Article

Incidence of meniscal injury in cats with cranial cruciate ligament ruptures

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Abstract — This retrospective study evaluated the incidence of meniscal injury in cats with cranial cruciate ligament (CCL) ruptures. Medical records for cats diagnosed with CCL ruptures treated by a lateral fabellotibial suture (LFS) were reviewed for signalment, history, physical examination and surgical findings. Ninety-five cats (98 stifles) met the inclusion criteria. The incidence of meniscal injuries in feline CCL deficient stifles was 67%. Isolated medial meniscal injuries were found in 55 stifles (56%), isolated lateral meniscal injuries were found in 5 stifles (5%), and lateral and medial meniscal injuries were found in 6 stifles (6%). There was no correlation between the presence of a meniscal injury and age, breed, sex, weight, duration of lameness, presence of concurrent medial patellar luxation, degree of degenerative joint disease, or presenting side of lameness. Given the high rate of meniscal pathology in cats with CCL ruptures, exploratory surgery for meniscal assessment and concurrent stifle stabilization should be considered in feline patients.

Résumé — Incidence des blessures du ménisque chez les chats avec des ruptures des ligaments croisés crâniaux chez les chats. Cette étude rétrospective a évalué l'incidence des blessures du ménisque chez les chats avec des ruptures des ligaments croisés crâniaux (LCC). Les dossiers médicaux des chats diagnostiqués avec des ruptures du LCC traitées à l'aide d'une suture fabellotibiale latérale (SFL) ont été examinés pour obtenir le signalement, l'anamnèse, les résultats de l'examen physique ainsi que les constatations à la chirurgie. Quatre-vingt-dix-huit (98 grassets) satisfaisaient aux critères d'inclusion. L'incidence des blessures du ménisque chez les grassets félins avec un LCC défectueux était de 67 %. Des blessures isolées du ménisque médial ont été trouvées dans 55 grassets (56 %), des blessures isolées du ménisque latéral ont été trouvées dans 5 grassets (5 %) et des blessures du ménisque latéral et médial ont été trouvées dans 6 grassets (6 %). Il n'y avait aucune corrélation entre la présence d'une blessure du ménisque et l'âge, la race, le sexe, le poids, la durée de la boiterie, la présence de luxation concomitante de la rotule médiale, le degré de maladie dégénérative des articulations ou le côté de la boiterie. Compte tenu du taux élevé de pathologie du ménisque chez les chats avec des ruptures du LCC, une chirurgie exploratoire pour l'évaluation du ménisque et une stabilisation concomitante du grasset devraient être considérées chez les patients félins.

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Introduction

The medial and lateral menisci are semilunar fibrocartilagenous structures which function in energy absorption and stress transfer, stabilization, and lubrication of the stifle joint, and prevention of synovial impingement between the articular surfaces of the femur and the tibia (1,2). Meniscal injuries include tears, displacement of the caudal pole cranially without tears, and compressive injuries, and are a common source of discomfort and stifle dysfunction in dogs and humans (1). Damage to the meniscus usually occurs when the weight-bearing joint is subjected to a combined flexion-rotation or extension-rotation (3). If the force occurs during extension of the stifle, then the damage is usually to the cranial portion of the meniscus (3). In flexion, the caudal portion of the meniscus sustains the damage (3). Internal rotation of the joint during weight-bearing usually results in tearing of the medial meniscus (3).

The medial and lateral genicular arteries branch to supply the menisci. The inner 2/3 of the meniscus is relatively avascular, accounting for poor healing in meniscal injuries (4). Meniscal damage is common in canine cruciate ligament (CCL) deficient stifles, occurring in 48% to 70% of cases (4–7). It is recommended that meniscal damage be assessed and meniscal injury addressed during stabilization of the canine CCL deficient stifle, as meniscal injury contributes to lameness and degenerative joint disease (1,5,7–9). While this subject has been extensively researched in the canine patient, relatively little has been written on the subject in the feline patient.

