



Monthly Update

Issue Contributor: William B. Henry DVM, DACVS

Editor: William B. Henry DVM, DACVS

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Radiographic Diagnosis of Cranial Cruciate Ligament (CrCL) Disease

William B. Henry DVM, DACVS



What is your diagnosis?

HISTORY OF PARTIAL OR COMPLETE CrCL RUPTURE DIAGNOSIS:

Prior to 1990 it was considered a result of a traumatic injury. Since that time, we have come to recognize the frequent bilateral incidence of the CrCL disease and the short time interval of occurrence of a contralateral CrCL rupture. However, the referring veterinarian often is unaware of the radiographic changes we learned to recognize. It has been published but often it was in journals that general practitioners do not read, until now.¹ As surgeons, we have realized in cases of unilateral CrCL rupture the contralateral stifle joint should be radiographed as there is a high incidence of bilateral CrCL disease. There are classic radiographic changes seen in the contralateral stifle that is the predictor of future complete CrCL tears in that limb.^{1,2} Only 4% to 17% of dogs have bilateral CrCL rupture diagnosed on initial evaluation, yet 22% to 54% of dogs with an initial diagnosis of unilateral CrCL will subsequently have contralateral rupture diagnosed after a median of 10-17 months.^{3,4} Two early studies^{4,5} highlighted the importance of bilateral stifle joint radiography in evaluating dogs with unilateral CrCL rupture. Prior to these studies, the distinction between unilateral and bilateral CrCL was based solely on the clinical signs and orthopedic examination findings, and bilateral radiography was only performed if bilateral CrCL rupture was suspected on the basis of the orthopedic examination findings. In these studies, 50% to 52% of the dogs with unilateral CrCL rupture had radiographic findings consistent with CrCL rupture in the contralateral stifle

joint. The presence and progression of these findings were both significant risk factors for subsequent contralateral CrCL rupture.^{3,4} These results suggest that many dogs with diagnosed unilateral CrCL rupture may actually have subclinical bilateral CrCL partial or complete rupture. Thus the reported incidence of bilateral CrCL injury/disease on initial evaluation may be highly underestimated.

RADIOGRAPHIC CHANGES INDICATIVE OF CrCL PARTIAL OR COMPLETE RUPTURE:

The radiographic changes secondary to CrCL injury occur in the infrapatellar fat pad and has been termed "infrapatellar fat pad sign".¹ The infrapatellar fat pad sign (density) is one of the earliest and most consistent findings in dogs with CrCL partial or complete rupture.^{6,7} These changes are not visible following a recent acute tear unless there was a pre-existing injury. The response to a partial or complete CrCL tear is the ingrowth of neocapillaries and fibroblastic proliferation in the infrapatellar fat pad creating the radiographic density. It takes 2-3 weeks post injury for the density to appear in the infrapatellar fat pad. This results in a radiodense "gray cloud" in what is normally a radiolucent

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CT Scan Diagnostics

CCVS CT Scan Hours:

8:00 AM-6:00PM 7 days a week. 1-800-457-4900

The breakdown of CT charges are as follows:

1. CT Scan, In patient \$905.00 (case already hospitalized at CCVS or referred to CCVS for work up and treatment and has a CT scan)
2. CT Scan, Additional image (if you add an additional scan site \$300.00)
3. CT Scan, Out patient \$985.00 **(case sent to CCVS exclusively for a CT; this includes charges for doctor overseeing case, IV catheter, and fluids post CT).
4. CT "Met Check" \$590.00
5. CT STAT fee, \$50.00 (on top of whatever you are doing).

These charges cover the CT, the contrast, radiologists read, rapid infuser, sevo anesthesia, and technician fee if we need to call someone in for the CT. It does not cover injectable drugs, if needed for IV anesthesia; estimated additional cost \$50.00-\$75.00.

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triangular space between the cranial tibial plateau, the distal femoral condyles, and the patellar tendon's insertion on the tibial tuberosity. (Figure 1) When compared to a normal stifle joint, the abnormal infrapatellar fat pad density becomes very recognizable. (Figure 2) With the advent of widespread digital radiographic capability in general veterinary practices, these changes have become much more recognizable. We were literally often "in the dark" when our only option was analog radiographs. The ability to change the contrast and enlarge the images with digital radiography has greatly increased our diagnostic acumen for CrCL disease.

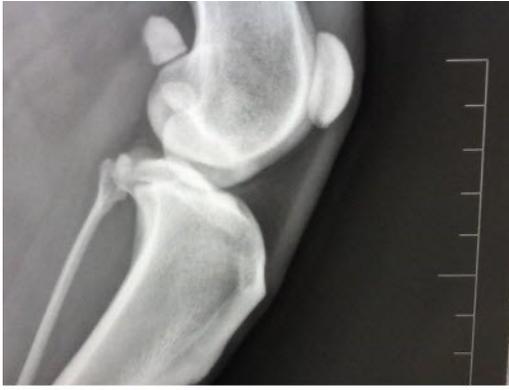


Figure 1: Lateral radiograph of a normal stifle based on the triangular radiolucent space between the cranial tibial plateau, the distal femoral condyles, and the patellar tendon's insertion on the tibial tuberosity.

