ROCKY MOUNTAIN VETERINARY NEUROLOGY

Neurology/NeuroSurgery
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Intervertebral Disc Disease

The spine of both dogs and cats is anatomically similar to that of humans. Beginning at the back of the skull and continuing down through the neck, back and to the tail, the spinal cord is the highway system connecting the brain to the rest of the body through nerves that make up the spinal cord and connect to nerves exiting the spinal cord to reach the body. The bones of the spine, the ***vertebrae***, provide support and protection of the spinal cord. Each vertebra joins another by two joints along the ***dorsal*** (top) and by the intervertebral disc along the ***ventral*** (bottom). The intervertebral disks sit below the spinal cord, which resides above it within the boney confines of the vertebrae, the ***vertebral canal***. Companion animals differ by the number of vertebrae in each region of the spine. Dogs and cats possess 7 cervical vertebrae, 13 thoracic vertebrae, 7 lumbar vertebrae, 3 fused sacral vertebrae; and variable numbers of caudal vertebrae, which is dependent upon the length of the tail.

The intervertebral disc is made up of a centrally located "Jell-O" cushion, the ***nucleus pulposus***, and an outer ring of woven fibers, the ***annulus fibrosis***. In dogs and cats the nucleus pulposus sits in a more dorsal or upward fashion closer to the spinal cord than in humans. Much like a car tire, with the outer tread holding the air within, breakdown of the tread can allow the air, or nucleus in this case, to rupture or move out of its confines. When this happens in an upward direction, injury to the spinal cord can occur.

Normal age related degenerative change occurs with the canine and feline spine similar to humans. These changes create increased stresses on the supporting structures (annulus fibrosis) and if a weakened region of the annulus fibrosis exists, the nucleus (Jell-O) may push through this weakened area and compress the spinal cord which is housed within a bony canal of the vertebrae. This is termed an ***intervertebral disk extrusion*** or ***"ruptured disk"***. In most cases the extruded nuclear material is of normal gelatinous and/or degenerative "calcific or fibrotic" nature. This is common in small breed dogs with short legs, ***chondrodystrophic breeds***. In large-breed dogs, the nuclear material often undergoes a fibrous degenerative change. As such, large breed dogs can present with bulging or protruding discs where the nucleus has not ruptured out of its normal position. Upward displacement or pushing of the nuclear material without rupture through the annulus fibrosis results in an ***intervertebral disk protrusion***, which may compress the spinal cord and cause spinal cord damage over a longer time period.

Intervertebral disk extrusions are not uncommon in the canine species and are very prevalent in the chondrodystrophic breeds (dogs with premature closure of their legs; for example, Dachshunds, Shih Tzu's, "Pekinese," Lhasa Ahpso) and large breed, athletic dogs. A genetic predisposition for weakened annulus fibrosis coupled with degenerative aging changes of the intervertebral disk, and ultimately the dynamics of spinal movement results an intervertebral disk extrusion. Intervertebral disc extrusions have also been note in the cat. The most common sites for intervertebral disk extrusions in the dog occur between T11-12 and L2-3 and the cervical intervertebral discs C2-C3>C3-C4> the remaining cervical discs. Males are more commonly affected than females, with an incidence of 3-6 years of age for back problems and 6-9 years of age for neck problems.

Intervertebral disk extrusions can be classified as ***acute*** (sudden) and/or ***chronic*** (slow or old). Acute intervertebral disk extrusions are often characterized by the ***sudden onset of dysfunction of the spinal cord and pain***. Chronic intervertebral disk extrusions are more common in large-breed dogs, Miniature schnauzers, and Miniature pinchers. With the latter form of disc compression, ***slow, progressive dysfunction without pain is common.***

