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Positive outcomes after surgical correction of grade IV medial patellar luxation in small breed dogs

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Abstract

Background: Medial patellar luxation (MPL) is a common orthopedic condition in dogs. After surgical correction, the recurrent rates appear to be higher and outcomes worse in grade IV than in lower grade MPL.

Aim: To describe the outcomes of surgical correction of canine grade IV MPL.

Methods: This retrospective study analyzed the medical records of 16 dogs (11 females, 5 males; mean age = 5.05 years) with 22 stifle joints (8 left and 14 right) that underwent MPL surgery at Rakuno Gakuen University between May 2015 and October 2020. The procedures included capsulorrhaphy, trochlear block recession, tibial tuberosity transposition, medial retinacular release, and lateral fabellotibial suturing. The types of postsurgical complications, including a recurrence of MPL, were recorded.

Results: Twelve of the 16 (75 %) dogs had concurrent contralateral MPL, and 2 dogs (12.5%) had concurrent cranial cruciate ligament rupture. The mean follow-up was 12.1 months. No lameness was observed. The outcomes of surgery for grade IV MPL were not associated with bilateral surgery, age, sex, body weight, or the preoperative quadriceps angle. Although none of the dogs showed any major or catastrophic complications following surgery, postoperative minor and major complications were observed in 8 of the 22 stifle joints (36.4%).

Conclusion: Grade IV MPL is a complex orthopedic disease in dogs, which requires surgical patellar realignment to improve limb function. The surgical techniques used in this study were associated with a good prognosis without a surgical revision.

Keywords: Canine diseases, Cranial cruciate ligament, Medial Patellar Luxation, Outcomes assessment, Postoperative complications.

Introduction

Medial patellar luxation (MPL) is one of the most common orthopedic diseases in dogs (Roush, 1993). MPL is categorized according to Singleton's four-grade system and is associated with anatomic abnormalities (Singleton, 1969). The most severe form is a grade IV luxation, which is characterized by permanent patellar luxation that cannot be reduced manually. Generally, various skeletal abnormalities, such as coxa vara, distal femoral varus, hypoplastic trochlear ridges, medial femoral condylar hypoplasia, tibial varus, and torsion, can be associated with MPL and are more common in dogs with grade IV MPL than in those with lower grade MPL (Bound *et al.*, 2009; Wangdee *et al.*, 2013; Yasukawa *et al.*, 2016). Surgical treatment is recommended for dogs with MPL because it reduces pain and lameness. The risk of complications increases with the grade of MPL, and the severity of patellar luxation is associated with the number of corrective procedures required (Alam *et al.*, 2007; Wangdee *et al.*, 2013; Cashmore *et al.*, 2014). In small breeds, the rate of MPL recurrence is higher, and outcomes are worse after surgical correction of grade

IV MPL than those in lower grade luxation (Wangdee *et al.*, 2013; Dunlap *et al.*, 2016). The cranial cruciate ligament (CCL) is critical for the stability of the stifle joint. The function of this ligament has been described as stabilization during cranial tibial movement, preventing excessive relaxation of the stifle joint and internal rotation of the tibia (de Rooster *et al.*, 2006). Lateral fabellotibial suturing techniques have been used as antirotational techniques for canine MPL (Hammer, 1979). However, to our knowledge, no studies have evaluated the outcomes and complications after internal rotation reconstruction using lateral fabellotibial suturing techniques for grade IV MPL in dogs. The purpose of this study was to determine the complications and surgical outcomes of surgical correction with internal rotation reconstruction of grade IV canine MPL in small breeds at 12 months after surgery.

Materials and Methods

Study population

We reviewed the medical records of 100 dogs with MPL referred to the Rakuno Gakuen University that

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underwent surgery between May 2015 and October 2020. Among these, only dogs that had undergone surgery for grade IV MPL were included in the study. This resulted in 16 dogs with 22 affected stifle joints (8 on the left and 14 on the right) being analyzed in this study.

Medical record review

Medical records were reviewed to collect information on the dog breed, sex, and body weight at the time of surgery. Information was recorded on the affected limb, the presence and grade of concurrent contralateral MPL, and all surgical procedures, any implants, and preoperative quadriceps (Q) angles in radiographs (Pinna and Romagnoli, 2017). The surgical procedures performed, intra- and postoperative complications, were recorded. Complications were categorized as minor (not requiring additional surgical or medical treatment to resolve), major (complications or associated adverse effects requiring further surgical and medical treatment), and catastrophic (complications or associated adverse effects that caused permanent unacceptable impairment of function, were directly related to death, or prompted euthanasia), as defined previously (Cook *et al.*, 2010). The only exception was that pin migration requiring removal under sedation was classified as a minor complication. For analytical purposes, recurrent MPL was classified as a major complication only when a surgical revision requiring general anesthesia had to be performed; a surgical revision was recommended but declined by the dog owner; or a grade IV MPL recurred. Additionally, a stifle joint with recurrent MPL and an outcome defined as unsuccessful on follow-up evaluation was classified as a major complication. The revision was defined as a surgical procedure performed at the anatomic site of the original surgery. The grade of any postoperative MPL was also recorded.

