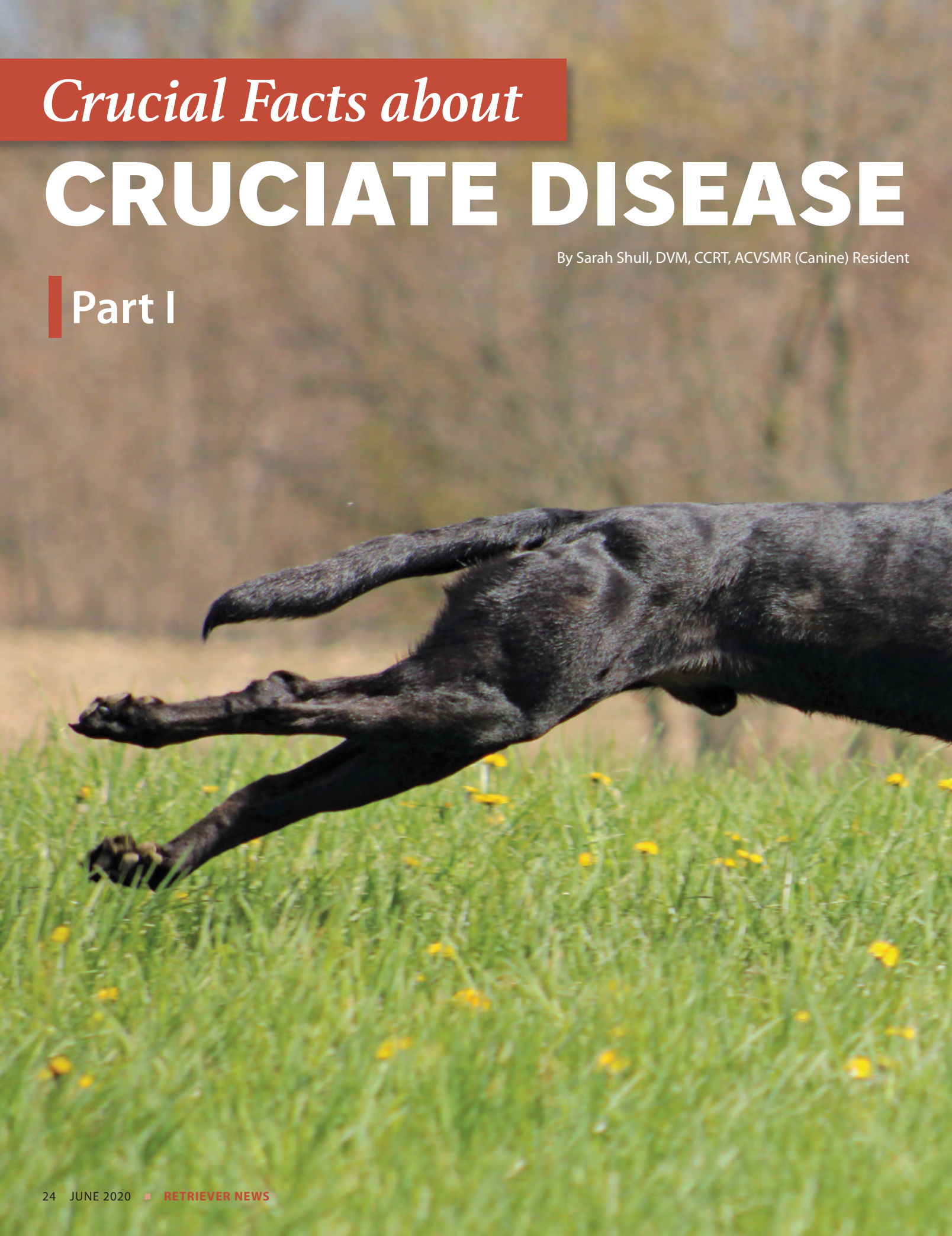
Crucial Facts about
CRUCIATE DISEASE

By Sarah Shull, DVM, CCRT, ACVSMR (Canine) Resident

Part I



EVERYONE READING THIS has had experience with cruciate disease in dogs, you either have worried about it, have been through it or at least know someone that has. The impetus for this article comes from all of you that have asked me these great questions at the tailgate, at training or in the gallery.

