Low-field magnetic resonance imaging findings of the caudal portion of the cervical region in clinically normal Doberman Pinschers and Foxhounds

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Objective—To determine the spectrum and frequency of abnormalities for low-field magnetic resonance imaging (MRI) examinations of clinically normal Doberman Pinschers and Foxhounds.

Animals—37 clinically normal dogs (20 Doberman Pinschers and 17 Foxhounds).

Procedures—For each dog, MRI of the cervical vertebrae (sagittal, dorsal, and transverse T1- and T2-weighted images) was performed. Variables assessed were intervertebral disk degeneration, disk-associated compression, compression of the dorsal portion of the spinal cord, vertebral body abnormalities, and changes in intraparenchymal signal intensity. Associations between these variables and age, breed, sex, and location of the assessed intervertebral disk spaces were evaluated.

Results—Severe MRI abnormalities were detected in 17 dogs, including complete disk degeneration (n = 4 dogs), spinal cord compression (3), or both (10). Vertebral body abnormalities were detected in 8 dogs, and hyperintense signal intensity was detected in 2 dogs. Severity of disk degeneration and disk-associated compression was significantly associated with increased age. There was a significant association between disk degeneration, disk-associated compression, and compression of the dorsal aspect of the spinal cord and location of the assessed intervertebral disk space, with the intervertebral disk spaces in the caudal portion of the cervical region being more severely affected.

Conclusions and Clinical Relevance—Abnormalities were commonly seen on MRI examinations of the caudal portion of the cervical vertebral column and spinal cord of clinically normal Doberman Pinchers and Foxhounds. Such lesions were probably part of the typical spinal cord degeneration associated with the aging process of dogs. (*Am J Vet Res* 2010;71:428–434)

Plain radiography, myelography, and computerized tomography, alone or in combination, have been used to diagnose neurologic disorders affecting the cervical vertebral column and spinal cord.[1] Because of the invasive nature and diagnostic limitations of myelography,[2,3] MRI has become a popular diagnostic tool for use in evaluation of the spinal cord. Magnetic resonance imaging is an attractive diagnostic alternative because it is a noninvasive technique, involves no radiation, is not known to be associated with any major adverse effects, and provides superior resolution of the anatomy, particularly of soft tissue structures, in multiple anatomic planes.[4] Magnetic resonance imaging can be useful in evaluating and diagnosing a variety of disorders of the cervical spinal cord and vertebral column of dogs.[5–7] The high sensitivity of MRI can cause problems in interpretation of images because nonimportant lesions become evident.[8] One canine[8] and several human[9–15] studies have revealed the existence of cervical spinal cord compression in subjects without clinical signs. However, little is known about the clinical relevancy, progression, and prognosis for these cervical spinal cord compressions that do not cause clinical signs

Abbreviations

MRI	Magnetic resonance imaging
TE	Echo time
TR	Repetition time

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and whether they would justify meticulous clinical and MRI monitoring or even early surgical decompression before clinical manifestation of a neurologic deficit. To determine the importance of abnormalities detected during MRI examinations, the spectrum and frequency of structural abnormalities that may not cause problems must be considered. At this time, little is known about this subject in veterinary medicine.

In the study reported here, the low-field MRI features of the cervical vertebral column and spinal cord, with special emphasis on the caudal portion of the cervical region, of clinically normal Doberman Pinschers and Foxhounds were investigated. It was hypothesized that structural abnormalities existed in a substantial portion of the study population and that breed, age, and sex could influence the development and severity of these findings. Furthermore, it was hypothesized that the development of certain abnormalities could be associated with the location of the assessed intervertebral disk space. This study was part of a larger investigation of the diagnosis and treatment of disk-associated wobbler syndrome in dogs.

