Association between various physical factors and acute thoracolumbar intervertebral disk extrusion or protrusion in Dachshunds

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Objective—To determine whether body weight, body condition score, or various body dimensions were associated with acute thoracolumbar intervertebral disk extrusion or protrusion and whether any of these factors were associated with severity of clinical signs in Dachshunds.

Design—Cross-sectional clinical study.

Animals—76 Dachshunds with (n = 39) or without (n = 36) acute thoracolumbar intervertebral disk extrusion or protrusion.

Procedures—Signalment, various body measurements, body weight, body condition score, and spinal cord injury grade were recorded at the time of initial examination.

Results—Mean T1-S1 distance and median tuber calcaneus–to–patellar tendon (TC-PT) distance were significantly shorter in affected than in unaffected dogs. A 1-cm decrease in T1-S1 distance was associated with a 2.1-times greater odds of being affected, and a 1-cm decrease in TC-PT distance was associated with an 11.1-times greater odds of being affected. Results of multivariable logistic regression also indicated that affected dogs were taller at the withers and had a larger pelvic circumference than unaffected dogs, after adjusting for other body measurements. Results of ordinal logistic regression indicated that longer T1-S1 distance, taller height at the withers, and smaller pelvic circumference were associated with more severe spinal cord injury.

Conclusions and Clinical Relevance—Results suggest that certain body dimensions may be associated with acute thoracolumbar intervertebral disk extrusion or protrusion in Dachshunds and, in affected dogs, with severity of neurologic dysfunction. (J Am Vet Med Assoc 2006;229:370–375)

Thoracolumbar IVDD is an important disease in dogs, in that intervertebral disk extrusion or protrusion can potentially lead to paraspinal hyperesthesia, urinary incontinence, paraplegia, or long-term disability. Among breeds of dog, the Dachshund is the most frequently affected by IVDD, with 19% to 24% of Dachshunds expected to develop clinical signs of thoracolumbar IVDD during their lifetimes.1,2 In addition, most dogs with loss of deep nociception secondary to disk extrusion or protrusion are said to develop a recurrence of clinical signs after surgery that are dogs of other breeds.3,4 A study3 of the pedigrees of Dachshunds with IVDD suggested that the condition has an autosomal polygenic heritance pattern and may be associated with coat type. In that study, however, affected dogs were identified by participating breeders and were not necessarily examined by veterinarians, so it is unclear whether all animals were appropriately classified. Other studies4-12 have shown that the risk of disk calcification, a marker of chondroid degeneration, may be associated with hair coat type and parentage in Dachshunds. Premature senescence of chondrocytes in the intervertebral disks undoubtedly plays a large role in the high incidence of IVDD in Dachshunds, and chondroid degeneration of the intervertebral disks may be histologically apparent by as early as 2 months of age in Dachshunds.5,13

Body weight, body condition score, and various body dimensions do not seem to alter the risk of intervertebral disk calcification in Dachshunds.5 However, because disk calcification and degeneration are predominantly a result of inherent chondrocyte abnormalities, biomechanical stress may not play a large role in their development. Thus, it is not surprising that disk calcification is relatively evenly distributed within the vertebral column in dogs.14 In contrast, disk extrusion tends to occur at high-motion sites, such as the thoracolumbar junction,15 suggesting that biomechanical factors may play a role in extrusion or protrusion of degenerated disks.

Because biomechanical forces on the intervertebral disks relate, at least in part, to body morphometry, it seems possible that variations in body morphometry might alter the frequency of intervertebral disk extrusion or protrusion in Dachshunds.16 To our knowledge, however, the physical characteristics of Dachshunds with clinical signs of thoracolumbar intervertebral disk extrusion or protrusion have not been compared with characteristics of unaffected dogs. The purposes of the study reported here, therefore, were to determine whether body weight, body condition score, or various body dimensions were associated with acute thoracolumbar intervertebral disk extrusion or protrusion in Dachshunds and to determine, in affected dogs, whether any of these factors were associated with severity of clinical signs.