When an intervertebral disk extrudes, or ruptures, it strikes the spinal cord much like hitting your thigh with your fist. The result is a bruising of the interior of the spinal cord, the ***gray matter***. The gray matter is a collection of nerve cell bodies that send out their processes, ***axons***, to the muscles and other structures of the body. This is termed ***central hemorrhagic necrosis*** and is responsible for permanent damage to the center of the spinal cord over the disc that has ruptured. Because the highway system of the spinal cord resides in the outer portions of the spinal cord (***white matter***), return of function behind the region of injury is possible. Chronic intervertebral disk extrusions result in slow interior (gray matter) and long-term white matter (highway) degeneration. *Chronic extrusions cause slow, progressive dysfunction, which often times worsens in a rapid fashion as the compensatory limits of the spinal cord are exceeded.*

Diagnosis of intervertebral disc disease is based upon the clinical presentation, history, and ultimately, ***the imaging findings***. Myelography (contrast-assisted radiographs), contrast assisted computed axial tomography, and magnetic resonance imaging are utilized to diagnose intervertebral disk disease and compressive spinal cord lesions. **Magnetic resonance imaging is the preferred, and the standard for imaging of the spinal cord.** Emergent diagnosis and treatment is often necessary to allow for the greatest degree of recovery of function. Magnetic resonance imaging is performed exclusively for all spinal cord imaging, including intervertebral disk disease diagnosis by Rocky Mountain Veterinary Neurology. Magnetic resonance imaging allows for definition of the site and direction of the

extrusion for surgical planning and treatment. It also allows definition of the interior of the spinal cord for long-term prognostic predictions. Surgical intervention often follows imaging.

Treatment of intervertebral disk extrusions and compressive spinal cord disease is surgical for long-term success and pain resolution. Removal of the extruded nuclear material and hemorrhage (***hematoma***) crushing the spinal cord is necessary to allow for revascularization, removal of toxic byproducts within the spinal cord, and resolution of swelling or edema. Decompression is based upon the location of the extruded nuclear material and hemorrhage. ***Thoracolumbar*** (back) intervertebral disk extrusions require a ***dorsolateral*** (from the top half) decompressive technique. Intervertebral disk extrusions in the ***cervical*** (neck) region can require a ***ventral*** (under the neck) or ***dorsolateral*** (from the top) approach. In addition to surgically decompressing the spinal cord to allow for spinal cord recovery, preventing further extrusions by the removal of the nucleus from the offending disk and other discs which can rupture is commonly performed in breeds with a high incidence of repeat disc extrusions. This procedure is termed a ***fenestration*** in veterinary medicine. The removal of the nucleus pulposus prevents extrusion. Replacement of the nucleus is not performed or necessary in companion animals. The procedure does not result in change to the spine nor does it result in arthritis. It is not uncommon to fenestrate the intervertebral disks in chondrodystrophic breeds or breeds or small breeds commonly affected by disk extrusions.

Following surgery, all patients are maintained in a confined fashion to prevent excessive movement and pain. Pain medication is given through the catheter, as a continuous infusion during the first 24-48 hours following surgery. The narcotic medications Fentanyl, Oxymorphone and Hydromorphone are commonly used as both injections and sustained release from a dermal patch. These agents are at least 8 times more potent than Morphine for optimal pain control over the next 3 days.

Functional improvement is often noted as the spinal cord swelling and edema begins to resolve, usually between day 3-5 following surgery. As the swelling and hemorrhage resolve, electrical impulses are able to pass the area of injured spinal cord, through the outer white matter highway system. This is initially noted as movement to the limbs, characterized by pulling the legs up when attempting to walk. With continued improvement, the legs start to move, your pet attempts to push up on the legs only to wobble and fall. With continued improvement, walking in a drunk or ataxia fashion is followed by improved strength and balance. *Gradual improvement over the following 4-6 weeks is expected. Strength always improves faster than wobbliness or ataxia. Complete recovery is variable, but may occur over a 6-24 week period.* Unlike human spinal surgery, ***successful surgery leaves companion animals pain free.***

Postoperative recovery is often aided by controlled exercise and physiotherapy. Walking on smooth surfaces with good footing, hydrotherapy in the form of swimming and water treadmill exercise, massage and acupuncture all have their place in maximizing the recovery of your pet following spinal cord surgery. Your neurologist will work with you in choosing and recommending the optimal recovery program for you pet.