Materials and Methods

Animals—Two groups that comprised 37 clinically normal dogs were prospectively evaluated. One group consisted of 20 client-owned Doberman Pinschers. This breed was selected for inclusion because of their predisposition for neurologic syndromes that affect the caudal portion of the cervical vertebral canal and spinal cord.[16] The other group consisted of 17 Foxhounds (13 were client-owned dogs and 4 were laboratory-owned dogs). This breed was selected for inclusion because their conformation and amount of activity are comparable to those of Doberman Pinschers and the fact that this breed is not predisposed to neurologic syndromes that affect the caudal portion of the cervical vertebral canal and spinal cord. Written owner consent was obtained prior to enrollment of client-owned dogs in the study. The study was conducted in accordance with the guidelines of the Animal Care Committee of the University of Ghent.

The dogs were defined as clinically normal on the basis of history and results of physical and neurologic examinations, CBCs, and serum biochemical analyses. All Doberman Pinschers underwent an additional echocardiographic examination and standardized testing to determine mucosal bleeding time. Dogs were assigned to 2 age categories: dogs < 5 years old (10 Doberman Pinschers and 8 Foxhounds) and dogs ≥ 5 years old (10 Doberman Pinschers and 9 Foxhounds). Sex distribution was equal between the groups of dogs. All owners were contacted at the end of the study and encouraged to have another physical and neurologic examination performed on their dogs.

MRI procedures—A permanent, 0.2-T magnet[a] was used to perform MRI in all dogs. Dogs were positioned in dorsal recumbency with the head and neck extended. The forelimbs were positioned parallel to the thorax. The cervical vertebral column was positioned in a joint coil (circular transmit-receive coil) with an inner diameter of 19 cm. Then, T1 and T2 spin echo–weighted images were obtained for all dogs in sagittal, dorsal, and transverse planes. Images for the transverse plane were aligned perpendicular to the cervical vertebral column. Images of the spinal cord were obtained from C2 through C7 in the sagittal and dorsal planes and from C4 through C7 in the transverse plane. For all MRIs of the vertebral column, the field of view was 29 cm for the sagittal plane, 24 cm for the dorsal plane, and 20 cm for the transverse plane.

The T1-weighted sagittal images were obtained with a TR of 700 milliseconds and a TE of 25 milliseconds. The T2-weighted sagittal images were obtained with a TR of 2,700 milliseconds and a TE of 125 milliseconds. Dorsal images were obtained for the T1-weighted sequence with a TR of 600 milliseconds and TE of 25 milliseconds, whereas dorsal images for the T2-weighted sequence were obtained with a TR of 3,900 milliseconds and a TE of 120 milliseconds. Transverse T1-weighted images were obtained with a TR of 1,100 milliseconds and a TE of 25 milliseconds, and the T2-weighted transverse images were obtained with a TR of 5,000 milliseconds and a TE of 120 milliseconds. Slice thickness was 4 mm for the sagittal and dorsal planes and 3 mm for the transverse plane, with no interslice gap for any of the sequences.

Interpretation of MRI—Variables assessed for MRI were disk degeneration, disk-associated compression of the spinal cord, compression of the dorsal portion of the spinal cord, changes in signal intensity of the spinal cord, and vertebral body abnormalities. For the sagittal and transverse images, intervertebral disk spaces C2-3 through C6-7 and C4-5 through C6-7, respectively, were evaluated. To enable comparisons with published results, these variables were assessed and graded in accordance with the description provided in a study[8] on the diagnosis and pathogenesis of cervical spondylomyelopathy in Doberman Pinschers. All images were reviewed separately by 2 investigators (SDD and IMVLG), and a consensus interpretation was reached.

Because disk degeneration is associated with a decrease in signal intensity on T2-weighted images, assessment of intervertebral disk degeneration was based on the signal intensity of each intervertebral disk on midsagittal T2-weighted images (**Figure 1**). A nondegenerated disk (score 0) had a homogenous hyperintense signal, a disk with partial disk degeneration (score 1) had heterogeneous loss of the hyperintense signal, and a disk with complete disk degeneration (score 2) had complete loss of the hyperintense signal.

