



Client Information Sheet for Torn Cranial Cruciate Ligament and Tibial Tuberosity Advancement (TTA) Surgery as a Repair Option

What is the Cranial Cruciate Ligament?

The stifle joint is the junction between the large femur and smaller tibia bones. The femur extends from the hip to the knee (stifle joint), and the tibia extends from the knee to the ankle (hock) joint. The stifle joint is referred to as a hinge joint, meaning it moves forward and backwards only. There is no rotation movement as in the hip joint. Without ligaments, the stifle joint would move in all directions and be unstable and would be non-functional.

There are four ligaments that stabilize the stifle joint. Two of these are on the sides of the knee and the other two are in the knee joint itself. The two ligaments on the sides of the knee are called the collateral ligaments. One is on the outside (lateral) and the other in on the inside (medial). The two ligaments located inside the stifle joint itself are named (in animals) the cranial cruciate ligament and the caudal cruciate ligament. In people the cranial cruciate ligament is the same as the anterior cruciate ligament, which is commonly torn by athletes. The cranial cruciate ligament prevents the stifle from moving forward (cranial) and the caudal ligament prevents the knee from moving backwards (caudal). Both ligaments attach to the femur and tibia within the stifle joint.

Why does a torn Cranial Cruciate Ligament cause lameness?

If the cranial cruciate is torn, then the tibia will move forward in relationship to the femur. You may hear your veterinarian call this an "anterior drawer sign". Anterior just means that the tibia moves forward, indicating a torn cranial cruciate ligament. Tearing of the cranial cruciate ligament is the most common cause for lameness in the dog. The caudal cruciate ligament is rarely torn and usually only occurs when the knee is severely injured from a traumatic incident. On the other hand the cranial cruciate ligament, especially in large breed dogs, can tear just from normal activity or very minimal stress to the ligament.

Why is a torn Cranial Cruciate Ligament more common in larger breed dogs?

The prevalence of torn cranial cruciate ligaments in larger breed dogs has been related to genetic conformational abnormalities, obesity (genetic or overfeeding), excessive activity, slow developing degenerative joint disease (arthritis formation) which weakens the ligament and growth rate differences, during the growth period, between the femur and tibia which causes an abnormal angle of the stifle and additional stress on the cranial cruciate ligament.

What is happening in the affected stifle joint?

When the cranial cruciate ligament ruptures acutely, the dog typically exhibits a sudden lameness in the affected rear leg. Usually the dog will not be able to bear full weight on the leg and may carry the leg. Over the next few days, the dog may appear to get better; however, will usually become lame again over the next few weeks or months. Some pets will have a more mild sequence of events. They may have a lameness that appears to come and go before an episode of sudden lameness occurs, when the ligament breaks completely. Some of these animals may have

had a partial tear of the cranial cruciate ligament. Dogs with a partial tear have some degree of osteoarthritis in the affected stifle joint.

During the time following the injury to the cranial cruciate ligament, the dog will develop osteoarthritis in the affected stifle joint. As the instability continues and the ligament deteriorates, certain biologic inflammatory factors are released in the affected stifle joint. Because of these inflammatory factors and the continued instability, the arthritis can develop quickly.

In addition, damage to the medial meniscus may occur. The medial meniscus acts as a cushion between the femur and tibia and is made of cartilage, which is softer than bone. Due to the instability present, every time the dog walks on the affected leg, the femur slides forward and damages this cartilage cushion. The added damage to the meniscus will accelerate the arthritis development and can worsen the pain.

What can happen to the other rear leg following a torn Cranial Cruciate Ligament?

About fifty per cent of the dogs suffering a torn cranial cruciate ligament in one leg will develop a torn ligament in the opposite rear leg. In some cases, this may occur within months or a year. Studies on weight bearing in dogs with damaged cranial cruciate ligaments have shown that the affected dogs bear only 20-30% of their weight on the affected limb and shift the weight load to the normal leg. This places a significant amount of added stress on the non-affected rear leg. Since the larger breed dogs are already prone to tear their cranial cruciate ligament, it is not surprising that many may also tear the opposite ligament following the initial injury.

