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Intervertebral Disc Protrusions in the Canine

John Oltman

There are 27 vertebrae between the head and the sacrum. With the exception of the first two, these vertebrae are separated from each other by intervertebral discs which are very closely connected to the vertebral bodies. Immediately dorsal to the vertebral bodies is the vertebral canal which houses the spinal cord and its investing membranes. Between the outermost of these membranes (dura mater) and the vertebral bodies, is the dorsal longitudinal ligament which starts at the odontoid process of the second cervical vertebrae and ends at the body of the first coccygeal vertebrae. As it passes over each intervertebral disc it expands laterally and blends with the disc tissue. In the thoracic region a series of ligaments, the conjugal ligaments, are interposed between the discs and the dorsal longitudinal ligament.

Each disc consists of an outer fibrous ring, the annulus fibrosis, and a central jelly-like mucoid mass, the nucleus pulposus. The annulus fibrosis is usually much broader ventrally than dorsally and is markedly lamellated. The nucleus pulposus is a remnant of notochordal tissue which has become highly specialized to act as a “shock-absorbing water cushion.”

With age the cartilage cells of the discs increase in number while the nucleus cells decrease. At the same time the fluid portion of the nucleus pulposus decreases in amount. These changes render the disc more fibrous and less able to absorb shock.

PATHOLOGY

A. Rupture of the intervertebral disc.

This signifies a partial or complete breakdown of the fibers of the annulus fibrosis.

1. Ventral displacement of the nucleus pulposus.

Degenerative changes of the ventral part of the annulus fibrosis are usually found in the condition of spondylitis deformans. This is a form of spinal ankylosis in which osteophytes are found locally or generally, usually on the ventral surface of the region of the intervertebral discs of the thoracic and lumbar parts of the vertebral column.

H. Debard published a thesis dealing with the occurrence and pathogenesis of the osteophytes on the ventro-lateral aspects of the vertebral column, especially seen in the posterior lumbar region, that are found quite commonly, and with ad-
vancing frequency in advancing age, in the dog, but only rarely in the cat. These osteophytes are always accompanied by lesions of the intervertebral discs, and the author shows how the formation of these bony growths can be considered to be the result of these lesions. When degenerative changes occur in the nucleus pulposus, resulting in loss of its elasticity, the nucleus may fail to return to its normal position following ventral displacement as it should do during normal movements of flexion and extension of the vertebral column. The intervertebral distance becomes smaller, and the nucleus may become more or less permanently displaced or herniated ventrally. The annular fibers of the ventral part of the disc bulge downward, and in this way lead to deformity of the inferior common ligament passing beneath. The tension thus put upon the ligament leads to osteogenesis at the site of the attachments on the vertebral bodies at either side of the disc concerned, and the osteophytes are formed with their bases a little distance from the articular surfaces of the vertebral bodies. As a result of these and associated changes, there may be signs of pain or stiffness, and some degree of ankylosis; there may also be some interference with movements necessary for defecation, or possibly respiration.

2. Dorsal displacement of the nucleus pulposus.

These may vary in extent from slight degeneration and breakdown of fibers, allowing a small bulge upward of the still intact dorsal surface of the disc (Fig. 2), to a complete rupture of the annulus fibrosis and ejection of the nucleus pulposus. The route may be direct or thin and tortuous. In some cases lifting of the dorsal longitudinal ligament will occur. (Fig. 3); in other cases the protrusion may occur beside the longitudinal ligament (Fig. 4); and in yet other cases the protrusion may occur beside the longitudinal ligament (Fig. 4); and yet in other cases the material may split the dorsal longitudinal ligament to impinge on the dura mater (Fig. 5). Any one or more of the intervertebral discs may rupture, but dorsal ejection of the nucleus pulposus tissue is rarely reported from the discs covered by conjugal ligament. It would seem that this ligament acts as a reinforcing band to the dorsal annulus.

Lacroix\(^3\) classifies protrusions into two types. Protrusions of type I will usually be of considerable size, covering the major part of the profile of the vertebral canal, or if the expansion has been horizontal, it may cover the length of one vertebra. The prolapsed disc is characterized by an uneven granulated surface which is generally adherent to the dura. Type II is characterized by smaller proportions, even surface, circumscribed, and regular form with firm consistancy.

Prolapses of type I are found in dogs of the chondrodystrophic types and in rather young dogs. Prolapses of type II seem to affect all breeds and considerably older dogs, and are associated with senile changes. The prolapses are always preceded by disc degenerations. Type I prolapses present a more acute clinical picture with total prolapse of the disc, type II results from partial prolapse of the disc, with slight to moderate clinical symptoms evident.

