

# Cranial Cruciate Ligament Injury

## *Diagnosis and Treatment*

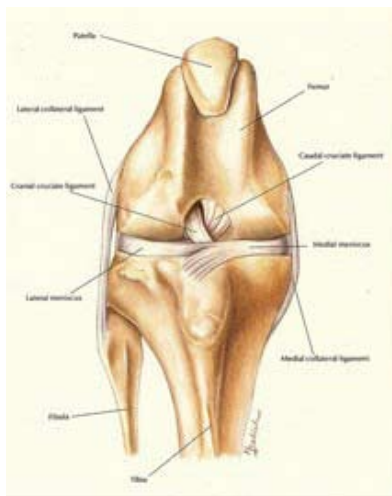


The most common orthopedic injury that presents to VOSM in our canine patients is a rupture of the cranial cruciate ligament (CCL). A rupture of this ligament can cause pain and lameness, injury to other structures of the knee, such as the meniscus, and lead to long term osteoarthritis of the knee. Surgical options to resolve this injury are the Tibial Plateau Leveling Osteotomy (TPLO) and Extracapsular Stabilization. We recommend the TPLO to treat this injury. Contrary to popular belief, TPLO surgery is not reserved for large breed dogs; patients weighing as little as 10 pounds and as large as 240 pounds can benefit from TPLO surgery. TPLO surgery provides a more rapid recovery, improved range of motion, reduction in the progression of arthritis, and can return the patient to complete pre-injury performance as compared to other surgical options.

### What is a cranial cruciate ligament and what does it do?

Although the knee joint in dogs is similar to ours, the forces applied to the joint during weight bearing are vastly different. Our hip, knee and ankle joints are perpendicular to our weight bearing surface: our feet. When we stand, there is minimal stress to the ligaments in our knee. Dogs, however, stand on their toes with the ankle elevated and the knee forward. The top of the dog's tibia (tibial plateau)

is sloped. Weight bearing creates a shear force that pushes the femur down the slope of the tibia. This force is called "tibial thrust" and it is the job of the CCL to resist this motion. Each time the dog bears weight, the CCL is called into work. If you think of the tibial plateau as a hill and the femur as a car parked on the hill, the CCL is the emergency brake. If the ligament ruptures, it allows the femur to slide down the slope or, in our car example, the emergency brake releases and the car rolls down the hill. When the ligament is ruptured, each time the dog bears weight, this motion occurs and causes discomfort. Within the joint, there will be inflammation and swelling, referred to as synovitis and effusion.



### How does a rupture of the cranial cruciate ligament occur?

Rupture of the CCL can occur in several different ways. There may be a single incident which causes a sudden complete rupture of the ligament. When this occurs, the dog is typically in pain and will not bear weight on the leg. The CCL can also slowly deteriorate over time with normal activity. Dogs with a high tibial plateau angle (greater slope) have greater stress to the CCL and the ligament can tear more readily. Dogs can also partially tear the ligament due to an incident. With a partial rupture, the dog typically experiences an intermittent lameness.

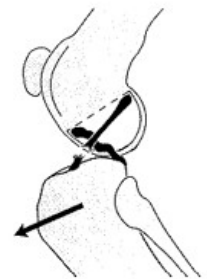
The majority of partial ruptures will progress to a complete rupture within weeks to months. Common causes of partial and complete ruptures include hyperextension and internal rotation of the knee from sudden turns or stepping into a hole; jumping or leaping if the force of cranial tibial thrust exceeds the breaking strength of CCL; repetitive normal activities; and degeneration associated with aging. Obesity can increase the risk of a rupture, as can the "weekend warrior" routine, in which the pet is relatively inactive during the week but becomes highly active on weekends. Dogs that have ruptured their CCL in one knee have a 50% - 70% chance of rupturing the CCL in their other knee. Therefore, surgical correction is recommended as soon as possible to decrease the stress placed on the uninjured CCL, thereby decreasing the risk of CCL rupture to that knee.

### What are signs that my pet has a rupture of the CCL?

If the CCL rupture is complete and acute, often the pet will be non-weight bearing on the affected leg. However, in the case of a partial or gradual rupture, the pet will be weight bearing or demonstrate an intermittent lameness. Lameness will often worsen with activity. Stiffness upon rising and a stiff gait are other common complaints. You may also notice that your pet will sit with the affected leg out to the side. He or she may also have difficulty rising and be less active. You may note signs of changes to the joint including swelling or thickening of the knee and muscle atrophy (degeneration) in the affected leg. Dogs which have ruptured the CCL in both knees do not routinely carry or off-load their weight to a particular limb since they do not have a good leg to stand on (their gait is especially stiff).