What are the treatment options for a torn Cranial Cruciate Ligament?

The usual recommended treatment for a torn cranial cruciate ligament is surgery. Surgery is intended to halt further damage to the knee and give the pet as pain free use of the leg as possible. Due to the release of inflammatory agents into the joint when damaged and unstable, delay in surgery will lead to more and more osteoarthritis. The continued instability can also lead to damage to the medial meniscus. In addition, the dog will shift its weight to the unaffected leg, thus placing more stress on the good intact cranial cruciate ligament, which will increase its chances of rupturing also. Surgery, especially in the larger breeds, provides the best means to reduce these progressive and painful consequences of a ruptured cranial cruciate ligament.

There have been roughly over 200 cited procedures in the veterinary literature as possible surgical treatment options for cruciate ligament tears in dogs. This indicates, that over the years, there is no one procedure that provides completely satisfactory results; however, over the last 10 years, the list has been reduced to 4-5 procedure groups.

In cats and small dogs, maybe 20 pounds or less, one can take a wait and see approach. Many of these animals will heal without surgery and develop little post-injury arthritis. Because of their small size and less weight to bear, waiting a month or so will not be detrimental. If they continue to have lameness in the affected leg after the waiting period, then they would become a surgical candidate. Many of these dogs may have a medial meniscus injury, which is contributing to the continued lameness. Unfortunately, this does apply to the dog that is 40 pounds or more. In fact, the larger the dog and the more active the dog is, the more important it is to stabilize the knee surgically as soon as possible.

The surgical procedures available today can be grouped as follows:

1. Extracapsular lateral suture imbrication
2. Fibular head transposition
3. Fascial strip replacement
4. Ligature bone tunneling
5. Stifle force alteration

A lateral suture imbrication uses a large suture, usually made of monofilament nylon or some type of braided fiber material. The suture is placed on the outside (lateral) surface of the stifle joint and is secured to the femur and tibia to eliminate the instability of the knee. The purpose of the suture is to cause inflammation, which will lead to significant fibrosis. The fibrosis then acts as the ultimate stabilizing force and not the suture. In fact, following the fibrosis, the suture could be removed and the joint will still be stable. It is not unusual that many of the sutures will break down, cause draining tracts and need to be removed anyway. Because of their smaller size and less forces placed on the stifle joint, the extracapsular lateral suture is very successful in the smaller dogs and the vast majority does very well. As with any surgical procedure, there is never a 100% success rate. Once a dog reaches 40 pounds or more there is much more stress placed on the repair. The larger the dog the more stress is applied. The extracapsular lateral suture procedure does not neutralize the forces (as a TPLO or TTA) that caused the cruciate ligament to rupture in the first. These animals will continue to develop significant osteoarthritis and eventually the material used breaks down.

The fibular head transposition procedure moves the top of the fibular bone (fibular head), which is attached to the lateral collateral ligament, forward. The new position is maintained with an orthopedic pin and stainless steel wire. Because the lateral collateral ligament is attached to the end of the femur and the fibular head is now anchored more forward on the tibia, it also will stop the instability. This is a technically difficult procedure and the fibular can be fractured trying to free it to be moved forward. Again the stress forces are not neutralized and the collateral ligament can strengthen and weaken.

There are several fascial strip replacement methods. Fascia is the tough connective tissue that overlies the muscles and is cut into a strip and essentially is used to replace the cranial cruciate ligament. These strips are secured either with sutures or an orthopedic staple. They actually weaken initially and don't increase in strength until about 4 weeks after surgery. Due to the forces placed on them, they may breakdown in the early phase of healing and tend to stretch over time. This repair works well in the smaller dog; however, when used alone in the larger dogs, it will have a higher tendency to break and fail. It also does not neutralize the forces, which are stressing the cranial cruciate ligament.

A bone tunneling procedure is similar to the lateral suture imbrication procedure but tunnels are drilled in the femur and tibia. The suture material, similar to that used in the lateral suture procedure, is passed through the tunnels, tightened and secured, thus stopping the instability. Due to the continued forces placed on them while walking, the suture can actually cut through the bone. They also will cause fibrosis as in the lateral suture procedure. A draining tract can also occur which will require the removal of the suture.

