

# Prevalence of cranial cruciate ligament rupture in a population of dogs with lameness previously attributed to hip dysplasia: 369 cases (1994–2003)

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**Objective**—To determine the prevalence of cranial cruciate ligament rupture (CCLR) in dogs with lameness previously attributed to canine hip dysplasia (CHD).

**Design**—Retrospective study.

**Animals**—369 client-owned dogs.

**Procedures**—Hospital medical records from 1994 to 2003 were reviewed for dogs in which the referring veterinarian had diagnosed hip dysplasia or hip pain. Dogs were designated as having hind limb lameness because of partial or complete CCLR or CHD.

**Results**—8% of dogs were sexually intact females, 43% were spayed females, 14% were sexually intact males, and 35% were castrated males. Mean age was 3.8 years (range, 3 months to 15 years). The most common breeds were the Labrador Retriever (21%), German Shepherd Dog (13%), and Golden Retriever (11%). The prevalence of CCLR as the cause of hind limb lameness was 32% (95% confidence interval, 27.2% to 36.8%). The distribution of CCLR among hind limbs was left (29%), right (28%), and bilateral (43%). Of 119 dogs with CCLR, 94% had concurrent radiographic signs of CHD, 92% had stifle joint effusion, and 81% had a cranial drawer sign.

**Conclusions and Clinical Relevance**—On the basis of the high prevalence of CCLR in dogs referred for lameness because of CHD, it is important to exclude other sources of stifle joint disease before making recommendations for treatment of CHD. (*J Am Vet Med Assoc* 2005;227:1109–1111)

**C**anine hip dysplasia (CHD) is the most common orthopedic disease diagnosed in large- to giant-breed dogs.<sup>1,2</sup> Although CHD is a common diagnosis, clinical signs may be absent in 76% to 86% of dogs with radiographic evidence of the disease.<sup>3b</sup> Nevertheless, examination of dogs with a history of hind limb lameness and supporting radiographic evidence of CHD may lead many practitioners to make a diagnosis of CHD and ascribe the lameness to CHD. Because many dogs with CHD have no associated clinical signs, other orthopedic diseases should be ruled out before attributing the lameness to CHD, especially when the degree of hind limb lameness has changed, acutely or insidiously.

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Cranial cruciate ligament rupture (CCLR) is also a common cause of hind limb lameness and is the most common cause of osteoarthritis in the stifle joint in dogs.<sup>4</sup> In a previous study,<sup>5</sup> degeneration of the cranial cruciate ligament and CCLR were observed in middle-aged to older dogs that were overweight. More recent studies<sup>6,8</sup> have revealed that CCLR may occur more frequently than was thought in younger, more active dogs.

Diagnosis of CHD and CCLR is made on the basis of signalment, history, physical examination findings, and results of imaging studies. Because CHD and CCLR both cause hind limb lameness, it is possible for CHD to be incorrectly diagnosed as the cause of lameness if a thorough physical examination is not performed. We hypothesized that many dogs referred to the teaching hospital for evaluation of lameness that was thought to result from CHD actually had CCLR. The goal of the study was to determine the prevalence of the dogs that were examined for CHD or hip pain but in which CCLR was diagnosed as the primary cause of hind limb lameness or pain.

## Criteria for Selection of Cases

Medical records of all dogs examined at the Washington State University Veterinary Teaching Hospital (WSU-VTH) from 1994 to 2003, in which a diagnosis of CHD or hip pain had been made by the referring veterinarian, were reviewed. Inclusion criteria included that there was a complete medical record available for review. Dogs were excluded if the complaint involved neurologic dysfunction, results of examination did not specify a specific joint, or the medical record was otherwise incomplete.

## Procedures

Data collected from records included initial complaint, age, breed, sex, physical examination findings (pertaining to palpation and manipulation of the coxofemoral and stifle joints), radiographic interpretation of images of the coxofemoral and stifle joints, surgical findings, and treatment. Dogs were assigned to 1 of 2 groups on the basis of physical examination and radiographic findings. Group 1 included dogs with or without clinical or radiographic signs of CHD, with lameness that was caused by partial or complete CCLR as diagnosed by WSU-VTH clinicians on the basis of palpation (ie, detection of a cranial drawer sign with or without cranial tibial thrust, stifle joint effusion, or focal thickening of the joint capsule and hypertrophy of the medial collateral ligament [medial buttress]), radiographic findings (ie, stifle joint effusion or osteophyte development), or inspection of the CCL during surgery.

Dogs in group 2 had no indication of stifle ligament injury but had clinical signs caused by CHD, including signs of discomfort during hip flexion, extension, abduction, or other manipulation and radiographic findings (ie, osteophyte development, osseous remodeling, subchondral bone sclerosis, or subluxation of the coxofemoral joint).

