

Crucial Facts about

CRUCIATE DISEASE

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Part II



AS DISCUSSED IN THE LAST ISSUE, a cruciate limp is typically caused from instability and/or inflammation. On that basic premise, we can discuss the treatments that help to alleviate the pain and instability of the stifle joint and attempt to restore normal function to the limb.

Just like so many training situations you encounter, what is right for one situation, person, or dog may not be right for another, because of this these decisions can be associated with controversy. There are people passionately opinionated on all sides of this topic, with some people being anti-surgery, believing it causes more problems than it fixes, and some feeling surgery is the only way to go. The most common questions that are asked when determining how to address this problem are, what treatments to do for partial cruciate tears, whether or not to do surgery, and if surgery is chosen, when to do the surgery, what surgery to perform, who should do the surgery, and what to do

with the meniscus at the time of surgery. The majority of practitioners and clients come to agree that the approach to cranial cruciate disease is a multi-modal approach that involves many treatments being used simultaneously.

Our general goals for surgery are to promote early functional recovery, decrease progression of osteoarthritis, and minimize complications. The ideal procedure would eliminate cranial tibial translation, limit tibial internal rotation, and prevent stifle hyperextension which are the three actions of the normal cranial cruciate ligament (CrCL).

No currently performed surgical technique in dogs is a repair of the actual cruciate ligament. Instead, the surgical techniques are designed to replace the need for the cranial cruciate ligament. The cruciate ligament tissue has very poor blood supply itself and does not have good healing potential which makes repairing it difficult, which explains why it is not done. Although there is no absolute published evidence to say one type of treatment is better than the other in working dogs (yet!), surgical treatment is most often regarded as superior for return to athletic function with the most consistent outcomes.

Surgical Options for CrCL Rupture

Surgery for cranial cruciate disease is primarily aimed at treating the instability in the joint because treating the instability helps to minimize the pain and inflammation. The surgeries are generally in two broad categories: osteotomy-based and extracapsular suture-based techniques. Osteotomies are defined as cutting the bone and the extracapsular techniques are stabilization outside the joint capsule surrounding the stifle. Intracapsular (in the joint) procedures have been attempted in dogs but have proven to be significantly inferior to extracapsular and osteotomy approaches and thus will not be discussed here.

Three Days to Kill, "Vivi," owned and handled by Sarah Shull, DVM; photo by Sarah Shull.

