Arthroscopic evaluation of menisci in dogs with cranial cruciate ligament injuries: 100 cases (1999–2000)

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**Objective**—To determine prevalence of meniscal injuries by use of arthroscopic examination in dogs with cranial cruciate ligament (CCL) injuries.

**Design**—Retrospective study.

**Animals**—94 dogs with 100 injured CCLs.

**Procedure**—Record for 94 large dogs (> 20 kg [44 lb]) with 100 naturally occurring CCL injuries that were examined arthroscopically were reviewed. Pathologic findings in the CCL (complete or partial tears), prevalence and type of meniscal injuries, and periarticular osteophytes were recorded.

**Results**—77% of joints had tears of the lateral meniscus; most were a series of small radial tears of the cranial horn. Fifty-eight percent of joints had tears of the medial meniscus. Positive correlation between complete tears of the CCL and medial meniscal damage was found. No significant relationships were detected between periarticular osteophyte formation and meniscal injury, medial and lateral meniscal injury, or degree of CCL tear and lateral meniscal injury.

**Conclusions and Clinical Relevance**—There is a strong association between CCL injury and lateral and medial meniscal injuries in dogs. Clinical importance of lateral meniscal lesions is not known; a much higher percentage of dogs had such injuries than has been reported previously, possibly because of use of arthroscopy. 

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Injuries to the cranial cruciate ligament (CCL) are a common orthopedic problem seen in the stifle joint of dogs.1 The lameness and osteoarthritis secondary to these injuries are well documented.2–10 Meniscal injuries are common sequelae to these injuries and have been implicated in the lameness and degenerative changes that develop in affected dogs.11,12 The prevalence of reported meniscal injuries is 10 to 70% in dogs with CCL injuries and these injuries are almost exclusively confined to the medial menisci.13,14,16 These injuries most commonly involve the caudal horn and are frequently a longitudinal tear known as a bucket-handle tear.

The meniscal cartilages play several roles in proprioception.11,17,20,21 Only the thick peripheral portion of the meniscus has a vascular supply, and the thin avascular inner portion heals poorly.12,13,17,20

Arthroscopic surgery is the current standard of care for human knee joint surgery. The veterinary community has not yet fully adopted this modality, but there are several reports documenting its usefulness and ability to fully view the stifle joint in dogs, for debridement of CCL remnants, and for partial meniscectomy.14–19 Arthroscopic examination provides a minimally invasive means of critical inspection of the intra-articular ligamentous structures, the synovium, menisci, and articular cartilage. Because the structures are highly illuminated and greatly magnified in an aqueous environment, viewing is greatly improved over traditional arthrotomy. This permits improved diagnostic capability when evaluating fibrillated cartilage, synovial changes, smaller meniscal tears, and subtle partial tears and inflammatory changes of the cruciate ligaments. Treatment, including surgical management of the menisci, debridement of the torn cruciate ligaments, partial synovectomy, and surgical management of the articular cartilage, can be enhanced. The purpose of the study reported here was to determine the prevalence of arthroscopically detected meniscal injuries in dogs with CCL injuries.

**Criteria for Selection of Cases**

Medical records for 1999 to 2000 were reviewed for large dogs (> 20 kg [44 lb]) with arthroscopically confirmed CCL injuries. This weight limitation was imposed because of mechanical considerations regarding the size of the arthroscopic equipment used.

**Procedures**

Preliminary diagnosis of the CCL injury was made on the basis of history and physical examination findings and was confirmed by arthroscopic examination. For consistency of technique, all arthroscopic examinations were performed by 1 of the authors (WOW). Physical examination findings, surgery reports, and intraoperative pictures were reviewed.

The stifle joints were evaluated systematically as described29 with a 2.7-mm 30° fore oblique arthroscope.9 Cranial cruciate injuries were confirmed and classified as partial or complete tears. Particular care was taken to examine both menisci and note the presence and type of any lesions. Presence and severity of periarticular osteophytes (PAOs) was also noted. A subjective grading system for PAOs was established (grade 0, no visible PAOs; grade 1, small, discrete

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PAOs: grade 2, large, discrete PAOs or mosaic pattern of PAOs; grade 3, more severe coalescing or confluent PAOs). This grading system was similar to other reported systems.4,5,30 If different regions had different grades of PAOs, the highest grade was used to describe the joint. Historical findings were reviewed for duration of clinical signs.

Statistical analyses—Statistical analyses comparing medial meniscal injuries, lateral meniscal injuries, PAO grade, complete or partial tear of CCL, and duration of clinical signs were performed by use of the Pearson $\chi^2$ test. Values of $P \leq 0.05$ were considered significant.

