

DISCOSPONDYLITIS IN THE DOG

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INTRODUCTION

Infection of the spine in small animals could potentially involve any anatomical site including vertebral bone, intervertebral discs, vertebral endplates, epidural space, as well as surrounding soft tissues. Multiple terms exist to categorize the various types of infection based on the anatomical location involved. Vertebral physitis is caused by a disruption in normal endochondral ossification, and is limited to growing animals whose skeleton is still developing. Spondylitis involves infection of the vertebral bone itself while diskitis is an infection of the vertebral disc. Discospondylitis is defined as an infection of the cartilaginous end plates as well as the intervertebral discs, and results from a primary infection of the cartilaginous end plates of the vertebral bodies that then secondarily spreads to the intervertebral disc.¹ With the advancement of imaging techniques, spinal infections are more easily recognized and diagnosed in veterinary patients. Depending on the site of infection as well as the causative agent, treatment and prognosis can vary widely. This paper focuses on discospondylitis describing its typical clinical features, pathophysiology, diagnosis, and treatment/prognosis with a particular emphasis on the canine patient.

HISTORY, PRESENTATION AND DIFFERENTIAL DIAGNOSES

The typical presenting signalment of cases of discospondylitis is a large breed, middle-aged dog, although any breed is potentially susceptible. The most commonly reported breeds include the Great Dane, German shepherd, and Labrador.² These breed predilections are hypothesized to be due to the extra strain on the spine of large dogs compared to other breeds.³ There is also a sex predilection as males outnumber females by 2:1.⁴⁻⁶ In cases of fungal disease

German shepherds are over-represented most likely due to a reduced immune response in this breed.⁷⁻¹⁰ Disease is not limited to canine patients in the veterinary medical field. In cats, disease is relatively rare, although presentation is similar to that of dogs.¹¹ Case reports of discospondylitis also exist in camelid,¹² equine,¹³ bovine,¹⁴ and avian species.¹⁵

Discospondylitis has a variable presentation. Clinical signs may range from general malaise to paraplegia. Patients may present with GI signs such as vomiting and anorexia, neurological deficits ranging from ataxia to loss of motor function, hyperesthesia or general spinal pain. Spinal pain is the most common presenting complaint and is reported to occur in over 80% of cases with intensity being patient dependent.⁶ Owners report the animal to be more lethargic and hesitant to run or jump, and typically dogs show progressive clinical signs with time, although acute presentation has been known to occur.⁶ Neurological deficits vary dependent on the case, however, are typically not the presenting complaint. Approximately 30% of dogs present with fever, weight loss or other signs of potential systemic disease.⁶ Given the nonspecific nature of the clinical presentation differential diagnoses must include spinal neoplasia, intervertebral disc disease, spondylosis deformans, and vertebral physitis in young animals.¹⁶

Physical exam findings can vary depending on severity and location of infection. Patients presenting relatively early typically present with spinal hyperpathia. Those presenting later in the course of disease usually have more severe pain, paraparesis, and potentially paraplegia. An acute presentation is not common, but cases of non-ambulatory paraparesis and paraplegia have been known to occur.

PATHOPHYSIOLOGY

The pathophysiology of discospondylitis is still not completely understood and may occur through a variety of mechanisms depending on the individual case. While the source of infection may be autogenous, iatrogenic causes are also reported in the literature.¹⁷ Most reports of infection are thought to arise from hematogenous spread from distant sites.¹⁸ Organisms typically invade the spine from the arterial blood supply, traveling to the vertebral end plate, the primary site of infection. Pathogens normally localize in the venous channels due to their sluggish flow rate, and then spread through diffusion to the avascular disc and potentially other vertebrae via the venous plexus.⁶ Once infection is established inflammation and bacterial/fungal growth cause necrosis leading to erosion of vertebral end plates resulting in lytic lesions radiographically. Depending on the immune status of the patient infection may spread rapidly. Neurological deficits can then develop resulting from compression of the spinal cord due to inflammation of surrounding tissues. If infection becomes more advanced pathologic fractures from severe osteolytic lesions and infection of the spinal cord itself can occur.