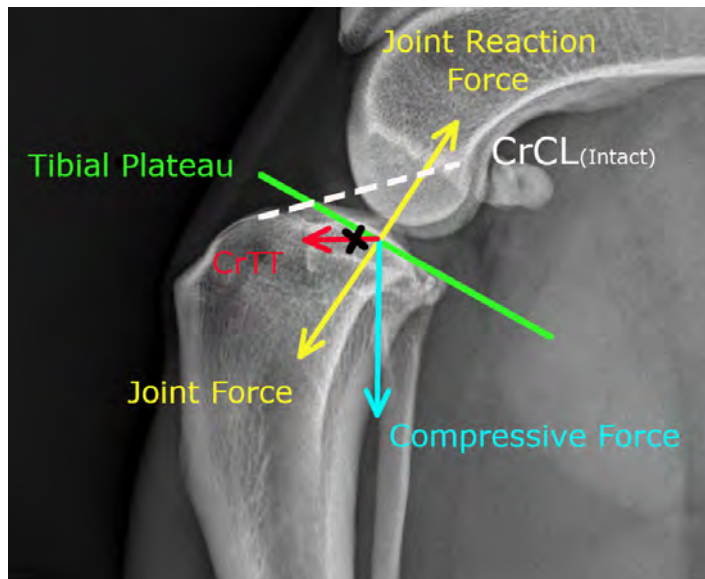


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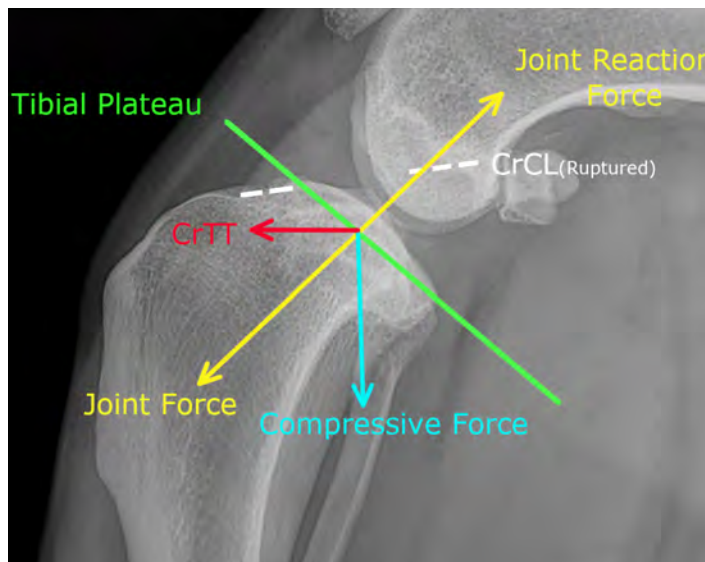
Tibial Plateau Angle (TPA) and the Forces on the Stifle

In order to understand the osteotomy procedures, a brief explanation of the *Tibial Plateau Angle (TPA)* and the forces on the stifle is required. The measurement of the TPA is the basis for surgical correction. The TPA is calculated by taking properly positioned radiographs and drawing bisecting lines through the tibia lengthwise and across the tibial plateau. As discussed in the last issue, a steep TPA without clinical signs or symptoms, does not warrant preventative surgical correction, even though this was considered a possibility in the past.

Between 1983 and 1993, Drs. Slocum and Devine described the forces acting on the canine stifle while bearing weight. These compressive and joint forces result from the femur pushing down on the tibia with the rounded ends of the femur against the slope of the top of the tibia (tibial plateau). The tibia does not slide forward in a normal stifle, this is due to the hamstrings, the menisci and an intact CrCL acting on the tibia to keep it in place. With a ruptured CrCL, the tibia slides forward in response to those stresses during weight-bearing resulting in cranial tibial thrust (CrTT) or instability. This work became the basis behind the adoption of the CrTT palpation technique for the diagnosis of a CrCL rupture, also called thrust or indirect drawer.

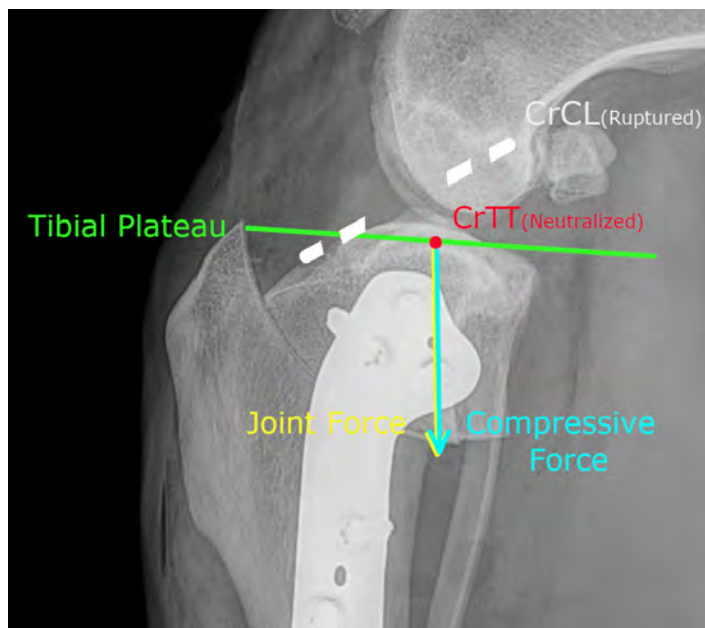


Normal forces acting on the canine stifle. An intact CrCL and moderate tibial plateau angle (TPA) prevents cranial tibial thrust (CrTT), counteracting the normal joint forces and compressive forces.



Instability with a ruptured CrCL.

A ruptured CrCL and steep tibial plateau angle allows cranial tibial thrust (CrTT) felt by the dog as instability during weight-bearing.



Post-Op TPLO with Cranial Tibial Thrust (CrTT) Neutralized.

As the tibial plateau angle (TPA) is reduced with a TPLO, the joint and compressive forces are aligned and CrTT is neutralized, resulting in a stable stifle during weight-bearing.