Over the next few months, we will be navigating through the realm of cruciate disease with hopes of providing education to assist you in making decisions for your dog(s) futures. There will not be black and white answers and concrete advice available here, as is the case with most health-related issues, however hopefully this will help when you are confronted by this problem that has many shades of grey.

To put it in perspective imagine, it is the end of a great training session; your dog has just nailed a concept that they have been struggling with for weeks and you throw a happy bumper on the way back to the truck. As they dive on the bumper, you hear a yipe and they come hobbling back to you on three legs. Or maybe you get them off the truck, and they are as happy as can be yet only barely toe touching that one hind leg, even though that leg was completely sound when you put them in the crate for the trip.

In a span of three minutes, you cycle from denial to anger to worry and back again, thinking of all the potential causes. In that moment you wonder if they broke or dislocated something and you curse and swear and finally decide it has gotta be a cruciate. It's always a cruciate right?

Cruciate disease is the most common cause of hind leg issues in dogs. It is responsible for 20% of canine lameness and burdens U.S. pet owners with at least $1 billion in healthcare costs each year.

Certain dog breeds are known to have a higher incidence of cruciate diseases including the Rottweiler, Newfoundland, Staffordshire Terrier, Mastiff, Akita, Saint Bernard, Chesapeake Bay Retriever, and Labrador Retriever. It has also been found in a few studies that females have a higher incidence than males and the typical age of first presentation of both males and females is 5-8 years. The prevalence across all breeds is reported to be 0.5-2% and yet in Labradors it is closer to 6%.

Though cruciate disease is the often the cause of hind leg problems it is important to remember that there are numerous other things that may cause a hind end limp. There are over a hundred bones, joints, tendons, ligaments and structures that make up one hind leg, and damage to any of them can cause a limp.

What does a cruciate limp look like?

Cruciate problems typically are what we refer to as acute on chronic. Oftentimes that sudden (acute) incident is what drew your attention to that hind leg, but as you think back maybe a few weeks to months ago they did have an intermittent subtle limp (chronic). Retrospectively, it was worse when they first got out of crate but as they worked it seemed to improve, maybe they were a little reluctant to jump up on the couch or acted a little stiff. These are all common potential signs of cruciate disease. That yipe you heard when diving on the happy bumper was not when the disease began.

After the acute presentation, over the next 3-5 days the limp progresses from non-weight bearing to toe touching, to sometimes intermittent limping with exercise as inflammation settles and fibrosis begins. The dog often holds the affected hind leg out to the side when standing, won't sit square, or puts their leg extended out to the side when they sit (often referred to as a positive sit test). Many dogs will shift their weight away from the damaged leg when they stand but the lameness is less obvious during walking.

Rimfire's I'm Your Huckleberry, "Huck," owned and handled by Fred Lehnertz; photo by Sarah Shull, DVM.

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

Oftentimes these limps can be almost non-existent when going fast, but more obvious when they are slowed to a walk. (thank you all that have humored me in this request to get your dog to walk slow, I know it's not easy!)

Other potential signs include, swelling, pain, difficulty rising from a sit, trouble jumping up, decreased activity level, lameness of variable severity, decreased muscle mass in the affected leg (atrophy), decreased range of motion of the stifle (knee), a popping noise, thickening on the inside of the tibia (fibrosis or scar tissue) or by the patella (knee cap). An affected dog can show any number of these symptoms.

These can be confusing signs as they can also be common presentations in our retrievers with: tick-borne disease, hip arthritis, Achilles tendon disease, diseases of feet or toes, dysfunction of the lumbosacral disc space compressing nerves in the lower back, panosteitis (an inflammatory bone disease seen mainly in young, large breed dogs) or osteochondrosis (OCD). Pain in the iliopsoas (groin) muscle also can be mistaken as the cause of a limp caused by cruciate disease.

Why do they limp?