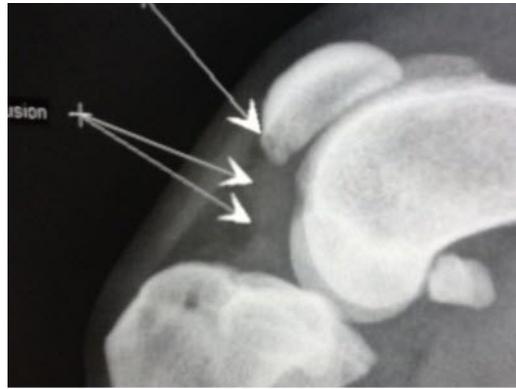


Figure 2: The most proximal arrow on the distal patella points to an osteophyte secondary to a CrCL injury. The two distal arrows point to the infrapatellar fat pad sign (density), a "gray cloud". This is a palpably stable stifle in a 3 year old PitBull with a contralateral complete CrCL tear.

ETIOLOGY OF CrCL INJURY:

Historically, CrCL rupture in dogs has been considered an accidental injury, with the subsequent development of stifle arthritis. However, since the early 1990s this paradigm has been challenged. It was established that a high risk of contralateral CrCL rupture existed in affected dogs and that the typical history and clinical signs of CrCL rupture could not be easily explained by traumatic injury. Recent studies have clearly shown that stifle arthritis precedes the development of CrCL rupture and associated stifle instability in the majority of affected dogs.⁸

ADVANTAGE OF EARLY DIAGNOSIS OF CrCL DISEASE:

The point of this discussion is that often dogs presented with intermittent mild rear leg lamenesses should be radiographed to determine the presence of the infrapatellar fat pad changes bilaterally. Early diagnosis of unilateral CrCL rupture is very advantageous in avoiding acute bilateral complete CrCL ruptures. We frequently see dogs who had a subtle intermittent hindlimb lameness in one or both legs in our referral practices. They may have had either a current radiographic study or a past radiographic study for hip dysplasia and the lameness was attributed to CHD. When these dogs are presented to us with an acute rear leg non-weight bearing lameness from a CrCL injury, we want to know the status of the contralateral CrCL. The reason for this is the post-op recovery restrictions must be adhered to in order to avoid a contralateral CrCL tear. If the contralateral stifle is normal the patient is at risk of rupturing that CrCL until the ipsilateral stifle is normal or nearly normal following surgery. We now have the fastest recovery to normal or nearly normal function post-op with TTA or TPLO repairs, 8-12 weeks in many cases. If the contralateral stifle has a radiodense infrapatellar fat pad and is palpably unstable, we know that patient has bilateral CrCL disease and will need bilateral repairs. Often we stage them 6 weeks apart resulting a very comfortable/functionally active patient in 3-4 months post-op. Bilateral disease impacts our financial discussion with the owner. We feel responsible in helping the owner understand how to try and avoid a contralateral CrCL tear if that stifle is radiographically normal, ie. leash walks primarily and avoidance of strenuous exercise with other dogs, ball play, squirrel chasing, etc. These efforts are not a guarantee of avoiding a contralateral CrCL tear. If the contralateral stifle is free of the infrapatellar fat pad density radiographically we are more lenient in the exercise restrictions. If the contralateral stifle has an infrapatellar fat pad density and is palpably stable, we know we have a partial tear that will completely rupture unless the exercise consists of just leash walks. Often, for financial reasons, an owner will elect restriction to leash walks only in hopes of avoiding a second surgery or to delay the financial impact of two surgeries in a short space of time. If the owner has good insurance coverage or the financial ability to surgically repair a contralateral partial tear preemptively prior to significant OA or meniscal injury, the surgical outcome is much better. Another reason for radiographing both stifles early in the CrCL disease process is to have a dated record of their integrity. If they have one radiographically normal knee and purchase Trupanion insurance and avoid a CrCL injury for 18 months in that limb via exercise restriction, it is not considered a pre-existing injury, and Trupanion will pay 90% of the second surgery if that becomes necessary (Should be mutually determined by the owner and Trupanion immediately following confirmation of a radiographic normal contralateral knee).