For the larger dogs, none of the first four procedures correct the forces, which caused the cranial cruciate ligament to rupture in the first place. They all simply stop the forward motion. Any of the first four procedures will work well in dogs 40 pounds or less. However, in the larger dogs, without correcting the forces, all of the above repair methods are under the same stresses that the cranial cruciate ligament was before rupturing. Therefore, repair breakdown and progressive arthritic development may occur in many of these cases.

There are two procedures used to correct the forces causing the rupture of the cranial cruciate ligament in larger dogs. One is called Tibial Plateau Leveling Osteotomy (TPLO) and the other is called Tibial Tuberosity Advancement (TTA). These two procedures have become the most popular and effective techniques available today. Both provide stability to the unstable canine knee. The TPLO has been around for several years and was first developed in the 1993. The TTA was introduced to surgeons in the United States in 2004. Prior to the TTA, the TPLO was considered the preferred repair method for larger breed of dogs with ruptured cranial cruciate ligaments. TPLO has been the most common procedure performed for cranial cruciate repair at all the colleges of veterinary medicine in the United States. However, there is a gradual growth to offer TTA surgery also. Both procedures require a tibial osteotomy (cutting of the bone) and using a bone plate to secure the osteotomy to its new location.

Without getting into the biomechanics, essentially both procedures remove the need for the cranial cruciate ligament and relieve the forces that were causing the ligament to rupture.

When success of surgery is defined as improvement in limb function, a resolution of pain and return to normal or near normal activity, then the success rate for TTA and TPLO has been about 90%. However, because of the nature of a cranial cruciate injury, it is not realistic to expect that every patient would have the exact same recovery or results.

What are the potential complications with TPLO or TTA surgeries?

The complication rate for both is low. Although, infection is a possible complication with any surgery, infections are rare and can usually be resolved with treatment and time. Though rare, implant reactions, plate breakage, bone cracks and plate become loose are possible. The implants to be used for the TTA are all made of titanium, which is the least reactive material possible. Most of the other complications listed, usually result from not following the post-operative restrictions, the animal being too active during the healing process or if the animal takes a fall. Progressive arthritis, probably the least with TTA and the most with procedures that don't neutralize the stress forces, can progress.

With the anesthetics used and the monitoring equipment available today, anesthetic complications are extremely rare; however, as in human medicine, problems can arise.

It should be noted there are complications and failures in any of the procedures mentioned and no procedure fits every case. One can only try to select the procedure that provides the best outcome for that particular case.

What are some of the advantages for a TTA versus TPLO?

First of all, even though it is relatively a newer procedure, thousands of TTA procedures have been performed. From the veterinary literature and reports by surgeons performing TTAs, the following observations have been made:

1. Quicker recovery – The procedure is less invasive and requires less surgical time.
2. Less implant failure – The strain put on the plate is less than what is seen with TPLO.
3. Good results with chronically arthritic knees
4. Fewer complications
5. Early research suggests that arthritis does not progress with a TTA as seen in the other procedures used.

6. Does not compromise the weight-bearing portion of the tibia.
7. Less invasive procedure
8. Better range of motion is maintained.
9. The titanium implants used for TTA are more bio-mechanically compatible.
10. The TTA decreases the joint forces

What is the aftercare following surgery?

The majority of the postoperative care involves restriction of the dog's activity, especially for the first 8 weeks. **No off leash activities are allowed.** Inside the house the dog should avoid stairs, and slippery floors. **Absolutely, no running, jumping or playing is allowed the first 8 weeks after surgery.** When your dog is not under your direct control, the pet should be kept confined to a small room, cage or crate, if possible. A comprehensive postoperative care handout will be supplied at the time of discharge. The dog should be radiographed 8 weeks after surgery to check on the healing process. With proper healing, activity will be increased.

Hopefully, this information will be helpful in not only understanding your pet's condition but also help you in making an informed decision about which treatment option which is best for you and your pet. As outlined, several surgical options exist and many combinations of factors are considered in technique selection, such as body weight, age, pre-injury activity level, current health status and the presence of other concurrent orthopedic problems.