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**Ancylostoma caninum, Ancylostoma tubaeforme, Ancylostoma braziliense,
Uncinaria stenocephala**
Hookworms

Affected Animals:

Hookworms from the *Ancylostoma caninum* species affect dogs, while hookworms from the *Ancylostoma tubaeforme* species affect cats. Parasites from the *Ancylostoma braziliense* species, found in the southern United States, can infect both canines and felines. In Canada, the *Uncinaria stenocephala* affects canines and felines as well. Puppies and kittens are more at risk for serious illness from hookworms. Hookworms tend to do less damage to felines than to canines.

Overview:

A parasite that frequently infects puppies and kittens, hookworms actually have heads that "hook" into the small intestine, where they begin to eat away at the tissue and suck blood. This parasite has been called a "voracious blood sucker" and can pose severe health problems for puppies and kittens that do not have a large blood supply to begin with and can suffer badly from blood loss; anemia, diarrhea, weight loss, weakness, and sometimes death can result. Hookworms are considered a human health hazard since the infective larvae can penetrate the skin and migrate locally, called cutaneous larval migrans.

Clinical Signs:

Clinical signs of hookworm infection can include pale gums due to anemia; diarrhea which can be bloody, dark or tarry looking; weakness; weight loss; and sudden death in severely infected puppies and kittens. Sometimes the hookworm larvae cause itching due to burrowing into the skin of the animal.

Symptoms:

See clinical signs.

Description:

Hookworms live in the small intestines and "graze" on the intestinal walls. These parasites can infect both dogs and cats, but dogs are infected much more commonly. Hookworms actually have mouthpieces that "hook" into the small intestine, where they begin to digest away the tissue and suck blood. In addition, hookworms secrete an anticoagulant that makes the blood lose its ability to clot. Thus, the worm is able to consume as much blood as it can before moving to the next site, causing severe problems for puppies and kittens since the old sites continue to bleed and young animals often cannot withstand significant blood loss. Puppies and kittens can die from

hookworms very quickly.

Diagnosis:

Diagnosis involves performing a fecal flotation examination and identifying the hookworm eggs under a microscope. A complete blood count of red blood cells, white blood cells, and platelets will reveal if the animal has anemia, or a low number of red blood cells.

Prognosis:

With proper deworming treatment, mature animals that are n

Breeds genetically predisposed to degenerative disk disease include those affected with chondrodystrophy, or abnormal cartilage development. Affected breeds include dachshunds, beagles, cocker spaniels, Pekingese, French bull dogs, basset hounds, Welsh corgis, small poodles and other mixed-chondrodystrophoid breeds.

Large, older dogs without chondrodystrophy may also develop degenerative disk disease.

Transmission or Cause:

Transmission to dogs and cats occurs by several methods. The dog or cat can eat the infective hookworm larvae, which is passed and develops within the feces of an infected animal. The worms can also penetrate through the skin, or they can be passed in the mother's milk to the nursing puppies or kittens. In rare cases, the parasites can be transmitted through the placenta before birth. Dogs and cats that eat an animal infected with hookworms -- such as a rodent -- may also become infested with the parasite. Humans can fall victim to the skin penetrating abilities of hookworms and develop irritating skin lesions called cutaneous larval migrans.

Treatment:

Degeneration of a vertebral disk may result in eventual protrusion, or herniation, of the disk into the spinal canal with impingement of the spinal cord. In dogs with chondrodystrophy, genetic predisposition to disintegration of a disk combines with the normal forces of weight bearing and motion about the joints of the spinal column to cause vertebral disk degeneration and herniation. Large, older dogs without chondrodystrophy develop disk degeneration and herniation from long-standing stresses on the spine alone.

| -| Pain, ataxia, loss of conscious proprioception, paresis, and paralysis are common. Occasionally dogs become anorectic.

| -| The spinal cord is encased by the backbone, which is composed of a series of individual vertebrae separated by disks. Together, the vertebrae and disks compose the vertebral column, which extends from the head to the tail of an animal. Disks act as cushions between the vertebrae and permit flexibility of the vertebral column. The inner core of each disk is called the nucleus pulposus, a jelly-like substance that promotes spinal flexibility. The outer covering is the anulus fibrosus, which is normally a tough, fibrous structure.

