Short Paper

Retrospective study of surgical treatment of various patellar luxations in dogs from 2004 to 2007

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Summary

Today, the treatment of patellar luxations using current techniques has become a very common procedure as part of the surgical treatment. Nevertheless, there are some doubts about such procedures in restraining the patella in lower grade cases. The purpose of the present retrospective clinical study was to determine the efficacy of the soft tissue and bone reconstructive procedures used for various grades of patellar luxation. Forty small and toy breed dogs between the ages of 6 months to 7 years have been used in this study. Following the medical examination, it was seen that all dogs suffered from knee pain and unilaterally or bilaterally intermittent to constant non-weight bearing lameness. All dogs with the exception of two, recovered back to the normal movement within three months. Re-luxation was observed in two dogs that were treated for patellar reconstruction using soft tissue techniques in grade I. These findings suggest that improvement can be achieved in patellar luxation, following appropriate soft tissue and bone reconstructive procedures. However, re-luxation limits the validity of the use of soft tissue reconstructive procedures in operated dogs with grade I luxation. Therefore, the authors have suggested considering a surgical treatment that utilizes combinatorial techniques, in which soft tissue and bone reconstructive techniques are integrated to achieve definite improvement in grade I, surgery before the maturity in grade IV, and no delay on undergoing an operation in grade I, II, and III.

Key words: Patellar luxation, Surgical treatment, Prognosis, Dog

Introduction

Femoropatellar instability, anteversion angle of femur and inclination leading to patellar luxation is a common cause of lameness in dogs (Denny and Butterworth, 2000; Fossum *et al*., 2007). The condition varies from complete, irreducible luxation of the patella and severe lameness to mild instability without associated clinical signs (Tomlinson, 2003). The luxation may be lateral, medial, or proximal, and the cause may be traumatic or developmental (Fossum *et al*., 2007). Lateral luxation in small dogs is rare and is usually congenital lateral patellar luxation. In large dogs, it is often a distinct syndrome associated with severe limb deformities and carries a much more guarded prognosis (Nau *et al*., 2002; Tomlinson, 2003; Alam *et al*., 2007). Putnam's classification of the patella luxation is as follows: grade I, II, III, and IV (Denny and Butterworth, 2000; Tomlinson, 2003; Fossum *et al*., 2007). The most common diagnosis is congenital or developmental medial patellar luxation in small dogs. However, larger dogs have a higher percentage of lateral luxation than small dogs (Tomlinson, 2003).

The majority of toy-breed dogs suffer from various types of patellar luxation, and it has been suggested that soft tissue and

bone reconstructive procedures improve such conditions. Recently, significant progress has been achieved with respect to the understanding of anatomy, structure, biomechanics, and repair. All of this has led to the introduction of a new procedure with minimal post-operative complications.

Most cases suffering from grade I and II patellar luxations were treated surgically by using soft tissue reconstructive technique, nevertheless, there is some confusion regarding the efficiency of these procedures for improvement of various grades of patellar luxations, particularly in grade I and II. The purpose of this retrospective clinical study was to determine the efficiency of soft tissue and bone reconstructive procedures of various patellar luxations.

Materials and Methods

Forty small and toy-breed dogs experiencing developmental and traumatic medial patellar luxation with various grades of luxation, were referred to the small animal clinic from 2004 to 2007 (Table 1). All dogs suffered from pain on stifle joint manipulation and unilaterally (twenty nine dogs) or bilaterally (eleven dogs) intermittent to constant non-weight bearing lameness (debilitating on carriage hind limbs with crablike posture). The dogs were between the ages of 6 months to 7 years, and fifteen of the dogs suffered from grade I, 19 grade II, 15 grade III and 2 grade IV knee luxation. Clinical findings were characterized by marked internal rotation and lateral bowing of the tibia and crablike posture. Two dogs suffering from grade III had concomitant cranial cruciate ligament rupture and two other dogs with grade I experienced degenerative joint disease (DJD) in the proximity of the apex on the articular aspect of the patella. The owners of two dogs with grade II postponed the surgical treatment for two years. Their conditions had changed from grade II to grade III luxation, leading to the cranial cruciate ligament rupture.