Follow-up evaluation

The follow-up was short-term from at least 3 months to 6 months postoperatively (Cook *et al.*, 2010; Dunlap *et al.*, 2016). The mean follow-up time was 12.1 ± 11.4 months (between 6 and 44 months). The dog owners completed a questionnaire on their perceptions of their dogs' postoperative pain, function, and quality of life (Cook *et al.*, 2010). An orthopedic examination and radiography were performed when possible. A single observer (Dr. Isaka) performed all orthopedic examinations. The presence and grade of MPL, joint effusion, muscle atrophy, crepitus, CCL rupture, medial buttress, and signs of pain on joint palpation were recorded. Lameness at standing was evaluated while the dog was standing, walking, and trotting using the scale by Cook *et al.* (2010): 0 = no observable lameness; 1 = intermittent mild weight-bearing lameness with little, if any, change in gait; 2 = consistent mild weight-bearing lameness with little change in gait; 3 = moderate weight-bearing lameness with obvious lameness and noticeable change in gait; 4 = severe weight-

bearing lameness (toe-touching lameness only); and 5 = nonweight-bearing lameness. The study protocol was approved by the review and ethics committee of Rakuno Gakuen University (VH20B9).

Statistical analysis

Categorical data of complications were presented as number and percentage. Other data were shown as average \pm standard deviation. Comparisons of categorical data between dogs with and without complications were made using the Fisher exact test, with values of $p \leq 0.05$ considered significant.

Results

Study dogs

Five dogs were male (4 castrated and 1 intact) and 11 were female (7 spayed and 4 intact). The breeds were as follows: Toy poodle ($n = 7$), Pomeranian ($n = 3$), Chihuahua ($n = 2$), Yorkshire Terrier ($n = 2$), Italian Greyhound ($n = 1$), and mixed breed ($n = 1$). Body weight at the time of surgery ranged from 1.95 to 6.92 kg (3.59 ± 1.44 kg). Age at the time of surgery ranged from 6 months to 12.0 years (5.05 ± 4.03 years; six dogs were less than a year old). Twelve of the 16 (75%) dogs had concurrent contralateral MPL (one grade I, one grade II, four grade III, and six grade IV). In addition, concurrent CCL rupture diagnosed by orthopedic examination, including cranial drawer signs and tibial compression test, without injury of tears was observed in 2 of 16 dogs (12.5%). Preoperative radiographic evaluation demonstrated a mean Q angle of $37.4 \pm 6.0^\circ$, which was not associated with postoperative complications (mean postoperative Q angle of $8.3 \pm 2.1^\circ$).

Surgical methods

The surgical techniques entailed capsulorrhaphy, trochlear block recession, tibial tuberosity transposition (TTT), medial retinacular release, and lateral fabellotibial suturing in all cases. Fabellotibial suturing was used of a single strand swaged on monofilament nylon (SECUIROS, USA), and the tunnel location of the tibia was 2–3 mm apart from the osteotomy site of TTT (Fig. 1). Dogs with bilateral grade IV MPL underwent a single-stage bilateral procedure.

Complications of MPL reconstruction

Postoperative complications were observed in 8 of the 22 stifle joints (36.4%). No complications developed in the other 14 (63.6%) joints. Minor complications were confirmed in four stifles (18.2%), and major complications developed in four (18.2%) joints (Table 1). No surgical revision of any joint was necessary. None of the variables, age, body weight, concurrent contralateral MPL, ipsilateral CCL rupture, or the total number of procedures performed at the first surgery, was statistically associated with the development of minor and major postoperative complications. At the short-term follow-up examination, the MPL was resolved in all joints, and there was no lameness in any dog (100%).