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There is a group of feline patients that have CCL injuries of similar pathogenesis to that observed in canine patients (10,11). Feline CCL injuries have frequently been treated with conservative medical management based on previous studies indicating good clinical outcomes with that treatment (1,12–14). The recommendation for exploratory surgery and stabilization was reserved for feline patients that had persistent lameness longer than 8 wk following conservative treatment (1,13). It was reported that lameness in feline patients treated with conservative management appeared to resolve, but approximately 80% of patients had persistent instability and radiographic progression of degenerative joint disease (12). Recent studies have indicated that surgical stabilization allows for an apparently quicker and more reliable return to function and at least as good clinical function as cats that are treated with conservative management (10,15). In a study of 8 cats with CCL ruptures in 9 stifles, only 1 stifle had a meniscal tear (10).

The purpose of this study was to evaluate the incidence of meniscal injuries in cats with CCL ruptures. The hypothesis was that most cats with CCL ruptures have concurrent meniscal injuries.

Materials and methods

Inclusion criteria

Medical records (1999 to 2009) of cats with CCL ruptures treated with a lateral fabellotibial suture (LFS) technique by surgeons at Veterinary Surgical Associates were reviewed. Inclusion criteria were cats with CCL rupture and absence of other simultaneous ligamentous damage in the stifle stabilized with a LFS and with medical records that included signalment and surgical report. Cats identified as having simultaneous medial patellar luxation (MPL), acute or chronic, were included in the study.

Data collection

Information collected from each medical record where available included age, weight, sex, breed, pertinent medical history, duration of lameness, presence of trauma preceding injury, physical examination findings, and surgical findings. Acute injuries were defined as injuries less than 2 wk old. Any injury that was older was considered chronic. Complete CCL injuries were defined as being 100% ruptured. A CCL injury that had any portion of the ligament intact at the time of exploratory arthrotomy was defined as a partial rupture.

Surgical technique

Surgery was routinely recommended for all cats identified as having a CCL rupture. All surgical procedures were performed by a board certified surgeon or a directly supervised surgical resident. A craniolateral approach to the affected stifle and a lateral parapatellar arthrotomy were performed in all patients. In some patients, a medial parapatellar arthrotomy was also performed to enhance visualization of the joint. The CCL was assessed, and the degree to which it was ruptured was recorded. The degree of damage to both the lateral and medial meniscus was assessed in all patients. Degree of degenerative joint disease was noted by some surgeons in a subjective manner. If a portion of either meniscus was damaged, a partial meniscectomy was performed. Intact menisci did not receive a meniscal release. Cranial cruciate ligament instability was addressed using a LFS.

Statistical analysis

Means +/− standard deviation were calculated for normally distributed data and median and range for nonparametric data. Categoric data (sex, presenting limb, duration of lameness, presence of MPL, breed, degree of degenerative joint disease) were compared by use of a chi-squared (χ^2) test, and continuous variables (body weight, age) were compared by use of independent *t*-tests. A *P*-value < 0.05 was considered significant for all analyses.

Results

Of the 187 cats treated with a LFS for stabilization of a CCL-deficient stifle, 95 met the inclusion criteria for the study. Twenty-seven cats that had multiple ligamentous injuries consistent with a deranged stifle and 65 cats with incomplete medical records were excluded.

Signalment and history

Of the 95 cats in the study, 47 were spayed females (49.5%), 47 were neutered males (49.5%), and 1 was an intact female (1%). There was no significant correlation between sex and presence of a meniscal injury ($P = 1$). Fifty-nine cats were domestic short hair (62%), 17 were domestic long hair (18%), 9 were domestic medium hair (10%), 4 were Siamese (4%), 2 were Manx (2%), and there was 1 each of Siamese cross, Maine Coon, American Short Hair, and Turkish Van (1%). There was no significant correlation between breed and meniscal injury ($P = 0.83$). Median age of cats at the time of surgery was 7 y (range: 6 mo to 14 y). There was no significant correlation between age and meniscal injury ($P = 0.16$). Body weight was available in 70 of the 95 cases; median body weight was 5.7 kg (range: 3.6 to 12 kg). There was no significant correlation between body weight and the presence of meniscal injury ($P = 0.10$). The duration of the lameness was noted in 66 patients. The injury was classified as acute in 50 (75%) and chronic in 16 (25%). There was no significant correlation between duration of lameness and presence of meniscal injury ($P = 0.64$). Three cats had pre-existing medical conditions: 1 cat had hypertrophic cardiomyopathy, 1 had diabetes, and 1 had asthma. Four cats (4%) had acute traumatic episodes witnessed, which included being chased by a dog, hit by car, leg trapped in a piano, and unsuccessfully trying to jump over a 6-foot fence.