A dog with a cruciate disease limps because of inflammation, pain and instability. These causes can be in varying degrees over time and depends on how much of the cruciate ligament is torn, and how much inflammation is present day to day within the body. Over time, the body responds to the joint inflammation and instability and begins to form scar tissue, most commonly over the medial or inside surface of the upper tibia. We call this medial buttress and can be useful in helping to diagnose partial cruciate tears as the level of instability may be minimal in those patients.

Promotion of inflammation in the body is exacerbated by excessive fat on their body. Fat itself is an active pro inflammatory organ and can add directly to the excessive mechanical strain and wear and tear on the tissue while also creating more inflammation in joints. The vicious cycle known as arthritis is fed by inflammation, thus since cruciate disease is a degenerative process, arthritis begins often before your dog ever comes up noticeably lame and before an official diagnosis is made.

The most common complication caused by cruciate disease is long-term impairment due to arthritis. The goal of every treatment including surgery is to minimize the progression of arthritis and decrease the effects of instability. We will fully discuss all the treatments available in upcoming issues. These arthritic changes cause loss of stifle range of motion, muscle atrophy and guarding of offloading of the affected limb. These changes can then lead to earlier breakdown or increased injury to the other joints, limbs and musculoskeletal tissues of the body compensating for the affected hind leg

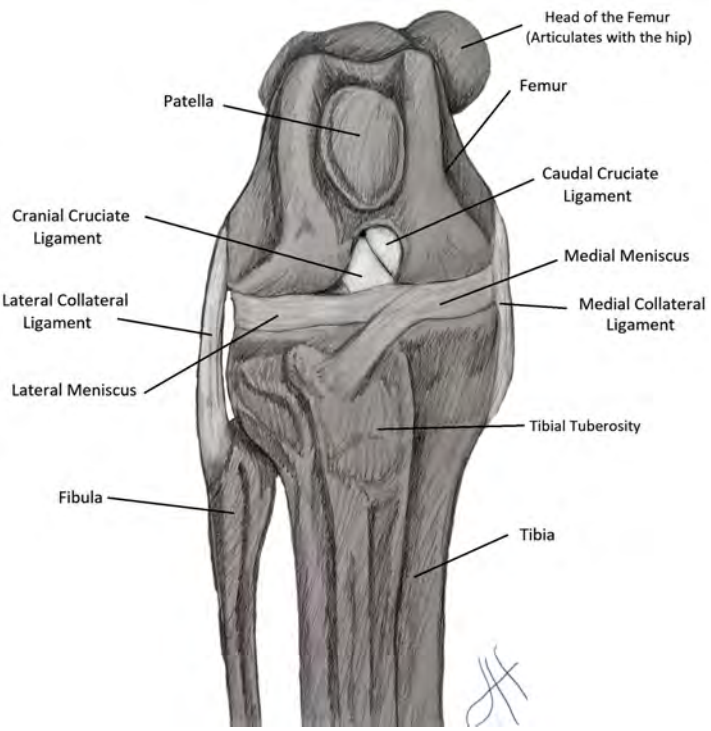
Why is it called cruciate disease?

The human equivalent of the dog's cranial cruciate ligament (CrCL) is called the anterior cruciate ligament (ACL), both names referring to their orientation more to the front of the body. The most common cause of cruciate damage in people is a sudden trauma. For example, the quarterback gets sacked and their leg bends in a way it shouldn't (and you see the replay at least 104 times) or from your skiing or soccer adventures. This traumatic rupture is less common in dogs, accounting for less than 15% of cruciate tears.

Also, in dogs, it is a disease affecting both legs. Over 50% of dogs are going to have trouble in their other stifle within a year after diagnosis on the first side. When we radiograph the other hind leg, up to 85% in some studies show signs of disease such as joint swelling and arthritis even without outwardly visible signs or instability in that leg.

It is a degenerative condition, meaning the ligament is not healthy when it ruptures, and it is a degeneration that has been taking place over time. The development of this problem in dogs is much more complex than in humans. Dogs suffer from different degrees of rupture which can be partial or complete and many partial tears progress to full tears over time and with added stress.

It is caused by a combination of many factors, including aging of the ligament, obesity, poor physical condition, and breed. Additional predispositions include conformation and structure of hind legs and pelvis. There are many other potential considerations such as spaying and neutering, and genetic causes are actively under investigation.