Standard craniocaudal and mediolateral radiographs showed that the patella had been displaced medially in grade III and grade IV luxations. On the other hand, in grade I and grade II luxations, the patella was within the trochlear sulcus without radiologic signs. Full limb X-ray showed torsion of the tibia

Table 1: Description of patellar luxation cases, surgical procedures, post-operative complications and outcomes

Grade of patellar luxation	I	II	III	IV
Number of hindlimb	15	19	15	2
CCLR and meniscal injury (MI)	-	-	2	-
Number right hindlimb	8	10	8	2
Number left hindlimb	7	9	7	-
Unilaterally cases	7	11	9	2
Bilaterally cases	8	8	6	-
Medial restraint release technique	+	+	+	+
Lateral restraint reinforcement technique	+	+	+	+
Tibial tuberosity transposition technique	+[α]	+	+	+
Trochlear groove deeping technique	-	-	+	+
Tibial osteotomy technique	-	-	-	+
Femoral osteotomy technique	-	-	-	-
Antirotational suture technique	-	-	-	-
Transposition of rectus femoris technique	-	-	-	-
Intracapsular CCLR reconstruction technique	-	-	2	-
Recurrence	2[β]	-	-	-
(DJD, CCLR, MI and CLI)[γ]	2	-	-	-
outcome	Excellent	Excellent	Excellent	Favorable

[α] Tibial tuberosity transposition technique was performed on one dog with grade I luxation with no re-luxation post-operatively. [β] Re-operation and tibial tuberosity transposition technique were performed on two dogs with grade I luxation. [γ] Degenerative joint disease (DJD), cranial cruciate ligament rupture (CCLR), meniscal injury (MI), and medial or lateral collateral ligament insufficiency (CLI) were not seen till 15 months after surgery with the exception of one case with CLI and one case with DJD

and femur in two dogs with grade IV luxation. The choice of surgical treatment depends on the clinical history, physical findings, frequency of luxations, and the patient's age.

After physical restraint, dogs received dextrose-saline solution at (20 ml/kg/h) preoperative medication with atropine sulfate (0.03 mg/kg, SC) 30 min prior to anesthesia. Cefazoline (22 mg/kg, IV) was administrated as a prophylactic antibiotic before operation. Diazepam and ketamine hydrochloride combination (0.27 mg/kg and 5.5 mg/kg, IV) were administrated as an induction and propofol (7.5 mg/kg, IV) for maintenance of anesthesia (Fossum *et al*., 2007). The animals were positioned in dorsal recumbency, and the leg was prepared from the lumbar to the tarsal joint. Incision in patients with grade IV luxation was as long as for applying the bone plate from the tarsal joint to the dorsal of the stifle and through the lateral aspect of the leg to the proximal ⅓ femur. Generally, a combination of techniques was required to achieve intraoperatively stability of the patella in the treatment of grade I to IV in dogs, such as medial restraint release, lateral restraint reinforcement, trochlear groove deeping, tibial tuberosity transposition and tibial osteotomy for correction of patellar luxation. In all cases, a well-padded wrap was maintained for one week.

Intracapsular technique, which aims to restore stability by replacing the ligament with eight-strands of polyester suture material was used in two dogs with cranial cruciate ligament rupture in addition to routine techniques for treatment of grade III patellar luxation.

As part of the recovery process, the dogs were restricted to short leash walk for eight weeks, and the owners were encouraged to provide current post-operative rehabilitation protocols such as massage, passive range of motion and swimming to regain the strength of the muscle mass.

Results

All dogs responded to surgery within 8-12 weeks after operation with the exception of two dogs (5.26% among dogs with various grades and 11.1% among dogs with grade I luxation) in whom re-luxation occurred because of soft tissue reconstruction (Table 1). After operation, lateral collateral ligament rupture (CLR) and degenerative joint disease (DJD) were seen in one dog by 3 months and in another by 9 months, respectively (Table 1).

