are to collect samples through open biopsy when there is no response to medical therapy, to decompress the spinal cord in patients with substantial neurologic deficits, and to stabilize the spine if instability is contributing to neurologic dysfunction.

is required if intradiskal débridement results in instability or if instability was recognized on preoperative radiographs.¹⁹

Dorsal spinal plating, spinal stapling, and vertebral body plating have been described in a few cases of diskospondylitis to reduce compression of the spinal cord and nerve roots and to provide stability to the spine. These surgical techniques have been only moderately successful.^{7,11,19} Surgical treatment by a distraction-fusion technique was successful in three cases of lumbosacral diskospondylitis.¹¹ The intervertebral space was spread with a bone spreader, and distraction was maintained by placing a Steinmann pin.¹¹ The procedure is followed by antibiotic therapy. Potential complications of the technique include pin breakage, pin migration, and L7 spinous process breakage.¹¹

Prognosis

The prognosis for patients with diskospondylitis depends on the etiology, results of the neurologic examination at presentation, and the patient's re-

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CE QUESTIONS 2 CE hours

You can earn two hours of Continuing Education credit from Kansas State University by answering the following questions on canine diskospondylitis. Circle only the best answer for each question, and transfer your answers to the form on page 696.

Article #1

1. What is the most commonly isolated organism in cases of diskospondylitis in dogs?

- a. *Brucella canis*
- b. *Streptococcus* species
- c. *Staphylococcus intermedius*
- d. *Staphylococcus aureus*
- e. *Escherichia coli*

2. What are the most common sites for diskospondylitis in dogs?

- a. Cervical vertebrae
- b. Cervical and lumbar vertebrae
- c. Sacral vertebrae
- d. Thoracic and lumbar vertebrae and lumbosacral junction
- e. Coccygeal vertebrae

3. Which breed is overrepresented in diskospondylitis?

- a. Boston terrier
- b. Greyhound
- c. German shepherd
- d. Great Dane
- e. Both C and D

4. What is often the first and only clinical sign of diskospondylitis?

- a. Paresis
- b. Pain
- c. Paralysis
- d. Lameness
- e. None of the above

5. Which is not a change observed on spinal radiographs in diskospondylitis?

- a. Lysis of vertebral end plates

- b. Spondylosis
- c. Narrowed disk space
- d. Calcified disk material
- e. Vertebral fracture

6. Which test is the most sensitive and specific test for *Brucella canis*?

- a. Rapid-slide agglutination
- b. Tube agglutination
- c. Urine culture
- d. Agar gel immunodiffusion
- e. Blood culture

7. Which antibiotic is most effective when used for empirical therapy of diskospondylitis?

- a. Amoxicillin trihydrate-clavulanate potassium
- b. Tetracyclines
- c. First-generation cephalosporins
- d. Chloramphenicol
- e. A or C

8. What is the shortest duration of antibiotic therapy in cases of diskospondylitis?

- a. Two weeks
- b. Three weeks
- c. Four weeks
- d. Six weeks
- e. Three months

9. In cases of grass-awn-associated diskospondylitis, which antibiotic is not effective?

- a. Metronidazole
- b. Cephalexin
- c. Clindamycin
- d. Chloramphenicol
- e. Both A and B

10. What is the prognosis in cases of diskospondylitis with spinal instability?

- a. Good
- b. Excellent
- c. Guarded
- d. Fair
- e. Favorable