Evidence for a Superior Method for Treatment of Canine Cruciate Rupture: Is There Any?

Thomas Gibson BSc, BEd, DVM, DVSC, Diplomate ACVS, Diplomate ACVSMR, Grand River Veterinary Surgical Services, Cambridge, Ontario

Introduction

Cranial cruciate ligament rupture is the most frequent cause of lameness in dogs with $1.32 billion spent by owners in the U.S. in 2003[1]. Instability of the canine stifle leads to progressive osteoarthrosis and possible damage to the n=medial meniscus. This largely degenerative process affects both stifles within a year of the initial injury in up to 40% of dogs[2]. The decision to treat conservatively with medical management or surgically remains an area of controversy. Conservative management is advocated by some with success rates ranging from 84-90% in dogs <15 kg but poor results if dogs are >15kg [3]. In most cases, surgical intervention is recommended. The intent of surgical intervention is to re-establish joint stability, slow the progression of secondary degenerative joint disease, address concurrent and prevent late meniscal injuries and to return the dog to a functional state.

Conservative management

Conservative management includes cage rest with short controlled leash walks, NSAIDs, weight management, analgesics such as gabapentin, amantadine, chondromodulating agents and dietary supplements.[4] Other multimodal components of conservative management that have been suggested include rehabilitation, acupuncture and regenerative medicine.[4,5] It has often been suggested that small breed dogs with a body weight less than 10 kg can be managed conservatively. This information is largely based on a retrospective study published in 1984 where it was reported that 85% of small dogs were considered to be normal or improved with nonsurgical management. It was also reported that recovery was prolonged with a mean of 4 months. This study was retrospective and outcome measures were based on veterinarian evaluation with no objective outcome measures. Additionally, 43% still had a positive cranial drawer, 67% had increased medial buttress, 19% of dogs with apparent resolution of lameness had clinically evident muscle atrophy and 100% had evidence of radiographic progression of degenerative joint disease (DJD). The remaining 15% of dogs that did not respond to conservative treatment underwent surgical stabilization and medial meniscectomy.[6] Conservative management of small breed dogs is still widely recommended. A recent survey of UK veterinarians indicated that immediate surgical management was performed in only 16% of small breed dogs present with ccl rupture.[7] This study also reported that the decision for conservative versus surgical management depended on a variety factors such as age, body weight, severity and duration of lameness, and degree of instability. Surgical management consisted of extracapsular stabilization (ECS) (63%), corrective osteotomies (33%) and intra-articular methods (7%). Witte et al reported that none of the small breed dogs in their study responded to conservative management of mean duration of 8 weeks.[8]

One method of conservative management that is commonly proposed is the use of a brace. This is a controversial topic among surgeons and rehabilitation physicians in both the human and veterinary medical fields. A recent study by Hart et al. compared dogs treated with a custom made stifle joint brace and dogs undergoing the TPLO procedure. They found that the proportion of owners who reported that their dogs had mild or no lameness and rated the intervention as excellent, very good, or good was significantly greater for the TPLO group than for the orthosis group. However, ≥ _85% of respondents in both groups reported that they would choose the selected treatment again. Of 151 respondents from the orthosis group, 70 (46%) reported skin lesions associated with the device, 16 (11%) reported that the dog subsequently underwent surgery, and 10 (7%) reported that the dog never tolerated the device. Owner satisfaction was found to be high in both groups Results indicated high owner satisfaction rates for both interventions. When considering nonsurgical management with an orthosis, owners should be advised about potential complications such as persistent lameness, skin lesions, patient intolerance of the device, and the need for subsequent surgery.[9]

One factor that must be considered when debating conservative versus surgical management is the medial meniscus. Meniscal tears at the time of surgery are reported to be between 30 and 80% in CCL deficient stifle joints. The more widespread use of arthroscopy and probing of the meniscus have lead to a higher sensitivity in detecting meniscal tears in our patients. Regardless of the choice between conservative or surgical management, our patients will remain lame if meniscal pathology is not properly diagnosed and addressed initially or our treatment choices do not adequately stabilize the joint resulting in late meniscal tears.

Is There a Superior Surgical Method?

