

DEGENERATIVE SPINAL DISEASE IN LARGE FELIDS

Christine Kolmstetter, M.S., D.V.M., Linda Munson, D.V.M., Ph.D., and Edward C. Ramsay, D.V.M.

Abstract: Degenerative spinal disorders, including intervertebral disc disease and spondylosis, seldom occur in domestic cats. In contrast, a retrospective study of 13 lions (*Panthera leo*), 16 tigers (*Panthera tigris*), 4 leopards (*Panthera pardis*), 1 snow leopard (*Panthera uncia*), and 3 jaguars (*Panthera onca*) from the Knoxville Zoo that died or were euthanatized from 1976 to 1996 indicated that degenerative spinal disease is an important problem in large nondomestic felids. The medical record, radiographic data, and the necropsy report of each animal were examined for evidence of intervertebral disc disease or spondylosis. Eight (three lions, four tigers, and one leopard) animals were diagnosed with degenerative spinal disease. Clinical signs included progressively decreased activity, moderate to severe rear limb muscle atrophy, chronic intermittent rear limb paresis, and ataxia. The age at onset of clinical signs was 10–19 yr (median = 18 yr). Radiographic evaluation of the spinal column was useful in assessing the severity of spinal lesions, and results were correlated with necropsy findings. Lesions were frequently multifocal, included intervertebral disc mineralization or herniation with collapsed intervertebral disc spaces, and were most common in the lumbar area but also involved cervical and thoracic vertebrae. Marked spondylosis was present in the cats with intervertebral disc disease, presumably subsequent to vertebral instability. Six of the animals' spinal cords were examined histologically, and five had acute or chronic damage to the spinal cord secondary to disc protrusion. Spinal disease should be suspected in geriatric large felids with decreased appetite or activity. Radiographic evaluation of the spinal column is the most useful method to assess the type and severity of spinal lesions.

Key words: Felid, intervertebral disc disease, jaguar, leopard, lion, *Panthera*, degenerative spinal disease, spondylosis, tiger, snow leopard.

INTRODUCTION

Degenerative spinal disorders involving intervertebral disc disease and spondylosis are common in certain domestic dog breeds but are seldom recognized clinically in domestic cats.^{4,7} Although disc protrusions frequently occur in domestic cats over 6 yr of age, associated neural dysfunction and signs of pain are rare.^{6,11,17} Spondylosis is a degenerative spinal condition in which osteophytes develop at intervertebral joints forming partial or complete bony bridges between adjacent vertebrae. This condition is commonly observed in older animals and can also occur secondary to intervertebral disc protrusion.^{2,15,19} Although spondylosis is typically asymptomatic, clinical signs of pain may occur if adjacent spinal nerves are affected, if traumatic fracture of osteophytes results in spinal cord compression, or if there is intervertebral disc extrusion compressing the spinal cord.^{1,19}

Clinical problems associated with degenerative spinal disease have been noted in geriatric felids at

the Knoxville Zoo over the past two decades, and the present retrospective study was conducted in order to determine their incidence. Characteristic manifestations, diagnostic procedures, and therapies of affected animals were evaluated in order to propose diagnostic, treatment, and preventive strategies for degenerative spinal disease in large felids.

MATERIALS AND METHODS

All members of the genus *Panthera* from the Knoxville Zoo that died or were euthanatized at greater than 1 yr of age between 1 January 1976 and 31 December 1996 were studied. The medical record, radiographic data, and the necropsy report of each animal were examined for evidence of degenerative spinal disease. Radiographic and/or necropsy data related to the spinal column were available on all animals. A diagnosis of degenerative spinal disease was based on radiographic or necropsy evidence of intervertebral disc abnormalities or spondylosis, as defined by the presence of one or more of the following conditions: narrowed intervertebral disc space(s), mineralized disc(s), collapsed or herniated disc(s), osteophyte formation along one or more vertebrae, and fibrous or bony bridges joining two or more vertebrae.^{1,19}

RESULTS

Thirty-seven individuals were studied (Table 1). Age at time of death was 4–25 yr (median = 15 yr) for all animals. Eight animals (three lions, four

From the Departments of Comparative Medicine (Kolmstetter, Ramsay) and Pathology (Munson), College of Veterinary Medicine, University of Tennessee, Knoxville, Tennessee 37901-1071, USA. Present addresses: 2916 Ivory Reef Court, Las Vegas, Nevada 89117, USA (Kolmstetter); and Department of Pathology, Microbiology, and Immunology, College of Veterinary Medicine, 1 Shields Avenue, Davis, California 95616-8739, USA (Munson).