Osteotomy-based techniques (TPLO and TTA)

The most common osteotomy type procedures are the *Tibial Plateau Leveling Osteotomy (TPLO)* and the *Tibial Tuberosity Advancement (TTA)*. These procedures work by changing the biomechanics of the stifle.

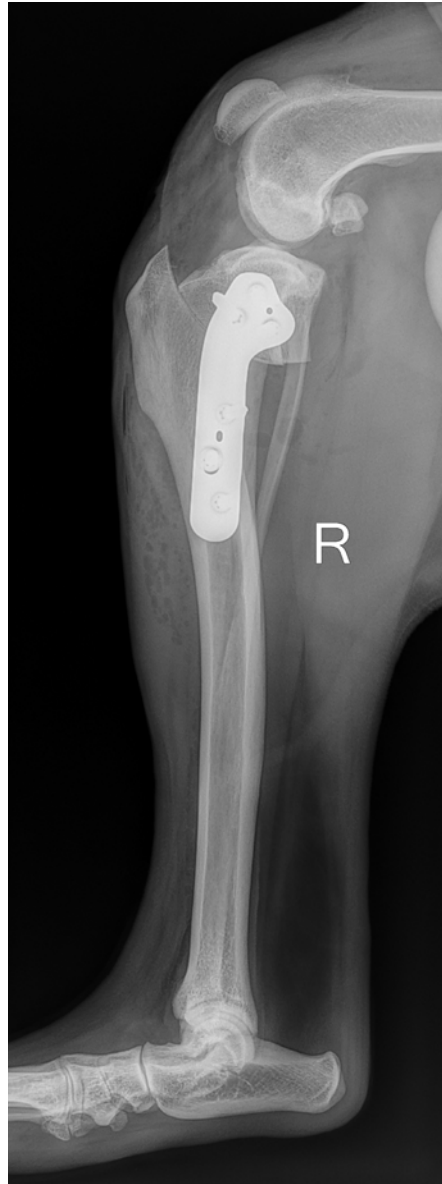
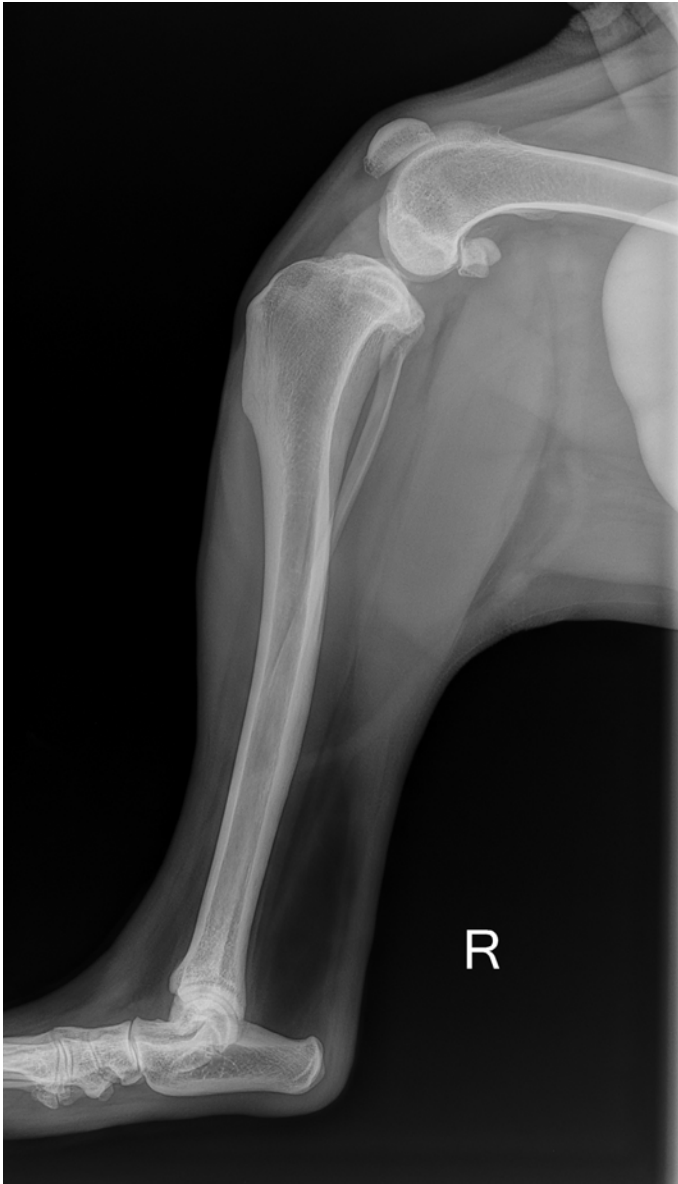


The field trial retriever patient is ready for a right sided TPLO.



