Cruciate Surgery Complications: Pelvic Limb Lameness

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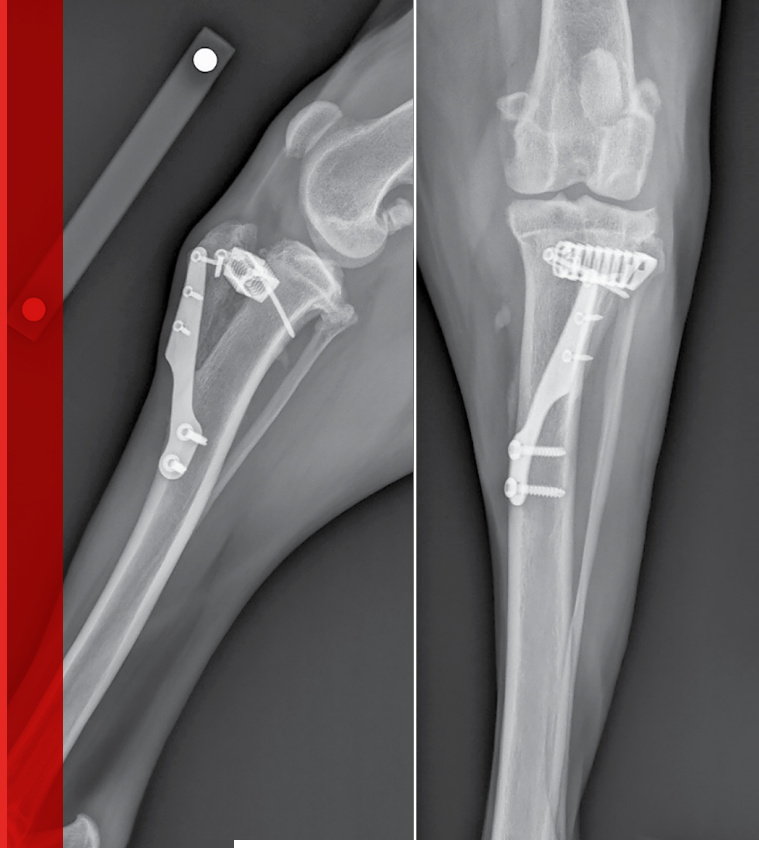


▲ **FIGURE 1** Orthogonal radiographs of the left stifle joint 6 weeks after tibial tuberosity advancement

THE CASE

A 4-year-old neutered male Labrador retriever is presented for lameness in the left pelvic limb. Another veterinarian previously diagnosed cranial cruciate ligament (CrCL) rupture and performed a tibial tuberosity advancement (TTA) 6 weeks before presentation. The otherwise healthy patient did well for 4 weeks postoperatively, then became acutely more lame in the operated limb.

The general physical examination is considered normal, aside from signs of the recent surgery (ie, shaved left pelvic limb, a healing surgical scar over the medial aspect of the proximal tibia). Orthopedic examination reveals a grade 4 of 5 (ie, toe-touching) left pelvic limb lameness at a walk and trot. The patient abducts and externally rotates the left stifle during gait and shifts weight off of this limb while standing. There is moderate muscle atrophy of the left pelvic limb and joint effusion of the left stifle. An implant is palpable along the proximal medial tibia with a prominent tibial tuberosity.

Mild discomfort and crepitus can be noted on passive range of motion of the left stifle. There is positive cranial drawer but negative cranial tibial thrust of the left stifle. There is mild effusion of the right stifle joint; otherwise, no pain, instability, or limitations on passive range of motion are appreciated. The dog is sedated, and radiographs of the left stifle joint are obtained (***Figure 1***).

What are the next steps?

THE CHOICE IS YOURS ...

CASE ROUTE 1

Suspicious of a meniscal tear, you recommend revision surgery to re-explore the left stifle joint. Go to page 28.

CASE ROUTE 2

Suspicious of infection, you perform arthrocentesis of the left stifle joint. Go to page 30.