Table 1. The species and sex of felids in the genus *Panthera* from the Knoxville Zoo in a retrospective study of degenerative spinal disease. The study group included all *Panthera* spp. animals that died or were euthanized from 1 January 1976 to 31 December 1996. The median age at time of death for each group is shown in parentheses.

Species	Number of animals studied		Number with spinal disease	
	Male	Female	Male	Female
Lion (<i>Panthera leo</i>)	6 (14.5 yr)	7 (16 yr)	1 (18 yr)	2 (16 yr)
Tiger (<i>Panthera tigris</i>)	9 (16 yr)	7 (15 yr)	3 (18 yr)	1 (19 yr)
Leopard (<i>Panthera pardus</i>)	2 (18.6 yr)	2 (17.5 yr)	1 (19 yr)	0
Snow leopard (<i>Panthera uncia</i>)	1 (12 yr)	0	0	0
Jaguar (<i>Panthera onca</i>)	2 (11 yr)	1 (12 yr)	0	0

tigers, one leopard; five males, three females), all older than 10 yr, were diagnosed with degenerative spinal disease (Table 1). Three of the unaffected animals were less than 10 yr of age at time of death. The median age at initial diagnosis of spinal disease was 18 yr (range = 10–19 yr), and age at death for affected animals was 14–19 yr (median = 18 yr). In five cases, the diagnosis was based on both radiographic and necropsy data, and in each remaining case, the diagnosis was based on either radiographic or necropsy data.

Specificity and duration of clinical signs of the eight animals with degenerative spinal disease varied considerably. All eight animals exhibited progressively decreased activity levels for at least several months and as long as 6 yr prior to euthanasia. Five animals had moderate to severe rear limb muscle atrophy and/or chronic intermittent rear limb paresis during this time period. Two animals exhibited severe, acute, persistent rear limb paresis and ataxia for 1–2 days prior to euthanasia. Five of the eight animals were euthanized for progressive weight loss, ataxia, lameness, and/or rear limb paresis. Three animals with marked spinal disease were euthanized because of severe systemic, non-

spinal problems. Comments regarding apparent weight loss were made in the medical records of all eight affected animals over several months prior to euthanasia. Five of the eight affected cats were in poor body condition at the time of death.

The spinal columns of six of the affected animals were evaluated radiographically, immediately prior to euthanasia on one animal and 2 mo–6 yr prior to euthanasia on the others. All showed narrowed or collapsed disc spaces or disc mineralization characteristic of intervertebral disc disease, and five showed evidence of spondylosis (Table 2; Figs. 1, 2). Lesions involving intervertebral disc mineralization or herniation with collapsed intervertebral disc spaces were frequently multifocal along the cervical, thoracic, and/or lumbar spine, although the lumbar area was most commonly affected. Three of six animals had lesions in more than one region of the spine (Table 3). Radiographs of Siberian tiger 1's spine, taken 5 mo after diagnosis, demonstrated marked progression of spondylosis but no change in intervertebral disc disease.

Necropsy verified radiographic findings of degenerative spinal disease in four of the five animals for which results were available. Radiographs of

Table 2. Radiographic and necropsy findings of eight members of the genus *Panthera* from the Knoxville Zoo diagnosed with degenerative spinal disease between January 1976 and December 1996.

