Clinical comparison and short-term radiographic evaluation of Tight Rope and Lateral Suture procedures for dogs after cranial cruciate ligament rupture

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ABSTRACT: The aim of this study was to monitor short-term osteoarthrosis progress in relation to a recently introduced novel extracapsular method called the Tight Rope procedure and after Lateral Suture with nylon in cruciate-deficient dog stifle joints. Twelve dogs were included in the study. Treatment type was not randomised. Mediolateral radiographs from 12 stifle joint were evaluated preoperatively and six months after surgery. A modified scoring system for evaluation of osteoarthrotic changes was used. The initial osteoarthrotic score in the TightRope group ranged from three to six and in the Lateral Suture group from 0 to 11. In the TightRope group 66.6% of dogs had an osteoathrotic score difference of ≤ 5 and 33.3% dogs had an osteoarthrotic score difference of > 5. For the Lateral Suture group 50% of dogs had an osteoarthrotic score difference of ≤ 5 and 50% dogs had an osteoarthrotic score difference of > 5. The Wilcoxon signed rank test revealed a significant difference between preoperative and postoperative osteoarthrotic scores (P = 0.0038). No significant differences were noted between TightRope and Lateral Suture groups in terms of changes in mean radiographic osteoarthrotic score preoperatively and at the six-month postoperative end point. Both groups had numerically higher radiographic scores six months after surgery.

Keywords: cruciate-deficient stifle; extracapsular method; radiology; dog

List of abbreviations

CCL = cranial cruciate ligament, LS = Lateral Suture, OA = osteoarthrosis, SD = standard deviation, TR = Tight Rope

Cranial cruciate ligament (CCL) provides craniocaudal stability, prevents hyperextension and constrains medial rotation of the tibia in the canine stifle joint. CCL rupture is the leading cause of hind leg lameness; it is also the most frequent cause of degenerative disease of the canine stifle joint (Johnson and Johnson 1993). The primary goal of surgical management of a CCL rupture is to promote return to normal function, by providing joint stability. Functional stability is thought to minimise or slow down the progression of osteoarthrosis (OA) (Slocum and Slocum 1998). Many surgical procedures have been used to secure the stability of the stifle joint with torn cranial cruciate ligament, but there is no evidence to show that any given surgical treatment is to be preferred the over others (Aragon and Budsberg 2005, Au et al. 2010; Conzemius et al. 2005). These methods can be classified as promoting static or dynamic stabilisation according to the technique used (Boudrieau 2009; Kuhn et al. 2011). Extracapsular Lateral Suture (LS) is a commonly performed technique for static stabilisation of the stifle (Caporn and Roe 1996). More recently, a novel extracapsular method called the Tight Rope procedure (TR) has been introduced, which is based on the lateral retinacular imbrication suture principle (Cook et al. 2010). Our objective was to evaluate outcomes by assessing subjective measurement of cranial drawer and cranial tibial thrust at 6 months after surgery (Cook et al. 2010). Our next objective was to use a previously reported radiographic stifle OA scoring system (Vasseur and Berry 1992) to com-

Supported by the Scientific Sponsorship Agency of the Ministry of Education of the Slovak Republic (Project VEGA MS SR No.1/2945/12).

pare short-term postoperative radiographs, comparing Tight Rope with Lateral Suture techniques.

MATERIAL AND METHODS

Dogs presented at the Small Animal Clinic, UVM from October 2011 to March 2012 for unilateral hind limb lameness and with CCL rupture as the confirmed cause were considered for study inclusion. Dogs were excluded when concurrent orthopaedic and/or neurological disorders were diagnosed. CCL rupture was diagnosed based on orthopaedic examination of dogs, which consisted of adspection of the dog's gait and palpation of affected stifle joint, pain, periarticular fibrosis, positive cranial drawer and positive cranial tibial thrust.

Treatment type was not randomised. Dogs were pre-medicated, anaesthetised, positioned in dorsal recumbency, and prepared for aseptic surgery. Aseptic technique was strictly adhered to throughout all aspects of both procedures. For all dogs, the CCL was completely debrided. Damaged meniscus, when present, was treated by complete meniscectomy. Tight Rope or Lateral Suture was then performed as previously described (Hulse and Johnson 1997; Cook et al. 2010) to correct stifle instability.

