Arthroscopic Technique for Transection of the Canine Cranial Cruciate Ligament

Summary: Transection of the cranial cruciate ligament (CCL) in dogs is a commonly used model of experimental osteoarthritis (OA). However, a detailed description of the arthroscopically guided CCL transection technique is lacking. In this study, the technique for arthroscopic CCL transection in the dog as it was applied to an investigative study of a novel anti-arthritic agent is described in detail.

Transection of the cranial cruciate ligament (CCL) in dogs is a commonly used model of experimental osteoarthritis (OA). It has been used frequently as a means of testing new medications for the treatment of OA. This model is characterized by mechanical instability that leads to progressive changes in the articular cartilage that closely mimic the early events of canine and human OA. Three previously described techniques used for CCL transection are a percutaneous stab incision, an open arthrotomy, and arthroscopy. Historically, the most common, least invasive technique for CCL transection is the percutaneous stab incision. However, this technique does not allow direct visualization of the CCL, and it has the potential to cause a great deal of damage to structures within the joint, such as articular cartilage. An open arthrotomy avoids many of the problems inherent with the percutaneous stab incision technique, because it allows direct visualization of the CCL. However, it has its own inherent problems since it requires extensive soft tissue dissection, creating a variable degree of injury to nerves and vessels around the joint.

Because of the problems in these two methods, other investigators have performed arthroscopically guided CCL transection. Arthroscopy allows direct visualization for transection of the CCL with minimal damage to the articular cartilage or caudal cruciate ligament. It maximizes the advantages of the other techniques by performing the surgery through a small stab incision, while at the same time allowing a thorough examination of structures in the joint. This results in less incisional morbidity, thereby allowing for quicker rehabilitation. However, a detailed description of the arthroscopically guided CCL transection technique is lacking. Therefore, Dr. Troy Trumble, working with Dr. Wayne McIlwraith and Dr. Clark Billinghurst, described, in detail, the technique for arthroscopic CCL transection in the dog as it was applied to an investigative study of a novel anti-arthritic agent.

In order to ensure a reproducible approach for arthroscopic CCL transection, the technique described was initially standardized on 35 stifles of canine cadaver specimens. The only arthroscopic instruments required for completion of the CCL transection included a meniscectomy blade and a vacuum-assisted motorized synovial tissue resector. All stifle joints of the cadavers were dissected to document complete CCL transection, and to determine the extent of damage to other intra-articular structures. This technique was then applied to 60 healthy, young (> 14 months) adult, purpose bred, male Walker hounds with an average weight of 24.1 kg (range, 16.8 - 33.3 kg). All dogs had normal physical, orthopedic, radiographic, and force plate examinations. The care and housing of the dogs was in accordance with standards established by the Animal Care and Use Committee of Colorado State University.

The right hindlimb was secured in maximal flexion and the stifle was infused with 10 ml of saline. The arthroscope was inserted lateral to the patellar ligament, midway between the lower aspect of the patella and the top of the tibia at the point of maximal distention (Figure1). The medial aspect of the CCL could then be identified arthroscopically (Figure 2). The location for the instrument portal was identified by placement of a 20-guage needle medially in the optimal location as to allow complete transection of the CCL and not injure other structures in the joint. This resulted in an instrument portal placed in front of the medial femoral condyle and above the medial meniscus. A meniscectomy blade was used to transect the cruciate ligament by encompassing the medial aspect of the CCL and cutting it from a medial to lateral direction. The arthroscope was then directed between the transected ends to verify complete transection. If incomplete, the meniscectomy blade was repositioned around the intact portion of the lateral aspect of the CCL and transection was completed. Transection was confirmed by the presence of instability that can be palpated by moving the lower limb forward against a stationary upper limb (cranial drawer response).

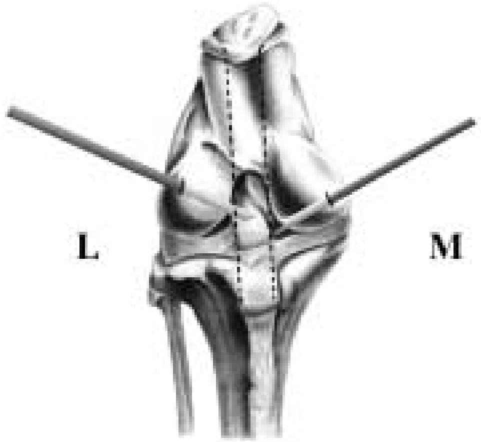

Figure 1: Schematic of the arthroscopic technique in a canine stifle placed in maximal flexion. The dashed lines represent the patellar ligament. Medial (M) and lateral (L) are labeled accordingly. The arthroscope is inserted laterally and the meniscectomy blade is inserted medially. Placement of these portals allows access to the midbody of the cranial cruciate ligament.

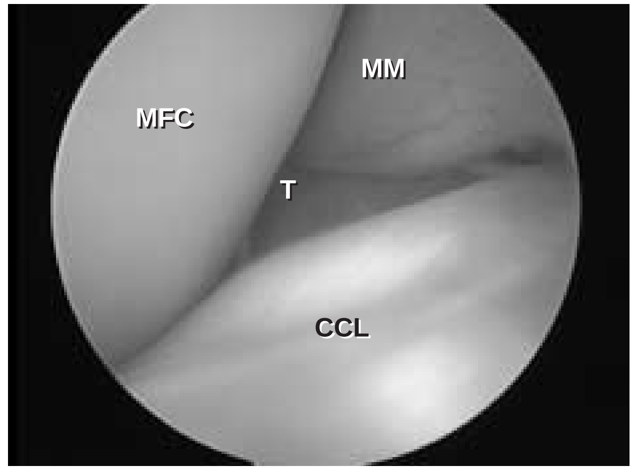

Figure 2: Arthroscopic photograph of the medial compartment of the canine stifle via the approach in Figure 1. The medial femoral condyle (MFC), medial meniscus (MM), proximal medial tibia (T), and the medial aspect of the cranial cruciate ligament (CCL) can be identified, allowing clear visualization for transection.

For the 60 dogs, an average of 14 minutes (range, 4-40 minutes) was needed to complete the CCL transection from the first skin incision to the closure of the last portal. Surgery time decreased as experience with the technique improved. Transection of the CCL was verified in all but one dog at post-mortem. Two passes of the meniscectomy blade were required for complete transection in the majority of dogs (34/60, 57%). The fat pad was resected in 8 (13%) of the dogs. Intraoperative complications included fibrillation of cartilage on the axial aspect of the medial femoral condyle (7/60, 12%), intra-articular hemorrhage (7/60, 12%), and periarticular accumulation of saline (11/60, 18%). Of those requiring fat pad resection, 5/8 (63%) also had hemarthrosis and/or periarticular saline accumulation.

The arthroscopic procedure for CCL transection described in this study provides a reproducible model of OA with little morbidity and damage to other intrasynovial structures. It minimizes the post-operative morbidity through small stab incisions and minimal intraoperative complications. It is important to note that arthroscopy of the canine stifle requires patience and practice. However, once the surgeon has experience with the arthroscopic procedure for CCL transection described in this report, it is a very reliable and reproducible technique for the induction of OA in the dog. Application of this technique for creation of experimental OA can be used to evaluate novel anti-arthritic agents for both animals and humans.

Publication

Trumble TN, McIlwraith CW, Billinghurst RC. "Technique for arthroscopically guided transection of the cranial cruciate ligament as a model for osteoarthritis." Vet Surg. 2001. 508.

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