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ABBREVIATIONS

IVDD Intervertebral disk disease

Dachshunds, and Dachshunds are more likely to develop a recurrence of clinical signs after surgery than are dogs of other breeds.1,2 A study3 of the pedigrees of Dachshunds with IVDD suggested that the condition has an autosomal polygenic heritance pattern and may be associated with coat type. In that study, however, affected dogs were identified by participating breeders and were not necessarily examined by veterinarians, so it is unclear whether all animals were appropriately classified. Other studies4-12 have shown that the risk of disk calcification, a marker of chondroid degeneration, may be associated with hair coat type and parentage in Dachshunds. Premature senescence of chondrocytes in the intervertebral disks undoubtedly plays a large role in the high incidence of IVDD in Dachshunds, and chondroid degeneration of the intervertebral disks may be histologically apparent by as early as 2 months of age in Dachshunds.5,13

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Because biomechanical forces on the intervertebral disks relate, at least in part, to body morphometry, it seems possible that variations in body morphometry might alter the frequency of intervertebral disk extrusion or protrusion in Dachshunds.16 To our knowledge, however, the physical characteristics of Dachshunds with clinical signs of thoracolumbar intervertebral disk extrusion or protrusion have not been compared with characteristics of unaffected dogs. The purposes of the study reported here, therefore, were to determine whether body weight, body condition score, or various body dimensions were associated with acute thoracolumbar intervertebral disk extrusion or protrusion in Dachshunds and to determine, in affected dogs, whether any of these factors were associated with severity of clinical signs.
Materials and Methods

Patient selection—Client-owned Dachshunds examined at the Texas A&M University College of Veterinary Medicine between September 2005 and February 2006 were prospectively enrolled in the study. Two groups of dogs were established: neurologically normal dogs (unaffected) and dogs with acute thoracolumbar intervertebral disk extrusion or protrusion (affected). Dachshunds were eligible for inclusion in the unaffected group if they were being examined because of any condition other than neurologic disease or for health maintenance purposes and were ≥ 1 year old. In addition, dogs were included in this group only if results of a neurologic examination were normal and the owner indicated that the dog did not have any history of paraspinal hyperesthesia, ataxia, or paraparesis. Dachshunds were eligible for inclusion in the affected group if they were ≥ 1 year old and had a history of neurologic dysfunction with an acute onset (≤ 7 days) of clinical signs. In addition, dogs were included in this group only if results of a neurologic examination were consistent with a diagnosis of thoracolumbar intervertebral disk (ie, T3 through L7) extrusion or protrusion. For dogs in this group that underwent surgery, the diagnosis was typically made on the basis of results of myelography or computed tomography and confirmed at the time of surgery. For dogs in this group that were euthanized, the diagnosis was confirmed at necropsy. For the remaining dogs in this group, a presumptive diagnosis was made on the basis of history and results of neurologic examination.

Study procedures—The study protocol was approved by the Texas A&M University College of Veterinary Medicine Clinical Research Review Committee. Owners of all dogs enrolled in the study provided informed consent.

For all dogs enrolled in the study, age, sex, hair coat type (ie, short-haired, long-haired, or wire-haired), and body weight were recorded. A body condition score ranging from 1 to 9 was assigned by 1 of 3 authors (JML, SCK, or BFH). For affected dogs, severity of neurologic dysfunction at the time of initial examination was graded by 1 of 3 authors (JML, SCK, or BFH). A modified Frankel spinal cord injury scale was used to assign these grades, with grade 0 defined as paraplegia with no superficial nociception, grade 1 defined as paraplegia with no superficial nociception, grade 2 defined as paraplegia with nociception, grade 3 defined as nonambulatory paraparesis (grade 3a if weight bearing and grade 3b if non–weight bearing), grade 4 defined as ambulatory paraparesis and ataxia, and grade 5 defined as spinal hyperesthesia only. For all dogs enrolled in the study, various body dimensions were measured at the time of initial examination. Body dimensions that were measured were based on those described by previous investigators. In all Dachshunds, measurements were performed in a standing weight-bearing position. For those dogs that were nonambulatory, manual support was used to maintain an approximate similar position. All measurements were obtained by 1 of 3 authors (JML, SCK, or BFH) or by a veterinary technician with a tape measure and were recorded to the nearest half centimeter. Dimensions that were recorded included height at the withers, maximum thoracic girth, maximum abdominal girth, pelvic circumference, distance from the tuber calcaneus to the midpoint of the patellar tendon (TC-PT distance), and distance from T1 to S1 (T1-S1 distance). Height at the withers was measured as the vertical distance between the ground and the most dorsal extent of the scapulae. Maximum thoracic girth was recorded by placing the tape measure around the thorax and recording the largest circumference. Maximum abdominal girth was measured as the circumference of the abdomen at the level of the umbilicus. Pelvic circumference was recorded as the circumference of the most caudal portion of the abdomen, just cranial to the wings of the ilia. The distance from the tuber calcaneus to the midpoint of the patellar tendon was measured as the distance between the proximocaudal point of the tuber calcaneus and the midpoint of the patellar tendon. The distance from T1 to S1 was recorded as the distance between the cranial edge of the T1 spinous process and the cranial edge of the sacral crest.