The three main categories of surgical intervention for cranial cruciate ligament rupture in dogs are extracapsular techniques, intra-articular reconstruction and osteotomy procedures. Surgical techniques can also be classified as passive or dynamic stabilizing techniques. Those techniques imparting passive stability utilize autogenous, allogenic or synthetic materials placed within or about the joint. Those providing dynamic stability do so by modifying joint biomechanics.

Passive Stability Techniques

The lateral fabelloibial suture (LFTS) extracapsular repair has been reported to result in 82 to 85% good to excellent function. The complication rate reported is 17.4 % with second surgeries required reported to be 7.2 to 13.8%. Case selection is important with higher complication rates reported in dogs with increasing body weight and young age[10]. The Arthrex Tightrope procedure has a 95.2% success rate with 43.4% of these cases being describes as excellent and 51.8% of these cases good. These results are reported in an Arthrex brochure and utilized data from 479 cases with a weight range of 2 to 93 kg. Overall, the veterinary literature reports that these methods good to excellent limb function in most cases with 90-95% owner satisfaction. These techniques are relatively simple to perform. Most act as an ‘internal splint’ and rely on joint fibrosis to provide stabilization of the joint. Sub optimal outcomes are usually the result of failure to obtain adequate stability at the time of surgery, failure to identify and address meniscal injury,

premature suture breakage, failure to maintain long term stability, failure to stop the progression of osteoarthritis and failure to prevent future meniscal injuries.

Dynamic Stability Techniques

The majority of veterinary surgeons performing orthopaedic surgery routinely perform one of the many dynamic stabilizing techniques. These techniques alter stifle biomechanics using some form of osteotomy. The most common of these surgical methods are the tibial plateau levelling osteotomy (TPLO) and the Tibial Tuberosity Advancement (TTA) technique. Slocum originally reported subjective faster return to function and outcome of 73% excellent, 21% good and 3% fair[11]. There have been many scientific studies reporting the outcome and complications following TPLO surgery. Most of the published studies have reported success rates and owner satisfaction in excess of 90%. Similar results have been reported following TTA. Good to excellent function in 90 % of cases, complication rates of 20 to 59% and 11 to 14% requiring additional surgery. Owner satisfaction approaches 95%[12].

Comparison of Surgical Methods

The veterinary literature has many published accounts of comparisons of current cruciate repair techniques. A summary of the methods, the outcomes and the quality of these reports is beyond the scope of this presentation. There have been several systematic reviews published most concluding that there is not enough quality evidence to support one single surgical method that can consistently return dogs to normal function after CCL injury[13]. Most recently a study was published that looked 444 studies on cruciate disease and dogs determining that 34 studies met the evidence criteria for inclusion. The most common procedures evaluated included the tibial plateau leveling osteotomy, lateral extracapsular suture, and tibial tuberosity advancement. The evidence most strongly supports the ability of the TPLO to result in dogs returning to normal function. There was also strong support that functional recovery in the intermediate postoperative time period was superior following TPLO compared to lateral suture. Unfortunately, there was insufficient data to adequately evaluate other surgical procedures[14]. A recent study compared long term function of the TTA to the long term function of dogs undergoing TPLO or extracapsular stabilization (ECS) for treatment of a ruptured cranial cruciate ligament. They concluded that at the walk, TTA achieves normal function by 12 months. However, at the trot TTA is indistinguishable from ECR. TPLO resulted in operated limb function that was similar to the control population by 6–12 months postoperatively at the walk and the trot.[15]

Additional Food for Thought

Some interesting information has recently come to light as researchers further explore canine cruciate ligament rupture and treatment. One such study has looked at real time kinematics of the cruciate deficient stifle both before and after surgery. This study has changed the way we think of the biomechanics of the stifle joint when the cruciate ruptures and may make us scrutinize our current methods of repair. This study investigated TPLO, TTA and extracapsular stabilization and reported that in vivo stifle kinematics questioned our ability to achieve stability of the stifle following these

procedures with ≥ 50% of stifles remaining unstable at surgical follow up. TPLO stifles with a post-operative tibial plateau angle of ≤ 5° were stable. TTA stifles remained unstable regardless of the patellar tendon angle[16, 17]. This is contrary to reported favorable outcomes following TTA and TPLO and suggests that there is a component to biomechanics of the cranial cruciate ligament deficient stifle that remains to be fully understood.

How Do We Choose?