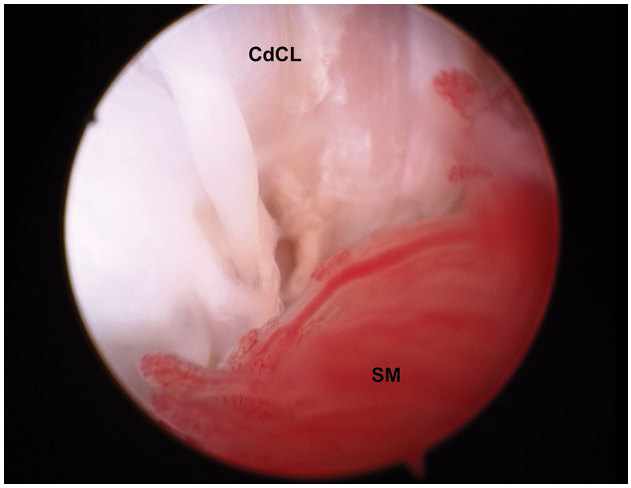
CrCL = cranial cruciate ligament
TTA = tibial tuberosity advancement

CASE ROUTE 1

You elect to perform revision surgery to re-explore the left stifle joint.

Case Progression

In a discussion with the patient's previous clinician, you learn the operative findings from the initial TTA procedure: intact medial and lateral menisci, full rupture of the CrCL, and fraying of the caudal cruciate ligament. You make an arthroscopic portal to inspect the joint. There is moderate synovitis (***Figure 2***). You confirm a fully torn CrCL.



▲ **FIGURE 2** Arthroscopic view of the caudal cruciate ligament with surrounding synovial membrane inflammation

The caudal cruciate ligament is intact, with mild frays and splits in the ligament and surrounding synovial inflammation. Both the medial and lateral menisci have mild superficial frays but are largely intact (***Figure 3***). You elect to perform a medial meniscal release.

Clinical Considerations

In this clinical scenario, meniscal tear would be near the top of the differential diagnoses list. Other differential diagnoses include infection, implant failure, bone failure, and patellar luxation.

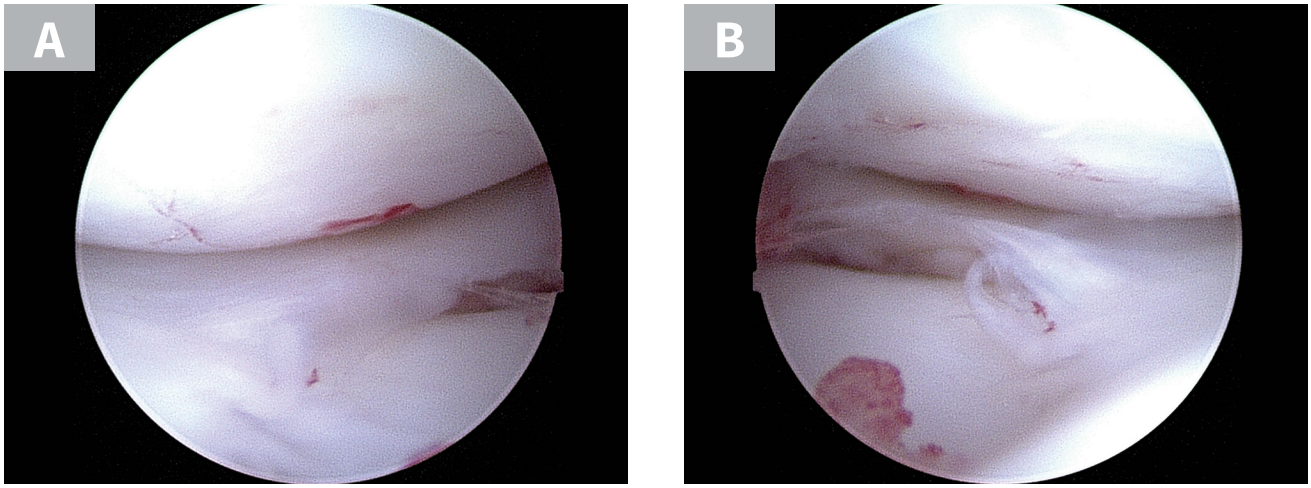
The reported rate of medial meniscal tears associated with an unstable CrCL rupture is approximately 50%.[1-3] The rate of meniscal tears in dogs with a stable partial CrCL tear is not well described but is likely less than unstable joints.[1,4] Despite the meniscus appearing normal at the time of TTA, it is possible that the clinical signs relate to a meniscal tear. Presence of a palpable or audible click is reported to increase the likelihood that meniscal pathology is present by a factor of 11.3 and has a positive predictive value of 85%.[5,6]