Data were analyzed by use of descriptive statistics.<sup>a</sup> Ninety-five percent **confidence intervals** (CIs) were determined by use of the binomial distribution. Comparisons of sex and age between groups were made with a  $\chi^2$  and unpaired *t* test, respectively. Values of  $P \leq 0.05$  were considered significant.

## Results

Three hundred sixty-nine dogs met the inclusion criteria. In group 1, there were 7 (6%) sexually intact females, 57 (48%) spayed females, 14 (12%) sexually intact males, and 41 (35%) castrated males. In group 2, there were 21 (8%) sexually intact females, 101 (40%) spayed females, 39 (16%) sexually intact males, and 89 (36%) castrated males; the distributions of sex between the groups were not significantly different ( $P = 0.46$ ). Mean age distributions between the groups were significantly ( $P < 0.001$ ) different. Mean age for dogs in group 1 was 5.3 years (range, 0.75 to 15 years; SD, 3.0 years), whereas mean age for dogs in group 2 was 3.1 years (range, 0.25 to 14 years; SD, 2.9 years). The most common breeds represented were the Labrador Retriever (79/369 [21%] dogs), German Shepherd Dog (48/369 [13%]), Golden Retriever (39/369 [11%]), and mixed breeds (60/369 [16%]). Of 369 dogs, 361 (98%) had coxofemoral radiographs; of those dogs, 345 (96%) had radiographic changes consistent with CHD.

**Group 1**—There were 119 dogs with 165 stifle joints that were affected with complete or partial CCLR. Of 165 stifle joints with CCLR, 134 (81%) had a cranial drawer sign or cranial tibial thrust. A medial buttress was detected in 100 (84%) dogs.

Results of radiographic imaging of the stifle joint were available for 72 (61%) dogs. Of those, 71 (99%) had radiographic changes that were compatible with osteoarthritis of the stifle joint. Results of evaluation of stifle joint effusion with radiographs or palpation were available for 96 dogs; 88 (92%) had effusion and 8 (8%) had no radiographic or palpable evidence of effusion.

Results of radiographic examination of the coxofemoral joints were available for 111 of 119 dogs with CCLR. Concurrent radiographic changes considered to be diagnostic for bilateral coxofemoral joint osteoarthritis were detected in 104 (94%) of the dogs with CCLR.

The prevalence of CCLR as the inciting cause of hind limb lameness was 32% (95% CI, 27.2% to 36.8%). Dogs of the Labrador Retriever breed had the highest prevalence of CCLR in this group, with 26 of 119 (22%) having CCLR as the inciting cause of hind limb lameness. The distribution of affected limbs among designations of left unilateral, right unilateral, or bilateral CCLR was 29%, 28%, and 43%, respectively.

**Group 2**—Of 250 dogs, 243 (97%) had radiographic changes consistent with osteoarthritis, with or without subluxation of the coxofemoral joint. Three

dogs in the group had radiographic signs of CHD, but 1 dog had a medial luxation of the patella, 1 dog had intervertebral disc disease, and 1 dog had bilateral elbow joint dysplasia. Of the remaining 247 dogs, 161 (65%) were managed conservatively with medical treatment (eg, weight reduction, exercise modification, administration of nonsteroidal anti-inflammatory drugs, and oral administration of glucosamine and chondroitin sulfate). Eighty-five (34%) dogs received surgical treatment.

## Discussion

Results support our supposition that many dogs referred to the VTH for evaluation of hind limb lameness thought to be caused by CHD actually had CCLR. The practice of making a diagnosis of CHD on the basis of radiographic changes alone may have resulted in CHD being cited as a cause of hind limb lameness more frequently than was true. Although CHD is reportedly the most common orthopedic disease diagnosed in large- to giant-breed dogs, most dogs with CHD have no clinical signs.<sup>3b</sup> Many dogs in our study were lame because of CCLR, not CHD.

One hundred sixty-one of 247 (65%) dogs with clinical signs of hind limb lameness or pain that were ascribable exclusively to CHD were managed nonsurgically. Our data corroborate findings from previous studies<sup>3b</sup> indicating that many dogs with even severe coxofemoral osteoarthritis from CHD can be successfully treated with medical management alone.

Studies<sup>6,8</sup> reveal that CCLR is detected more commonly in younger animals (< 4 years of age) than was previously thought. A peak age range of 6 to 10 years has been reported.<sup>7,9</sup> The mean age of dogs with CCLR in our dogs was 5.1 years.