As disks degenerate, the nucleus pulposus loses its gelatinous consistency and may calcify. The anulus fibrosus also weakens. Disk calcification is usually apparent on spinal radiographs. This condition eventually permits a disk to protrude or herniate into the spinal canal, compressing the spinal cord and interfering with its functions. The injury to the spinal cord is progressively worsened by vascular and chemical changes. These changes occur in the tissue and cells of the spinal cord and begin immediately after, and in response to, spinal cord damage by the herniated disk. The result is altered blood flow producing areas with reduced oxygen, and the release of toxins and excessive amounts

of neurotransmitters. These chemicals lead to cell damage and death.

There are two kinds of intervertebral disk degeneration. Hansen Type I disk degeneration typically occurs in small dogs that have a particular type of skeletal development, termed chondrodystrophy, where cartilage, including spinal cartilage, develops abnormally. Hansen Type I degeneration can cause abrupt disk rupture, with sudden onset of pain and paralysis as nuclear material explodes into the spinal cord. Clinical signs of this type of disk degeneration usually develop in middle-aged dogs.

Hansen Type II disk degeneration occurs in older, large, and non-chondrodystrophoid breeds. In these cases there is a gradual protrusion of the nucleus pulposus, and a slow progression of pain and weakness.

Because of the anatomical characteristics of the vertebral column, the most likely sites of disk rupture are the neck, or cervical region, and in the mid-to-lower back, or thoracolumbar region. Disk disease in the neck typically results in neck pain, lack of coordination, and, less frequently, weakness of all four limbs. Occasionally there is lameness and pain in one front limb, and, in rare cases, complete paralysis of all four limbs. The clinical signs of thoracolumbar disk herniation depend on the amount of disk material involved, and the force with which the herniation occurs. Signs can range from back pain alone to complete paralysis and loss of sensation in the hindquarters.

|A provisional diagnosis of degenerative disk disease is based on the symptoms, history, the breed and age of the dog, and the findings of a neurological examination. The diagnosis is confirmed and the exact site of the disk rupture determined by spinal x-rays. Commonly, a myelogram is performed to fully visualize the affected disk, especially if surgery is elected. A myelogram is a spinal x-ray where radiopaque contrast or dye has first been injected around the spinal cord. Rarely, diagnosis may require advanced imaging, as with MRI or CT.

|A dog with intervertebral disk degeneration, and resulting herniation, may have general symptoms including reluctance to move, decreased appetite, and crying out in pain, or hiding from others. The affected dog may stumble when attempting to walk, or be unable to rise.

When the disk herniation occurs in the neck, or cervical spine, the animal may also show symptoms of stiff neck and muscle spasms, with occasional lameness and pain in one front limb. The dog may hold its head low. Infrequently, paralysis of all four limbs may occur.

A dog with degeneration and herniation of a thoracolumbar disk, or a disk in the mid-to-lower back, may have an arched back, in addition to the general signs. Weakness in the rear limbs may be present, and may progress to hind-limb paralysis and incontinence, or inability to control bladder and bowel function. A severely affected dog will lose all sensation to the hindquarters.

|Intervertebral disks connect the vertebrae, or bones, of the spinal column together. These disks provide flexibility and support. Degeneration of an intervertebral disk may lead to protrusion, or bulging, or it may cause herniation, or rupture. Pain and weakness or paralysis may occur, depending on the degree of damage to the spinal cord. Damage is the result of both mechanical compression of spinal tissue and secondary reactive vascular and chemical changes within the tissue. This damage to tissues results in disruption of normal spinal cord function.

Small dogs, especially those with faulty development of the cartilage, termed chondrodystrophy, are prone to sudden disk ruptures and to a rapid onset of symptoms. Large dogs are much more likely to have gradual disk protrusions with slowly progressive pain and weakness, although they can also experience rapid herniations. Dogs with symptoms of disk herniation should be evaluated immediately by a veterinarian.

Diagnosis of a disk herniation is confirmed with x-rays and/or a myelogram, which is a special dye study that allows precise localization of spinal cord lesions. Depending on the severity of the case, and the overall condition of the affected dog, treatment may involve medication or surgery. Many dogs with disk ruptures recover. However, in very severe cases, in which the dog has lost the ability to feel deep-tissue pain, the paralysis may be permanent.

|-|Dogs should be fed properly and regularly exercised since excessive weight and lack of muscular fitness are among factors that lead to disk degeneration.