A meniscal tear noted on revision surgery may either be a subsequent meniscal tear that occurred sometime after TTA stabilization or was present during the original TTA procedure but missed during joint examination (ie, a latent tear). Regardless of the cause, the occurrence rate of meniscal tears is estimated to be 12% to 28% following TTA and 2% to 12% after tibial-plateau–leveling osteotomy (TPLO).[1,2,7,8]

A key step in any cruciate surgery is to obtain adequate exposure for a thorough visual examination of the joint. Several instruments (eg, self-retaining Gelpi retractors, stifle distractors, small [1.5-mm] meniscal probes) can be useful in this approach.

Stifle arthroscopy, although limited to select practices and associated with a steep learning curve, also provides magnification and illumination and is particularly useful in the stifle joint. Probing the menisci, in addition to using arthroscopy, increases the sensitivity of tear detection by 1.5 to 2 times as compared with arthrotomy alone.[9] Tears are almost exclusively confined to the caudal horn of the medial meniscus because of its firm attachment on the tibial plateau. The most common tear pattern is a displaced vertical longitudinal or "bucket-handle" tear, which accounts for the palpable click as the torn meniscus flips caudal-to-cranial in the joint.

Lateral meniscus tears are rare because robust caudal meniscofemoral attachments allow the meniscus to move with the femur during active range of motion. The



▲ **FIGURE 3** Arthroscopic view of normal (**A**) medial and (**B**) lateral menisci

original descriptions of both TPLO and TTA procedures advocated for a meniscal release at time of stabilization to prevent late tears.

A meniscal release involves cutting through the meniscus. The meniscus drops to the back of the joint and reduces the potential for a subsequent tear after stabilization. This can be done at the meniscotibial ligament (via craniomedial approach) or midbody just caudal to the medial collateral ligament (more often via a blind caudomedial approach). In a cadaveric model, the efficacy of release was only 56% to 81%, depending on the approach used.[10] Surgeon skill and experience likely impacted this result, so it is important to confirm by visual examination once complete. Meniscal release is effectively the same as meniscal excision; therefore, the decision should be based on individual case selection and scientific evidence.[11]

Outcome

The patient is discharged the next day with instructions for activity restrictions and initiation of physical therapy. On recheck examination at 6 weeks, slow progressive increases in weight bearing and mobility are documented.

Your Choice's Implications

In this scenario, immediate surgical exploration was elected. Although the outcome was successful, revision surgery was costly, and release of the meniscus could lead to long-term medial compartment osteoarthritis and impaired mobility.[12]

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CrCL = cranial cruciate ligament
TPLO = tibial-plateau–leveling osteotomy
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CASE ROUTE 2

You perform arthrocentesis of the left stifle joint to check for a suspected surgical site infection.

Case Progression

Arthrocentesis of the left stifle yields a large volume (>6 mL) of straw-colored joint fluid with poor viscosity. Fluid and cytologic analysis is performed (***Table***). Aerobic and anaerobic culture of the synovial fluid reveals no growth. You prescribe a course of NSAIDs and antibiotics (ie, cephalexin [30 mg/kg PO q12h for 30 days]) for a presumptive surgical site infection.

The dog initially does well and returns in 4 weeks for evaluation. The general physical and orthopedic examination are similar to previous examinations with grade 4 lameness and effusion. You perform repeat radiography and arthrocentesis of the left stifle (***Table***). Aerobic culture of synovial fluid reveals no growth. You elect to continue NSAIDs and antibiotics for an additional 4 weeks.

The dog, now lame on both pelvic limbs, returns 8 weeks after the initial examination, and the owner is unhappy. All examination findings are similar, except you appreciate increased joint effusion in the right stifle joint and detect positive cranial drawer and tibial thrust.

You elect to perform radiography and arthrocentesis of multiple joints. Synovial fluid cytology results of both carpi are normal; left and right stifle joints are detailed in ***Table***. You elect to perform arthroscopy and TPLO on the right stifle and concurrent arthroscopy of the left stifle. Arthroscopic findings of the left stifle include full tear CrCL, intact (but with superficial frays) caudal cruciate ligament, and intact medial and lateral menisci. You perform a biopsy of the left stifle joint synovial membrane/capsule. Histologic evaluation demonstrates moderate lymphoplasmacytic synovitis. Aerobic culture of the synovial biopsy reveals no growth.