After precise calculations, a bone saw is used to make the proper cut in the tibia for rotation of the tibial plateau in a TPLO.

First, we will talk about the most commonly performed surgery in our field trial population, the *TPLO*. The TPLO involves making a circular cut in the upper tibia and rotating its contact surface (tibial plateau) to reduce the TPA. The TPLO aims to provide functional stifle stability when weight bearing (stance phase) which eliminates CrTT, and the need for an intact CrCL. The cut in the upper tibia is bridged with a bone plate and screws post rotation to anchor it in place and allow for proper healing. Once the bone has healed, the bone plate and screws are not needed, but they are rarely removed unless there is an associated problem such as irritation or infection.



A planning radiograph taken of our field trial retriever prior to his TPLO.

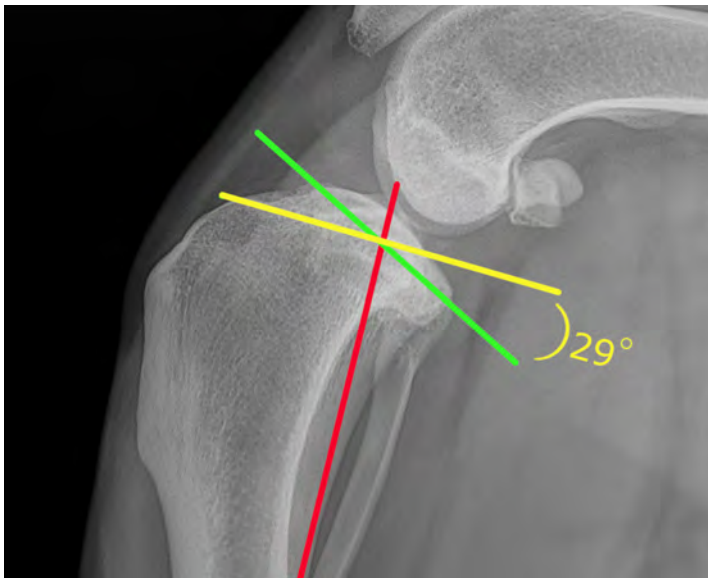
His immediate post TPLO radiographs showing the bone cut and rotation and the implants (bone plate and screws).

WORDS TO KNOW

- Stifle – knee
- Femur – thigh bone
- Tibia – shin bone
- Patella – knee cap
- Radiograph – X-ray
- CrCL – Cranial Cruciate Ligament
- CaCL – Caudal Cruciate Ligament
- Medial – towards midline of body, inner surface
- Lateral – away from midline of body, outer surface
- Cranial – towards head
- Caudal – towards tail
- CrTT – Cranial Tibial Thrust
- TPA – Tibial Plateau Angle

COMING IN FUTURE ISSUES

- Part III – Prevention**
 - Genetics – Update from University of Wisconsin
 - Activities to do or not to do?
 - Research
- Part IV – Rehabilitation**
 - Adjunct treatments
 - Follow a cruciate patient through rehab and return to sport



Tibial Plateau Angle (TPA) Pre-Op TPLO
Green Line Represents the Tibial Plateau Slope of 29°

Initially, Dr. Slocum's recommendation was to reduce the angle to 0°, but work at Michigan State in 2001 showed that reducing it to 6.5° was superior to preserve stifle biomechanics and protect the caudal cruciate ligament. Most surgeons currently reduce this angle to 5-6° with good clinical outcomes. TPAs at the time of surgery are often greater than 20° as seen in the images here where our pre-op TPA was 29° and our post-op TPA was reduced to 5°.