Discussion

Most toy breed dogs with medial patellar luxation can be diagnosed within the first 6 months of life (Denny and Butterworth, 2000). Medial patellar luxation in larger dogs is a relatively frequent diagnosis, and is the most common type regardless of the body size (Tomlinson, 2003). Cats are also prone to development of patellar luxation, usually medial, but much less commonly than dogs (Denny and Butterworth, 2000; Tomlinson, 2003).

Surgeons suggest that surgery is seldom warranted in asymptomatic older patients, whereas younger animals and those that are physically disabled usually benefit from the surgery (Fossum *et al*., 2007). In the present study, young and old patients were symptomatic with symptoms such as pain, the stifle joint during physical examination and unilaterally (twenty nine dogs) or bilaterally (eleven dogs) intermittent to constant non-weight bearing lameness. Based on these findings, surgery was performed on all dogs.

Numerous surgical procedures are aimed at restraining the patella within the trochlear groove in various grades of patellar luxation (Nunamaker, 1985; Ahlfeld *et al*., 1987; Slocum and Slocum, 1998; Denny and Butterworth, 2000; Kealy and McAllister, 2000; Tomlinson, 2003; Fossum *et al*., 2007). Researchers have suggested different techniques up to now, but the following techniques are as medial restraint release, lateral restraint reinforcement, tibial tuberosity transposition, troclear groove deepening, femoral and tibial osteotomy, antirotational sutures, and transposition of the origin of rectus femoris are common procedures for correction of patellar luxation (Kumar and Maffulli, 1999; Tomlinson, 2003). In this study, the authors used current

procedures depending on the severity of clinical signs and grade of luxation.

Correlation of re-luxation with the method or methods of surgical correction has not been reported (Arnoczky *et al*., 1986; Slocum and Slocum, 1998; Denny and Butterworth, 2000). The authors of this study did not study the correlation between the procedures and recurrence, but they showed that bone reconstructive procedures such as tibial tuberosity transposition technique in grade I patellar luxation have better outcomes (Table 1).

When the conservative surgical treatment takes place in the proper time the prognosis for patients undergoing surgical correction of a grade I to III patellar luxation is excellent (Slocum and Slocum, 1998; Denny and Butterworth, 2000; Kealy and McAllister, 2000; Tomlinson, 2003; Fossum *et al*., 2007). Some investigators reported that recurrence of luxation is up to 50% (Denny and Butterworth, 2000; Kealy and McAllister, 2000) but in another report the frequency of patellar re-luxation is about 8% (Arthurs and Langley-Hobbs, 2006). In our study, re-luxation was diagnosed in two dogs with grade I patellar luxation (frequency is about 4%). The authors believed that soft tissue procedures are unable to restrain patella in situ long term because the re-luxation will occur due to the elasticity character of the peripheral soft tissue of the stifle joint (Table 1).

Investigators in South Korea have shown that the prognosis of the patellar luxation in young dogs with lower grades is better, and the outcome was excellent. They also emphasized that the combination of surgical techniques is more effective and the results are superior. In the present study, while the surgery was carried out in lower grade (I and II) and in proper time, the best results were achieved (with the exception of 2 cases) with grade I. Although the bone reconstructive surgery was favorable on them, the outcome was not satisfactory. In the cases of delayed treatments, degenerative joint disease (DJD) would be the result. In grade III and IV, possibility of the cranial cruciate ligament rupture exists (CCLR) due to the absence of patellar's role for the absorption of stress to the joint (Lopez-Vazquez *et al*., 1991; Gibbons *et al*., 2006). In this study, DJD and CCLR were not found post-operatively except in two grade I cases with DJD and collateral ligament injury (CLI). The reason for CLI is due to long-time stress on the stifle joint. Regarding grade IV patellar luxation, the majority of reports indicated that prognosis for these patients is guarded (Denny and Butterworth, 2000; Tomlinson, 2003). Reports claimed that guarded prognosis is generally seen in dogs with grade IV medial luxation when surgical correction has been attempted at the end of growth or after 1 year of age (Arnoczky *et al*., 1986; Tomlinson, 2003; Fossum *et al*., 2007; Mascarenhas and MacDonald, 2008), but other reports have showed that grade IV luxations has a favorable outcome in dogs less than 3 to 4 months of life. Authors achieved successful surgical correction in two cases with grade IV medial luxation aged 9 and 11 months. Statistically, these cases are insignificant.