Disk-associated compression of the spinal cord (compression of the ventral aspect of the spinal cord) was assessed on the midsagittal images and, when available, confirmed on the transverse (C4 through C7) T2-weighted images (**Figures 2 and 3**). Disk-associated compression was classified as follows: score 0, no compression; score 1, partial compression of the ventral portion of the subarachnoid space; score 2, complete compression of the ventral portion of the subarachnoid space without compression of the spinal cord; and score 3, compression of the spinal cord with deviation or distortion of the spinal cord. Compression of the dorsal portion of the spinal cord was evaluated on the same images and with the same classification scheme as used for assessment of disk-associated compression of the spinal cord.

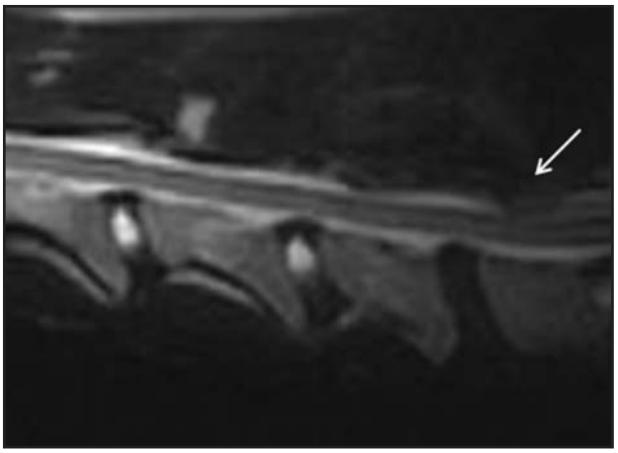

Figure 1—Sagittal T2-weighted image obtained during MRI of the caudal portion of the cervical vertebrae of a clinically normal Doberman Pinscher. Disk degeneration is graded as no disk degeneration (score 0; disk space to the left), partial disk degeneration (score 1; disk space in the middle), and complete disk degeneration (score 2; disk space to the right). Each of these intervertebral disks is causing partial compression of the ventral portion of the subarachnoid space (score 1). Complete compression of the dorsal portion of the subarachnoid space (score 2) is indicated (arrow).

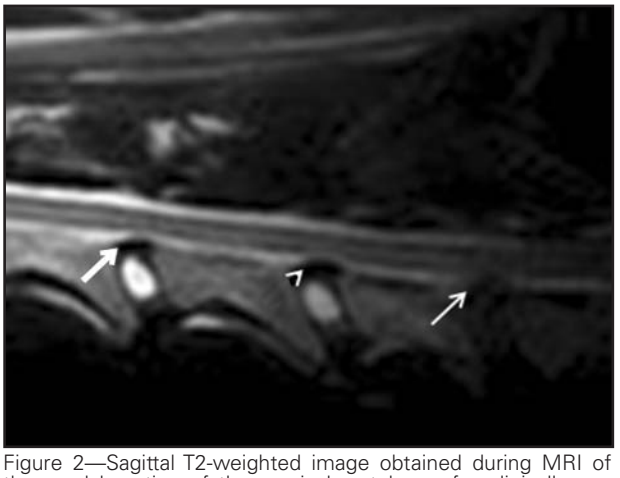

Figure 2—Sagittal T2-weighted image obtained during MRI of the caudal portion of the cervical vertebrae of a clinically normal Doberman Pinscher. For these 3 disk spaces, disk-associated compression was classified as partial compression of the ventral portion of the subarachnoid space (score 1 [thick arrow]), complete compression of the ventral portion of the subarachnoid space (score 2 [arrowhead]), and compression of the spinal cord (score 3 [thin arrow]).