B. Calcification of the intervertebral discs.

Calcification of protruded discs appears to be frequent phenomena, but calcification is also common in those discs that do not show the slightest bulge towards the vertebral canal. Many authors agree that little importance should be attached to calcification other than it is a sign of degeneration. Nevertheless, it is well to remember that since a calcified disc is degenerate it is more liable to rupture and allow protrusion of the disc tissue. Calcification, as previously pointed out may also predispose to the formation of osteophytes and spondylitis.

INCIDENCE

Horlein's work shows that the pathology of protrusions is variable and that incidence is equally divided between the sexes. Dogs 3 years of age were most frequently affected. Some of Horlein's subjects revealed disc pathology at necropsy.
FIG. 1

Epidural Space
Dura Mater
Arachnoid Mater
Sub-Arachnoid Sp.
Pia Mater
Spinal Cord

Dorsal Long. Lig.
Conjugal Lig.
Annulus Fibrosis
Nucleus Pulposus
Ventral Long. Lig.

FIG. 2

FIG. 3

FIG. 4

FIG. 5
but many of these had presented no symptoms during life. Discs most frequently affected were the last thoracic and first lumbar.

Riser states that protrusions seldom occur before 2 years of age, and occur most frequently from 4 to 8 years of age. He also states that there is a higher incidence in the male than in the female. The breeds most frequently affected include the Pekinese, Daschshund, and Cocker Spaniel in that order. This group, along with the French Bulldog form the so called chondro-dystrophoid group.

Smith and King state that the Dachshund, French Bulldog, and Pekinese are the most frequently affected, the Cocker Spaniel and Beagle are often affected, while the Sealyham and Bulldog are also more susceptible than other dogs.

SYMPTOMS

Smith and King list four syndromes associated with this condition.

1. Pain—this may be abdominal, lumbar or generalized, and may be constant or intermittent. There may be kyphosis or scoliosis.
2. Paresis and/or incoordination—If the lesion is on one side the paresis will be unilateral. If the lesion is in the cervical region there may be paresis of all limbs.
3. Paraplegia, spastic or flaccid—if the paraplegia is spastic there will be exaggerated reflexes. If flaccid, there will be incontinence of urine and feces.
4. Progressive ascending paralysis from acute disc prolapse—characterized by sudden onset, possibility of great pain, complete sensory and motor paralysis of the hind part of the body, urinary and fecal incontinence, as ascending paralysis leading to diaphragmatic respiration, and finally death due to respiratory failure from diaphragmatic or bulbar paralysis.

Green states that a typical history is that of recurrent and/or intermittent paraplegia or partial paraplegia. All the affected dogs remain vigorous and as active as possible. Laboratory examinations showed only an increase in blood urea. Whether the kidney damage or the spinal lesion occurs first is unknown. Traumatic injury may herniate the nucleus and interfere with innervation to the kidney, or there is the possibility that the edema often accompanying nephritis might extend into the nucleus pulposus and thereby predispose this part to injury.

DIAGNOSIS

Although symptoms and history suggest a general diagnosis of disc protrusion, to obtain more specific information as to the site and extent of damage one must resort to radiography. Normal radiography (as opposed to contrast) can be used to diagnose a good proportion of lesions.

Radiographs are taken laterally and ventro-dorsally.

For normal radiographs a diagnosis can be based on two findings, (I) a calcified protrusion into the vertebral canal and (II) diminished space between adjacent vertebrae. Only the first is absolute proof, while the second is suggestive only.

Any examination using contrast media should be performed carefully. As the epidural space is filled with fat the obvious route is by sub-occipital puncture into the cisterna magna to show the subarachnoid space. The technic is as follows. The dog is placed under general anesthesia. The needle is inserted while the dog is on its right side with the neck flexed, and the head slightly elevated. Injection should not begin until the cerebrospinal fluid stops dripping from the needle. Inject the medium slowly, then immediately place the dog with the head high on the table slanting at an angle of 30 degrees.

Contrast media include thorotrast, Panopaque, Lipiodol, iodized oil, and air. Of these thorotrast and Panopaque have found the most favor. Thorotrast is a colloidal preparation containing 24-28 percent thorium dioxide and carbohydrate of a protective nature. Thorotrast is water soluble and gives good effect but is somewhat irritating and slightly radioactive. Most authors agree
that it is advisable to drain off as much of the medium as possible after use. The smallest dogs require about 1 cc, and the largest about 5 cc. To drain after use, inject one half to one liter of hypotonic (0.45%) saline intravenously at about 30 cc per minute. The contrast media and some cerebro-spinal fluid will then flow back out of the needle which has been reinserted in the cysterna magna. The needle is left in the cysterna magna until about 15 minutes after completing the injection.

Pantopaque is an absorbable oil-type contrast media of low viscosity and no attempt has been made to drain it after use, with no adverse affects. Horlein considers this substance to be the most practical contrast media.