The source of infections emanating from hematogenous spread cannot always be determined. Potential sites include the urinary and respiratory tract, penetrating wounds, abscesses, endocarditis, and infections of the mouth.^{19,20} The urinary tract is the most likely culprit for origin of infection, however the exact mechanism of spread is still not well understood.^{6,16} The most common genus of bacteria isolated is *Staphylococcus* and both *S. aureus* and *S. intermedius* have been implicated. A number of other agents have been reported to cause discospondylitis including the fungal organisms *Aspergillus*^{20,21} and *Paecilomyces*,⁹ as well as other bacterial agents such as *Bordetella*,²² *Brucella*,²³ and *Salmonella*,²⁴ but potentially any infectious agent could cause disease. Immunosuppression may play a role in disease and

some studies have reported compromised immune function in patients diagnosed with discospondylitis.⁶ Penetrating wounds and migrating plant material can also serve as sources of infection which directly delivers organisms to the space. Migrating plant awns tend to be more of an issue in certain areas of the country and usually target L2-L4 most likely due to migration from the lungs to the diaphragm.⁶

Iatrogenic infection has been reported after epidural injection and post spinal decompression surgery in the dog. Incidence rates of post-surgical spinal infections in human ranges from 3-12% which has increased in frequent years.³ Of all bone and joint infections in man, spinal infection accounts for a relatively small percentage.²⁵ *Staphylococcus aureus* is the most commonly reported etiologic agent, and similar to disease in veterinary patients, infection can occur through hematogenous dissemination or iatrogenic introduction. Risk of infection is higher in overweight patients, those with poor diet, use of NSAIDs, advanced age, certain endocrine disorders, and extensive surgical time. There is limited research available on incidence rates of infection in canine patients however a recent study that included nearly 400 dogs found an incidence rate of 2.2%, although they speculate this is falsely low potentially due to owner compliance.³ Recurrence of spinal pain was the most common presenting complaint in these patients, none of which showed outward signs of infection at their surgical site. It's imperative to closely monitor patients after spinal surgery, especially overweight and large breed patients and use appropriate diagnostics if pain returns.

DIAGNOSTIC APPROACH

Discospondylitis should be included in the differentials for any patient presenting with spinal pain especially in overrepresented breeds. Examination should include a thorough neurological exam. Pain on spinal palpation may further increase suspicion.

Radiographs are typically the first diagnostic tool used, and a diagnosis can typically be made with this imaging modality alone. Radiographic evidence of an early infection typically manifests as subtle irregularities on the surface of the vertebral end plates. The disc between L7-S1 is the most common site affected.⁶ At this initial stage, the disk space may be smaller. As infection develops vertebral end plates become progressively more lytic leading to widening of the disc space. Eventually bone begins to regenerate evidenced by sclerosis and osteophytes. In late stage or severe disease, pathologic fractures, spinal collapse, spinal deformities and ankyloses can occur.⁶ If discospondylitis is the only disease present lesions are limited to the disc space and end plates. Involvement of other parts of the vertebrae indicate that osteomyelitis is also occurring. A myelogram may be indicated if spinal compression is suspected, and this should be recommended in patients with significant neurological deficits. If the spinal cord is compromised, it typically is dorsally deviated over the site of infection.⁶

More advanced imaging techniques such as computed tomography (CT) and magnetic resonance imaging (MRI) are ideal for diagnosis as more minute changes can be detected and therefore diagnosis can be made earlier. Either technique would be useful in cases where radiographs were non diagnostic. CT can detect changes to the bony endplates and determine extent of lesions. CT also has the advantage of determining what type of tissue is involved if the spinal cord is compressed. MRI is the imaging technique of choice due to its ability to image soft tissues and detect subtle changes. Initial changes with infection include an increased water signal manifested by decreased intensity and definition of endplates on T1-weighted images.²⁶ As with

other imaging techniques bony lysis is also apparent in later infections.²⁶ Edema may also be visualized in the surrounding tissues. MRI is reported to have 96% sensitivity and 94% specificity for identifying spinal infections in man.²⁵ The gold standard for imaging is gadolinium contrast-enhanced MRI which is potentially capable of detecting infection in as little as 2 days.²⁵

