Scoliosis and associated cystic spinal cord lesion in a dog

Rodney S. Bagley, DVM; Gena M. Silver, DVM; Bernard Seguin, DVM; James D. Lincoln, DVM, MS; Lisa G. Britt, DVM

- Scoliosis often is associated with cystic spinal cord lesions.
- Scoliosis may result from denervation of local epaxial spinal musculature.

A 7-month-old female Mastiff was admitted for weakness in the hind limbs and an abnormal gait. Clinical signs began at 3 months of age and were attributed to possible hip dysplasia. Findings on orthopedic examination of the hind limbs, however, were normal. There was obvious scoliosis (convex side to the right) in the midlumbar region. The dog had conscious proprioceptive deficits in both hind limbs, worse on the left side, with intact spinal reflexes. The cutaneous trunci reflex was difficult to elicit caudal to the thoracolumbar junction. The dog had signs of hyperesthesia when the scoliotic area was palpated. In association with scoliosis, a spinal cord lesion in the area of T3-L3 was suspected.

Radiography of the vertebral column, analysis of CSF obtained from the lumbar area, electromyography, and myelography were performed. On radiographic evaluation, scoliosis was detected (convex side to the right), the focal point of which was at L1-L2. The vertebrae in this area also deviated slightly ventrally (lordosis). The cranial endplate of L1 was malformed and displaced dorsally relative to the vertebral body. On electromyographic evaluation, fibrillation potentials and positive sharp waves were found in the epaxial muscles of the vertebral column lateral to the spinous processes of T13-L4 on the right (convex) side of the body.

Cerebrospinal fluid was collected for analysis at L5-6, and values were within reference ranges (protein, 9.9 mg/dl; 2 nucleated cells/µl). For myelographic evaluation, contrast medium[a] was injected into the subarachnoid space at L5-6 (Fig 1). At T11-T13, contrast medium filled the epidural and subdural space in an irregular pattern. As contrast medium filled the entire spinal canal, it could not be determined from the myelographic views whether the lesions were in the epidural or subdural spaces. The cranial aspect of this lesion terminated in a teardrop-shaped pattern in the area of the dorsal subarachnoid space of T11. Computed tomography and magnetic resonance imaging were used for better clarification of the lesion. On both studies, there was a bizarre appearance to the spinal cord, again suggesting a cystic lesion. Overall, however, no additional information was gained from these studies, compared with myelography. Because it was believed that the spinal cord abnormalities may have contributed to scoliosis,[1-3] exploratory surgery was elected, with associated straightening of the vertebral column to be attempted.

While under general anesthesia, the dog was placed in sternal recumbency. A routine approach was made to the left lateral aspect of T10-T13. The approach was extended to expose both sides of the vertebrae at L1-L4. A left lateral hemilaminectomy was performed at T10-T13. The laminectomy was extended dorsally so the dorsal aspect of the spinal cord could be seen. The meninges were yellow and appeared distended. Fluid was apparent beneath the dura mater and filled the distended area. This cystic structure was incised with a No. 11 blade, and clear, watery fluid resembling CSF was released. Fluid flowed from the incised cystic structure as though it was under pressure. The spinal cord ventral to the cystic cavity that remained appeared indented in a dorsal to ventral direction but was otherwise normal. After drainage of the cavity, tissue encasing the cyst was resected to the level of normal appearing dura mater cranially and as far laterally as could be seen. A gel foam sponge[b] was placed over the laminectomy defect. Histologic examination of the excised tissue showed proliferation of leptomeninges and subdural vasculature.