A mediolateral radiographic projection of each stifle was evaluated preoperatively and at final examinations. Radiographic evidence of stifle OA was scored using a modification of the system described by Vasseur and Berry (1992). An OA score for each stifle was determined by evaluating 14 specific radiographic features of OA. Structures evaluated included the patella (apical osteophytes, basal osteophytes, cranial apical enthesiopathy), femur (trochlear groove periarticular osteophytes, supratrochlear lysis, fabellar periarticular osteophytes), tibia (cranial periarticular osteophytes, caudal periarticular osteophytes, subchondral cystic lesions, condyle remodelling, central tibial plateau osteophytes), and surrounding soft tissues (joint effusion and/or capsular joint thickening, intracapsular mineralised osseous fragments, enthesiophytes at the patellar ligament insertion on the tibia). Degenerative changes were recorded as 0 = absent, 1 = mild, 2 = moderate, or 3 = severe. Each feature was weighted equally. By analysing these 14 features, a given absolute OA score for each stifle could range from 0 to 42. Scores were then assigned to two groups in order to reflect clinical relevance. We evaluated the differences between preoperative and postoperative radiographic scores. Dogs with a radiographic score change of ≤ 5 were classified as improved or as exhibiting no change. Dogs with a radiographic score change > 5 were considered to have worsened. The Wilcoxon signed rank test was used to statistically compare preoperative and postoperative OA scores. Significance was set at $P < 0.05$.

All dogs were assessed six months after surgery. Physical and orthopaedic examinations were performed. Cranial drawer and cranial tibial thrust were subjectively measured in millimetres.

RESULTS

Twelve dogs were included in the study. Six dogs were included in the Tight Rope group and six dogs were in the Lateral Suture group. Mean (± SD) body weight for the whole group was 32.3 ±

Table 1. OA scores for Tight Rope and Lateral Suture techniques

Group	Dog number	Initial OA score	OA score at least 6 months post-surgery	Difference in OA score pre-/post-operatively	OA score change	Number of dogs
Tight Rope	1	4	6	2	≤ 5	4 (66.6%)
	2	6	11	5		
	3	3	7	4		
	4	4	8	4		
	5	6	12	6	> 5	2 (33.3%)
	6	4	11	7		
Lateral Suture	1	0	3	3	≤ 5	3 (50%)
	2	1	1	0		
	3	2	7	5		
	4	11	18	7	> 5	3 (50%)
	5	8	16	8		
	6	4	11	7		

11.0 kg (range, 23–61 kg) and mean age for the whole group was 4.3 ± 2.3 years (range, two to nine years). Tight Rope group mean (±SD) age was 4.2 ± 2.6 years and Lateral Suture group mean (±SD) age was 4.5 ± 2.1 years. Mean (±SD) body weight for the Tight Rope group was 29.8 ± 7.5 kg; Lateral Suture group mean (±SD) body weight was 34.8 ± 14.0 kg.

The OA scores are shown in Table 1. The initial OA score in the TR group ranged from three to six, where only joint effusion was present. The initial OA score in the LS group ranged from 0 to 11. For the TR group there were four dogs with an OA score difference of ≤ 5 (66.6%) and two dogs with an OA score difference of > 5 (33.3%). For the LS group there were three dogs with an OA score difference of ≤ 5 (50%) and three dogs with an OA score difference of > 5 (50%). The Wilcoxon signed rank test revealed a significant difference between preoperative and postoperative OA scores ($P = 0.0038$). No significant differences were noted between TR and LS groups for changes in mean radiographic OA scores preoperatively and at the six-month postoperative end point. Both groups had numerically higher radiographic scores six months after surgery.

Assessment of cranial drawer and cranial tibial thrust showed no statistically significant differences in preoperative measurements between treatment groups. No statistically significant differences were noted between Tight Rope and Lateral Suture groups for cranial tibial thrust at the postoperative evaluation (Figures 1 and 2).