	Lion 1	Lion 2	Lion 3	Tiger 1	Tiger 2	Tiger 3	Tiger 4	Leopard
Age at death (yr)	18	12	16	16	18	14	19	19
Radiographic findings								
Narrowed or collapsed disc space(s)	+	+	+	+	NA ^a	+	NA	+
Mineralized disc(s)	–	+	–	+	NA	–	NA	–
Spondylosis	+	+	–	+	NA	+	NA	+
Pathology findings								
Intervertebral disc disease and/or spondylosis	+	NA	NA	+	+	+	+	+
Spinal cord compression	+	NA	+	NA	+	+	+	–

^a NA = data not available.

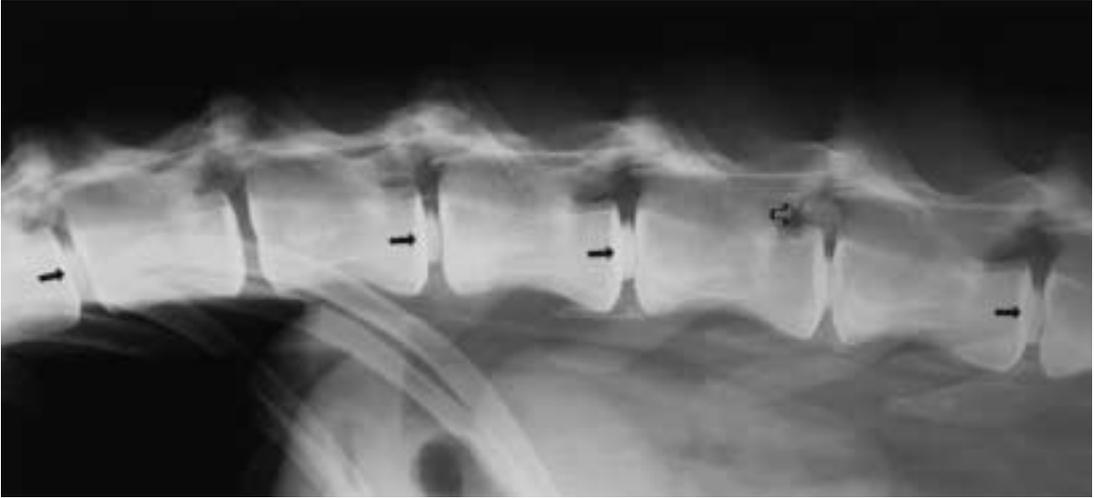


Figure 1. Lateral radiographic view of the spinal column of a 16-yr-old male Siberian tiger (*Panthera tigris*) with rear limb weakness and muscle atrophy. Multiple mineralized intervertebral discs are present at T₁₂₋₁₃, L₁₋₂, L₂₋₃, and L₄₋₅ (closed arrows). The mineralized disc at L₃₋₄ has protruded into the vertebral canal (open arrow).

one lion (lion 2) suggested cervical disc herniation and intervertebral disc mineralization, but no such cervical lesions were found at necropsy.

Two animals were treated for spinal disease. The

leopard with mild chronic intermittent rear limb paresis was treated with meclofenamic acid (Fort Dodge Animal Health, Fort Dodge, Iowa 50501, USA; 1 mg/kg p.o. e.o.d. for 4 wk), but no signif-



Figure 2. Lateral radiographic view of the lumbosacral spinal column of a 19-yr-old male Chinese leopard (*Panthera pardus*) with a chronic, stiff, rear limb gait. There are multiple areas of ankylosing spondylosis with collapsed disc spaces along the lumbar spine (closed arrows).

Table 3. Regions of the spinal column of *Panthera* felids from the Knoxville Zoo showing either radiographic signs or necropsy lesions of degenerative spinal disease from January 1976 to December 1996.