The degree of intervertebral disk degeneration, disk-associated compression, and compression of the dorsal portion of the spinal cord were evaluated in 2 ways. First, the score of the most severely affected disk space in each dog was evaluated. This was defined as the severity of disk degeneration or compression of the spinal cord in that dog. Second, the sum of the scores of all affected disk spaces in each dog, which was defined as the sum of scores for the assessed intervertebral disk spaces in that dog, was evaluated. Changes in signal intensity of the spinal cord were based on the relative increase in signal intensity on T2-weighted images or decrease in signal intensity on T1-weighted images (or both) when compared with signal intensity for the surrounding spinal cord parenchyma. Vertebral body

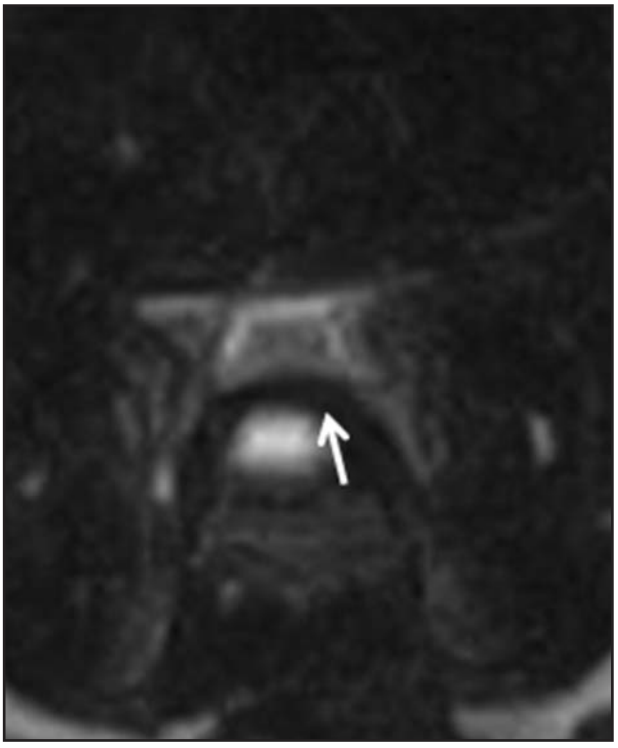

Figure 3—Transverse T2-weighted image obtained during MRI of the caudal portion of the cervical vertebrae of a clinically normal Doberman Pinscher. Disk-associated compression of the spinal cord is characterized by deviation or distortion of the spinal cord (arrow).

Figure 4—Sagittal T1-weighted image obtained during MRI of the caudal portion of the cervical vertebrae of a clinically normal Doberman Pinscher. Vertebral body abnormalities are characterized as a flattening of the cranioventral border of the vertebral body (arrow).

abnormalities were evaluated on the midsagittal T1-weighted images. Vertebral body abnormalities ranged from flattening of the cranioventral border of the vertebral body to a triangular shape of the vertebral body (**Figure 4**).

Data analysis—The effect of breed, age category, and sex on severity and the sum of scores for the assessed intervertebral disk spaces were evaluated by use of the Wilcoxon rank sum test. Associations between severity of the assessed variable and location of the assessed intervertebral disk space were tested in 2 ways. First, the Friedman test (with dog as a block factor) was used. Second, the Page test was used to determine whether severity increased with the more caudally located intervertebral disk spaces. The effect of age category on the location of the assessed abnormality was evaluated by use of the Wilcoxon rank sum test. To evaluate the correlation between the assessed variables, Kendall correlation coefficients were determined. Significance was established at a value of $P < 0.05$.