Physical examination

All recorded physical examinations indicated clinical signs of lameness on the affected limb, as well as examination findings consistent with a CCL rupture (stifle effusion, stifle discomfort on palpation, cranial drawer motion, and/or cranial tibial thrust). Three cats had bilateral disease on initial presentation. One cat had both stifles operated at initial presentation; 2 cats had only 1 stifle operated, and were not returned to have the second stifle operated. Two cats that were initially presented with right stifle disease subsequently went on to rupture the CCL in the left stifle, at 2 y and at 5 mo after initial presentation. In

total, 98 stifles were operated in 95 cats. Fifty-two cats (55%) were initially presented with a left CCL rupture, and 43 cats (45%) were initially presented with a right CCL rupture. There was no significant correlation between side injured at presentation and presence of a meniscal injury ($P = 0.44$).

Twelve cats had concurrent MPL, with 3 of the 12 having bilateral MPL but only unilateral CCL injury. All bilateral MPL were classified as grade 2/4. The other 9 cats with patellar luxations only had a MPL in the stifle with the CCL injury. The MPL was classified as grade 1/4 in 3 cats, grade 2/4 in 4 cats, and grade 3/4 in 5 cats. Of the cases with historical information available, 2 cats with a MPL had a chronic duration of lameness and 7 cats with a MPL had an acute duration of lameness. Nine stifles with concurrent MPL injury had a meniscal tear. There was no significant correlation between presence of MPL and meniscal injury ($P = 0.54$). One cat had an intermittent gallop rhythm and 1 cat had a grade 2/6 systolic heart murmur. Five cats (5%) had other orthopedic or soft tissue injuries not involving the stifle. One cat each had a degloving tail injury, tibiotarsal luxation, chronic femoral neck fracture, bilateral coxofemoral degenerative joint disease, or lateral tarsal instability. The chronic femoral neck fracture was on the contralateral limb as the CCL rupture. The tibiotarsal luxation and tarsal instability were on the same limb as the CCL rupture.

Surgical findings

In total, 98 stifles in 95 cats were operated. Six stifles had partial CCL ruptures and 92 stifles had complete ruptures. Three stifles had 50% of the ligament ruptured, 1 had 75% ruptured, 1 had 80% ruptured, and 1 had 90% ruptured. Three cats (3 stifles) with partial CCL ruptures had an acute duration of lameness and 1 cat (1 stifle) had a chronic duration of lameness. The degree of degenerative joint disease was noted in 40 stifles and was classified as none in 6 stifles (15%), minimal in 13 stifles (33%), mild in 9 stifles (22%), moderate in 8 stifles (20%), and marked in 4 stifles (10%). Of the 6 stifles with no degenerative joint disease, 3 had meniscal tears. Of the 13 stifles with minimal degenerative joint disease 12 had meniscal tears. Eight of the 9 stifles with mild degenerative joint disease had meniscal tears. Meniscal tears were identified in 4 of 8 stifles with moderate degenerative joint disease, and all 4 stifles with marked degenerative joint disease. The degree of degenerative joint disease was not significantly related to the presence of a meniscal tear ($P = 0.65$). Of the cats identified as having no degenerative joint disease for which historical information was available, 3 cats were identified as having an acute onset of lameness and 2 cats as a chronic onset of lameness. Minimal degenerative joint disease was found in 12 cats with an acute onset of lameness and 1 cat with a chronic onset of lameness. Five cats had an acute onset of lameness and 1 cat had a chronic onset of lameness in the group of cats identified as having mild degenerative joint disease. Moderate degenerative joint disease was identified in 3 cats that had an acute onset of lameness and 3 cats that had a chronic onset of lameness. Among the cats that had marked degenerative joint disease 2 had a chronic onset of lameness and 1 had an acute onset of lameness.