The focal point of scoliosis was centered over L1-L2. The epaxial musculature on the right side of the dorsal spinous processes was pale, compared with the left-sided musculature. A small portion of this pale muscle was collected for histologic evaluation. This muscle contained changes consistent with denervation atrophy. The articular facets at L1-L2 were abnormally shaped, appearing flatter in a medial to lateral plane, compared with the articular facets on adjacent vertebral articulations. After exposure of the vertebrae to the level of the transverse processes, six 3.5-mm cortical bone screws were placed in the vertebral bodies (3 in L1 and 3 in L2). Two of the screws were placed on the left side and 4 on the right. A lamina spreader was placed between the 2 left-sided screws and expanded. This increased the distance between the 2 screws on the left side and subsequently straightened the vertebral column (Fig 2). Once straightened, a wire was placed in a tension band fashion between the 2 middle screws on the right side. Four Kirschner wires were placed transversely in the dorsal spinous processes of T13 and L3. Polymethyl methacrylate bone cement[c] was applied on the right side in a cylindrical fashion to encompass the screws, pins, and wires. Prior to placing polymethyl methacrylate, a Steinmann pin was cut to the appropriate length and wired to these pins on the right side in an attempt to increase the strength of the cement. After the right side was cured, the lamina spreader was removed from the left side and the additional 2 screws and left-sided pins were encompassed in a second application of polymethyl methacrylate. After this second application of cement

From the Department of Clinical Sciences, College of Veterinary Medicine, Washington State University, Pullman, WA 99164-6610.

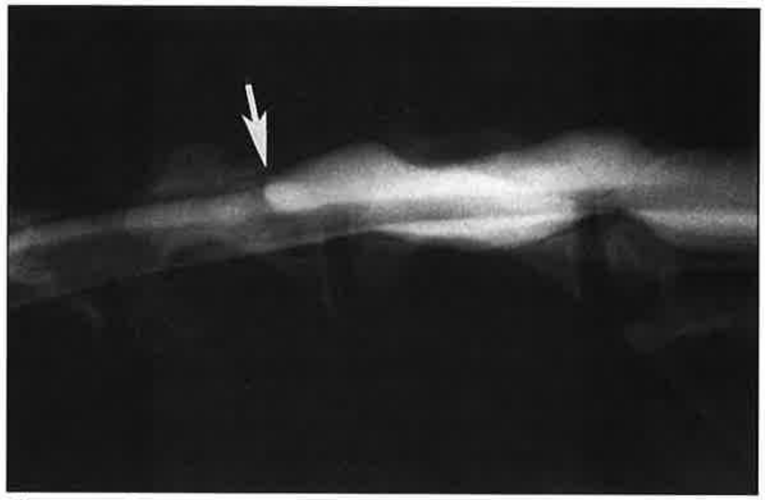

Figure 1—Dorsoventral (left) and lateral (right) myelographic views of T11-T13 after contrast medium was injected into the subarachnoid space at L5-6. Notice the abnormal teardrop shape of the contrast medium (arrow) in the dorsal portion of the subarachnoid space of T11.

hardened, the incision was closed routinely. A fentanyl transdermal patch[d] was applied for postoperative pain relief. Complications did not develop after surgery, and the dog was discharged 3 days later.

Three months after surgery, the dog was readmitted. The vertebral column appeared straight. The coat was lighter overlying the surgical area but otherwise had healed normally. Obvious deformations from the implanted apparatus were not observed. The dog was walking well. Proprioceptive deficits were not found in the hind limbs. Radiographic views of the vertebral column indicated that there had been no change in the alignment of the thoracic and lumbar vertebrae or of the implanted apparatus since the time of surgery. Six months after surgery, the dog was walking normally, had no conscious proprioceptive deficits, and was not sensitive on spinal palpation.

Scoliosis is a common disease in people, being the most common structural spinal deformity in children.[4-6] This disease most often affects females. Scoliosis in human beings can be congenital or acquired after skeletal maturity (adult scoliosis).[4-7] The cause is not always discernible (idiopathic). In people that develop scoliosis prior to skeletal maturity, abnormalities of vertebrae, ribs, and associated ligaments are possible.[4-6,8] These abnormalities may contribute to spinal bending resulting from the associated loss of stability of the vertebral column. Previous surgery, such as hemilaminectomy, may contribute to abnormal spinal curvature.[8] Lastly, abnormal muscular support has been suggested as a contributing factor to some spinal deformities, such as kyphosis.[9] Similar causes have been described in dogs.[10-14] Interestingly, scoliosis of dogs is often associated with cystic spinal abnormalities.[1-3]