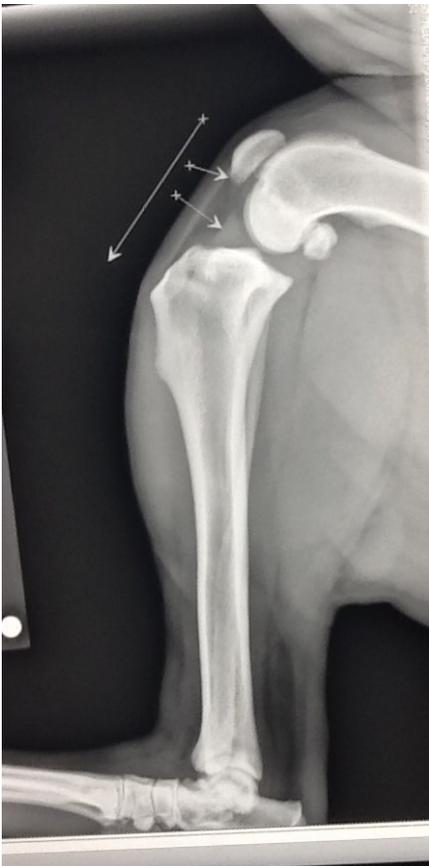
STRESS RADIOGRAPHY TO DETERMINE A COMPLETE CrCL RUPTURE:

We sedate most of our dogs for their stifle radiographs and palpation for instability. The infrapatellar fat pad sign is visible on an extended lateral radiograph. (Figure 3) A tibial compression (stress) radiograph will demonstrate the infrapatellar fat pad density and the instability, ie. a complete CrCL tear. To perform the tibial compression radiograph, the dog is positioned in lateral recumbency. A standard lateral radiographic view of the stifle is obtained with the joint in neutral stance position. While maintaining the neutral angle of flexion of the stifle joint, the tarsal joint is maximally flexed by the use of manual pressure which provides the tibial compression view. (Figure 4). The tibial compression view with flexion of the stifle and tarsal joint as is done in the same way one would palpate for cranial tibial thrust. In the extended lateral view, the presence of a complete or partial CrCL injury can not be demonstrated unless the tibial compression lateral radiograph is taken.

Figure 3: A lateral radiograph in neutral flexion. The central arrow points to the infrapatellar fat pad sign. The arrow parallel to the patellar tendon is only 10-15 degrees from vertical without hyperflexion of the tarsal joint.



Figure 4: Compression lateral radiograph with hyperflexion of the tarsal joint as would be done for a tibial compression test to determine CrCL rupture by palpation. The central arrow points to the infrapatellar fat pad sign. The arrow parallel to the patellar tendon is now at 40 degree angle due to a complete CrCL rupture. The lack of an intact CrCL allows the tibia to shift forward on the femoral condyles.



References:

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- ⁹ Doverspike M, et al. Contralateral cranial cruciate ligament rupture: incidence in 114 dogs. JAAHA 1993; 29: 167-170.

TECH TIP

Dexdomitor/Antisedan

Intro: We do a lot of out-patient radiographic studies, bandage/splint changes, suture removals etc. in our referral practices. I have used Dexdomitor for over 10 years and found it to be very safe and effective in most patients. We give it intravenously at the dosage the manufacture recommends. If the patient is older or younger than 4 months we decrease the dose 10-15%. All patients are monitored with a pulse oximeter and given oxygen by mask during their sedation. We now give Antisedan in the Semitendinosus / Semimembranosus muscles solely because it is been shown to be absorbed more quickly from that injection site. If we do not get enough relaxation when palpating for CrCL injury or for Ortolani hip laxity we add either Torbugesic or Sevoflurane via a mask. The Torbugesic is reversed with Naloxone allowing the pet to recover rapidly and go home. We follow the manufacture's safety information listed below.

Important Safety Information: Do not use DEXDOMITOR or DEXDOMITOR 0.1 in dogs or cats, and ANTISEDAN in dogs, with cardiovascular disease, respiratory disorders, liver or kidney diseases, or in conditions of shock, severe debilitation, or stress due to extreme heat, cold or fatigue. DEXDOMITOR and DEXDOMITOR 0.1 should not be administered in the presence of preexisting hypotension, hypoxia, or bradycardia. As with all α_2 -adrenoceptor agonists, the potential for isolated cases of hypersensitivity, including paradoxical response (excitation), exists with DEXDOMITOR and DEXDOMITOR 0.1. The use of DEXDOMITOR and DEXDOMITOR 0.1 as a preanesthetic in dogs and cats significantly reduces the amount of induction and maintenance anesthetic requirements. Careful patient monitoring is necessary to avoid anesthetic overdose. Arrhythmias, bradycardia, apnea, emesis, convulsions, hypersalivation may occur with DEXDOMITOR and DEXDOMITOR 0.1 use. Severe dyspnea and respiratory crackles due to acute or delayed pulmonary edema could develop in cats. DEXDOMITOR and DEXDOMITOR 0.1 have not been evaluated for use in breeding, pregnant, or lactating dogs or cats; in dogs younger than 16 weeks of age or in cats younger than 12 weeks of age; or in geriatric dogs or cats. Occasional vomiting may occur with ANTISEDAN use. Rarely, a brief state of excitement or apprehensiveness may be seen in ANTISEDAN-treated dogs. Other potential side effects of α_2 -antagonists, such as ANTISEDAN, include hypersalivation, diarrhea, and tremors.