Meniscal injury was identified in 66 stifles: isolated medial meniscal injuries in 55 stifles (56%), isolated lateral meniscal injuries in 5 stifles (5%), and medial and lateral meniscal injuries in 6 stifles (6%). Meniscal injuries (all in the medial meniscus) were identified in 4 of the 6 stifles with partial CCL ruptures. Two of the stifles had a 50% partial tear, 1 stifle had a 75% tear, and 1 stifle had a 90% tear in the CCL. Due to the small numbers of stifles that had partial tears, statistical significance could not be determined. The remaining 62 meniscal injuries occurred in stifles with complete CCL ruptures.

All stifles were stabilized with a LFS. One stifle had a LFS and a medial fabellotibial suture. Additional surgical procedures that were performed included lateral imbrication in 2 stifles, trochlear wedge recession in 3 stifles, a trochlear wedge recession and tibial tuberosity transposition in 1 stifle, and fascia lata strip in 2 stifles. Of the 2 cats with orthopedic injuries in the same limb (lateral tarsal instability and tibiotarsal luxation), only the cat with the tibiotarsal luxation had a meniscal injury.

Discussion

This study evaluated the incidence of meniscal injuries in cats with stifle injuries limited to CCL rupture with or without concurrent MPL. The incidence of meniscal injuries in this study (67%) was similar to the incidence of meniscal injuries in dogs with CCL ruptures (4–7). One report indicates that there are 2 distinct populations of cats with CCL ruptures: 1 group consisting of cases that are traumatically induced and often involve damage to multiple ligamentous structures and the other consisting of cats that rupture the CCL with little or no known trauma (10). The most recent paper on this subject reported meniscal injuries in 7 of 11 cases in cats with multiple ligamentous injuries (10). However, to the authors' knowledge there have been no studies with a large number of cats to evaluate the incidence of meniscal injuries in cats with CCL ruptures.

The median age of cats in this study was 8 y, which is similar to the 8.5 y in a previous report (10). Similarly, small dogs ($<$ 15 kg) seem to rupture their CCL later in life, usually older than 7 y of age (1). The incidence of CCL ruptures in spayed female dogs was 3.26% versus 1.74% in intact females and 1.52% in intact males (1). However, there was no difference in the incidence of CCL ruptures or presence of meniscal injury between spayed female or neutered male cats in the present study.

Twelve cats had a MPL diagnosed concurrently with a CCL injury but the relationship between MPL and CCL rupture is not known (1,3,15). It was suspected by the authors that most cats with a concurrent MPL had the condition secondary to increased internal rotation allowed by the CCL rupture, which allowed the patella to luxate medially. Only 4 of these stifles received additional procedures other than the LFS for treatment of the MPL. Also, the presence of a MPL was not significantly associated with the presence of a meniscal injury. Of the cats with other orthopedic injuries, only 1 cat had an associated meniscal tear. This occurred in the cat with the tibiotarsal luxation. This case was included because only 1 ligament was damaged in the stifle. However, this cat may have sustained additional trauma compared with the other cats in this study;

therefore, it could be argued that this case should not have been included.

The incidence of CCL ruptures is much lower in cats than in dogs (10,14,15). The reason for this is unclear, but it may be partly due to the fact that the CCL is larger than the caudal cruciate ligament in cats, whereas the CCL is smaller than the caudal cruciate ligament in dogs (10,14,15). Given the previously reported good outcome with conservative management of this injury, it is also possible that in a proportion of cats with CCL ruptures treated conservatively the lameness resolves after several weeks and the cats are never presented for re-evaluation (10). This would seem to imply that cats in which the lameness resolves do not have a clinically significant meniscal tear.

