Schweizer Archiv für Tierheilkunde
A. Gutbrod et al., Band 155, Heft 9, September 2013, 505–509
DOI 10.1024/0036-7281/a000500

Repair of a canine patellar ligament rupture using the ComPact UniLock 2.4/3.0 mm System

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Summary

An 11-year old, female, Mix Breed dog was presented after being hit by a car with a rupture of the left patellar ligament. Due to a suspected wound infection close to the stifle joint, surgical repair was delayed for 10 days. The ruptured ligament was sutured and augmented with fascia lata. Additionally, two ComPact UniLock 2.4/3.0 mm plates connected with 1.0 mm orthopaedic wire were used to protect the primary repair. No immobilization of the stifle joint was needed. The implants were removed after 7 weeks, because of suspected infection and loosening. The successful utilization of an alternative surgical technique for the repair of the patellar ligament rupture in the dog has also been documented by pre- and post-operative temporal-spatial gait analysis (GaitFour®).

Keywords: dog, patellar ligament, rupture, UniLock, trauma

Chirurgische Behandlung einer Ruptur des Kniescheibenbandes beim Hund mit ComPact UniLock 2.4/3.0 mm System

Eine 11-jährige, kastrierte Mischlingshündin wurde nach einem Autounfall mit einem Riss des linken Patellarbandes vorgestellt. Aufgrund einer vermuteten Wundinfektion im Bereich des Kniegelenks wurde eine chirurgische Versorgung der Patellarbandruptur erst nach 10 Tagen durchgeführt. Das gerissene Band wurde genäht und mit Faszia lata Streifen verstärkt. Um die primäre Naht zusätzlich zu schützen, wurden zwei ComPact UniLock 2.4/3.0 mm Platten verwendet, die über 1.0 mm orthopädischen Draht verbunden wurden. Eine Ruhigstellung des Kniegelenks war nicht notwendig. Nach 7 Wochen wurden die Implantate wegen einer Infektion und Lockerung entfernt. Die erfolgreiche Anwendung einer alternativen chirurgischen Technik für die Behandlung einer Ruptur des Kniescheibenbandes beim Hund wurde auch durch prä- und postoperative Ganganalysen (GaitFour®) dokumentiert.

Schlüsselwörter: Hund, Patellarligament, Ruptur, UniLock, Trauma

Introduction

Rupture of the canine patellar ligament is a rare injury and primary surgical repair of the ruptured ligament in combination with an internal splint to protect the suture is recommended (Piermattei et al., 2006; Shipov et al., 2008; Archer et al., 2010). This has been achieved using orthopaedic wire, fishing line or augmentation with fascia lata with a favourable prognosis. This case report describes an alternative approach for internal splinting of the patellar ligament using two ComPact UniLock 2.4/3.0 mm plates, one fixed to the patella and one to the tibial tuberosity, connected with 1.0 mm orthopaedic wire.

Clinical examination

An 11-year old, female, spayed Mix Breed dog was presented to the Small Animal Clinic of the University of Zürich after being hit by a car. After hemodynamical stabilization and treatment of the open skin wounds including antibiotic therapy with cefalexin (Kefzol®, Teva Pharma AG, 4147 Aesch, Switzerland) and enrofloxacin (Baytril®, Provet AG, 3421 Lyssach, Switzerland), a complete orthopaedic and neurologic exam was performed. An obvious lameness without weight bearing during trotting was observed in the left hind limb with an inability to maintain stifle extension during the stance phase.

Table 1: Results of the gait analysis with a markedly reduced asymmetry index post-operatively indicating equally distributed weight-bearing of the two hind limbs. The asymmetry index is the mean of the individual differences of the measured data related to the mean of the respective value.

	Total pressure index			Number of sensors		
	Median right leg	Median left leg	Asymmetry index (R-L)	Median right leg	Median left leg	Asymmetry index (R-L)
Preoperative	41.2 (± 5.9)	30.8 (± 8.3)	0.31 (± 0.27)	12.7 (± 1.0)	8.8 (± 3.3)	0.40 (± 0.27)
1d post OP	20.4 (± 1.2)	19.9 (± 2.3)	0.03 (± 0.15)	8.1 (± 1.1)	7.6 (± 1.2)	–0.06 (± 0.23)
2wks post OP	20.3 (± 3.0)	19.9 (± 1.9)	0.01 (± 0.19)	8.2 (± 1.7)	8.1 (± 1.8)	0.01 (± 0.28)
9wks post OP (after implant removal)	29.6 (± 7.6)	26.0 (± 3.4)	0.11 (± 0.24)	10.0 (± 1.4)	10.1 (± 2.0)	–0.01 (± 0.20)

Figure 1: Pre-operative radiograph of the right stifle joint shows proximal displacement of the patella, a thickening of the patellar ligament and multiple small mineral opaque structures superimposed on mid and distal aspect of the patellar ligament.