Results

Animals—Clinically normal dogs (20 Doberman Pinschers and 17 Foxhounds) were included in the study. The group of 10 Doberman Pinschers < 5 years old consisted of 6 males and 4 females that were between 1.5 and 4.7 years old (mean, 2.6 years; median, 1.8 years) and weighed between 30 and 46 kg (mean, 33.7 kg; median, 35 kg). The group of 8 Foxhounds < 5 years old consisted of 4 males and 4 females that were between 1.5 and 4 years old (mean, 2.3 years; median, 1.9 years) and weighed between 27 and 34 kg (mean, 29.1 kg; median, 27.8 kg). The group of 10 Doberman Pinschers ≥ 5 years old consisted of 5 males and 5 females that were between 5.3 and 8 years old (mean, 6.6 years; median, 6.2 years) and weighed between 30 and 46 kg (mean, 37 kg; median, 36 kg). The group of 9 Foxhounds ≥ 5 years old consisted of 5 males and 4 females that were between 5 and 12 years old (mean, 7.4 years; median, 6 years) and weighed between 28 and 38.6 kg (mean, 32.5 kg; median, 33 kg).

MRI abnormalities—Only 1 dog had no abnormalities on MRI examinations. All other dogs had at least 1 abnormality for one of the assessed variables.

Intervertebral disk degeneration—Nine of 37 (24%) dogs did not have evidence of intervertebral disk degeneration. Only partial intervertebral disk degeneration was detected in 14 (38%) dogs. Complete intervertebral disk degeneration was detected in another 14 (38%) dogs. Multiple affected disks were evident in 10 (27%) dogs. Among the 185 disks examined in all dogs, 42 had signs of degeneration; of these, 25 were partially degenerated and 17 were completely degenerated. The disks most frequently involved were C6-7 (n = 29 disks) and C5-6 (8). Other affected disks were C2-3 (n = 3 disks) and C4-5 (2). Severity of intervertebral disk degeneration and the sum of the scores of the assessed intervertebral disks were significantly associated with the higher age category ($P = 0.005$ and $P = 0.003$, respectively) but not with breed ($P = 0.36$ and $P = 0.51$, respectively) or sex ($P = 0.98$ and $P = 1.00$, respectively). Severity of disk degeneration was significantly ($P < 0.001$) associated with the location of the assessed intervertebral disk, with the more caudal intervertebral disk spaces significantly ($P < 0.001$) associated with the most severe degeneration. There was not a significant ($P = 0.41$) association between the location of the affected disk and age category.

Disk-associated compression of the spinal cord—Three of 37 (8%) dogs did not have any sign of disk-associated compression. Partial compression of the ventral portion of the subarachnoid space was detected as the most severe compression in 9 (24%) dogs. Complete compression of the ventral portion of the subarachnoid space was detected as the most severe compression in 14 (38%) dogs, and compression of the spinal cord with deviation or distortion of the spinal cord was detected in 11 (30%) dogs. Multiple sites with some degree of compression were detected in 28 (76%) dogs, with 4 (11%) dogs having multiple sites of spinal cord compression. Among the 185 intervertebral disk spaces examined, 88 had some degree of disk-associated compression; of these, 43 had partial compression of the subarachnoid space, 28 had complete compression of the subarachnoid space, and 17 had spinal cord compression. The intervertebral disk spaces involved most often were C6-7 (n = 26 disks) and C4-5 (20). Other affected intervertebral disk spaces were C2-3 (n = 15 disks), C3-4 (14), and C5-6 (13). Severity of disk-associated compression was significantly ($P = 0.048$) associated with the higher age category. However, the sum of the scores for the assessed intervertebral disk spaces was not significantly ($P = 0.13$) associated with age category. Severity and sum of the scores for disk-associated compressions were not significantly associated with breed ($P = 0.58$ and $P = 0.44$, respectively) or sex ($P = 0.17$ and $P = 0.46$, respectively). Severity of disk-associated compression was significantly ($P = 0.004$) associated with the location of the assessed intervertebral disk space, with the most severe compressions significantly ($P = 0.019$) associated with the more caudal intervertebral disk spaces. There was not a significant ($P = 0.84$) association between the location of the affected intervertebral disk space and age category.