TABLE

SYNOVIAL FLUID CYTOLOGY

	Total Nucleated Cell Count	
	Left Stifle	**Right Stifle**
Initial visit (post TTA)	81.65 × 10^3/µL; 91% neutrophils	N/A
Recheck #1	11.04 × 10^3/µL; 63% neutrophils	N/A
Recheck #2	40 × 10^3/µL; 79% neutrophils	2.34 × 10^3/µL; 98% mononuclear cells

Normal values: joint fluid <3000 cells; >90% mononuclear cells

Clinical Considerations

In this scenario, the synovial fluid contained a high nucleated cell count of predominantly neutrophils. Septic arthritis would be the top differential diagnosis. If effusion were present in multiple joints, other immune-mediated or infectious arthropathies should be considered. Surgical site infection is an inherent risk of any procedure, particularly one that involves orthopedic implants. The reported surgical site infection rate in elective orthopedic procedures is 5%,[13] although rates as high as 10% have been reported for certain procedures (eg, TPLO).[14] *Staphylococcus* spp and *Streptococcus* spp are the most common isolates to colonize the joint and/or implants.[13]

Infections following TTA may present as septic arthritis or implant-associated deep tissue infections, which typically have disparate clinical signs. Septic arthritis rapidly destroys joint surfaces and can cause profound pain, inflammatory infiltrates, and—in severe cases—dependent limb swelling.[15] High neutrophilic cell counts are observed in septic synovial fluid, but bacterial organisms are rarely seen.[15] Microbial culture may also be falsely negative as bacteria trap in the synovial membrane. Use of blood culture flasks (rather than culture swabs) may

improve culture efficacy.[16,17] Implant-associated infections typically present as soft tissue draining tracts with local swelling and inflammation. Although plates and screws engage the bone, osteomyelitis is uncommon unless infections are neglected. Implant infections are problematic due to formation of biofilms—which are notorious in staphylococcal infections—and are unlikely to be completely eradicated without implant removal.[18] Use of postoperative antibiotics has become common but remains a topic of debate, as efficacy data are conflicting.[19] The increasing incidence of antibiotic-resistant bacterial infections suggests that alternative strategies are needed.[14]

Synovial inflammation is an early feature associated with degenerative CrCL rupture. This is typically a lymphoplasmacytic response, although other inflammatory cell types may play a role in the pathophysiology of cruciate disease.[20] The improvement and then recrudescent cellular infiltrate in this case may have been related to a profound inflammatory response associated with cruciate fiber rupture.[20] Synovitis can cause further degradation of the CrCL[21] such that stable partial tears typically progress to full tears over time.[22] Radiographic joint effusion and osteophytosis are risk factors for subsequent CrCL rupture.[23]

Many options, including immunomodulatory treatment (eg, doxycycline, leflunomide) and regenerative approaches (eg, platelet-rich plasma, stem cells), have been explored, but none have been effective in reducing stifle inflammation and subsequent CrCL rupture.[20,24] Ultimately, the risk for contralateral rupture is between 40% and 60% within 12 to 17 months of CrCL diagnosis, and 10% to 15% of dogs present with bilateral CrCL rupture.[22]

Outcome

The dog recovers well. Recheck 8 weeks after surgery confirms radiographic healing of the right TPLO. Clinical function of both stifles continues to slowly improve.

Your Choice's Implications

In this scenario, pursuing the more conservative approach initially is important to rule out a potentially treatable problem. If the synovial fluid from the initial culture had been positive, a more aggressive surgical route would have been avoided. The dog responded positively to empiric antibiotic therapy, suggesting the possibility this was a false-negative culture result. The initial cost of diagnostic evaluation and treatment was less than the cost in ***Case Route 1***; however, owners should be prepared for repeat visits, sedation, and imaging.

CrCL = cranial cruciate ligament
TPLO = tibial-plateau–leveling osteotomy
TTA = tibial tuberosity advancement

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Continues on page 72

CASE ROUTES

CONTINUED FROM PAGE 39

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