Dogs with a history of intervertebral disk disease may be restricted from stairs or situations that add to stress on the spine, such as jumping onto furniture or into the car, or down from heights.

|-|Dogs with degeneration of a cervical disk have good prognoses. Many dogs will improve with medical management alone, although there is a 33 percent chance of recurrence of the problem. Additionally, the neck pain tends to respond more slowly, and may be more difficult to control with medical management. Decompression and fenestration yield better results in a higher percentage of dogs than medical treatment alone. When a cervical disk rupture results in a dog not being able to walk, the degree of recovery depends on the location of the disk rupture and duration of immobility before surgery is performed.

Dogs with degeneration of the thoracolumbar disk have prognoses that depend on whether the dog is able to feel deep-tissue pain. Even dogs that are severely weak or paralyzed have a good chance of recovery, as long as they can feel deep-tissue pain, and undergo surgical decompression within 48 hours of symptom onset. Dogs may respond to medical management alone, but without surgery, recurrence is likely.

Following recovery from disk herniation, dogs may experience problems at another site. The reported incidence of additional herniation varies from seven to 15 percent in various studies.

|-|Dogs with symptoms of disk disease should be seen by a veterinarian without delay. It is important to keep them quiet and still. Confinement in a cage or crate until examination is recommended. The dog should not be encouraged to walk or jump, as this may make the situation dramatically worse by causing more disk material to herniate. The sudden onset of weakness or paralysis calls for emergency treatment. The goal of treatment is to reduce spinal cord swelling, inflammation, and compression as quickly as possible, so that normal spinal function will return. Disk herniation may be managed either medically or surgically, depending on the findings of a neurological examination and the overall condition of the dog.

Medical treatment consists of strict cage rest for three to four weeks. Medication to reduce pain and inflammation may be used with care when the patient is under direct veterinary supervision. Eliminating an animal's pain entirely encourages it to become overactive, and this will increase spinal cord injury. Medical management is indicated for

initial episodes of pain, pain combined with mild lack of coordination, dogs with other medical conditions that preclude surgery, and dogs that have lost the ability to feel deep-tissue pain for more than 48 hours. Many dogs that have maintained the ability to feel deep-tissue pain will improve with medical treatment alone. In these cases, however, recurrence is likely, and some residual neurological deficits may remain.

Surgery should be considered when there have been repeated episodes of mild signs, when a dog that is being treated medically deteriorates, when there is progressive neurological dysfunction, or when there is moderate to severe weakness or paralysis. Surgical techniques may involve fenestration, decompression, or both.

Fenestration is a surgical technique in which the disk space is opened and the nucleus pulposus is removed without entering the spinal canal. Fenestration alone may be beneficial in cases in which there have been repeated episodes of pain without any other signs, or when there is a second episode of pain and mild weakness.

Surgical decompression is a technique in which a portion of the vertebra at the disk rupture site is removed, thus reducing the compression of the spinal cord and allowing removal of the ruptured disk from the spinal canal. Decompression is indicated when there is moderate to severe weakness or paralysis. Dogs that are paralyzed and have no deep-tissue pain sensation should ideally undergo decompressive surgery within two hours. If a dog has lost deep-tissue pain sense for greater than 48 hours, the likelihood that surgery will be beneficial is extremely small and surgery is not recommended.

Methods of decompression include ventral slot, in which the spinal cord is approached through the bone from the bottom. This is generally done only with cervical disk disease. Hemilaminectomy, in which the spinal cord is approached from the right or left side, is usually performed with thoracolumbar disk disease. Dorsal laminectomy, in which the spinal cord is approached from the top, is performed in some cases of cervical, thoracolumbar, and lumbar disk disease.

Adequate nursing care both for post-operative patients and for weak or paralyzed dogs that are being managed medically is critical to their overall recovery. The dogs should be kept clean and dry, and provided with a well-padded surface to prevent the development of bedsores. Urinary bladder function must be carefully monitored and maintained to prevent over-distension and secondary bacterial infection. Most patients are hospitalized until they regain control of bowel and bladder. Strict exercise restriction for three to four weeks is critical. Physical therapy is important for post-operative patients, in order to maintain muscle tone and flexibility.

Prevention:

All animals should be dewormed regularly to prevent infection and shedding of eggs into the environment. Feces should be picked up and disposed on a weekly basis, if not more frequently. Kennel areas should be cleaned regularly with a disinfectant such as water-diluted bleach.