Compression of the dorsal portion of the spinal cord—Sixteen of 37 (43%) dogs did not have any sign of compression of the dorsal portion of the spinal cord. Partial compression of the dorsal portion of the subarachnoid space was detected as the most severe compression in 11 (30%) dogs. Complete compression of the dorsal portion of the subarachnoid space was detected as the most severe compression in 7 (19%) dogs, and compression of the dorsal portion of the spinal cord with deviation or distortion of the spinal cord was detected in 3 (8%) dogs. Multiple sites with any degree of compression of the dorsal portion of the spinal cord or subarachnoid space were detected in 9 (24%) dogs. For the 185 intervertebral disk spaces examined, 30 had some degree of compression of the dorsal portion of the spinal cord or subarachnoid space; of these, 19 had partial compression of the dorsal portion of the subarachnoid space, 8 had complete compression of the subarachnoid space, and 3 had compression of the dorsal portion of the spinal cord. The involved intervertebral disk spaces were C6-7 (n = 17 disks), C5-6 (9), and C4-5 (4). Laminar malformations or abnormalities of the articular facets were not evident in any dog. Examination of images for the dorsal plane did not

reveal any lateral compressions. Severity and sum of the scores of compression of the dorsal portion of the spinal cord or subarachnoid space were not significantly associated with age category ($P = 0.66$ and $P = 0.71$, respectively), breed ($P = 0.43$ and $P = 0.32$, respectively), or sex ($P = 0.85$ and $P = 0.97$, respectively). Severity of compression of the dorsal portion of the spinal cord or subarachnoid space was significantly ($P < 0.001$) associated with the location of the assessed intervertebral disk space, with the most severe compressions significantly ($P < 0.001$) associated with the more caudally located intervertebral disk spaces. There was not a significant ($P = 1.00$) association between location of the affected intervertebral disk space and age category.

Changes in signal intensity of the spinal cord—A hyperintense intramedullary signal change on T2-weighted images was evident in 2 of 37 (5%) dogs (2 Foxhounds of the higher age category at disk C4-5 and C5-6, respectively). A hypointense intramedullary signal change on T1-weighted images was not detected in any dog. There were no significant associations between changes in signal intensity of the spinal cord and age category ($P = 0.46$), breed ($P = 0.52$), or sex ($P = 0.12$).

Vertebral body abnormalities—Vertebral body abnormalities were detected in 8 of the 37 (22%) dogs. In all dogs, this was evident as a flattening of the ventrocranial border of the vertebral body. These abnormalities were detected in 7 of 20 (35%) Doberman Pinschers at the level of C7 and in 1 Foxhound at the level of C6. Vertebral body abnormalities were significantly associated with the Doberman Pinscher as a breed ($P = 0.043$) but was not significantly associated with age category ($P = 0.61$) or sex ($P = 0.82$). In 2 Doberman Pinschers, an additional abnormal position of the vertebral body with tipping or tilting of C7 was seen.

Correlation between assessed variables—A significant correlation was detected between the severity of intervertebral disk degeneration and severity of disk-associated spinal cord compression ($r = 0.52$; $P < 0.001$), sum of the scores for disk-associated compressions ($r = 0.41$; $P = 0.003$), and severity of compression of the dorsal portion of the spinal cord or subarachnoid space ($r = 0.31$; $P = 0.032$). The sum of the scores for intervertebral disk degeneration was significantly correlated with the severity of disk-associated compressions ($r = 0.58$; $P < 0.001$), sum of the scores of disk-associated compressions ($r = 0.50$; $P = 0.001$), and severity of compression of the dorsal portion of the spinal cord or subarachnoid space ($r = 0.33$; $P = 0.002$). There also was a significant correlation between the severity of disk-associated compression and compression of the dorsal portion of the spinal cord ($r = 0.30$; $P = 0.039$) and between the severity of disk-associated compression and vertebral body abnormalities ($r = 0.32$; $P = 0.037$).

