Arthroscopic Long Digital Extensor Tenodesis: Technique and Outcome in a Dog

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Abstract

Avulsion of the long digital extensor (LDE) tendon is an uncommon cause of pelvic limb lameness in the dog. Surgical exploration is recommended with reattachment of the tendon and the avulsed fragment of bone using a small screw in lag fashion. In more chronic cases, the bone fragment can be removed, and the tendon attached by suture or staple to the proximolateral tibia. Arthroscopic tenodesis of the LDE has not been previously reported in the literature. A 6-year-old male neutered Labrador Retriever was presented for evaluation of a left pelvic limb lameness that was localized to the stifle. Avulsion of the LDE tendon was diagnosed based on palpation and radiographs. Arthroscopic assessment of the joint was performed. The origin of the LDE was freed with the use of a mechanical 3.0-mm shaver and an arthroscopic punch. The freed end was then exteriorized from the lateral portal and mineralized tissue removed. The tendon end was captured using no. 2 braided suture loop using a SpeedWhip technique. A 4.75-mm SwiveLock® polyetheretherketone anchor was utilized to fasten the tendon in the proximal groove of the LDE. The dog returned to dock diving by 16 weeks postsurgery at the preinjury level of performance and remained free of lameness at 30 months postoperatively. Arthroscopic long digital tendon tenodesis is a feasible surgical option in canine patients.

Keywords

- arthroscopy
- tenodesis
- long digital extensor tendon
- dogs

Introduction

Avulsion of the long digital extensor (LDE) tendon is an uncommon cause of pelvic limb lameness but has been reported in the literature and is considered to result from low-grade trauma.[1,2] The tendon is an intra-articular structure originating from a fossa on the lateral aspect of the femoral condyle and courses through the joint just below the lateral joint capsule, exiting the joint in the extensor groove of the proximal tibia. The LDE inserts at the distal ends of phalanxes 2 to 5.[3] The LDE does not provide any stability to the stifle, but rather acts to extend the digits and flex the hock.[4] Dogs with LDE avulsions present with a nonspecific unilateral weight-bearing pelvic limb lameness. Immature large or giant breed dogs may be overrepresented for the condition.[1] Known trauma may or may not be reported, but often cases present as a chronic condition. Mild thickening, effusion, and crepitus may be palpated over the lateral aspect of the stifle during passive range of motion of the joint.[1] Palpation findings are otherwise unremarkable, although the condition can be seen concurrently with cranial cruciate ligament disease, in which case cranial drawer or tibial thrust may also be present.[5] Diagnosis of LDE avulsion can be made on plain radiographs if a fragment of bone is displaced with the tendon from the fossa or if there is chronic mineralization of the affected tendon. At the level of the origin of the LDE tendon (extensor fossa), a subtle lucency may be noted in the subchondral bone.[1] Small dystrophic rounded fragments tend to lie cranial to the left lateral femoral condyle and slightly distal to the level of the extensor fossa if mineralization is present.[1]

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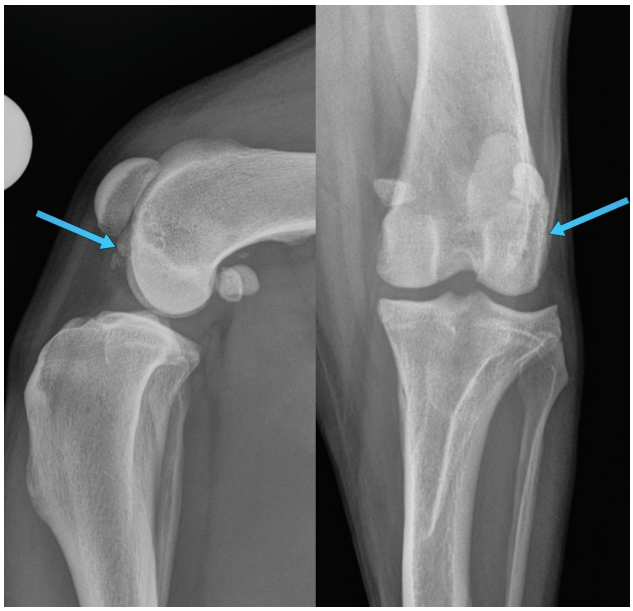

Fig. 1 Preoperative radiographs of the left stifle. *Arrows* point to dystrophic mineralization of the long digital extensor origin.