To determine the reproducibility of body measurements, all 4 individuals who performed measurements on dogs enrolled in the study performed the same measurements on 5 Dachshunds not otherwise included in the study. For each of the 6 body dimension measurements, the coefficient of variation was then calculated as the SD of measurements obtained by the 4 individuals divided by the mean value for that measurement.

Statistical analysis—Descriptive statistics were calculated for body weight, body condition scores, and all body dimensions. Data were assessed for normality by examination of histograms and use of the Anderson-Darling test. Body measurements were compared between unaffected and affected groups by means of the independent Student t test if data were normally distributed or the Mann-Whitney U test if data were not normally distributed. The descriptive analysis was performed independently for males and females to investigate confounding by sex.

Multivariable logistic regression was used to determine whether body dimension measurements could be used to predict study group. In addition, for affected dogs, multivariable ordinal logistic regression was used to determine whether body dimension measurements could be used to predict modified Frankel spinal cord injury grade and multivariable logistic regression was used to determine whether body dimension measurements could be used to predict whether dogs were ambulatory at the time of initial examination (injury grade 4 or 5) or not (injury grade 0 through 3).

For logistic regression models, continuous variables were categorized on the basis of quartiles to determine whether they satisfied the assumption of being linear in the natural logarithm of the odds. Variables that satisfied this assumption were included in the multivariable logistic regression models as continuous variables. Variables that did not satisfy this assumption were included as categorical variables. Adjacent quartile categories were combined when the P value for the Wald statistic was > 0.05. For example, the 25th, 50th, and 75th percentiles for height at the withers were 20.5, 22, and 24 cm (20.5 cm or > 22 to 24 cm, and > 24 cm) were compared with the lowest category (< 20.5 cm) as the referent. However, if the 20.5- to 22-cm category was not significant, then this category was combined with the lowest category, and the remaining 2 categories were compared with this new category as the referent. For the ordinal logistic regression model, all variables were included as continuous variables because the small number of affected dogs limited the ability to fit a complete model when variables were categorized. Multivariable models were built with a backwards, stepwise procedure starting with a complete model containing the main effects only. Variables were removed sequentially on the basis of a Wald P value ≤ 0.20. Once main effects were analyzed, all possible 2-way interactions for variables remaining in the model were added. In the multivariable binary logistic regression models, the significance of these 2-way interactions was tested in a single block by use of the likelihood ratio test. In the multivariable ordinal logistic regression model, the backwards, stepwise procedure was continued with a P value threshold of ≤ 0.05. Stepwise procedures were performed manually rather than by use of automated processes. The fit of final binary logistic
regression models was assessed by means of the Hosmer-Lemeshow test. The fit of the final ordinal logistic regression model was assessed by means of the Pearson χ² test. Sex was added to the final logistic regression models to determine whether it was an important confounder of measured associations, with a 20% change between adjusted and unadjusted odds ratios used as the criterion for confounding. All analyses were performed with standard software. Values of P < 0.05 were considered significant.

Results

Thirty-six unaffected Dachshunds and 39 Dachshunds with acute thoracolumbar intervertebral disk extrusion or protrusion were included in the study. All dogs examined during the study period that met the inclusion criteria were enrolled in the study. Of the 39 affected dogs, 31 were managed surgically, 7 were managed medically, and 1 was euthanized.

The unaffected dogs consisted of 2 sexually intact females, 21 spayed females, 4 sexually intact males, and 9 castrated males. The affected dogs consisted of 2 sexually intact females, 15 spayed females, 7 sexually intact males, and 15 castrated males. There were 30 short-haired Dachshunds, 5 long-haired Dachshunds, and 1 wire-haired Dachshund in the unaffected group and 37 short-haired Dachshunds, 1 long-haired Dachshund, and 1 wire-haired Dachshund in the affected group. Coefficients of variation for the 4 individuals who performed body dimension measurements were 3.4%, 2.1%, 3.4%, 3.0%, 4.8%, and 6.9% for height at the withers, maximum thoracic girth, maximum abdominal girth, pelvic circumference, T1-S1 distance, and TC-PT distance, respectively. Mean T1-S1 distance and median TC-PT distance were significantly shorter in affected than in unaffected dogs (Table 1). These measures were also smaller in affected dogs when comparisons were made independently for males and females.