DISCUSSION

The canine cranial cruciate ligament is commonly injured in dogs. A large number of different surgical procedures have been described for treatment of stifle instability. Stabilisation is accomplished either by osteotomy of the tibia (Kim et al. 2008) or by extracapsular stabilisation (Hulse and Johnson 1997). Extracapsular stabilisation involves a strong stabilising suture on the lateral aspect of the stifle joint and was first described in 1970 (DeAngelis and Lau 1970). The technique has become very popular and there are many modifications of the originally described technique. The basic concept is that a suture anchored around the lateral fabella and passed deep to the lateral fascia to the tibia will limit cranial draw and internal rotation of the tibia with respect to the femur. The suture consists mostly of a monofilament nylon leader line of 50–100 lb breaking strength and the can be secured with a knot or a crimp system. The method of loop fixation is based on surgeon preference (Ledecky et al. 2012). Recent innovations in extracapsular techniques include bone-to-bone fixation devices such as Tightrope (Arthrex, Naples, Florida, USA) (Cook et al. 2010). The technique uses more isometric fixation sites that lie just cranial to the lateral fabella on the lateral femoral epicondyle and just caudal to the long digital extensor groove and Gerdy's tubercle on the proximal tibia. These sites require fixation of the orthopaedic material to bone. However, the use of multifilament suture materials, such as Fibertape, needs careful consideration because these have been associated with higher infection rates (Cook et al. 2010).

Evaluation of stifle OA can be carried out using radiographic imaging (Vasseur and Berry 1992; Widmer et al. 1994). Outcome after surgery for CCL disease can be assessed based on the radiographic progression of stifle joint OA and by evaluating functional outcome, which is probably more

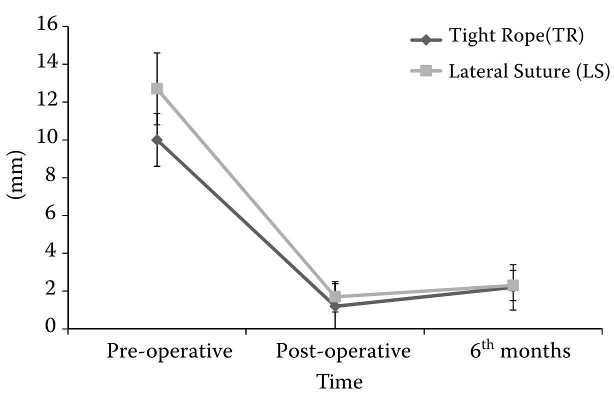

Figure 1. Cranial drawer test Tight Rope vs Lateral Suture

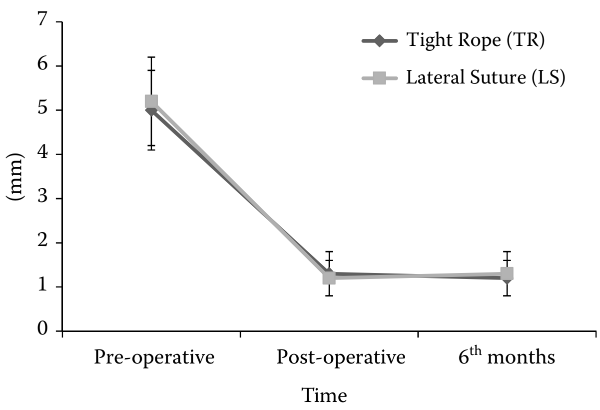

Figure 2. Tibial compression test Tight Rope vs Lateral Suture

clinically relevant. An advantage of radiographic OA scoring over other methods of evaluation is the ability to specifically isolate the stifle for examination (Vasseur and Berry 1992). One disadvantage of OA scoring is the bias of the individual reviewer, as well as intra- or inter-observer variability.

Based on the radiographic progression of OA and the subjective assessment of stifle stability, the Tight Rope CCL technique resulted in similar outcomes to those after Lateral Suture six months after surgery.

Based on our results, we conclude that stabilisation of cranial cruciate-deficient stifle joints in dogs using the extracapsular lateral suture technique or the Tight Rope method does not reduce progression of OA changes as evaluated radiographically.

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Received: 2013–11–11
Accepted after corrections: 2014–10–12

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