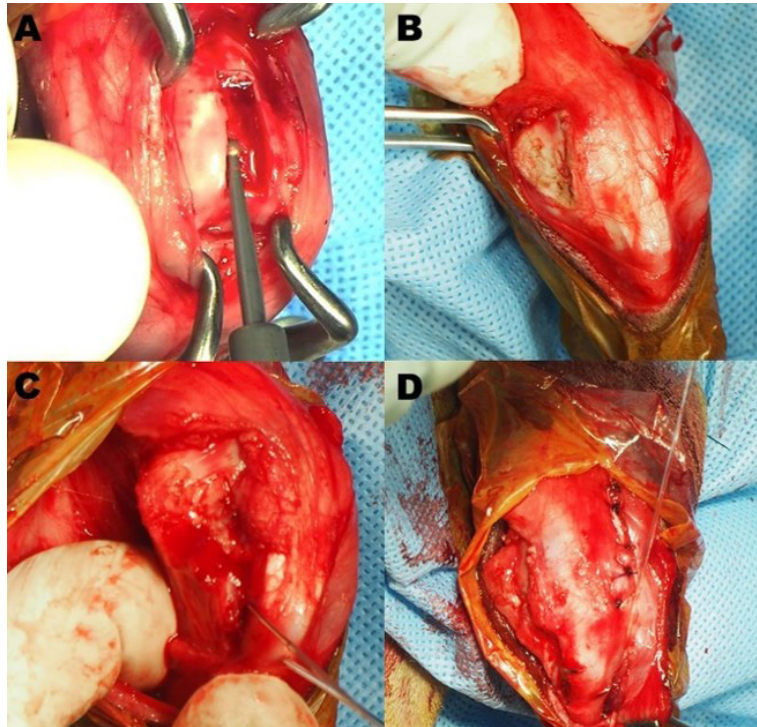


Fig. 1. Surgical procedures. (A) Trochlear block recession. (B) Medial retinacular release. (C) Tibial tuberosity transposition using two Kirchner wires. (D) Lateral fabellotibial suturing using monofilament nylon.

Table 1. Complications after surgical correction of grade IV medial patellar luxation in 16 small breed dogs ($n = 22$ joints).

Complication	Number (%)
Minor complications	
Tibiotarsal joint effusion	0
Implant fracture not requiring further surgery	0
Redness of the incision	0
Patellar tendonitis necessitating Kirschner wire removal	4 (18.2)
Kirschner wire migration necessitating removal	0
Major complications	
Recurrent MPL requiring further surgery	0
Avulsion fracture of tibial tuberosity	0
Pin excision	4 (18.2)
Implant failure	0
Catastrophic complication	
Femoral fracture resulting in limb amputation	0

Discussion

The risk of CCL rupture is higher in canine grade IV MPL than in lower grade luxations, which has been suggested to result from the chronic internal rotation of the tibia and increased strain on the CCL (Campbell *et al.*, 2010). However, in our study, only 12.5% of the joints with grade IV MPL showed concurrent CCL

rupture. In other words, general surgical techniques for MPL with lateral fabellotibial suturing are thought to be suitable for grade IV MPL in dogs with and without CCL rupture for preventing internal tibial rotation. The proportion of stifle joints that developed major complications after the surgical correction of grade IV MPL was much lower than that in other studies of grade IV MPL in small breed dogs (Dunlap *et al.*, 2016;

Hans *et al.*, 2016). Hans *et al.* (2016) found an overall complication rate of 25.5%, with major complications, including revision surgery, occurring in 12.8% of 47 grade IV stifles. In another study of 24 grade IV MPL (Dunlap *et al.*, 2016), approximately half of the dogs had postoperative complications (28% had minor complications and 24% had major complications), including a surgical revision rate of 21%. Approximately 40% of Pomeranian dogs with grade IV MPL showed a recurrence in a further study (Wangdee *et al.*, 2013). In our cohort, no stifle joint required revision surgery after surgical correction for grade IV MPL, and the overall proportion of a recurrence of MPL within the 3-month follow-up period was the same.

In our study, the preoperative Q angles showed no association with the surgical revision and recurrence rate of MPL, which is supported by the findings of Dunlap *et al.* (2016). Different surgical techniques have been used for grade IV MPL. Generally, a combination of surgical techniques has been found to be more effective than single procedures in the management of MPL (Alam *et al.*, 2007). Recently, combined tibial plateau leveling osteotomy and tibial tuberosity transposition (TPLO-TTT) has been shown to be a reliable and effective technique for treating CCL insufficiency with concomitant MPL (Leonard *et al.*, 2016). In the future, we need to compare TPLO-TTT with general surgical techniques and lateral fabellotibial suturing in the surgical correction of canine grade IV MPL. Single-session bilateral surgery for canine MPL has been associated with poor surgical outcomes (Fullagar *et al.*, 2017). In our study, only one surgeon (Dr. Isaka) performed all surgeries. Thus, simultaneous bilateral surgery resulted in good outcomes, a finding that is supported by a previous study (Balogh and Kramek, 2016). Our results need to be interpreted within the limitations of this study that include its retrospective design, the subjective outcome evaluation, and a lack of long-term outcome data. However, the outcome and complication definitions used in this study were as recommended by Cook *et al.* (2010) for retrospective orthopedic studies. Furthermore, it has been suggested that pelvic limb function should be normal or near normal between 8 and 12 weeks after surgery (Cook *et al.*, 2010). Thus, we consider that our study design allowed for an adequate evaluation of postoperative complications. In the future, long-term studies assessing objective outcome data (i.e., force platform gait analysis) could help to accurately assess pelvic limb function following surgical correction. Still, this may be difficult to achieve as the breeds overrepresented in MPL cohorts are toy breeds (DeAngelis and Hohn, 1970; Hayes *et al.*, 1994). In conclusion, grade IV MPL is a complex orthopedic disease in dogs that requires surgical patellar realignment to improve limb function. The surgical techniques described in this study resulted in a good prognosis without surgical revision during a follow-up of 12 months.

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Conflict of interest

The author has no conflict of interest to declare.

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