Complete CCL ruptures were identified in 94% of operated feline stifles. This is in contrast to dogs, in which a larger proportion of dogs have partial CCL ruptures identified at the time of surgery, ranging from 20% to 50% (6–9). All of the partial ruptures identified in the feline stifles of this study involved 50% or more of the ligament. It is assumed by the authors that a CCL rupture that is $>$ 50% is a mostly incompetent ligament. Therefore, it is not unreasonable that 4 out of the 6 stifles that had partial CCL tears had concurrent meniscal injuries. The reason for the lower incidence of partial tears may be due to the potential that CCL ruptures in cats are more traumatic in nature, even without a history of a specific traumatic event. It may also be that signs of early partial tears are overlooked by the owners. There were several stifles displaying moderate to marked degenerative joint disease that were classified as having an acute onset of lameness. There has been 1 report of a histologic sample from a feline CCL after rupture had occurred, which showed similar changes to those observed in dogs with CCL ruptures, including chondroid metaplasia, disorganized collagen fibers, and increased number of fibrocytes (10). It is unclear whether the pathogenesis of CCL ruptures in felines and canines is similar, or if feline patients are unique in that trauma plays a much greater role in their disease process.

All meniscal pathology in this study was evaluated via an arthrotomy. It has been shown in the canine stifle that arthroscopy is a more accurate tool to assess meniscal pathology (16). Due to the small size of the feline stifle joint, surgeon preference, and availability of arthroscopy equipment, arthrotomy was the selected diagnostic method for the reported cases. It is possible that some meniscal pathology went unrecognized as a result.

All meniscal injuries were treated by partial meniscectomy. It is known that removal of the meniscus results in progressive osteoarthritis and damage to the articular cartilage (5,17–19). Studies in canine stifles support preserving as much meniscus as possible when performing a menisectomy due to both the biomechanical importance of the medial meniscus and the lack of functional relevance of repaired meniscal tissue (5,17–19). The majority of meniscal injuries were identified in the medial meniscus, which is consistent with reported results in canine stifles (1–5). Eleven feline stifles in this study had lateral meniscal injuries, most of which had concurrent medial meniscal pathology. Given this finding, it is likely that the majority of cats with lateral meniscal injuries had more advanced trauma. However, the isolated lateral meniscal injuries are more difficult to interpret. One study found a higher incidence of lateral meniscal injuries than medial meniscal injuries in the canine stifle (8). The significance of this finding was unknown (8).

The recommendation for conservative therapy to address CCL ruptures in cats is based on 1 study of 16 cats (12). Most of these cats did have a good clinical outcome several months following restricted activity to allow the injury to heal. However, 80% continued to have instability in the stifle and radiographic progression of arthritis. It is unknown what effect these changes had on the cats beyond the study period. There have been no studies that have scientifically evaluated the outcome of cats treated with surgery and stabilization versus cats treated with conservative exercise restriction. However, the incidence of meniscal pathology in cats that were presented with CCL ruptures to this surgical practice was high. Given the discomfort and progression of degenerative joint disease that typically accompany this injury, stifle exploration and surgical stabilization should be considered in feline patients. However, a definitive recommendation for surgery cannot be made until a study evaluating the outcome of cats treated by the 2 modalities becomes available.

This study has a number of limitations. The retrospective nature of the study did not allow for all variables to be evaluated. Also, the specific type of meniscal pathology was not evident in most surgical reports. Further investigation into the specific type of meniscal tears that are sustained by cats with CCL ruptures should be considered. There were 14 surgeons responsible for the procedures in this study, resulting in variation in the surgical technique and in the assessment of joint pathology. This may have caused inconsistency in reporting variables such as the degree of degenerative joint disease, but should not have affected the recognition of the presence or absence of gross meniscal damage. Also, surgery is routinely recommended for cats that have stifle instability attributed to a CCL rupture at this practice. This did not allow for any outcome comparison to conservative management. Future studies evaluating the degree of osteoarthritis progression and lameness over time in feline patients treated conservatively versus surgically are warranted.

Meniscal damage is an indication for joint exploration and stabilization in CCL-deficient stifles (1). The incidence of meniscal damage in feline stifles with CCL ruptures in this study was 67%, supporting the hypothesis of this study. The reported incidence of feline meniscal injuries concurrent with CCL rupture in this study is similar to the incidence of meniscal damage reported in dogs with concurrent CCL ruptures. Given the high incidence of meniscal injuries in feline stifles with CCL ruptures, it is the authors' opinion that exploratory surgery to address meniscal pathology and stifle stabilization should be considered in the feline patient. CVJ

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