Nuclear scintigraphy has also been used in cases of spinal infection and can show evidence of disease prior to radiographs.^{6,18} Radionuclides target areas of increased metabolic activity which are typically sites of pathology. This technique is not specific for infection therefore interpretation must be made in light of clinical signs, however use of radiolabeled leukocytes may allow for discrimination between abscesses, neoplastic disease, hematomas, or collections of fluid which may not distinguishable on CT or MRI.⁶

Other laboratory tests to include in the diagnostic workup include bloodwork, urinalysis, urine culture, and blood culture. Analysis of CSF may also help rule out other diseases. Typical CBC findings include a leukocytosis if systemic disease is present, but may otherwise be unremarkable. Serum biochemistry is also typically unremarkable. Urinalysis may suggest inflammation, and in up to 40% of cases bacterial cystitis is present.¹⁶ Urine cultures show growth in a quarter to half of cases while a positive blood culture ranges from 45-75%.⁶ Analysis of CSF is usually normal or may show mild increase in protein content.⁶ Brucellosis screening should also be included in any intact animal due to the zoonotic potential. Useful screening tests include rapid slide agglutination (RSAT), tube agglutination (TAT), or ELISA. Approximately 10% of dogs with discospondylitis are positive for *B. canis* infection and should be confirmed by agar gel immunodiffusion (AGID).^{6,23}

Once spinal infection is confirmed isolation of the etiologic agent is needed to determine appropriate therapy in cases that don't respond to initial treatment. Disc space can be sampled via CT guided needle aspiration or during surgery if already indicated based on spinal cord compression and neurologic status of the patient.

TREATMENT

The mainstay of treatment is antimicrobial therapy pending culture and sensitivity results. First generation cephalosporins such as cefazolin or cephalexin are typically used initially.¹⁸ Bactericidal antibiotics are ideal since these patients may be immunosuppressed.⁶ Addition of another antibiotic may be indicated due to increased resistance in *Staphylococcus* strains.¹⁸ Response is usually seen within a week of starting treatment.⁶ Other important parts of treatment include analgesics and cage rest especially in patients with osteomyelitis who are at risk for pathologic fractures. Analgesics are typically only needed initially. Treatment duration tends to be case dependent as there is no set standard time. In human medicine recommendations include intravenous antibiotics for 6 weeks followed by 3-6 months of oral antibiotics.^{18,27} One study in dogs reported an average treatment duration of 53 weeks.¹⁸ Serial radiographs every 4-6 weeks can be used to track progress,²⁸ although there are few studies that use imaging to guide therapy. Monitoring for resolution of clinical signs in combination with radiographs is recommended. Radiographic evidence of improvement includes lack of lytic lesions, smoothing followed by loss of sclerosis around areas of lysis, and/or bridging of bone.¹⁸ Surgery may be indicated in cases of severe osteomyelitis to stabilize the spine or those refractory to medical therapy. Spinal decompression, stabilization, and debridement of necrotic tissue are the main aims of surgery.²⁸

Owners of dogs testing positive for brucellosis should be warned of its zoonotic potential.

Antibiotic therapy consists of doxycycline and enrofloxacin with serologic testing every 4-6 months.¹⁸

PROGNOSIS

Prognosis is variable and ultimately depends on the severity of the case and ability to eliminate the pathogenic organism. The majority of dogs respond to medical therapy alone if neurological deficits are nominal.⁶ Dogs with severe neurological deficits or fungal infections have a poor to guarded prognosis, however some may respond well to therapy, therefore treatment should be attempted if owners are willing.^{6,28}

CONCLUSION

Discospondylitis involves infection of the intervertebral disk and cartilaginous end plates of vertebral bone. It most commonly occurs via hematogenous spread with direct inoculation or iatrogenic introduction possible. With the advancement in imaging technology diagnosis of this disease is becoming easier. Prognosis is variable and treatment depends on the offending pathogen and potential susceptibility to drugs. In summary discospondylitis should be included on the differential diagnosis list for any veterinary patient presenting for spinal pain, as early diagnosis can improve response to treatment and better prognosis.

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