**Results**

Records of 100 consecutively examined stifle joints met inclusion criteria; because both stifle joints were affected in 6 dogs, there were 94 dogs in the study. Mean weight of dogs was 32 kg (70.4 lb). Seventy-nine (79%) stifle joints had complete tears of the CCL. Twenty-one (21%) had partial tears. Seventy-seven (77%) joints had lateral meniscal tears; these were all radial tears involving the inner portion of the cranial horn. Fifty-eight (58%) joints had medial meniscal tears. Thirty-three (57%) of these were bucket-handle tears (Fig 1), 2 (3%) were flaps, 14 (24%) were radial tears (Fig 2), and 9 (16%) were combinations of tears or were characterized by maceration of the meniscus (Fig 3). Stifle joints with complete tears of the CCL were significantly ($P = 0.01$) more likely to have a tear of the medial meniscus than those with partial tears. There was no significant relationship between the type of CCL injury and the presence or absence of lateral meniscal tears. There was also no significant correlation between the presence of lateral meniscal tears and medial meniscal tears. No significant relationship was found between duration of clinical signs ($\leq 14$ days or $>14$ days) and the presence of lateral or medial meniscal injuries. No significant relationship between presence of a medial or lateral meniscal tear and severity of PAOs was detected.

**Discussion**

The location and prevalence of medial meniscal lesions in the dogs in this study are similar to those observed in previous studies, which detected medial meniscal tears in 10 to 70% of dogs with CCL injuries.24,12,15,15-17,31 It is commonly reported in human and veterinary literature that meniscal tears contribute to the pain and arthritis associated with injuries to the CCL.4,10,11,23 Human meniscal injuries are often repaired primarily (sutured or stapled). However, in most of the literature on canine meniscal injuries, partial meniscectomy is recommended for treatment.12,16,30-32 Most meniscal tears in dogs are not considered good candidates for repair because they often have a macerated component and cannot be viewed well enough for
reduction and repair, and it is impossible to fully restrict activity of affected dogs after surgery. Loss of meniscal integrity or meniscectomy is associated with development of osteoarthritis in dogs and humans.\textsuperscript{1,2,10,12,15-17}\textsuperscript{1,2} It might be expected that there would be a higher grade of PAO formation in dogs with medial meniscal tears than in dogs without such tears. Our study found no correlation between medial meniscal tears and degree of PAO formation, but it did not address changes in the associated weight-bearing articular cartilage. This may indicate that meniscal tears do not substantially accelerate osteophyte formation, or dogs with meniscal injuries may have a greater degree of lameness and receive surgical treatment more rapidly than dogs that do not have meniscal tears. However, the retrospective nature of the study makes this hypothesis difficult to prove. The high degree of association between complete tears of the CCL and medial meniscal tears is similar to that reported in previous publications.\textsuperscript{1,2,10,13} This supports the model of medial meniscal injury in which the mechanism of injury is the instability of the CCL-deficient stifle joint.\textsuperscript{18}

Lateral meniscal tears are reported rarely in the literature, but have been reported several times in dogs as independent lesions not associated with CCL-related instability.\textsuperscript{1,2,9,18} These lesions have sometimes been associated with lameness. However, lateral meniscal tears have not been reported as common sequelae to CCL injuries in dogs. Lateral meniscal tears are mentioned in 2 reports of arthroscopic examination of the stifle joints of dogs.\textsuperscript{1,2} The veterinary literature, on the basis of meniscal examination via arthrotomy, states that lateral meniscal tears are much less common than medial meniscal tears.\textsuperscript{1,2,9} The nature of the lateral meniscal lesions detected in 77% of the stifle joints in our study would make them difficult to detect during an open procedure without magnification and with no fluid in the stifle joint. Even during arthroscopic examination, deliberate examination of the lateral meniscus is necessary to detect the tears, and this may not be done routinely because of the low reported prevalence of lateral meniscal lesions. We have occasionally observed other types of lateral meniscal injuries in dogs with cruciate injuries, including flap tears, bucket-handle tears, horizontal cleavage, and degenerative tears, although none of these was detected in the dogs in this study.

The mechanism for lateral meniscal injuries is not known. We speculate that these lesions result from a combination of rotational instability and cranial tibial thrust that causes the cranial horn of the lateral meniscus to repeatedly slide up the lateral intercondylar eminence. This edge of the cranial horn of the lateral meniscus can be seen being pinched between the lateral intercondylar eminence and lateral femoral condyle during full extension with cranial tibial thrust. Presumably the meniscofemoral ligament is pulling the lateral meniscus caudally with the femur during cranial tibial thrust. We have frequently seen deep areas of chondromalacia and fibrillation on the lateral femoral condyle where it would contact the lateral intercondylar eminence in conjunction with these tears. We do not know whether these lesions of the articular cartilage cause clinical signs in dogs, or whether their development is related to tears of the lateral meniscus. The fact that there was no significant difference in prevalence of lateral meniscal tears between the group of stifle joints with a complete tear of the CCL and the group with a partial tear may indicate that a partial tear causes sufficient instability to result in these injuries. This is supported by the fact that dogs with partial tears often had advanced degenerative changes in the stifle joint. Alternatively, a lateral meniscal tear may be an incidental finding that is not related to CCL injuries and instability. An age- and breed-matched population without CCL injury would have to be examined arthroscopically to confirm or refute this hypothesis.

The new finding from our study is that lateral meniscal injury may be more common in dogs with CCL injuries than was previously recognized. Arthroscopic examination, by allowing examination of the joint under magnification and with more physiologic aqueous conditions, may permit better evaluation of these changes; however, the clinical relevance of these findings is not known.

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