Severe swelling of the left stifle, a proximally displaced patella and a depression cranial at the level of the patellar ligament were noted. No neurologic deficits or further lameness was detected. Radiographs of both stifle joints (Fig. 1) and an ultrasonographic examination of the left patellar ligament were performed to confirm the clinical diagnosis of patellar ligament rupture. To minimize the risk of infection surgical repair of the patellar ligament was delayed for 10 days.

One day prior to surgery a temporal-spatial gait analysis was performed using a pressure sensitive walkway (GaitFour®, Sparta, NJ, USA) in order to obtain the total pressure index and the number of activated sensors per footstep. The values for the affected and unaffected limbs were compared and an asymmetry index was calculated. This showed a marked favouring of the unaffected limb during weight bearing with higher values for the total pressure index and activated sensors (Tab. 1).

Arthroscopy

Ten days after the trauma the dog an arthroscopic exploration of the stifle joint was performed using a 1.9 mm arthroscope and standard portal sites (Schulz, 2012). A complete rupture of the patellar ligament was observed at the level of the insertion at the tibial tuberosity. The patellar ligament was swollen, soft, frayed and markedly inflamed. The cruciate ligaments, menisci and the cartilage were unremarkable.

Surgical technique

The proximal tibial tuberosity, the cranial aspect of the patella and the patellar ligament with its torn fibers were then exposed A primary repair of the ligament was performed with two Ethibond® sutures (USP 6 and USP 1) applying a locking-loop in the proximal part and a fixation through a transverse drill hole in the tibia at the level of the insertion. This repair was additionally supported in the following way: The proximal aspect of a 6 hole 2.4/3.0 mm ComPact UniLock (Synthes Gmbh & Co KG, Umkirch, Germany) plate was contoured to fit the shape of the cranial margin of the patella and attached to the patella using two 2.4 mm locking screws ensuring that the tip was not protruding over the articular surface. A second plate was placed on the cranial aspect of the tibial tuberosity using 3 monocortical locking screws leaving the most proximal screw hole empty and protruding proximal over the tibial tuberosity. The most distal plate hole of the proximal plate was connected to the proximal plate hole of the distal plate with two 1.0 mm orthopaedic wires. The two wires were alternately tightened until the distance of the apex patella and tibial tuberosity matched the preoperatively measured distance in the contralateral stifle (Fig. 2). To augment the extensor mechanism of the stifle additional fascia lata strips were used. Patellar ligament plating was performed suturing the

Figure 2: Laterolateral and caudocranial post-operative radiographs showing the ComPact UniLock 2.4/3.0 mm plates fixed to the patella and tibial tuberosity, respectively, connected with two orthopaedic wires. The appropriate distance of the apex patellae and the insertion of the patellar ligament at the tibial tuberosity is restored.

patellar ligament to the proximal plate using 0 PDS in a simple interrupted pattern. The surgery site was flushed with copious amounts of sterile saline and a gentamycin soaked collagen sponge (Garamycin® 50 mg) was placed near the implants. No external stabilization of the stifle joint was applied. Antibiotic treatment was continued.

Postoperative care and outcome

The orthopaedic exam on the first day after surgery showed only an intermittent and consistently weight bearing lameness of the left hind limb with normal joint angles during walk. The temporal-spatial gait analysis showed a reduction for the asymmetry indices for the TPI and the activated sensors compared to preoperative values. This indicated an improved weight bearing in the operated leg (Tab. 1).
Three days after surgery the lameness gradually worsened and cytology after fine needle aspiration of the periarticular tissue showed a purulent inflammation with degenerated neutrophils and coagulase negative staphylococci were isolated resistant to the antibiotics the dog received. The antibiotic treatment was switched to clindamycin (Antirobe®, Pfizer AG, Zürich, Switzerland) and the leg was placed in a modified Robert-Jones bandage for 2 days. The swelling decreased within 2 days and the gait improved markedly to an intermittent and consistently weight bearing lameness again. For the next 7 weeks on weekly clinical exams and according to the owner no lameness was observed. The temporal-spatial gait analysis at this time also showed a reduction for the asymmetry indices for the TPI and the activated sensors compared to preoperative values. All implants were removed after 7 weeks, since radiographic examinations (Fig. 3) showed signs of implant loosening.

Figure 3: Radiograph 7 weeks after surgery shows well defined lucencies around the screws in the patella and less obviously around the base of the 3 tibial screws. There was a slight increase of the distance between the proximal part of the plate and the patella.