Computed tomography (CT) can be used to identify if an osseous fragment may be present within the joint. An irregular subchondral defect may be present on the lateral aspect of the femoral condyle if a fragment has avulsed.[5] Magnetic resonance imaging (MRI) can be used to help evaluate when the cause of lameness is not apparent on radiographs.[6] Decreased signal intensity on a T1-weighted image in the extensor fossa area suggests an avulsion injury. Decreased signal intensity in the region of the proximal portion of the LDE tendon on T1-weighted images may also be noted.[6] This finding is attributed to increased synovial fluid in the capsular synovial bursa and potential changes in the mechanics of the muscle.[1,6]

There is a paucity of information on the conservative management of LDE avulsion in the literature. Iatrogenic laceration of the LDE left untreated without subsequent lameness has been reported.[7] However, given that this condition often presents as a chronic lameness issue, forgoing treatment is not this author's recommendation.

Surgical exploration is recommended with reattachment of the tendon and the avulsed fragment of bone using a small screw in the lag fashion. In more chronic cases, the bone fragment can be removed through a parapatellar arthrotomy, and the tendon attached by suture or staple to the proximolateral tibia.[1,2]The outcome of this nonarthroscopic technique was reported to be a return to function.[2] Arthroscopic techniques are becoming more common, and arthroscopy of the stifle has been shown to reduce postoperative discomfort in the canine patient as compared with arthrotomy.[8] This current case report describes the surgical technique and clinical outcome of an arthroscopic tenodesis of the LDE in a sporting dog.

Case Description

A 6-year-old male neutered Labrador Retriever presented for evaluation of a left pelvic limb lameness of 10 months' duration without known trauma. The lameness was characterized as mild by the owner (stiff when first rising, would occasionally hold the limb up for a few steps), but more importantly to the owner, the lameness resulted in a performance issue of reduced average jump distance below his North America Diving Dogs (NADD) senior distance title.

On examination, a grade I/V left pelvic limb lameness was noted at a walk. Mild left pelvic limb muscle atrophy was present. Palpation of the left stifle revealed mild thickening of

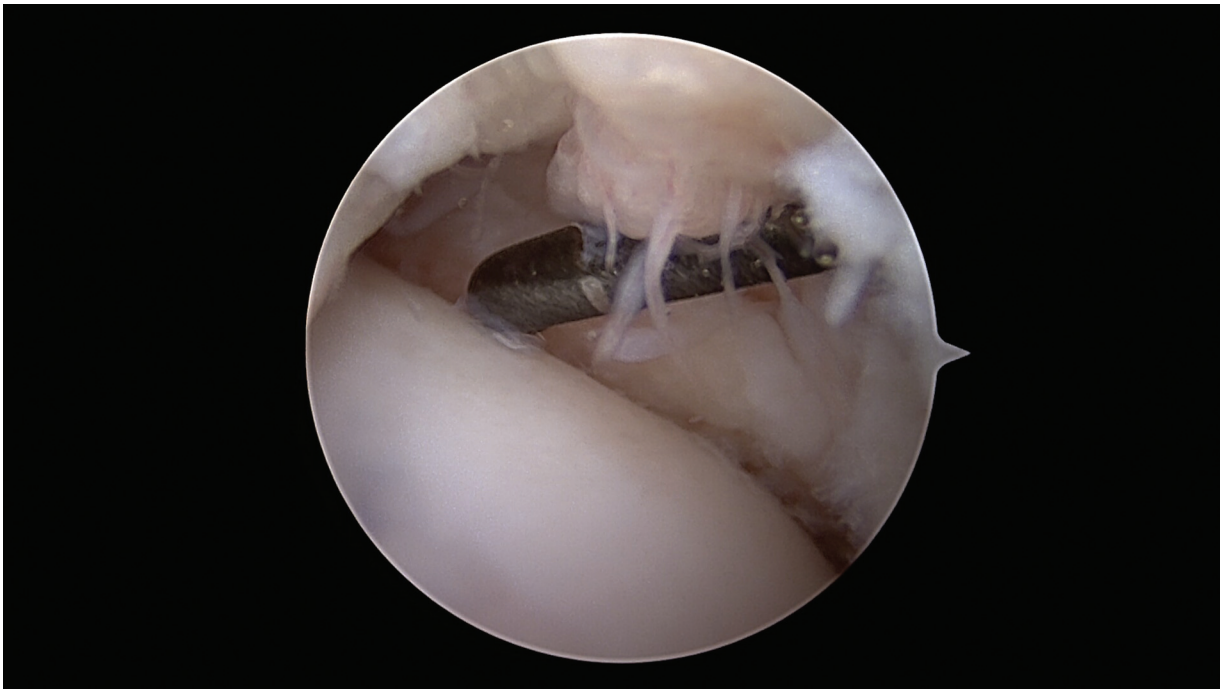

Fig. 2 Intraoperative image of the avulsed fragment.