Anatomy of the stifle

In addition to the two cruciate ligaments, the femur and the tibia, the canine stifle joint is made up of collateral ligaments on the medial (inner) and lateral (outer) surfaces, the patella on the front side, and two menisci. The bone ends are lined with cartilage and a synovial capsule surrounds the entire joint. The joint gets its nutrients from the joint fluid that circulates throughout the area every time the stifle flexes and extends and when a weightbearing step is taken. The surrounding muscles, tendon and skin provide additional stability, mechanical actions and sensory feedback.

The word cruciate is an adjective that means cross-shaped. The canine and human knee have two cruciate ligaments, one running from back to front and outside to inside and one opposite, crossing each other in the middle. A ligament is a connective tissue structure that goes from one bone to another, in contrast to a tendon that typically goes from a muscle to a bone. The cruciate ligaments run between the femur and the tibia.

The cranial cruciate ligament is the major stabilizer of the canine stifle. It functions to prevent cranial tibial translation (towards the head motion of the tibia in relationship to the femur), limit tibial internal rotation and limit stifle over-extension (straightening).

Expanding on the anatomy on the cranial cruciate itself, it runs from the back of the femur to the front of the tibia directed from more out-

side to inner plane of the leg. Two bands of tissue make up the ligament, one band is thin and is tight when stifle is flexed and extended whereas a larger band is only tight in extension.

These two parts of the cranial cruciate are important in partial cruciate tears as there still may be stability of the stifle on palpation and to the dog. With partial tears, the intermittent limp is caused typically by inflammation, swelling and pain whereas complete tears, oftentimes have more pronounced constant limps of variable severity because of the instability in addition to the inflammation and subsequent pain.

The two menisci are C-shaped cartilage-like structures sitting between the femur and tibia. They are the shock absorbers of the joint, accounting for 65% of the load transfer across the joint. They also give feedback to the dog what position the stifle and leg are in (proprioception). It is very commonly injured when the cruciate ruptures as it becomes trapped as the tibia slides forward under the femur. Meniscal injuries are very painful and oftentimes cause the "popping" noise that is heard when evaluating for cruciate tears. The medial or inner meniscus is by far the most commonly affected due to its attachments and the fact that dogs put more weight on that surface of their leg.

Meniscal injuries are very rare in dogs without concurrent cruciate disease, but approximately 45% of dogs with cruciate disease have meniscal tears. There is a lot of controversy about what to do with an uninjured medial meniscus at the time of surgery, as papers have gone back and forth on this over the years. An uninjured meniscus is often seen as a dog that doesn't break, it just hasn't broke yet; it can be a ticking time bomb for many dogs. Many surgeons currently will release an uninjured meniscus at the time of surgery to try to preserve its function while freeing up the attachments to minimize it from becoming trapped and tearing. If visibly damaged or torn at the time of surgery, the surgeon will remove the damaged tissue (a partial meniscectomy), while leaving as much tissue to serve the purposes as discussed.

The second cruciate, the caudal cruciate, has very limited function in the canine stifle and isolated tears of only the caudal cruciate are rare and if they do occur, often can be conservatively managed. However, the caudal cruciate becomes increasingly important in some of our surgical techniques such as the Tibial Plateau Leveling Osteotomy (TPLO) or Tibial Tuberosity Advancement (TTA) and one of the reason aftercare recommendations are critical to follow.

One interesting point about the cruciate ligaments and menisci are that they have very little if any healing potential. They have very poor blood supply on their own and receive their nutrients from surrounding tissues, which is important in choosing the most effective treatment option. We will talk more about surgeries in upcoming months. Nevertheless, it is good to mention it is crucial that the surgeon evaluate both the menisci and the entire cruciate ligament when performing the surgical repair chosen.