No hind limb lameness was observed 14 days after implant removal. After temporal-spatial gait analysis the asymmetry indices for the TPI and the number of activated sensors were calculated and the results comparable to the immediate post operative values (Tab. 1). Three weeks after implant removal the dog presented with neck pain and radiographs of thoracic spine showed an aggressive polyostotic bone lesion involving Th2 to Th4. However the owner declined further diagnostics and treatment and the patient was empirically treated for suspected discospondylitis. The owner decided to euthanize the dog 5 ½ month after the patellar ligament repair at their local veterinarian due to worsening of the neck pain.

Discussion

In this report we describe a successful treatment of a traumatic patellar ligament rupture using two ComPact UniLock 2.4/3.0 mm plates fixated in the patella and the tibial tuberosity respectively, connected with 1.0 mm orthopaedic wire. After healing an excellent outcome was observed clinically without lameness, an unrestricted range of motion and normal joint angles during ambu-

lation. This was further supported by the results of the temporal-spatial gait analysis.

The decision to use this alternative approach was based on the substantial defect in the patellar ligament as well as the marked inflammation of the soft tissues, which weakened the fascia lata and the patellar ligament further. A very stable internal fixation would be required to protect the primary repair and persistent lameness has been described in cases of large defects treated with traditional techniques (Gemmill and Carmichael, 2003). In a different case a single plate spanning the patellar ligament from the tibial tuberosity to the patella has been used before. However this plate broke and in a second operation the surgeon linked the two broken plate segments with orthopaedic wire. As this revision showed success we directly used two ComPact UniLock 2.4/3.0 mm plates fixed individually to the patella and tibial tuberosity, connected via two 1.0 mm orthopaedic wires maintaining the distance of the patella to the tibia and allowing full range of motion in the stifle joint in this case.

The most commonly described repair of patellar ligament ruptures is the placement of locking loop sutures with large nonabsorbable suture material and an internal splint. (Shipov et al., 2008; Archer et al., 2010). Additional stability can be achieved by augmenting the repair with autogenous fascia lata grafts (Aron et al., 1997; Gemmill and Carmichael, 2003). The use of transarticular splints, transarticular external fixateurs, or patellar ligament plating has also been described for further protection of the primary repair with little additional morbidity (Kowaleski et al., 2012). The benefit of our construct was that beyond relieving tension on the primary repair of the patellar ligament, the proximal plate was used for ligament plating simultaneously.

Immobilization of the stifle joint postoperatively has been suggested with the aid of transarticular external fixateurs or transarticular casts or splints (Smith et al., 2000; Shipov et al., 2008). The amount of necessary immobilization however is controversial. It is known that in dogs transarticular external fixateurs reduce the blood supply to injured tendons significantly (Gelberman et al., 1980). Reduced range of motion in the stifle joint can also result. Therefore in human medicine currently a limited immediate mobilization is recommended to decrease adhesion formation, cartilage damage and prevent a limited range of motion (Kasten et al., 2001; Grim et al., 2010). This will also result in a stronger repair, that resembles the histological features of a normal tendon better than a tendon healing while immobilized (Gelberman et al., 1980). We decided to avoid further external immobilization, since this technique provides sufficient internal stability.

In order to limit the risk of a postoperative infection, repair of the ruptured ligament was delayed and wound management was initiated to generate healthy granulation tissue in the injured stifle area prior to surgery. Further measures to prevent surgical site infection were strict aseptic preparations, placement of gentamycin sponges during surgery and the use of titanium implants, which are less susceptible to infection (Arens et al., 1996). An arthrotomy was also avoided. However infection and associated implant loosening could not be averted. Whether the implant loosening was due to the infection or due to weak implant seating and cyclic loading cannot be distinguished. Reasons for the infection might have been the multiple wounds, the polytrauma the patient had suffered and the presence of implants.

The use of braided multifilament suture material like Ethibond might have also predisposed to bacterial infection and should be avoided in similar cases in the future.

Prognosis after surgical repair of patellar tendon rupture has been described as fair to good, although in the experience of the authors a less favourable outcome seems more common. In addition to the more or less subjective orthopaedic exams, an impartial outcome measurement was intended using temporal-spatial gait analysis on a pressure sensitive walkway (GaitFour®). This method has been validated in healthy dogs (Viguier et al., 2007; Light et al., 2010) and used clinically in dogs with spinal cord disease (Gordon-Evans et al., 2009). Gait analysis in the presented dog showed an immediate postoperative return to the weight bearing of the contralateral hind leg, which was maintained over three months. However during the healing process complications could not be avoided and lameness recurred and had to be controlled with antibiotics and analgetics until the implants were removed.

This case shows the successful treatment of a traumatic rupture of the patellar ligament with a substantial loss in the integrity of the ligament and a local infection using two 2.4/3.0 mm ComPact UniLock plates linked flexible with two orthopaedic wires. No external coaptation or transarticular fixateur was needed. Further evaluations of this technique are needed to show its benefits in relation to comparable methods.

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Received: 5 July 2012
Accepted: 28 July 2012