After injection of either of the above mentioned substances, the dog is placed on the slanted table for up to 20 minutes, being turned occasionally to promote even distribution of the medium. If thorotrast has been used one must guard against the medium entering the cranial cavity.

**TREATMENT**

Treatment of protruded discs is divided into two phases, medical and surgical.

The more consistent medical treatments used include complete rest with the aid of sedatives if necessary, vitamin B complex to improve the metabolism of the nervous tissue, careful nursing and control of infections, assistance with bowel and bladder functions, warm baths, heat lamps, and massage to prevent atrophy of muscles. A high plane of nutrition is important.

Two surgical techniques have been employed in an effort to influence this condition favorably. In the operation of laminectomy an attempt is made to remove the protrusion, whereas in the disc fenestration operation the intention is to unload the pressure on the cord.

**Laminectomy**

No improvement should be expected following this operation in less than 30 days, and the best results are obtained when the operation is performed as early as possible.

The skin is incised over the area above the right or left border of the dorsal spines of the vertebra involved. Fascia and muscles are reflected from the vertebra, taking care not to damage spinal nerves of the area. The neural arch of one side with attached facets is removed either by rongeur or trephine. If the protrusion can be seen, it is removed, avoiding if possible touching the spinal cord.

In this operation it is advisable to remove only half of the neural arch as a total laminectomy results in excessive exposure of the spinal cord to both injuries, and pressure from the resulting fibrosis.

The resultant bone hemorrhage may usually be successfully controlled by use of absorbable gelatin saturated with thrombin. If the diagnosis is correct the herniated portion of the nucleus may be seen protruding under the cord. This should be carefully removed with a small forceps. Hemorrhage should be aspirated rather than sponged to reduce damage to the cord.

Regression of the case may be expected for two weeks following surgery.

**DISC FENESTRATION**

To fenestrate means here to make an opening in the annulus fibrosis into the nucleus pulposus from outside the vertebral canal. The pressure on the protrusion should then decrease because of most of the pressure being conducted through the fenestra.

The technic is as follows;

Two or three days are allowed to elapse after myelography to allow the reaction to wane. For thoraco-lumbar intervention the skin and fascia are incised along the spinous processes. The muscles are reflected down to the transverse processes after stripping them from the vertebrae, taking care not to damage nerves and vessels in the vicinity. To operate on cervical discs the approach is via a skin incision along the trachea, the discs can then be reached by using only blunt instruments. To operate on thoracic vertebra cranial to thoracic vertebra 12, the approach is transthoracic by removal of Disc

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Race track

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to keep stimulated horses off the track, as well as sorelegged ones that have been blocked. This is dangerous and always taboo. Acute eye injuries are always very dangerous as it is imperative that a horse have good vision.

In conclusion, let me say that the veterinarian is an important cog in racing circles. My experience has been limited to the two tracks here in Arizona, both comparatively small. However, we do have approximately fifty racing days each winter, and I have been with the Commission the past seven seasons. Let me impress upon you that we still make an occasional error, and the opinions I have given you are my own and do not apply to other tracks, as each track has regulations to fit its own particular need. Our races are confined to thoroughbred and quarter horses, there being no harness races in Arizona at present, and the veterinarian is doing his best to keep both horse and dog racing honest and above board. Any violations from his standpoint are few and far between; as an example, in the season just closed we had one violation, which was caught, out of approximately four hundred and seventy races covering about 3,800 horses. A small percentage as you will note, but if the veterinarians were not on the job this percentage would soon soar and in a short time racing would surely deteriorate. No one wants to bet their money on a hop head, besides an element of danger to the jockey is always present with this type of horse.

REFERENCES


Clinical Medicine

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of Penicillin G procaine and 2½ grams of Dihydrostreptomycin sulfate were administered.

November 1, 1956, the horse was eating, moved around much better, had a temperature of 100.2°, and a pulse rate of 52. The abdominal edema was still increasing in area and a small amount of edema was noted about the area of incision.

On November 5, 1956, the horse was eating and drinking well, moved about freely, and showed no signs of depression. The edema, which had increased to extend from between the hind legs to the points of the olecranons and had a width of one foot and a thickness of two inches, had started to be absorbed. The temperature was 99.0° and the pulse rate was 60. The clinician in charge stated that now the prognosis was very good.

—Rodney E. Hall '58

Disc

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of a rib and the employment of artificial respiration. The disc in question is then fenestrated dorso-laterally (ventrally in the case of cervical discs) with a small knife or lancet. As much as possible of the loose content of the disc is removed with a scoup. The adjacent discs can easily be fenestrated through the same opening; this may be an advisable prophylactic measure.

REFERENCES


A few minutes' grooming of your dog's coat every day will not only make him a canine Beau Brummel but will definitely contribute to his good health.