Both T1-S1 distance and TC-PT distance were retained in the multivariable logistic regression model for predicting study group (Table 2). As T1-S1 distance increased, the odds that a dog would be affected decreased (ie, after adjustment for other variables, a 1-cm increase in T1-S1 distance was associated with a 0.48-times lower odds of being affected), or alternatively, as T1-S1 distance decreased, the odds that a dog would be affected increased (ie, after adjustment for other variables, a 1-cm decrease in T1-S1 distance was associated with a 2.1-times [1/0.48] greater odds of being affected). Similarly, as TC-PT distance increased, the odds that a dog would be affected decreased (ie, after adjustment for other variables, a 1-cm increase in TC-PT distance was associated with a 0.09-times lower odds of being affected), or alternatively, as TC-PT distance decreased, the odds that a dog would be affected increased (ie, after adjustment for other variables, a 1-cm decrease in TC-PT distance was associated with a 11.9-times [1/0.09] greater odds of being affected).

Table 1—Age, body weight, body condition score, and body dimensions for 39 Dachshunds with acute thoracolumbar intervertebral disk extrusion or protrusion (affected) and 36 clinically normal Dachshunds (unaffected).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Affected</th>
<th></th>
<th></th>
<th>Unaffected</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>5.6</td>
<td>5.0</td>
<td>2.0–13.0</td>
<td>5.6</td>
<td>5.0</td>
<td>1.0–17.0</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>6.7</td>
<td>6.5</td>
<td>3.2–12.3</td>
<td>7.5</td>
<td>6.8</td>
<td>3.9–15.9</td>
</tr>
<tr>
<td>Body condition score</td>
<td>5.8</td>
<td>5.0</td>
<td>3.5–9.0</td>
<td>5.9</td>
<td>6.0</td>
<td>3.0–9.0</td>
</tr>
<tr>
<td>Height at withers (cm)</td>
<td>22.3</td>
<td>23.0</td>
<td>17.5–28.5</td>
<td>22.4</td>
<td>22.0</td>
<td>18.0–28.0</td>
</tr>
<tr>
<td>Maximum thoracic girth (cm)</td>
<td>45.6</td>
<td>44.5</td>
<td>35.0–60.0</td>
<td>46.4</td>
<td>46.0</td>
<td>37.0–84.0</td>
</tr>
<tr>
<td>T1-S1 distance (cm)</td>
<td>27.8</td>
<td>28.0</td>
<td>22.0–32.0</td>
<td>30.6*</td>
<td>31.0</td>
<td>25.0–39.0</td>
</tr>
<tr>
<td>Maximum abdominal girth (cm)</td>
<td>40.6</td>
<td>40.5</td>
<td>27.0–56.0</td>
<td>42.3</td>
<td>41.0</td>
<td>29.5–72.0</td>
</tr>
<tr>
<td>Pelvic circumference (cm)</td>
<td>39.9</td>
<td>37.0</td>
<td>26.5–54.5</td>
<td>38.5</td>
<td>37.3</td>
<td>18.0–69.5</td>
</tr>
<tr>
<td>TC-PT distance (cm)</td>
<td>7.7</td>
<td>7.5</td>
<td>6.5–10.0</td>
<td>8.7</td>
<td>8.5</td>
<td>7.0–10.5</td>
</tr>
</tbody>
</table>

*Values were significantly (Student t test, P < 0.05) different. †Values were significantly (Mann-Whitney U test, P < 0.05) different. To convert weight in kg to weight in lb, multiply by 2.2.

TC-PT distance = Distance from the tuber calcaneus to the midpoint of the patellar tendon.

Table 2—Results of multivariable logistic regression analysis of possible associations between group status (affected vs unaffected) and various body dimension measurements for 39 Dachshunds with acute thoracolumbar intervertebral disk extrusion or protrusion and 36 clinically normal Dachshunds.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter estimate</th>
<th>Odds ratio (95% confidence interval)</th>
<th>Wald P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1-S1 distance (cm)*</td>
<td>–0.73</td>
<td>0.48 (0.39–0.76)</td>
<td>0.002</td>
</tr>
<tr>
<td>TC-PT distance (cm)*</td>
<td>–2.36</td>
<td>0.09 (0.02–0.37)</td>
<td>0.001</td>
</tr>
<tr>
<td>Pelvic circumference (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18–41 cm</td>
<td>Referent</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>&gt; 41–69.5 cm</td>
<td>3.35</td>
<td>28.5 (3.15–258)</td>
<td>0.003</td>
</tr>
<tr>
<td>Height at withers (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 17.0–22.0 cm</td>
<td>Referent</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>&gt; 22.0–24.0 cm</td>
<td>2.68</td>
<td>14.6 (1.80–119)</td>
<td>0.012</td>
</tr>
<tr>
<td>&gt; 24.0–28.5 cm</td>
<td>4.45</td>
<td>86.0 (4.50–1,643)</td>
<td>0.003</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1.12</td>
<td>3.06 (0.61–15.2)</td>
<td>0.173</td>
</tr>
<tr>
<td>Male</td>
<td>Referent</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