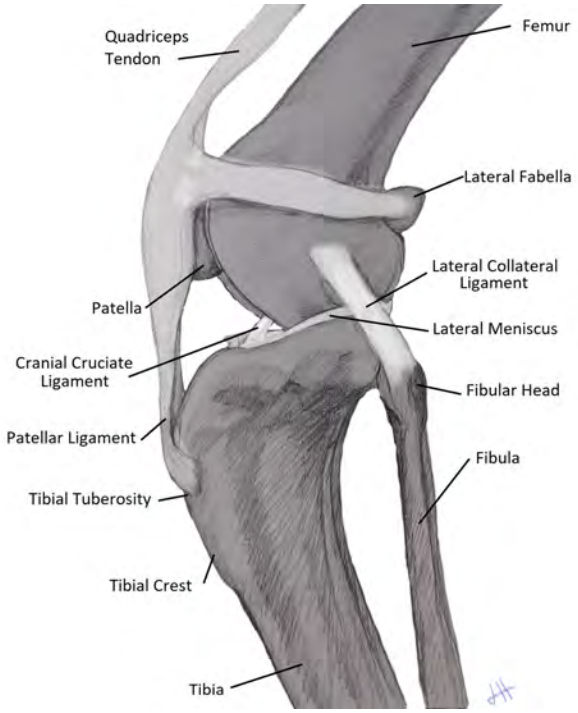
Diagnostics

Diagnosing complete tears of the CrCL is easily accomplished by a veterinarian using a combination of gait observations, physical examination findings, and radiography (X-rays). By contrast, the diagnosis of partial cranial cruciate tears may be more challenging.

The stifle joint will be taken through a full range of motion in both flexion and extension feeling for crepitus (friction), meniscal popping, joint effusion, medial buttress and reduced joint range of motion. The muscles of the entire hind leg are palpated for muscle atrophy and painful trigger points either from the initial injury or secondarily from the abnormal gait. The hips, hock (ankle) and toes are palpated, and toe pads and nails are inspected.

Once the orthopedic examination findings direct us to stifle disease, more specific tests to assess stifle stability are performed. These are typically referred to as drawer tests and can either be direct drawer, testing if the tibia can move forward in relationship to the femur (should not be able to with an intact cruciate), indirect drawer, also known as tibial compression, or thrust which is a test of the tibia moving forward when forces are put on the lower limb to simulate weight bearing. These tests can be done awake but may take sedation in a heavily muscled, active or painful dog.

Radiographs are taken to confirm the presence of joint effusion (abnormal fluid accumulation in the joint), the degree of arthritis, to aid in surgical planning and to rule out concurrent disease conditions such as bone cancer. Radiographs are black and white and shades of grey, they show positions and changes of bones well, but we cannot see the cruciate ligaments or menisci themselves. Therefore, we are looking for secondary changes of joint effusion, fibrosis, and arthritic changes.



Changes on radiographs can be detected as early as two weeks after cruciate ligament damage. When radiographing one stifle, the seemingly unaffected hind leg should be imaged as well as some studies show up to 85% early changes detected in the non-symptomatic leg at the time of diagnosis as previously mentioned.

When a properly positioned radiograph is taken, the Tibial Plateau Angle (TPA) can be measured for the planning of surgery. This TPA has gotten a lot of press over the years as the steepness of this angle was thought to be the cause of cruciate disease. However, after some extensive and varied research it has been found that, although some believe a steep TPA can be a predisposing factor, many dogs with steep TPAs don't end up developing cruciate disease and the definition of what constitutes steep has been up for discussion.

As we discussed earlier, many things can make your retriever have a hind end limp. Therefore, when their stifles are being radiographed to assess for cruciate problems, up to date images of their hips and lower spine can be valuable to include in this imaging, to evaluate for other causes or contributing factors.

In humans, MRIs and arthroscopy are commonly performed for diagnosing cruciate and meniscal injury. In dogs, because of likelihood of a surgical repair (with inspection of anatomy of stifle), the expense

and anesthesia required for an MRI usually does not justify it being performed. In addition arthroscopy in dogs also requires heavy sedation and/or anesthesia and full clipping of the hair around the area and is also usually performed only with a specific intent (i.e. to diagnose a meniscal tear not evident at surgery or to evaluate partial tears for certain treatments) rather than to make a cruciate diagnosis.