The focus of the TTA and TPLO is stability during weight bearing, the stifle can still be unstable at rest with no consequence. This represents a difference from intra and extracapsular stabilization techniques, which both aim at restoring stifle stability throughout the joint range of motion.

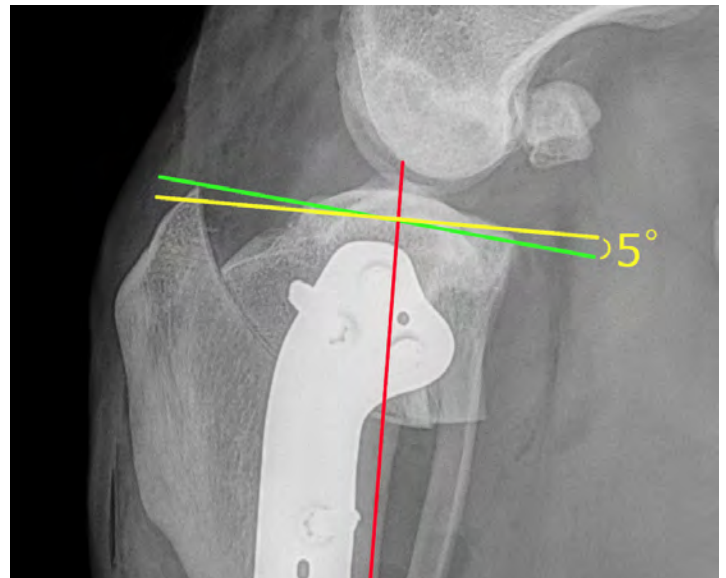
The perceived advantages of osteotomy techniques compared to suture-based techniques are the superior outcomes attained in larger dogs relative to limb function and athletic mobility with less progression of arthritis.

Potential Complications: Across all studies, the complications range from 5-15%, but each study had different definitions of complications, including anything from incisional irritation to implant failure. The complications seen can be implant (plate and screw) failures, tibial crest/tuberosity fractures, infections, technical errors, patellar ligament desmitis, delayed bone healing, pivot shift, and cancer in areas of the implants.

The major disadvantage is that an osteotomy requires healing of the bone, which takes time and proper care, and if a problem is observed (such as implant failure, or failure of the bone to heal), revision surgery may be required and may negatively affect short and long-term outcomes. Fortunately, such complications are rare, especially when the procedure is performed by an experienced board-certified surgeon.

Advantages: Clinically, it seems that the most rapid recovery comes from the TPLO, a better range of motion is seen than with extracapsular repairs, and they show a slower progression of OA.

Tibial Tuberosity Advancement (TTA) involves a linear cut along the front of the tibia (tibial tuberosity). The tibial tuberosity is advanced forward until the attachment of the quadriceps/patellar ligament is oriented approximately 90 degrees to the tibial plateau. This is another way to accomplish the same mechanical advantage offered by the TPLO that renders the knee more stable in the absence of the CrCL, neutralizing CrTT. The TTA and TPLO share similar advantages and disadvantages.



Tibial Plateau Angle (TPA) Post-Op TPLO
Green Line Represents the Tibial Plateau Slope of 5°.

Similar to the TPLO, the cut in the bone is stabilized using a specifically designed bridging bone plate and screws. Oftentimes the decision between TPLO and TTA is based purely on the opinion of your surgeon and their personal technical experience. Though TTAs are not recommended in patients with a TPA >30° and anecdotally, the TPLO is seen to be better suited for athletic dogs.

Potential Complications: Complication rates reported for the TTA are higher than the TPLO at approximately 19% and many surgeons view TTA implant failures as harder to revise than TPLO implant failures. Most commonly seen complications include, poor plate and/or cage positioning, narrow osteotomy width, and tibial tuberosity fracture.

Advantages: TTAs are potentially the surgery of choice for dogs that have both luxating patellas and CrCL rupture, but this combination is rare in retrievers.

Extracapsular Suture-Based Techniques

Extracapsular suture-based techniques rely on a heavy gauge suture material that is placed just on the outside of the knee joint, yet under the skin, to mimic the stability offered by the CrCL.

