

**TIBIAL TUBEROSITY ADVANCEMENT:**

**If an ACL is ruptured, when to head to the toolbox for this procedure (TTA).**

**Synopsis-- Anatomy and the Disease**

A cranial cruciate deficient stifle will experience dynamic laxity during weight bearing, termed cranial tibial thrust. Veterinary professionals diagnose a passive laxity most routinely with the cranial drawer sign; occasionally you can mimic the dynamic cranial tibial thrust sign during an exam.

Biomechanical testing has suggested that revising the angle between the patellar ligament and the tibial plateau to 90° will result in a neutral stifle during weight bearing with no cranial tibial thrust laxity. The TTA achieves this 90° by moving the patellar ligament “arm” of that angle. (The TPLO achieves this 90° by moving the tibial plateau “arm” of that angle.)

Partial cruciate tears present us with somewhat of a clinical challenge. These dogs typically have an intermittent lameness, mild joint effusion (palpably and radiographically) and pain on hyperextension of the knee. Radiographically, early osteophytes on the distal patella, the femoral trochlea, and at the cruciate insertion on tibia. Cranial drawer on exam may be challenging to elicit and subtle if present; rarely is it truly absent given adequate restraint/sedation and technique.

Significantly abnormal proximal tibial anatomy is occasionally seen when diagnosing a cruciate injury. These cases, with abnormal tibial crests and tibial plateaus tipped dramatically caudally, must be handled on a case-by-case basis; they require customized procedures and more detailed client discussions about complications/cost/outcomes.

The caudal pole of the medial meniscus is commonly injured (>75%) at the time of or subsequent to a substantial cranial cruciate ligament injury. Joint explore during surgery to stabilize a cruciate-deficient stifle is essential; visualizing and thorough probing of the meniscus can detect the majority of bucket-handle and crush injuries to the medial meniscus. If an injury is detected, the damaged portion of the meniscus is removed.

Treatment of a normal medial meniscus at the time of initial stabilization surgery continues to be debated, as with everything “cruciate”! **The therapeutic options include:**

- No meniscal treatment
- Meniscal release, prophylactic (meniscotibial ligament is transected, allowing meniscus to shift slightly caudally and theoretically out from under the compression of the femoral condyle.)
- Partial/mini-menisectomy, prophylactic (small portion of the at-risk caudal pole is removed)

Treating the normal meniscus prophylactically *will reduce, but not eliminate, a subsequent postoperative meniscal injury*, but may promote more progression of DJD. Conversely, leaving a normal meniscus unaltered at the time of surgery increases the risk of subsequent meniscal injury but may *decrease the progression of DJD* associated with a cruciate-deficient stifle.

Subsequent meniscal injury can present any time after surgery; this may manifest as a suboptimal postoperative recovery (“just never got back to comfortable use”) or an acute lameness following a full recovery. Not all meniscal injuries are created equal; some will resolve with time (4-week activity

restriction) while others create significant and persistent lameness. Surgical removal of the torn portion is recommended to treat ongoing associated lameness.

### **Surgical Overview:**

The procedure begins with a mini-arthrotomy performed on the medial stifle for debridement of the cranial cruciate ligament remnants, inspection +/- treatment of the menisci and evaluation of joint cartilage health (i.e. DJD). To stabilize the stifle, the TTA procedure involves an osteotomy of the tibial crest, advancement a predetermined/measured distance with a cage/wedge and stabilization with a plate applied to the medial proximal tibia.

If a meniscus is normal at surgery, a *treatment decision needs to be made*. This can remain “surgeon’s discretion” or can be client-driven. Given the high rate of meniscal injury with a complete cruciate tear, meniscal release may be preferred if a subsequent second surgery for meniscal treatment is not acceptable; the assumed theoretical risk is more progression of arthritis. Electing not to treat a normal meniscus may improve overall arthritis progression; the assumed risk is a possible future surgery for meniscal treatment if meniscal injury/lameness develops.

The **indications & rationale** for surgical treatment are:

- The TTA procedure is strongly recommended for dogs over 30lbs and for smaller dogs who are young, highly activity.
- Performance of the osteotomy techniques (TTA/TPLO) over the extracapsular/suture techniques is likely superior due to inherent or technical limitations of the extracapsular/suture techniques (discomfort related to soft tissue irritation of a non-isometric implant; incomplete joint stability afforded by replacement “ligament” that does not achieve normal biomechanics; or cycling and breakage/pull-out/creep of an over-taxed implant.)
- Atypical exam and radiographic findings may warrant additional diagnostic testing (joint fluid cytology, CT/MRI, joint ultrasound) prior to surgical intervention; surgical stifle exploratory may be useful as a diagnostic tool but carries a higher morbidity.