Region	Number of animals with radiographic findings (n = 6)	Number of animals with necropsy findings (n = 7)
Cervical	2	3
Thoracic	2	3
Lumbar/lumbosacral	5	6

icant clinical improvement was noted. A Siberian tiger (tiger 3) with acute, severe rear limb paresis initially responded to methyl prednisolone sodium succinate (Pharmacia and UpJohn Co., Kalamazoo, Michigan 49001, USA; 12 mg/kg i.v. once) followed by dexamethazone (Phoenix Scientific, Inc., St. Joseph, Missouri 64506, USA; 0.25 mg/kg i.m. b.i.d. for 6 days, 0.25 mg/kg i.m. s.i.d. for 2 days, and 0.5 mg/kg i.m. q. 48 hr for an unspecified length of time). Two subsequent episodes of mild hind limb paresis in this animal were treated with aspirin (5 mg/kg p.o. q. 48 hr for 2 wk) with no apparent clinical improvement.

Necropsy and histopathologic data related to the spinal column were available on seven of the eight animals with degenerative spinal disease (Table 2). Spinal disease was present in more than one region of the spinal column in four animals (Table 3). Five of the six large felids in this study that had their spinal cords examined histologically had acute or chronic traumatic damage from protrusion of disc material into the spinal canal. Damage to the spinal cord was characterized as local compression with axonal swelling or loss and ballooning of myelin sheaths in ascending and descending tracts.

DISCUSSION

This study demonstrated that degenerative spinal disease is common in large geriatric felids at the Knoxville Zoo and has caused progressive identifiable neurologic signs and muscle wasting in eight animals. Degenerative spinal disease resulted in the euthanasia of five animals. No sex predilection has been evident.

Progressive intervertebral disc disease occurs with advancing age in many species, including domestic cats in which the incidence of multifocal disc disease has been found to increase with age.⁸⁻¹⁰ In older domestic cats, dorsal intervertebral disc protrusions have been commonly found on necropsy but have rarely been associated with clinical

signs. Unlike in dogs, noncontrast radiography does not appear to be helpful in diagnosing disc disease in domestic cats. The dorsal disc protrusions noted on necropsy are often not accompanied by radiographic evidence of narrowed intervertebral disc spaces or disc calcification.⁸⁻¹⁰ These findings contrast with our study of degenerative spinal disease in large nondomestic felids, in which intervertebral disc disease resulted in both clinical signs and radiographic changes and in which histologic findings are typical of those seen in acute and chronic intervertebral disc disease in domestic dogs.¹⁸ These findings suggest that the clinical significance and relevant diagnostic tests for intervertebral disc disease may differ considerably between large nondomestic felids and domestic cats.

In the present study, marked spondylosis occurred in cats with intervertebral disc disease, presumably subsequent to intervertebral instability. Spondylosis occurs secondary to degenerative changes of the associated intervertebral disc because a degenerating disc leads to instability of adjacent vertebrae. Excessive movement causes periosteal bone stimulation and the formation of bridging osteophytes ventral and lateral to the affected vertebral bodies.¹⁴ Although spondylosis is generally asymptomatic, clinical signs such as pain, ataxia, or paresis may result from pressure along spinal nerves or from spinal cord compression secondary to traumatic fracture of osteophytes or disc rupture.¹

Options for treatment of degenerative spinal disease include medical management of periodic or chronic pain, weight and exercise control, and surgery.^{3,17} Options for pain management in felids are somewhat limited by unusual drug sensitivities of cats. In domestic cats, a variety of opioids, nonsteroidal anti-inflammatory agents, glucocorticoids, chondroprotective agents, and nutraceuticals have been used, although data are limited for nondomestic felids.^{3,5,12,13,16} In the current study, clinical effects of the few treatments attempted were variable and of insufficient number to permit the drawing of any conclusions. Additional recommendations for humans and domestic animals with degenerative spinal disease typically include weight loss for overweight individuals, minimizing high impact exercise such as jumping and running, and encouraging low impact exercises such as walking and swimming.¹² In captive nondomestic felids, weight management is a feasible option. Adjustment of exercise level is somewhat more difficult, although removal of elevated pallets that are frequently present in cat enclosures may help minimize high impact activities such as jumping. The concrete or other hard surfaces often present in cat enclosures

may also contribute to spinal problems. Environmental improvement and weight control may therefore help minimize development and progression of spinal disease in these felids.