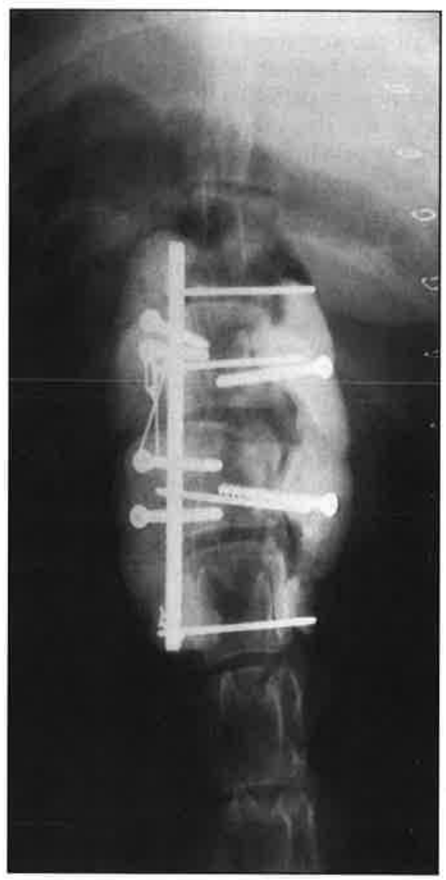

Figure 2—Dorsoventral radiographic view of T13-L3 after surgical straightening and fusion of the vertebrae.

Lateral deviation of the vertebral column can contribute to abnormal gait, changes in weightbearing, and chronic pain.[4,5,15-17] Pain may be the result of damage to the vertebrae or associated ligamentous support structures but often develops from damage to the intervertebral disks.[17] Chronic pain, which is more common in adults than children with scoliosis, is often the reason surgical treatment of scoliosis is attempted.[15] Scoliosis that develops prior to skeletal maturity is often progressive.[5] For younger patients, prevention of further structural deformity and associated problems such as abnormal posture, decreased pulmonary compliance, and improved appearance are often indications for surgical correction.[4,5,15]

The dog of our report had scoliosis associated with a cystic spinal cord lesion. On the basis of myelographic, surgical, and histologic findings, this cyst resembled an arachnoid cyst.[18-27] Arachnoid cysts have been reported with increasing frequency in dogs. Most affected dogs are < 18 months of age.[18-24] Other intramedullary cystic spinal cord lesions, such as syringomyelia and hydromyelia, have been associated with spinal deformities in dogs.[1-3] Although an association between these types of lesions and scoliosis is not yet defined, it has been theorized that local lower motor neuron cell bodies are damaged or destroyed secondary to the cyst.[1] This then results in denervation of the associated paraspinal musculature and contributing asymmetrical lateral muscle tension and subsequent vertebral deviation. Unfortunately, results of magnetic resonance imaging in the dog of this report could not discern the degree of local gray matter involvement in the area of the cyst. Results of electromyographic evaluation and findings of denervation muscle atrophy on the convex side of the scoliosis indicated that there was denervation of the paraspinal musculature. Denervation on the right side of the vertebral column may have allowed for greater muscle strength on the left side, thus deviating the vertebrae in this area toward the left (concave side of the scoliosis).

Surgical treatment of the disease in the dog reported here was attempted to achieve 2 goals, drainage of the cystic lesion and mechanical straightening of the vertebral column.[28,29] Drainage of arachnoid and other intraspinal cysts has previously resulted in improvement or resolution of clinical signs in dogs.[18-24] Incision of the cyst may be all that is needed in some instances. Additionally, although it was difficult to assess the degree of pain associated with scoliosis in the dog of this report, it was hyperesthetic to pressure in the scoliotic area. It was hoped that by adequately treating the cystic spinal cord lesion, the tendency for continued progression of scoliosis would be lessened.

Scoliosis, although generally seen, is reportedly uncommon in dogs. On the basis of information from the dog reported here and others, it seems prudent to evaluate dogs with scoliosis for associated spinal cord defects. Additional data regarding imaging characteristics and electrophysiologic abnormalities in similarly affected dogs may help to elucidate the pathophysiologic mechanisms perpetuating this spinal deformity.

[a]Isovue 300, Squibb Diagnostics, New Brunswick, NJ.
[b]Gelfoam, The Upjohn Co, Kalamazoo, Mich.
[c]Surgical simplex P, radiopaque bone cement, Howmedica, Pfizer Hospital Products Group, Rutherford, NJ.
[d]Duragesic (fentanyl transdermal system), Janssen Pharmaceutica, Titusville, NJ.

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