the lateral aspect of the joint with discomfort elicited on palpation over the lateral joint compartment. Minimal stifle effusion was appreciated. The stifle palpated without gross instability of the cruciate ligaments. Radiographs were obtained of the stifles, revealing a subtle lucency in the subchondral bone at the level of the origin of the LDE. A small dystrophic rounded fragment cranial to the left lateral femoral condyle and slightly distal to the level of the extensor fossa was noted (►**Fig. 1**).

Arthroscopic assessment of the joint was performed using a 2.7-mm 30-degree 4K arthroscope (Arthrex, Naples, FL). Standard parapatellar scope portals were made at the level of the proximal 50% of the tendon. Once it was established that the arthroscope was within the joint, fluid ingress via a fluid pump (DualWave Arthroscopy pump, Arthrex, Naples, FL) was started with a pressure setting of 30 mm Hg using lactated ringer's solution (LRS) and continued throughout the procedure. A standard lateral scope port was first utilized, with joint exploration and evaluation of the cruciate ligaments and menisci being performed with no abnormalities noted. The scope was then placed in the medial portal to allow for better visualization of the LDE tendon origin and direct manipulation of the LDE in the lateral joint compartment through the lateral portal (►**Fig. 2** and ►**Video 1**). Once the avulsion was confirmed, the origin of the LDE was freed with the use of a hand shaver with a soft-tissue attachment and an arthroscopic punch (►**Video 2**). The freed end was then exteriorized from the lateral portal with self-ratcheting graspers (►**Fig. 3**). Mineralized tissue was removed from the freed end. The tendon end was captured with a no. 2 braided suture loop using a SpeedWhip (Arthrex Vet Systems, Naples, FL) technique. An anchor socket was power drilled with a 3.6-mm spade tip drill bit (Arthrex Vet Systems) and tapped with a 4.75-mm power tap (Arthrex Vet Systems) under arthroscopic visualization in the proximal groove of the LDE, approximately 3 mm from the articular surface (►**Videos 3** and **4**). A 4.75 mm × 19.1 mm polyetheretherketone SwiveLock anchor (Arthrex Vet Systems) was utilized to fasten the tendon origin into the socket to allow for potential ingrowth of tendon into the bone bed (►**Video 5**). Closure of the incisions was accomplished with 2–0 Poliglecaprone 25 using a buried intradermal suture pattern.

Video 1

Arthroscopic probing of LDE fragment. Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/.

Video 2

Arthroscopic grasping and release of tendon (LDE). Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/.

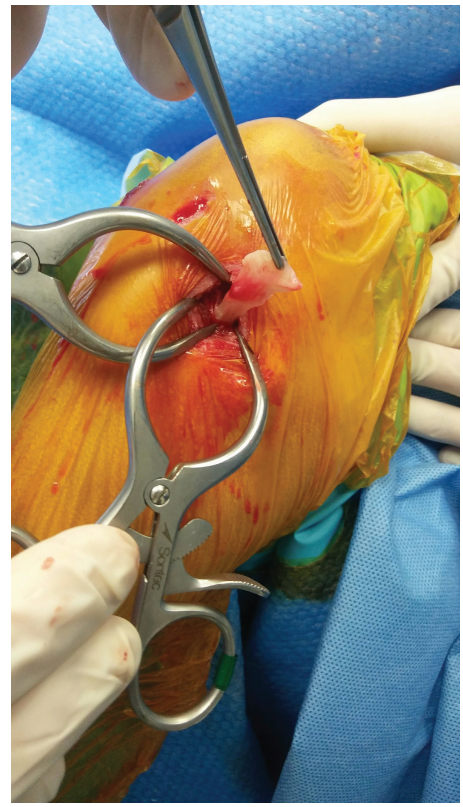

Fig. 3 Image of the exteriorized tendon with fragment. Note that the incision was lengthened and Gelpi retractors were only utilized to improve the quality of the image and are not necessary to perform the procedure.

Video 3

Drilling of anchor socket. Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/.

Video 4

Tapping of anchor socket. Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/.

Video 5

Insertion of Swivelok® anchor. Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/.