The level of spinal discomfort can be difficult to assess in geriatric captive felids with multiple problems and overall decreased activity levels. The results of this study suggest spinal disease should be among the differential diagnoses in large zoo felids with signs such as decreased appetite or activity. This study also indicates that radiographic evaluation of the spinal column is the most useful method for assessing the type and severity of spinal lesions. Because radiographic data were typically available only during the later stages of these animals' lives, at what age the spinal disease related problems actually began is unknown.

LITERATURE CITED

1. Bartels, J. E. 1994. Intervertebral disc disease. *In*: D. E. Thrall (ed.). *Textbook of Veterinary Radiology*. W. B. Saunders Co., Philadelphia, Pennsylvania. Pp. 56–65.
2. Beadman, R., R. N. Smith, and A. S. King. 1964. Vertebral osteophytes in the cat. *Vet. Rec.* 76: 1005–1007.
3. Boothe, D. M. 1996. Medical management of osteoarthritis. *Proc. 14th Am. Coll. Vet. Int. Med. Forum, San Antonio, Texas, 1996*: 274–277.
4. Chrisman, C. L. (ed.). 1991. *Problems in Small Animal Neurology*, 2nd ed. Lea and Febiger, Philadelphia, Pennsylvania.
5. Fox, S. M., and S. A. Johnston. 1997. Use of carprofen for the treatment of pain and inflammation in dogs. *J. Am. Vet. Med. Assoc.* 10: 1493–1498.
6. Heavner, J. E. 1971. Intervertebral disc syndrome in the cat. *J. Am. Vet. Med. Assoc.* 159: 425–427.
7. Hoerlein, B. F. (ed.). 1978. *Canine Neurology*. W. B. Saunders Co., Philadelphia, Pennsylvania.
8. King, A. S., and R. N. Smith. 1960. Disc protrusions in the cat: distribution of dorsal protrusions along the vertebral column. *Vet. Rec.* 72: 335–337.
9. King, A. S., and R. N. Smith. 1960. Disc protrusion in the cat: age incidence of dorsal protrusions. *Vet. Rec.* 72: 381–383.
10. King, A. S., and R. N. Smith. 1958. Protrusion of the intervertebral disc in the cat. *Vet. Rec.* 70: 509–512.
11. Littlewood, J. D., M. E. Hertage, and A. C. Palmer. 1984. Intervertebral disc protrusion in a cat. *J. Small Anim. Pract.* 25: 119–127.
12. Manley, P. A. 1995. Treatment of degenerative joint disease. *In*: Bonagura, J. D. (ed.). *Kirk's Current Veterinary Therapy XII Small Animal Practice*. W. B. Saunders Co., Philadelphia, Pennsylvania. Pp. 1196–1199.
13. Moore, M. G. 1996. Promising responses to a new oral treatment for degenerative joint disorders. *Can. Pract.* 21: 7–11.
14. Palmer, N. 1993. Bones and joints. *In*: Jubb, K. V. F., P. C. Kennedy, and N. Palmer (eds.). *Pathology of Domestic Animals*. Academic Press, Inc., San Diego, California. Pp. 153–158.
15. Read, R. M., and R. N. Smith. 1968. A comparison of spondylosis deformans in the English and Swedish cat and in the English dog. *J. Small Anim. Pract.* 9: 159–166.
16. Scherk-Nixon, M. 1996. A study of the use of a transdermal fentanyl patch in cats. *J. Am. Anim. Hosp. Assoc.* 32: 19–24.
17. Sparkes, A. H., and T. M. Skerry. 1990. Successful management of a prolapsed intervertebral disc in a Siamese cat. *Feline Pract.* 18: 7–9.
18. Summers, B. A., J. F. Cummings, and A. de Lahunta. 1995. *Veterinary Neuropathology*. Mosby, St. Louis, Missouri. Pp. 202–203.
19. Walker, M. A. 1994. The vertebrae. *In*: D. E. Thrall (ed.). *Textbook of Veterinary Radiology*. W. B. Saunders Co., Philadelphia, Pennsylvania. Pp. 52–55.

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