*Odds ratio represents odds associated with a 1-cm increase in distance.

NA = Not applicable.

See Table 1 for remainder of key.
increased (ie, after adjustment for other variables, a 1-cm decrease in TC-PT distance was associated with an 11.1-times [1/0.09] greater odds of being affected).

Other variables retained in the multivariable logistic regression model for predicting study group were height at the withers, pelvic circumference, and sex. After adjusting for other variables, taller dogs were more likely to be affected, compared with shorter dogs, and dogs with a larger pelvic circumference were more likely to be affected, compared with dogs with a smaller pelvic circumference. Although not significant, male dogs were 3.1 times as likely to be affected as females, after adjusting for other variables. No 2-way interaction terms or other main effects were significant, and the final model was found to fit the data (Hosmer-Lemeshow P value, 0.836).

Ordinal logistic regression revealed significant associations between body dimension measurements and spinal cord injury grade at the time of the initial examination (Table 3); the overall model fit was adequate (Pearson $\chi^2$ P value, 0.07). Pelvic circumference, height at the withers, and T1-S1 distance were retained in the model, along with the interaction between pelvic circumference and height at the withers and the interaction between height at the withers and T1-S1 distance. Because of the interaction terms, odds ratios cannot be interpreted without first specifying specific measurement values. As an example, a 1-cm increase in height at the withers for dogs that had a T1-S1 distance of 30 cm and a pelvic circumference of 40 cm was associated with a 1.14-times greater odds of being more severely affected (ie, a 1-unit decrease in spinal cord injury grade). However, a similar 1-cm increase in height for dogs that had a T1-S1 distance of 25 cm and a pelvic circumference of 30 cm was associated with a 0.05-times greater odds of being more severely affected. In general, larger pelvic circumference was associated with higher spinal cord injury grades (ie, less severe clinical signs). In contrast, larger height at the withers and longer T1-S1 distance were associated with lower grades (ie, more severe clinical signs). Neither TC-PT distance nor sex was retained in the final model.

No body dimension measurements were found to be statistically associated with whether dogs were ambulatory at the time of initial examination.

**Discussion**

Results of the present study suggest that certain body dimensions were associated with acute thoracolumbar intervertebral disk extrusion or protrusion in Dachshunds and, in affected Dachshunds, with the severity of clinical signs. In particular, T1-S1 distance and TC-PT distance were significantly shorter in affected dogs than in clinically normal Dachshunds, and multivariable logistic regression indicated that these 2 variables, along with height at the withers and pelvic circumference, were significantly associated with affected dogs.

We speculate that these particular variables were associated with acute thoracolumbar disk extrusion or protrusion in the present study either because they were associated with alterations in vertebral column biomechanics or serve as markers for the degree of chondrodystrophy. In Dachshunds, as in other chondrodystrophic dogs, disk degeneration is largely a result of inherent chondrocyte senescence. Degenerated disks are less able to resist compressive and torsional loading and, therefore, may undergo acute extrusion or protrusion fairly readily. Thus, it is possible that body dimensions were different in affected and unaffected dogs in the present study because these particular dimensions reflect differences in biomechanical loading of the vertebral column that predispose certain dogs to disk extrusion or protrusion. To our knowledge, no studies examining how body shape affects vertebral column biomechanics in dogs have been published, and drawing mechanistic conclusions from the limited human research that is available is difficult because of differences in gait between humans and dogs. It is conceivable, however, that dogs of different dimensions could have differences in vertebral column torsional, compressive and shear loads, which have been experimentally linked to disk degeneration, annular tearing, disk protrusion, and disk extrusion. Surprisingly, however, body weight and body condition score, both
of which could also be expected to be related to vertebral column biomechanics, were not found to be associated with study group (affected vs nonaffected) in the present study.