Common names for the suture methods include ex-cap suture, lateral fabellar suture stabilization, fishing line technique, but is most accurately termed the *modified retinacular imbrication technique (MRIT)*. The MRIT is a popular technique developed by Dr. Flo at Michigan State in 1975. While there are many variations of this technique, suture material used, and types of securing implants, the consistent goal is to replace the function of the CrCL with a suture placed in similar orientation to the original ligament. This limits the cranial drawer motion during weight-bearing and rest. The long-term goal is to facilitate the formation of organized scar tissue around the joint that will provide stability even as the suture gradually stretches or breaks (beginning at 8-12 weeks post-operatively). There is also a newly developed Tight-rope® procedure which uses a braided suture and is performed by some as an alternative to the MRIT.

Potential Complications: Reported complication rates are approximately 17%. This typically includes failure of the suture and progressive development of arthritis. The main risk factors for complications with suture-based techniques are patient size and age; with larger and younger patients having more complications. For these reasons, many surgeons reserve suture techniques for small breed, older, and/or inactive dogs.

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The disadvantages of these techniques involve a slower recovery and increased progression of osteoarthritis compared to osteotomy procedures. Because of these factors, the extracapsular techniques may not be optimal for young athletic dogs.

Advantages: Suture-based stabilization surgeries are lower cost procedures that do not require specialized training or equipment, are easy to perform and do not involve a bone cut. They are effective in eliminating cranial tibial drawer instability.

Treatment: Is Surgery the Answer?

Overall, long-term prognosis for animals undergoing surgical interventions in CrCL disease is favorable, with reports of significant improvement in 85-90% of the cases. When looking at use of leg one year after surgery, the procedures are very similar. In clinical experience, with long-term examination of post-surgical patients, the osteotomy-based procedures, specifically the TPLO, provide the best range of motion and joint health compared to the extracapsular procedures.

An advantage of surgery vs conservative management is it gives us a chance to explore the stifle. The meniscus can be inspected and treated if needed, and the torn cruciate edges can be debrided (removed). As previously mentioned, meniscal tears are common in cruciate deficient stifles, studies reporting anywhere from 33-77% of dogs with CrCL disease affected. The commonly accepted approach to meniscal treatments involves preservation of as much of the meniscus as possible during surgery, therefore only the damaged piece of the meniscus is removed leaving the rest to serve its function as a shock absorber in the stifle.

At this time, in cases of a steep TPA or in anticipation of the inevitable rupture of opposite CrCL, surgery as a preventative is not recommended before the stifle is symptomatic (limping, pain, or instability) as the risk of potential complications cannot be justified. Partial cruciate tears are a decision-making dilemma, with when to do surgery depending on how severe the dog's clinical signs and symptoms are, as well as anticipated length and intensity of potential future activity and career.

As complications are compared, it is not just a %, what really matters is how catastrophic the complication is. Risks associated with osteotomy procedures can be less frequent than extracapsular overall, yet the risks can be more detrimental to the dog. For example, total implant failure or infection in the bone spreading elsewhere in the body is more significant than stretching or failure of the suture in an extracapsular repair.

All options have risks and complications associated with them, as does leaving a CrCL rupture untreated. As discussed in Part 1, osteoarthritis is happening within 2 weeks of the beginning of cruciate rupture, often before clinical diagnosis has occurred. While arthritis can progress regardless of treatment type, it is expected to be slower when surgery is performed, especially when the TPLO and TTA are performed.

Treatment: Non-Surgical/Conservative

A study by Vasseur et al in 1984 showed that 85% of dogs less than 35lbs were significantly improved over time with conservative management, yet only about 19% of dogs over 35lbs showed similar improvement. Non-surgical treatment usually involves a combination of pain medications, exercise modification, joint supplements, physical rehabilitation, and possibly braces/orthotics.

Conservation (non-surgical) management of a cranial cruciate defi-

cient stifle can be successful, but with less predictable results. It relies on developing fibrosis and scar tissue around the stifle and targeted muscle strengthening to give the joint some stability.

Potential Complications: Conservative management typically involves exercise restrictions that begin like surgical restriction in first 6-8 weeks but can need a variety of lifelong restrictions. Although no study has been performed, clinically, conservative management involves more medications chronically than surgical repairs initially.

