Long Term Follow-up of Dogs Surgically Treated for Cranial Cruciate Ligament Disease

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Introduction

Cranial cruciate ligament (CCL) disease in dogs has become a billion dollar a year industry in the US. Numerous surgical procedures have been advocated for treatment of this condition, however, no procedure has been clearly proven to be superior to another. Since surgery for CCL disease in dogs is an elective procedure that is performed on such a high number of dogs each year, the surgical procedures used should be very safe and effective. The osteotomy procedures, tibial plateau leveling osteotomy (TPLO) and tibial tuberosity advancement (TTA), have been associated with high rates and severity of complications in several studies, while the non-osteotomy techniques have been reported to have higher safety profiles. No clinically significant differences among the techniques with respect to functional outcomes have been reported in the peer-reviewed literature.

Objective

- To compare long term (>1 year) outcomes with respect to safety and efficacy of three commonly used surgical procedures for treatment of CCL disease in dogs

Hypothesis

- The non-osteotomy technique (TightRope) will have significantly fewer complications and significantly more functional long term outcomes than the osteotomy techniques (TPLO and TTA)

Methods

Medical records of all dogs undergoing surgical treatment for cranial cruciate ligament disease using TPLO, TR, or TTA at the University of Missouri Veterinary Medical Teaching Hospital between November 2006 and April 2009 were retrieved. Cases were included when all medical record data were available and when clients returned a completed survey based on their assessments of the dog performed at least 1 year after surgery. Data regarding signalment, body condition score (1-9 scale), weight, procedure performed, CCL status, meniscal pathology, and postoperative complications were collected from the medical records and recorded. Complications were classified as catastrophic, major, or minor based on the system and criteria outlined by Cook, et al (Vet Surg 2010).

Follow-up surveys were mailed to each client and all data from completed surveys were included in the analyses. The surveys evaluated return to function as full, acceptable, or unacceptable based on the system and criteria outlined by Cook, et al (Vet Surg 2010). The surveys also included the client's assessment of percent function regained, complications, and their perception of the dog's level of pain.

Data were analyzed using ANOVA, Chi-square, and Fisher's exact tests with $p < 0.05$ considered statistically significant. Odds ratios were also calculated.

Results

The number of cases meeting the inclusion criteria were as follows: TPLO (n=65), TR (n=79), and TTA (n=18). There were no significant differences in age, gender, body condition score, or weight among the three groups.

Catastrophic complications occurred in 1.5% of TPLO patients, no TR patients and 5.6% of TTA patients. Major complications were documented in 18.5%, 8.9%, and 38.9% of TPLO, TR, and TTA patients, respectively. Subsequent meniscal tears were the most common major complication for each group and occurred in 12.3% of TPLO patients, 6.3% of TR patients, and 27.8% of TTA patients. TTA patients had significantly ($p<0.03$)) higher rates of major complications and subsequent meniscal tears than TPLO and TR patients, and TPLO patients had significantly higher rates of major complications and meniscal tears than TR patients. Minor complications were seen in 9.2%, 8.9%, and 22.2% of TPLO, TR, and TTA patients, respectively (Figure 1).

Percent of function as assessed by the owners at least one year after surgery was 93.1 ± 10.0% for TPLO, 92.7 ± 19.3% for TR, and 89.2 ± 11.6% for TTA. Long term outcomes based on levels of function definitions of full, acceptable, or unacceptable are shown in Figure 2. Significantly ($p=0.016$) more TPLO and TR patients were classified as reaching full function than TTA patients. The highest levels, frequency, and severity of pain were noted in TTA patients, however, no significant differences were noted among groups.

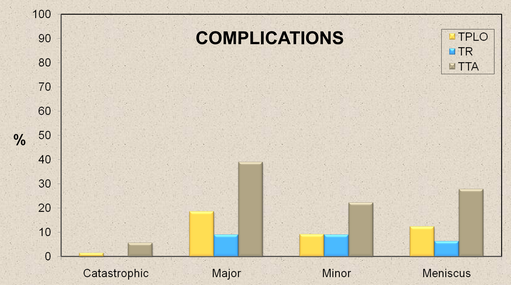

Figure 1: Odds ratios showed TPLO 2x more likely than TR and TTA 7x more likely than TR and 3x more likely than TPLO to be associated with major complications; TPLO 2x more likely than TR and TTA 6x morel likely that TR and 3x more likely than TPLO to be associated with subsequent meniscal tears requiring treatment.

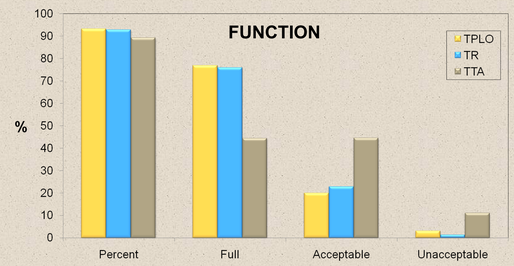

Figure 2: Odds ratios showed TPLO and TR to both be 4x more likely than TTA to be associated with a "full function" long term outcome.

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Discussion

In this group of patients, the TightRope procedure was associated with the fewest complications and had functional outcomes no different than TPLO and superior to TTA when assessed at least 1 year after surgery. Interestingly, except for catastrophic complications, clients reported lower complication rates than the rates determined from those recorded by the clinicians in the medical record. This suggests that on average, we are more stringent in defining and documenting major and minor complications than our clients.

In terms of long term functional outcomes, the three procedures were not found to be different with respect to owner assessed percent return to function or level, frequency, or severity of pain. However, in this group of patients, TPLO and TR were significantly more likely to be associated with "full function" outcomes compared to TTA. Importantly, 44-61% of dogs were reported by their owners to show "at least some pain" 1 year of more after surgery. While this may or may not be accurate and can result from a number of different causes, it is important to realize that none of the current CCL surgeries consistently result in long term pain-free function.

We also evaluated the "surgeon experience factor" by comparing complication rates and outcomes between cases with a resident versus faculty member as the primary surgeon. The only significant differences noted for these comparisons were for major complications in the TPLO cohort, major complications in the TR cohort, subsequent meniscal tears in the TR cohort, and major complications with all groups combined – all of which had significantly higher rates for residents compared to faculty members. However, we interpret these data with caution since a faculty member was always scrubbed in with the resident for these cases and none of the other categories showed significant differences.

The limitations of this study include its retrospective nature, the use of subjective outcome measures primarily, and the limited number of cases in the TTA cohort. The data should be interpreted with these limitations in mind.

Conclusions

- TightRope was associated with the fewest complications of the techniques evaluated, and had functional outcomes not different than TPLO and superior to TTA assessed >1 year after surgery
- Subsequent meniscal tears were the most common major complication seen for all three surgical treatment groups
- While functional outcomes are considered good for all three techniques, none of the CCL surgeries evaluated consistently resulted in completely pain-free function long term

Disclosure: Dr. Cook is a paid consultant for Arthrex and receives royalties associated with sales of Tightrope CCL.