Follow-up monitoring—Eighteen of 20 Doberman Pinschers and 9 of 17 Foxhounds were available for physical and complete neurologic examinations between 16 and 18 months after the MRI examination performed during the study. These examinations revealed no abnormalities. The owner of 4 other Foxhounds was available for a telephone interview 9 months after the MRI examinations performed during the study. According to that owner, the dogs were clinically normal. The remaining 2 Doberman Pinschers and 4 Foxhounds died of reasons unrelated to this study. According to the owners, these 6 dogs never had any clinical signs that were suggestive of a cervical myelopathy. None of these 6 dogs was available for postmortem examination.

Discussion

In the study reported here, the clinical relevance of cervical abnormalities identified by use of MRI was assessed by evaluating the range and frequency of findings in 2 groups of large-breed dogs. In another study,[8] investigators evaluated cervical images obtained via MRI in 16 clinically normal Doberman Pinschers. In that study, a surprisingly high frequency of abnormalities was detected, with 12 dogs having disk degeneration and 4 dogs having spinal cord compression. Because only 3 of the clinically normal dogs in that study[8] were > 6 years old and a specific breed with a high incidence of abnormalities in the cervical vertebral column was investigated, difficulties remain in extrapolating these data to other breeds and age categories. For these reasons, the dogs of our study were assigned to 2 age categories and, in addition, a breed with similar body conformation to that of Doberman Pinschers but no known predisposition to abnormalities of the cervical vertebral column was investigated. Analysis of results of the study reported here also indicated a surprisingly high frequency of abnormalities on MRI examinations of the clinically normal dogs. Although disk degeneration and partial compression of the ventral or dorsal portion of the subarachnoid space are not expected to complicate the clinical evaluation of MRI examinations, abnormalities of greater severity (such as spinal cord compression) have the potential to cause false-positive clinical interpretations.

In 28 of 37 (76%) dogs, some degree of intervertebral disk degeneration was detected, with complete disk degeneration in half of these dogs. Disk-associated compression of the spinal cord with deviation or distortion of the spinal cord was detected in 11 (30%) dogs, with multiple sites of spinal cord compression in 4 of these dogs. This incidence is somewhat higher than that reported in another study.[8] This difference can probably be attributed to the larger proportion of older dogs in the study reported here. This hypothesis is supported by the fact that intervertebral disk degeneration and disk-associated compression of the spinal cord were significantly associated with the higher age category. This is in agreement with results of studies[9–13] in humans in which age-related degenerative disk disease and compression of the cervical spinal cord in asymptomatic patients were reported. Only 3 of 37 (8%) dogs in the study reported here had compression of the dorsal portion of the spinal cord. Compression of the dorsal portion of the spinal cord can be caused by hypertrophy of the ligamentum flavum, hypertrophy of the articular facets, or bony laminar malformations.[17] Because none of the dogs that died was available for postmortem examination, we can only hypothesize with regard to the exact nature of this finding. Be-