Alternatively, certain body dimension measurements in the present study may have been markers for the degree of chondrodystrophy in individual dogs, with relative expression of chondrodystrophic traits affecting the development of intervertebral disk extrusion and protrusion. Shortening of the vertebral column, reduction of the length of the distal portions of the limbs, and disk degeneration are common in chondrodystrophic humans and dogs.22,26,27 It is conceivable that dogs with shorter T1-S1 and TC-PT distances might have more severe chondrocyte dysfunction, resulting in more severe disk degeneration and, ultimately, a relatively higher odds of intervertebral disk protrusion or extrusion. Dachshunds have also been shown to have higher spinal cord-to-vertebral canal ratios, compared with German Shepherd Dogs and dogs of other breeds, probably because of chondrodystrophic traits.8,22,26,29 and smaller Dachshunds might have even higher ratios than larger Dachshunds, with the result that smaller dogs would be less able to accommodate extrusions or protrusions.

In affected dogs in the present study, longer T1-S1 distance, taller height at the withers, and smaller pelvic circumference were associated with lower spinal cord injury grades (ie, more severe clinical signs), whereas body condition score, body weight, and TC-PT distance were not found to be significantly associated with severity of neurologic dysfunction in affected Dachshunds. It is unclear why longer T1-S1 distance and smaller pelvic circumference are associated with a lower odds of being affected, but with more severe spinal cord injury scores. Perhaps these differences reflect a relationship between morphometry, vertebral column biomechanics, and the various mechanisms leading to the development of spinal cord injury secondary to disk extrusion or protrusion. Vertebral column shape may be associated with severity of neurologic dysfunction in human patients with lumbar intervertebral disk protrusion and traumatic myelopathy.20,23,27,30,31 In a previous study,7 for instance, 55% of patients with severe neurologic dysfunction secondary to lumbar disk protrusion had vertebral canal measurements less than the fifth percentile for asymptomatic individuals.

Cross-sectional epidemiologic studies lack a time component. Therefore, it may be difficult to determine whether purported causes actually preceded development of the disease under study. However, this lack of information on temporality is not a problem for factors that do not change over time, such as sex. We believe that although body weight, body condition score, and girth could change in dogs with chronic disk herniation, such measurements would not likely have changed substantially after the time IVDD developed because only dogs with acute intervertebral disk extrusion or protrusion were included. Although width of the intervertebral disk can be reduced with disk extrusion, significant vertebral column shortening has not been recognized as a result of acute disk extrusion or protrusion in veterinary or human medicine, probably because intervertebral disks contribute only 8% to 17% of overall vertebral column length in most domestic species.8,20,22,29 In humans with certain chronic conditions associated with disk protrusion, such as senile thoracic kyphosis, vertebral column shape and length can be affected,13,35,36 but such changes are not typically recognized in dogs.

An important limitation of the present study is that all Dachshunds that were included were from Texas. Thus, it could be that the associations we found between certain body dimensions and intervertebral disk extrusion or protrusion apply only to the local population of this breed. A longitudinal study encompassing a more geographically diverse population is needed to definitively determine whether morphometric data are causally associated with acute thoracolumbar intervertebral disk extrusion or protrusion in Dachshunds.

References


Selected abstract for JAVMA readers from the American Journal of Veterinary Research

Evaluation of nonunion fractures in dogs by use of B-mode ultrasonography, power Doppler ultrasonography, radiography, and histologic examination

Marije Risselada et al

Objective—To investigate the use of ultrasonography to assess nonunion of fractures in dogs and to compare results of ultrasonography, radiography, and histologic examination.

Sample Population—8 nonunion fractures in 6 dogs (1 each in 5 dogs and 3 in 1 dog); dogs ranged from 7 to 94 months of age and weighed between 8 and 30 kg.

Procedures—Diagnostic assessment consisted of complete clinical and orthopedic examinations, radiography, B-mode (brightness mode) ultrasonography, and power Doppler ultrasonography. Biopsy samples were obtained during surgery for histologic examination. They were stained with H&E and immunolabeled by use of anti-CD31 antibodies. Correlations of power Doppler score, power Doppler vascularity of nonunion fractures during power Doppler ultrasonography was highly correlated with the number of vessels per hpf, where- as the correlation between the radiographic assessment and histologic evaluation was low.

Conclusions and Clinical Relevance—Radiographic prediction of the viability of nonunion fractures underestimated the histologically assessed vascularity of the tissue. Power Doppler ultrasonography provided a more accurate estimation of the viability of the tissue and therefore the necessity for debridement and autografts during revision surgery. (Am J Vet Res 2006;67:1354–1361)