Based on our retrospective clinical study, the authors suggested that the procedure is effective when considering bone reconstructive surgery for grade I, surgery before maturity in grade IV, and no delay on performing the operation in lower grade (I and II).

References

Ahlfeld, SK; Larson, RL and Collins, HR (1987). Anterior cruciate reconstruction in the chronically unstable knee using an expanded polytetrafluoroethylene (PTFE) prosthetic ligament. Am. J. Sports Med., 15: 326-330.

Alam, MR; Lee, JI; Kang, HS; Kim, IS; Park, SY; Lee, KC and Kim, NS (2007). Frequency and distribution of patellar luxation in dogs: 134 cases (2000-2005). Vet. Comp. Orthop. Traumatol., 20: 59-64.

Arnoczky, SP; Warren, RF and Minei, JP (1986). Replacemant of the anterior cruciate ligament using a synthetic prosthesis. An evaluation of graft biology in the dog. Am. J. Sports Med., 14: 1-6.

Arthurs, GI and Langley-Hobbs, SJ (2006). Complications associated with corrective surgery for patellar luxation in 109 dogs. Vet. Surg., 35: 559-566.

Denny, HR and Butterworth, SJ (2000). The stifle. In: Denny, HR and Butterworth, SJ (Eds.), *A guide to canine and feline orthopaedic surgery*. (4th Edn.), London,

England, Blackwell Science. PP: 517-525.

Fossum, TW; Hedlund, CS; Hulse, DA; Johnson, AL; Schulz, KS; Seim, HB; Willard, MD; Bahr, A and Carroll, GL (2007). Medial and lateral patellar luxation. In: Fossum, TW (Ed.), *Small animal surgery*. (3rd Edn.), St. Louis, USA, Mosby. PP: 1289-1299.

Gibbons, SE; Macias, C; Tonzing, MA; Pinchbeck, GL and McKee, WM (2006). Patellar luxation in 70 large breed dogs. J. Small Anim. Pract., 47: 3-9.

Kealy, JK and McAllister, H (2000). Bones and joints. In: Kealy, JK and McAllister, H (Eds.), *Diagnostic radiology and ultrasonography of the dog and cat*. (3rd Edn.), Philadelphia, USA, W. B. Saunders Co., PP: 259-260.

Kumar, K and Maffulli, N (1999). The ligament augmentation device: an historical perspective. Arthroscopy. 15: 422-432.

Lopez-Vazquez, E; Juan, JA; Vila, E and Debon, J (1991). Reconstruction of the anterior cruciate ligament with a Dacron prosthesis. J. Bone Joint Surg. Am., 73: 1294-1300.

Mascarenhas, R and MacDonald, PB (2008). Anterior cruciate ligament reconstruction: a look at prosthetics-past, present and possible future. Mcgill. J. Med., 11: 29-37.

Nau, T; Lavoie, P and Duval, N (2002). A new generation of artificial ligaments in reconstruction of the anterior cruciate ligament. Two-year follow-up of a randomised trial. J. Bone Joint Surg. Br., 84: 356-360.

Nunamaker, DM (1985). Patellar luxation. In: Newton, CD and Nunamaker, DN (Eds.), *Textbook of small animal orthopedics*. (1st Edn.), Philadelphia, USA, Lippincott. PP: 941-948.

Slocum, B and Slocum, TD (1998). Trochlear wedge resection for medial patellar luxation. In: Bojrab, MJ and Ellison, GW (Eds.), *Current techniques in small animal surgery*. (4th Edn.), Baltimore, USA, Williams and Wilkins. PP: 1232-1241.

Tomlinson, JL (2003). Vertebral fractures and luxations osteoarthritis. In: Slatter, D (Ed.), *Textbook of small animal surgery*. (3rd Edn.), Vol. 2, Philadelphia, USA, W. B. Saunders Co., PP: 1989-2001.