### How is a rupture of the cranial cruciate ligament diagnosed?

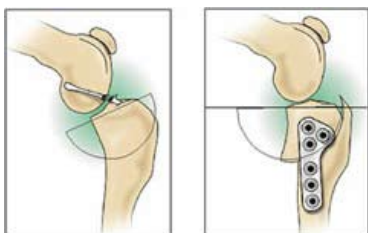
Diagnosis of a rupture of the CCL typically involves an orthopedic examination. Our surgeon will check for cranial drawer (abnormal movement at the knee) by holding the femur with one hand and the tibia with the other. He or she will then check for forward motion of the tibia. If this occurs, it is an indication that the CCL is ruptured. To further test for a rupture of this ligament, he or she will perform a tibial thrust test. This involves placing a hand over the knee joint and flexing the hock with the other hand. If the tibia has forward motion, it is an indication that the CCL is ruptured. In the case of a partial cruciate rupture, these motions will be noted when flexing or bending the knee. However, these motions may be difficult to assess. X-rays of the knee will be taken to evaluate the presence of excessive fluid within the knees and arthritis. If these tests alone are not completely diagnostic, arthroscopic evaluation of the joint and structures may be recommended. If arthroscopic evaluation reveals the ligament is injured, a TPLO can then be performed.



### What are the surgical options for a ruptured CCL?

There are two surgical options for correction of this injury, the TPLO and an Extracapsular Stabilization. The Extracapsular

Stabilization stabilizes the joint with a prosthetic ligament. This technique relies on scar tissue to ultimately stabilize the joint. The reported recovery time for the Extracapsular Stabilization is approximately 3 to 5 months. While the scar tissue is forming, there is possibility for the suture to stretch and break. The reported recovery time for the TPLO procedure is approximately 2 to 3 months. Following surgery, patients use the limb much sooner with the TPLO than with an Extracapsular Stabilization. Additionally, studies show that there is far less arthritic development in the long term following a TPLO versus the Extracapsular Stabilization (Lazar T Vet Surg, 2005). For these reasons, the TPLO is considered by most veterinary surgeons to be the “gold standard” for correcting this injury.



### What is a TPLO?

The TPLO procedure stabilizes the knee by leveling the tibial plateau. In the earlier example of a car parked on a hill, the TPLO levels the hill, eliminating the need for the brake. Radiographs of the

knee are taken prior to surgery. Using specific landmarks, our surgeon will measure your pet’s tibial plateau angle (slope) and precisely determine the amount of bone rotation that is needed to reduce the angle. During the TPLO procedure, our surgeon will make a circular cut (osteotomy) in the top of the tibia and rotate the bone segment so that the load bearing surface of the tibia is between 5 to 8 degrees. A biosynthetic bone graft (Consil®) can be applied to increase the rate of bone healing. A plate is then applied to hold the tibia in this position and allow for the bone to heal. Restricted activity is required while the bone heals.

The menisci are the cartilage “shock absorbers” of the knee and are located between the bottom of the femur and top of the tibia. There is a meniscus located on the inside (medial) and outside (lateral) aspects of the knee. When the knee is unstable due to a CCL rupture, either complete or partial, these structures are at risk for injury. Prior to the TPLO procedure, our surgeon will perform a mini arthrotomy to evaluate these structures, and if either meniscus has sustained an injury, the damaged portion will be removed.

### What can I expect after TPLO surgery?

After surgery, dogs are typically non-weight bearing or toe-touching lame for the first few days. Shortly thereafter, dogs begin to bear weight with an obvious lameness. When walking, they will use the limb but they will often hold the leg up when standing. Within two to three weeks, however, they are using the limb consistently, although a lameness will still be obvious. Patients are typically quite comfortable 2 or 3 days following surgery. Most owners report that the greatest challenge they face while caring for their recovering pet is preventing him or her from being too active! By the 4 week recheck and radiographs, the pet is typically fully weight bearing. By the 8 week recheck and radiographs, most pets are healed and may begin a gradual

return to normal activity. A few pets require an additional month to complete healing.

At-home care and rehabilitation therapy are the most important aspects of a successful recovery. A soft padded bandage will be applied to the leg post-operatively to help reduce swelling. This bandage will be removed in 2 to 3 days after surgery. An Elizabethan Collar or Bite Not Collar will be needed following surgery until the incision has healed and the staples are removed (10 to 14 days). Your pet will need to be confined to either a crate or a small area of the house where he or she does not have access to stairs or furniture. A crate is only recommended for pets that are normally confined in this manner. Your pet should not run, jump, or play for at least two months following surgery. Stairs should be limited to only those necessary. A sling and leash should be used when performing stairs, crossing slippery surfaces, and on uneven ground. You will be given rehabilitation exercises to perform at home. Your pet will be limited to short leash walks for elimination purposes only for the first 2 weeks. Thereafter, your pet will be allowed gradually increasing leash walks as part of the rehabilitation. Radiographs will be needed at 4 and 8 weeks and, possibly, 12 weeks post-operatively. This service will be performed by one of VOSM’s rehabilitation therapists. Based on the amount of healing noted on the radiograph at those appointments, changes to your at-home therapy program will be provided. All at-home care and rehabilitation exercises will be reviewed with you in detail. Like in humans, rehabilitation therapy will help to speed your pet’s recovery and return them to full function. Weekly therapy sessions may be performed by one of our rehabilitation therapists. Our therapists’ schedules tend to fill quickly; therefore, should you wish to enroll your pet in the TPLO post-operative therapy program, please contact us prior to your pet’s surgery. Alternatively, we can help you find a qualified therapist closer to your home, if desired.