The major disadvantage in sporting dogs is predictable return to sport, as we are relying on scar tissue for stability, there is often increased limping, inflammation and pain with increasing activity. Field activity involves quick turns and changing terrain that can cause flares, leading to pain and subsequent limping.

Advantages: The risks associated with conservative management are low with no anesthetic risks or surgical risks such as infection or implant failure. This approach is often taken with smaller or older patients or ones with increased risks from other conditions such as simultaneous neurologic or heart disease.

Treatment: How to decide?

Deciding on treatment involves weighing many options. You must consider the dogs' activity level, size, age, skeletal conformation, degree of knee instability, other ongoing conditions, body condition, if it involves one or both sides currently, meniscal injuries as well as financial limitations and previous experiences.

Choosing your surgeon

It is my opinion, that osteotomy-based procedures such as the TPLO and TTA should be performed only by board certified orthopedic surgeons especially in athletes as they are more experienced and less likely to have errors involved with the actual surgery. Finding a surgeon that has a lot of experience in performing the procedure, is familiar with sporting dogs, and will support post-op professional rehabilitation is paramount for best outcomes. Extracapsular repairs can be done successfully in many general veterinary practices, but the incorporation of post-op rehabilitation will optimize the outcome.

Treatment: Pharmaceuticals and Nutraceuticals

As we treat our dogs that have CrCL disease, we can address the inflammation and pain with anti-inflammatories such as Non-Steroidal Anti-inflammatory Drugs (NSAIDs), analgesics (pain medications) and a variety of nutraceuticals.

The most commonly prescribed NSAIDs include Rimadyl (carprofen), Deramaxx (deracoxib), Metacam (meloxicam), or Galliprant (grapiprant) with Gabapentin, Amantadine and Tramadol being the most commonly used analgesics. Many of these drugs are used initially post injury or post-op but also can be used for chronic osteoarthritis either daily or as needed during flares. In addition, injectable Adequan (glycosaminoglycan) has both anti-inflammatory and joint health benefits.

Nutraceuticals are used for the promotion of joint health as chondroprotectants and to decrease inflammation while improving joint fluid. Supplements in general are not regulated, so using products from reputable veterinary companies will give the most predictable results. The majority of research around these products is to determine if they have potential benefits in the short term, but little work has been done that proves long-term benefits. The products I recommend currently for osteoarthritis and joint health are Dasuquin (joint supplement) and Wellactin (omega fatty acids). These drugs and supplements all have pros and cons and will be discussed more during the rehabilitation part of the series.



A Field Champion's TPLO Recovery – Pre-op and post-op



Other Considerations

Universal recommendations no matter what treatment is performed for CrCL are maintaining proper body condition and management of osteoarthritis. As a reminder, excessive body weight contributes both to early breakdown of joints and tissues due to mechanical stresses, in addition fatty tissue also promotes inflammation within joints and all systems of the body. Although dogs in this sport are often in good muscular condition, anecdotally close to half of the dogs seen at trials are fat. According to research, obese dogs are 4 times more likely to tear their cruciate than dogs of an ideal body condition. Therefore it is important to consistently assess your dogs' body condition score and adjust diet and exercise to keep them in the proper range. Can you feel *your* dog's ribs?

We will delve deeper into the non-surgical adjunct options of CrCL disease in part 4 as we discuss rehabilitation therapy. This will include bracing, icing, laser therapy, therapeutic exercises including hydrotherapy and regenerative medicine (PRP and stem cell).

In summary, what is the right answer for the treatment of your dog's CrCL disease is up to you. The plan should be a combination of either surgical or medical management with the focus of minimizing pain, inflammation and instability. At home and professional rehabilitation therapy and multimodal osteoarthritis management is recommended for any dog with CrCL disease regardless of surgical treatment. More information needs to be collected and analyzed to develop field trial specific recommendations for returning to sport for our retrievers.

Throughout Part 2, 3, and 4 we will be following an FC through his TPLO recovery. He had his surgery on 6/5/2020 and at the time of this article, is doing fabulously. ■

Information compiled in this article is from lectures from Dr. Loic Dejardin, Michigan State University, Canine Cranial Cruciate Ligament Disease Part 3 – Treatment and Prognosis, Drs. Fauron and Perry, Veterinary Times, 2017 and www.acvs.org.

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