The dog was discharged from the hospital after 24 hours of hospitalization. Carprofen (2.2 mg/kg twice daily) was prescribed for 2 weeks, and oral codeine (0.5–1 mg/kg every 12 hours) for 3 days. To aid in restricting activity, particularly

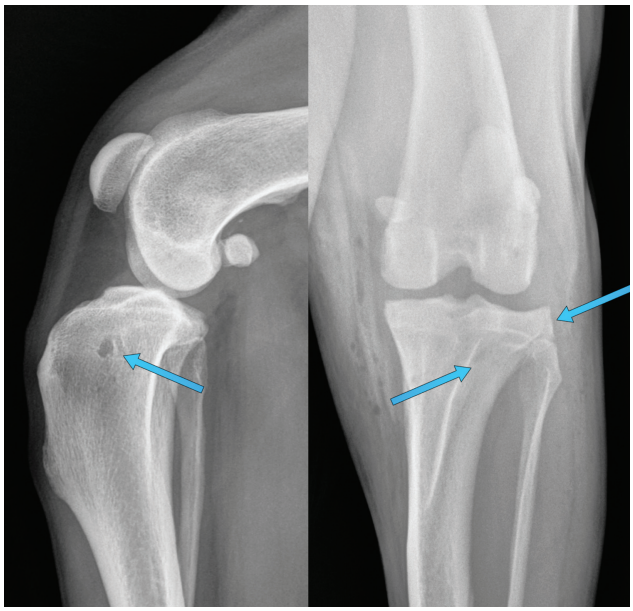

Fig. 4 Recheck radiographs of the left stifle 30 months following surgery. The *arrows* designate the anchor socket. There is minimal effusion and no progression of osteoarthritis.

during the initial 4 postoperative weeks, trazodone (2 mg/kg every 8–12 hours) was also prescribed. Exercise was restricted to 5- to 10-minute bathroom breaks on leash.

A follow-up video was provided by the owners 2 weeks postoperatively (►**Video 6**). The dogs' owner reported comfort and good mobility. The dog underwent an additional 8-week postoperative convalescent period with return to sports training at 12 weeks. The dog returned to dock diving at 16 weeks postsurgery at his preinjury level of performance. Follow-up evaluation and radiographs were available 30 months postrepair. At that time, the patient was free of pelvic limb lameness. Radiographs revealed persistent subtle lucency in the subchondral bone at the level of the extensor fossa consistent with the polyether-etherketone anchor site. There was subtle increased soft-tissue opacity within the left femorotibial joint, but no progression of osteoarthritis or complications associated with the bone tunnel (►**Fig. 4**).

Video 6

Two week postoperative patient gait. Online content including video sequences viewable at: https://www.thieme-connect.com/products/ejournals/html/.

Discussion

Long digital extensor tendon reattachment to the joint capsule has been previously reported to produce a good outcome. Olmstead and Butler treated a 5-month-old Doberman Pinscher with fragment removal without reattachment of the tendon; the postoperative gait was acceptable; however, a slight external rotation of the limb when ambulating was reported.[9] Pond reported four juvenile large to giant breed dogs with LDE avulsion; fragment fixation back to the LDE fossa of the femur using screws inserted in the lag fashion resolved the lameness.[1] Lammerding and colleagues later reported three juvenile giant breed dogs with LDE avulsion treated by fragment removal and tendon reattachment to the deep connective tissue at the level of the extensor fossa.[2] All dogs returned to normal function. However, the athletic nature of the dogs in these case series was not noted.

Unlike the previous reports, the dog in this report was skeletally mature. Arthroscopic LDE tenodesis was chosen in this patient as dock diving was the primary sport and relies significantly on hock flexion and digit extension for propulsion. This technique has not been previously reported in the canine patient but is a feasible surgical option and may offer advantage over suturing the tendon to the joint capsule in athletic patients. However, given the infrequency of this condition, it would be difficult to amass enough cases to compare an open joint capsule suture technique to the technique described in this case report.

If desired, the procedure can be modified to an entirely intra-articular procedure using two tendon capturing techniques that have been described in the human literature. One involves a Scorpion suture passer (Arthrex, Naples, FL) to pass the suture through the tendon or the loop and tack procedure.[10,11] These techniques offer the advantage of complete control of the free end of the tendon without exteriorization of the tendon end through an all-inside technique. Whether the described technique in this report or an all-intra-articular adaptation offers an advantage in clinical outcome over previously described techniques of suturing the tendon to the joint capsule cannot be determined based on this report.

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None.

Conflict of Interest
The author is a paid consultant for Arthrex Vet Systems, the manufacturer of the arthroscopy equipment and implant utilized in this case report.

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