To summarize, cruciate disease is a degenerative condition that commonly affects both hind legs in canines. Thus, the day your dog started limping was not likely the beginning of the disease process. A dog's body condition and genetic predisposition play crucial roles in the development of this disease, and there are still ongoing investigations into these and other causes of predisposition. Inflammation and instability are what cause the symptoms we see, and partial chronic tears are common. Arthritis is inevitable in this disease and there are many management techniques to aide in keeping your dog active and comfortable. Unfortunately, treatment and preventative options are not always black and white but in future issues we will explore what is known so far and how you can help to prevent this problem in the breed. ■

Information compiled in this article from lectures from Dr. Loic Dejardin, Michigan State University, Canine Cranial Cruciate Ligament Disease Part 1 – Pathophysiology, Drs. Fauron and Perry, Veterinary Times, 2017. Volume: 47: 24, Page: 26-29 and www.acvs.org.

Illustrations provided by Jessica Hynes, 2nd year DVM student, Michigan State University.

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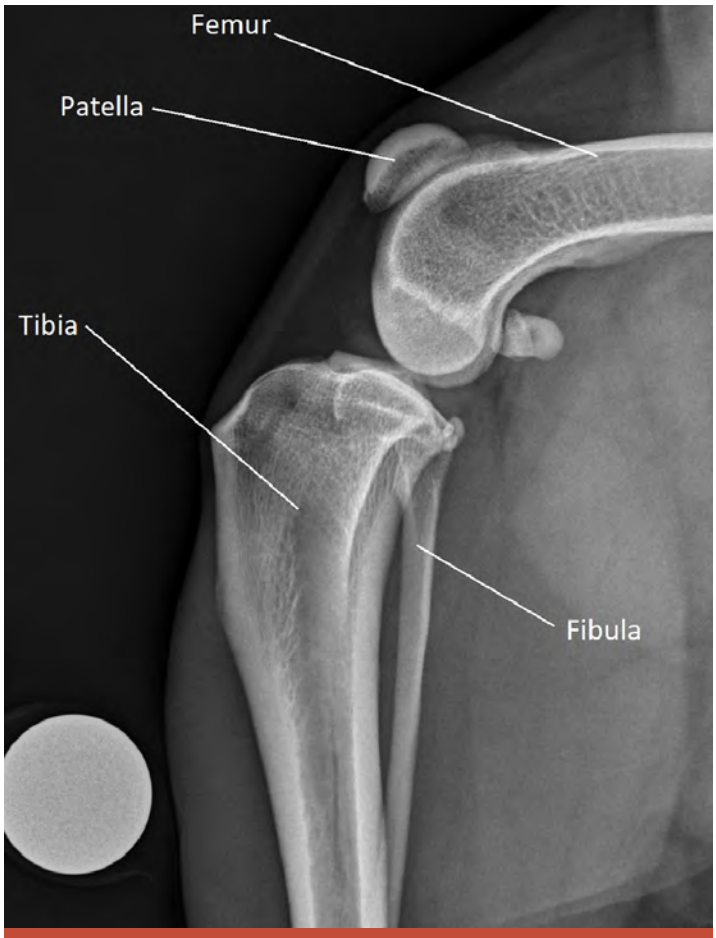
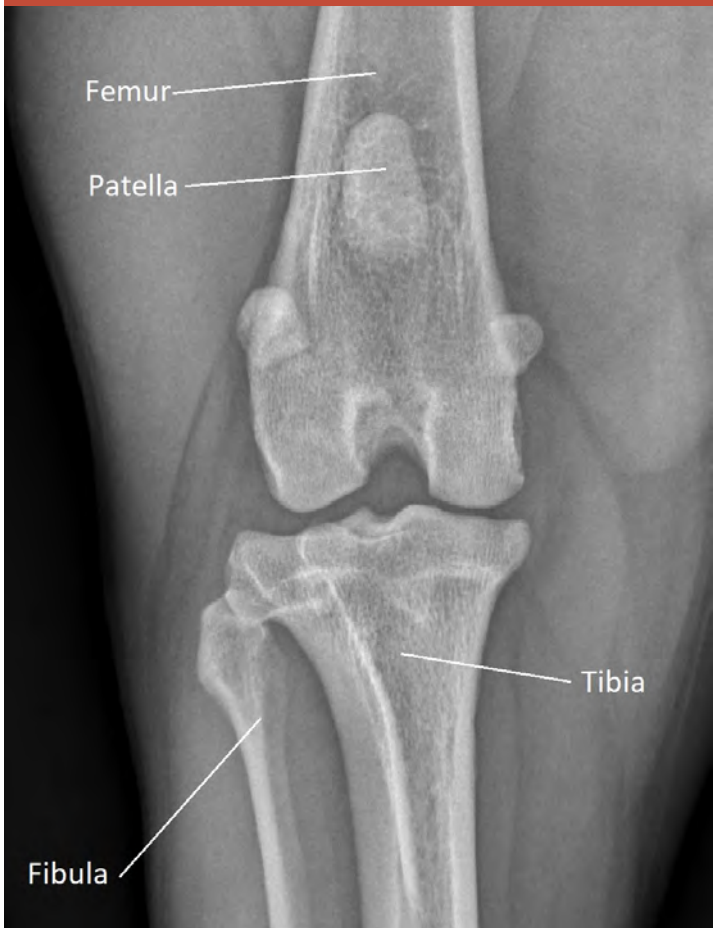