Among dogs with CCLR, spayed females (48%) were most likely to be affected with CCLR, followed by castrated males (35%), sexually intact males (12%), and sexually intact females (6%). The number of sexually intact male and female dogs with CCLR in our study was slightly higher than previously reported numbers.<sup>7</sup> Another study<sup>6</sup> revealed that there was a higher prevalence of CCLR in sexually intact male and female dogs. The discrepancy between these findings likely represents the difference in pet populations at the respective institutions; for example, the neutering of pets is not as regular a practice in Europe as it is in the United States. Moreover, results of earlier reports<sup>8,9</sup> suggested that neutering does not predispose dogs to developing CCLR.

In our study, 21% of the dogs with CCLR were Labrador Retrievers, a value that is higher than the proportion (15%) of Labrador Retrievers in the population of dogs examined annually at WSU-VTH. The prevalence of CCLR in Labrador Retrievers in our study was comparable to figures cited for the breed in other studies.<sup>8,9</sup>

Physical examination is an integral part of diagnosing CCLR in dogs. The detection of a medial buttress on the medial aspect of the stifle joint is a common finding. Depending on the length of time between the CCLR injury and examination of the dog, a medial buttress may or may not be present. In our study, 100 of 119 (84%) dogs had a palpable medial buttress. The fact

that 43% of the dogs in group 1 had bilateral CCLR may have confounded the ability of the referring practitioner to diagnose CCLR because in dogs with bilateral injury, there is no unaffected contralateral structure for comparison. Therefore, imaging techniques may be an important aid in diagnosing CCLR. Of dogs with radiographs of the stifle joint, 99% had radiographic findings of osteoarthritis that were compatible with CCLR (ie, joint effusion and periarticular osteophytes).

One side was not affected more frequently than the other in our dogs; the right (28%) and left (29%) stifle joints were equally affected, but bilateral disease (43%) was higher than has been previously reported.<sup>7</sup> The higher number of dogs with clinical signs similar to those of CHD but that had bilateral CCLR may explain why the dogs were referred for evaluation of lameness that was presumed to be caused by CHD and not cruciate ligament disease.

The differentiation of dogs that are lame because of CHD and that do not have CCLR from dogs that are lame because of unilateral or bilateral CCLR may be confounded by several factors, including stifle area symmetry, stifle joint instability, excitement level of the dog, and failure to thoroughly examine the structures of the hind limb during physical examination. Not only does palpation of bilaterally-affected dogs sometimes result, CCLR in the early stages may not have resulted in articular or extra-articular changes that can be detected by palpation. Instability of the stifle region may be a confounder by resulting in the absence of a distinct cranial drawer sign or cranial tibial thrust (tibial compression test). The dog's excitement level is important because apprehensive dogs may resist manipulation of the limb. When physical examination of the hind limbs is incomplete (eg, limited to extension of the hip), accurate localization of discomfort to a source between the hip and stifle joints can be difficult.

Canine hip dysplasia may be the most commonly diagnosed orthopedic disease, but it is possible that CCLR is the most common cause of hind limb lameness because most dogs with CHD have no clinical signs or moderate clinical signs that are managed medically. In this study, 119 of 369 (32%) dogs were lame as a result of CCLR. Of the remaining 250 dogs with CHD, only 85 (34%) were treated surgically and the rest were managed medically. Other investigators have concluded that the severity of osteoarthritis as seen on radiographs of the stifle or coxofemoral joints is not correlated with clinical limb function.<sup>3,10</sup> Therefore, radiographic signs of coxofemoral joint osteoarthritis do not necessarily rule out other causes of hind limb lameness.

The classification of cranial cruciate ligament injury into acute and degenerative categories has been discussed.<sup>5,6,11</sup> Other investigators<sup>8</sup> have proposed another classification for certain large-breed dogs that develop instability of the CCL and subsequent osteoarthritis at a

young age. Results of our study corroborate evidence from that study and suggest that greater awareness of CCLR by veterinarians will result in earlier and more accurate diagnosis of hind limb lameness in young large-breed dogs.

Limitations of our study were its retrospective nature and the fact that the study population may have been biased toward younger dogs because the initial diagnosis was CHD. There may also have been bias in that the study population consisted of dogs that had been taken to a veterinarian for surgical treatment. Multicenter prospective studies would yield additional information regarding the prevalence of CCLR injuries in dogs.

Because CCLR is a common cause of hind limb lameness and osteoarthritis in the stifle joint, careful palpation combined with radiographic examination is invaluable in distinguishing between CCLR and CHD as the cause of lameness. On the basis of our findings that 32% of dogs that were referred because of an initial diagnosis of CHD had CCLR, it is important that clinicians exclude other causes of stifle joint disease before making recommendations or initiating treatment for CHD, especially recommendations pertaining to surgery.

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