For the most part surgeon discretion and case selection drive selection of our surgical method and we base this mostly on anecdotal evidence and personal experience. The learning curve, expertise and experience, equipment, dog size and economics are all important considerations for many of us. Interestingly, a survey of ACVS Diplomate Surgeons revealed that they performed TPLO (63%), followed by extracapsular suture (16%), TTA (10%), non-surgical treatment (5%), and finally TR (2%) when they treated their own pet or the pet of a close friend/family. TPLO was the most commonly performed surgical procedure for cranial cruciate ligament rupture in dogs amongst ACVS Diplomates[18].

References

1 - Wilke VL, Robinson DA, Evans RB, et al. Estimate of the annual economic impact of treatment of cranial cruciate ligament injury in dogs in the United States. J Am Vet Med Assoc. 2005; 227:1604–1607

2 - Doverspike M, Vasseur PB, Harb MF, Walls CM. Contralateral cranial cruciate ligament rupture: Incidence in 114 dogs. J Amer Anim Hosp Assoc. 1993;29:167–170.

3 - Vasseur PB. Clinical results following nonoperative management for rupture of the cranial cruciate ligament in dogs. Vet Surg. 1984 4:243-246

4 - Budsberg SC: Medical therapy for stifle osteoarthritis in Advances in the cranial cruciate ligament. Hoboken, NJ, Wiley, 2018

5 - Fox SM: Multimodal Management of Canine Osteoarthritis. Boca Raton, FL, CRC, 2017

6 - Vasseur PB: Clinical Results Following Nonoperative Management for Rupture of the Cranial Cruciate Ligament in Dogs. Vet Surg 13:243-246, 1984

7 - Comerford E, Forster K, Gorton K, et al: Management of cranial cruciate ligament rupture in small dogs: a questionnaire study. VCOT 26:493-497, 2013

8 - Witte PG, Scott HW: Tibial plateau leveling osteotomy in small breed dogs with high tibial plateau angles using a 4-hole 1.9/2.5 mm locking T-plate. Vet Surg 43:549-557, 2014

9 - Hart JL, May KD, Kieves NR et al. Comparison of owner satisfaction between stifle joint orthoses and tibial plateau leveling osteotomy for the management of cranial cruciate ligament disease in dogs. J Am Vet Med Assoc 249:391-398, 2016

10 – Casale SA. Complications associated with lateral fabellotibial suture surgery for cranial cruciate ligament injury in dogs: 363 cases (1997–2005). JAVMA, 2009

11 - Slocum B, Slocum TD. Tibial plateau leveling osteotomy for repair of cranial cruciate ligament rupture in the canine. Vet Clin North Am Small Anim Pract 1993;23:777–795

12 - Stein S, Schmoekel H. Short-term and eight to 12 months results of a tibial tuberosity advancement as treatment of canine cranial cruciate ligament damage. JSAP. 2008 49:398-404

13 - Aragon CL, Budsberg SC. Applications of evidence-based medicine: cranial cruciate ligament injury repair in the dog. Vet Surg 2005;34:93–98.

14 - Bergh Mary Sarah, Sullivan C, Ferrell CL, Troy J, Budsberg SC. Systematic review of surgical treatments for cranial cruciate ligament disease in dogs. J Am Anim Hosp Assoc 2014 Sep-Oct;50(5):315-21.

15- Krotscheck U, Nelson SA, Todhunter RJ et al. Long term functional outcome of tibial tuberosity advancement vs. tibial plateau leveling osteotomy and extracapsular repair in a heterogeneous population of dogs. Vet Surg 45 (2016):261-268

16 - Boettcher P. Kinematics of the Cruciate Deficient Stifle –British Veterinary Orthopaedic Association Spring Scientific Meeting, 2013.

17 - Murhy Sean M, Chandler John C, Brourman Jeff D, Bond Laura. A Randomized Prospective Comparison of Dogs Undergoing Tibial Tuberosity Advancement or Tibial Plateau Leveling Osteotomy for Cranial Cruciate Ligament Rupture. ACVS Surgical Summit, San Antonio, Texas, 2013

18 -Duerr FM, Martin KW, M, Palmer RH , Selmic LE. Treatment of cranial cruciate ligament disease. A survey of ACVS Diplomates and primary care veterinarians. Vet Comp Orthop Traumatol 2014 20;27(6):478-83.