cause examination of images obtained by use of MRI for the transverse and dorsal planes did not reveal any abnormalities of the articular facets or laminar malformations, compressions of the dorsal portion of the spinal cord or subarachnoid space were attributed to varying degrees of hypertrophy of the ligamentum flavum. The clinical importance of this radiologic finding is unclear, although some authors believe it has clinical relevance.[18] Also in agreement with results of studies[9–13] in humans, intervertebral disk degeneration and spinal cord compressions in the dogs of the present study were significantly associated with the location of the assessed intervertebral disk space, with the more caudally located intervertebral disk spaces (eg, C5-6 and C6-7) being more severely affected. This is of major importance because several large-breed dogs are predisposed to neurologic syndromes affecting the caudal portion of the cervical region.[17,19] The high frequency of these findings can pose difficulties with regard to the judgment of clinical importance of abnormalities detected during MRI examinations. A possible explanation why the more caudally located intervertebral disk spaces are more frequently affected could be the difference between large- and small-breed dogs with regard to the shape of the articular facets in the caudal portion of the cervical region.[20] Large-breed dogs have a significantly higher incidence of concave articular facets in the caudal portion of the cervical vertebral column, compared with the incidence for small-breed dogs.[20] These concave-shaped articular facets facilitate axial rotational motion.[20,21] Axial rotational motion is considered to be the main force (more so than axial compression) that leads to intervertebral disk degeneration in nonchondrodystrophic dogs, with subsequent protrusion of the outer annulus fibrosus.[22] Doberman Pinschers and male animals are considered to be predisposed to develop degenerative neurologic syndromes affecting the caudal portion of the cervical region.[16,17,19] In the study reported here, intervertebral disk degeneration and spinal cord compression were not significantly affected by breed or sex. Only vertebral body abnormalities were associated with the Doberman Pinscher breed. These abnormalities were characterized in each affected dog as a flattening of the cranioventral border of the vertebral body. Vertebral body abnormalities were detected in 7 of 20 (35%) Doberman Pinschers. This is in agreement with results of another study[23] in which a third of the Doberman Pinschers had abnormally shaped vertebrae in the caudal portion of the cervical region before 16 weeks of age. The relationship between these vertebral abnormalities and the subsequent development of cervical myelopathy is unclear. Because the incidence of vertebral abnormalities was not associated with the higher age category in these clinically normal dogs, it can be suggested that these abnormalities are not necessarily associated with the development of clinical signs in older dogs.

In 2 of 37 (5%) dogs, a hyperintense intramedullary signal change was detected on T2-weighted images. Uncertainty exists about the diagnostic and prognostic value of this finding. Hyperintense intramedullary signal changes are considered to be a nonspecific finding.[24] They probably reflect a wide spectrum of reversible and irreversible changes of the spinal cord parenchyma and may indicate edema, inflammation, vascular ischemia, gliosis, or myelomalacia.[25] It was suggested that this finding could be of important diagnostic value to differentiate between clinically affected and clinically normal dogs.[8] However, studies[14,15] in humans have described hyperintense signal changes in asymptomatic people. Analysis of results of one of those studies[15] suggested that this hyperintense signal significantly predicted the progression from asymptomatic to clinically relevant spinal cord compressions over time. However, the 2 dogs with a hyperintense intramedullary signal in the present study remained clinically normal 18 months after the MRI examination.

Several significant correlations were detected between the assessed variables. The highest correlation existed between intervertebral disk degeneration and disk-associated compression of the spinal cord. This finding is not unexpected and is in agreement with findings in a study[12] in humans. It indicates that a degenerated disk will be more likely to cause spinal cord compression, compared with the likelihood that a nondegenerated disk will cause spinal cord compression.

It is important to emphasize that only 2 breeds were investigated in this study. These 2 breeds are not representative of the entire canine population, and it is possible that small-breed dogs would have another spectrum, frequency, and distribution of abnormalities.[26] The selected breeds only represented dogs with a similar body conformation with and without a known predisposition for neurologic syndromes that involve the caudal portion of the cervical region.

Analysis of the results of this study indicated that a wide variety of abnormalities evident during MRI examinations of the cervical region may not be clinically relevant in Doberman Pinschers and Foxhounds and that these abnormalities are commonly detected in the caudal portion of the cervical region of these breeds. This study further suggested that such lesions are part of the typical (or at least common) spinal cord degeneration associated with the aging process in dogs. Therefore, caution should be used when attributing clinical signs to structural changes detected during MRI examinations. This is of particular importance for the caudal portion of the cervical region of large-breed dogs. Studies are necessary to determine the prevalence of false-positive interpretations for MRI examinations of the cervical spinal cord in clinically unaffected dogs and to investigate the use and development of diagnostic tools to differentiate between clinically relevant and clinically irrelevant spinal cord compressions detected during MRI examinations.

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