### Optional Surgical Treatments

In some cases, optional treatments may be available for this surgery at an additional cost. The first step to performing the TPLO procedure is to confirm the CCL injury, evaluate the meniscus, and clean up the joint. This is typically performed through a routine arthrotomy (full/large incision into the joint). At VOSM, our standard practice is to perform a mini arthrotomy (a minimally invasive small incision into the joint). Alternatively, in cases where a cruciate ligament tear is not definitive, the first step of the procedure can be performed arthroscopically (minimally invasive procedure using a small camera). Recent reports have demonstrated a significant decrease in post-operative discomfort, inflammation, and improved function in dogs that have undergone an arthroscopic procedure versus an open arthrotomy (Vet Surg 2004). Due to the additional time, materials and equipment needed for an arthroscopic procedure, this option can add an additional \$800-\$1000 to the surgical fee.



The healing time for the bone following the osteotomy has been shown to range from 2 to 4 months, depending on the size and the age of the patient. A recent report demonstrated that a biosynthetic bone graft (Consil<sup>®</sup>) significantly increased the rate of bone healing in the TPLO procedure when compared to placebo (VOS, 2007). Consil<sup>®</sup> may be applied to the surgical site, subsequent to the osteotomy, if requested. It is strongly recommended for patients specifically in which slow healing may be a concern (geriatric and immunocompromised patients). The added cost of this treatment is \$200. If you would like to know if these options are appropriate for your pet, please contact our surgical services manager.

### **How do I prepare my pet for surgery?**

Pre-anesthetic blood work (CBC/Chemistry Profile) is required. If this blood work has been performed within the past month and there are no concerning abnormalities, no additional blood work is required. If this blood work has not yet been performed, please schedule an appointment with your regular veterinarian at least 2 business days prior to surgery. Please ask your veterinarian to fax the results to our office for evaluation. Alternatively, blood work may be performed at VOSM at the time of your consultation. If any concerning abnormalities are noted, our surgeon will call you to discuss.

If your pet has been scheduled for surgery, we ask that you withhold food after midnight the evening prior to surgery. Your pet may have water through the time of drop-off. If your pet is on a non-steroidal anti-inflammatory (Rimadyl, Deramaxx, Etogesic, Previcox, etc.) it should be discontinued 1 to 2 days prior to surgery. We ask that you drop off your pet between 7:30am and 8:00am the morning of surgery. A final estimate will be printed for you and a fifty percent deposit is required upon drop-off. If your pet is on any special diet, please bring 2 to 3 meals worth of food with you. Additionally, if your pet is on any medication that should be continued during hospitalization, please bring the medication and dosage instructions.

### **What is the protocol the day of and day after surgery?**

Upon arrival, your pet will be weighed and an IV catheter will be inserted. Our surgeon will perform a physical evaluation and your pet will be given a sedative prior to anesthesia to help him or her relax. The anesthetic used is similar to that used in human medicine. While anesthetized, your pet will be closely monitored. We monitor your pet's heart rate, EKG, breathing, oxygenation, blood pressure, temperature, and CO<sup>2</sup> output. Your pet's affected leg will be shaved from the hip to the ankle.

After surgery, a specially trained technician will recover your pet. Your pet will be closely monitored and comforted by the technician as he or she wakes from anesthesia. Our surgeon will call you after surgery with an update. You may call anytime to get further updates. Your pet will spend the night of surgery at the hospital under the direct supervision of a veterinarian. He or she will receive IV fluid therapy for pain, medication, and antibiotics. Rehabilitation, meaning cryotherapy will begin that evening. Food, water and walks will be offered once your pet is awake.

The next morning, our surgeon will perform another physical examination. Your pet's bandage will be changed, rehabilitation cryotherapy will be performed and the catheter will be removed. We ask that you call our office between 9:00am and 10:00am to schedule a pick-up time. Typically, discharges are scheduled between 11:00am and 6:00pm. When you arrive, a technician will review your discharge instructions and medications with you. While the length of time needed for discharge varies, you should plan to spend one hour with us. You will be provided with the prescribed antibiotics, pain medication, and an Elizabethan Collar. If you prefer a Bite Not Collar, you can purchase one at your local pet supply store or through [www.dog.com](http://www.dog.com). Once the instructions have been reviewed, our receptionist will assist you with the payment of your balance. We will then assist you with getting your pet into your car.

More information and resources can be found at [www.vosm.org](http://www.vosm.org). If you have any questions at any time, please feel free to call or e-mail. Our surgeon at [info@vetsportsmedicine.com](mailto:info@vetsportsmedicine.com) or our surgical services manager, will be happy to answer your questions.

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