**Other options** for treatment (besides surgery) are:

- Rigorous professional physical therapy geared toward maintaining joint range of motion, muscle mass and comfort.
- Conservative DJD treatment, including NSAIDs prn, chondroprotectants, high dose fish oil and strict weight loss.

**Supportive/ancillary** options with surgical treatment are:

- Maintenance of a lean-ideal body condition lifelong
- Conservative DJD treatment, including NSAIDs prn, chondroprotectants, high dose fish oil.
- Postoperative professional physical therapy geared toward regaining joint range of motion, building muscle mass/strength/agility and optimizing comfort
- Chondroprotectants and high-dose fish oil supplements

The **perioperative experience** for pet and owner includes:

- Post-anesthetic recovery up to 5d postop, assisting pet with comfort, hygiene, food/water (in-hospital/24-hour care referral option as needed)



- Bandage management, 1d postop
- Potential comfort “setback” day 3-4 as local anesthetics wear off and oral pain medications assume pain control
- Strict confinement to leash and small area of house for 8wk postop period.
- Direct supervision/assistance with ambulation provided to pet for 8wks postop
- Veterinary visit for exam 2wks, radiographs 2mo
- Steady improvement in leg use from non-weight bearing postop to normal gait, over healing period (1-3mo)
- Implant removal under general anesthesia (very rare, when applicable)

**Expectations** for outcome are:

- Reliable return to weight bearing and high level of function long-term for majority of patients.
- All dogs with a ruptured cranial cruciate will develop some degree of DJD/arthritis in their lifetime, manifesting as stiffness when rising, limping after vigorous activity. The goal of early TTA treatment is to delay and minimize this DJD development.

**Complications** that may arise with this procedure are:

- Superficial or deep **surgical infection** (rare; requiring long course Abx),
- **Implant infection** (rare and significant; requiring long course Abx and surgical implant removal)
- Implant breakage/**fracture** (rare and serious; requiring additional surgery)
- **Tibial tuberosity fracture** (rare, often incidental or lameness; may require additional surgery)

Postoperative **outcomes may be poor or delayed** due to the above complications, and/or:

- **Insufficient joint stability** (rare and serious, requiring additional surgery)
- **Pivot shift instability** (rare and serious; requiring professional PT or additional surgery)
- **Meniscal injury** subsequent to initial surgery (rare, if meniscus removed or released / low, if meniscus normal & untreated; may require additional surgery for explore and removal).
- **Progressive DJD/arthritis** (dependent upon patient lifestyle, joint health at surgery, meniscus status at surgery.)
- **Suboptimal joint range of motion** (dependent upon patient lifestyle, owner attention to rehabilitation, ongoing joint discomfort/disuse).

What a surgeon needs prior to surgery:

- Minimum preoperative diagnostics include:
  - **Exam finding** of cranial drawer/tibial thrust
  - Lateral/AP stifle **radiographs**, to rule-out other injuries or diseases mimicking cruciate disease and for surgical measurement.
  - Absent typical cruciate changes on either one of these tests, we recommend an additional exam with one of our surgeons.
- An *exact lateral* stifle radiograph taken with the stifle at 120-135 degrees (“standing angle”) and including the hock joint; femoral condyles should be exactly stacked on top of each other.
- **Affected leg/body part “marked”** by owner for confirmation (wax “costume makeup” works well)
- Skin near the surgery site **CLEAR of infection** (papules, pustules, crusts, collarettes, etc.) If urgent surgery, owner must be alerted to *increased risk* of incisional, deep and/or implant infections. **\*\*Contact us for discussions regarding chronic skin allergy/steroid-dependent patients.**



- Brief lameness history, pertinent exam findings, and current list of conditions and medications.
- **Meniscus treatment preference, if any.** (Otherwise, “surgeon’s discretion” will be employed.)

**General considerations and complications** for all surgery/anesthesia procedures are:

- *Difficult and/or painful anesthetic recovery (variable; may require additional medications or re-hospitalization)*
- *Incisional infections (rare, minor; usually require oral antibiotics)*
- *Incisional dehiscence (rare, minor or major; may require surgical revision)*
- *Adverse anesthetic event (rare, major; may result in serious impairment or death)*

Proper owner expectations are important to a successful experience and patient outcomes. Please discuss this information with your clients while assisting them with decision-making for **Tibial Tuberosity Advancement**.

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