Normal Stifles

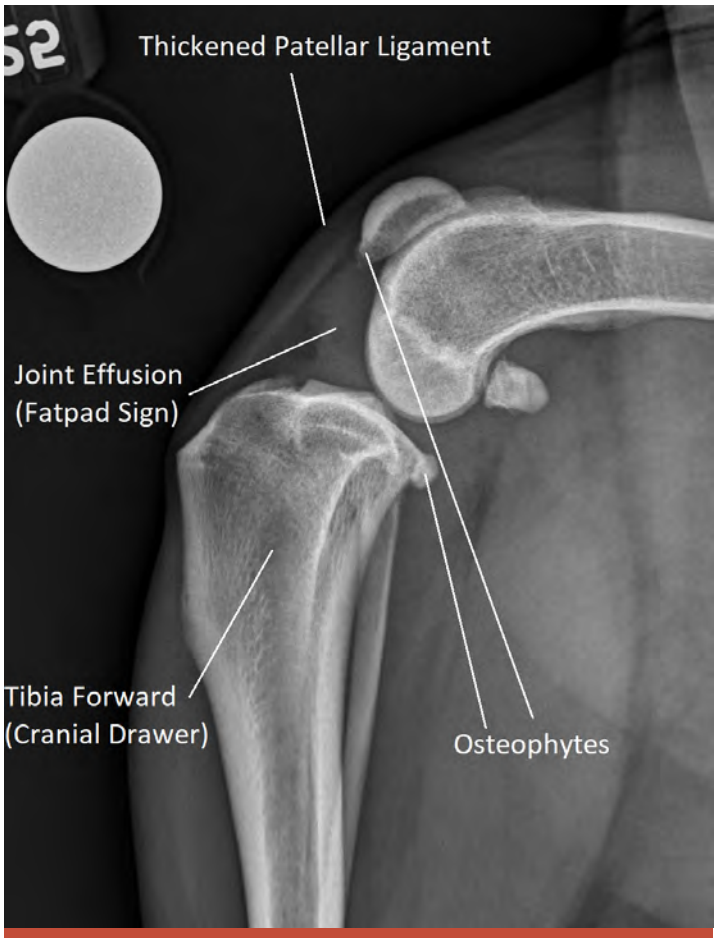


COMING IN FUTURE ISSUES

Part II – Treatment
Discussion of surgeries commonly performed
Pros and cons of the various treatment options
Non-surgical options?
Nutraceuticals /supplements

Part III – Prevention
Genetics – Update from University of Wisconsin
Activities to do or not to do?
Research

Part IV – Rehabilitation
Follow a cruciate patient through rehab and return to sport



Mild to Moderately Affected
(Where most of performance retrievers are going to be)

Severely Affected
(Osteoarthritis from chronic untreated cruciate disease)