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Case Report

Surgical Correction of Patellar Luxation in a Rabbit

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A two-and-a-half-year-old giant lop-eared rabbit, weighing 5.1 kg, presented with a one-month history of intermittent right hind limb lameness. The limb locked in extension during hopping. On examination, a grade-2 medial patellar luxation of the right hind was diagnosed, with associated stifle joint swelling. Radiographic findings of the right stifle comprised periarticular osteophyte formation consistent with mild degenerative joint disease and joint effusion. Surgical correction involving right trochlear wedge recession sulcoplasty and lateral imbrication was carried out to stabilise the patella in the trochlear groove. The right hind limb lameness resolved, and the patella was stable at a 6-month postoperative examination. One year postoperatively, the right patella was luxating again concurrent with bilateral stifle effusions. Euthanasia was performed twenty months after surgery due to recurrent lameness in the right hind limb.

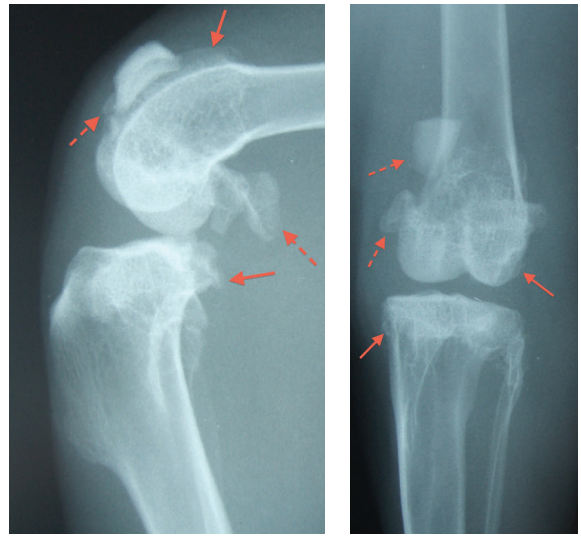
1. Introduction

Patellar luxation is a common disorder of the stifle, predominantly affecting small-breed dogs [1] but increasingly prevalent in larger-breed dogs [2] and cats [3, 4]. Medial luxation is reported more commonly in young, small-breed dogs with developmental disease and in cats [3, 5]. Approximately 50% of medial patellar luxation cases in dogs display bilateral involvement [6]. Clinical signs vary, according to the severity of the anatomical derangements and the degree of luxation, from intermittent, nonpainful, "skipping" lameness, reluctance to jump, and crouched gait to severe lameness and skeletal deformities.

In contrast to patellar luxation in dogs and cats, there is a lack of the literature regarding this condition, and other developmental orthopaedic abnormalities, in the rabbit species. Unilateral (left) medial patellar luxation with degenerative joint disease of the stifle has been described in a 1-year-old rabbit, concurrent with a shortened left femur, a shallow trochlear groove, a rotated proximal left tibia, and a left hip subluxation [7]. As this rabbit was ambulatory and not apparently painful, no treatment was given. Another report described bilateral medial patellar luxation in a 5-month-old rabbit [8] resulting in impaired mobility, but conservative management was elected. To the authors' knowledge, no reports of surgically corrected patellar luxation in the rabbit currently exist. This case report describes clinically significant patellar luxation in a pet rabbit in the UK and demonstrates the role of surgery in its management.

2. Case Presentation

A two-and-a-half-year-old, male neutered, lop-eared rabbit weighing 5.1 kg presented to the referring veterinarian with a one-month history of right hind limb lameness, reported to be acute in onset by the owners. The lameness was characterised as intermittent locking of the right hind limb in extension during normal hopping motion. The rabbit was deemed otherwise healthy. No gait abnormalities of the contralateral hind limb were noted, and the stance of the rabbit at rest was considered normal. Initial examination revealed right medial patellar luxation as the only orthopaedic abnormality. The rabbit underwent indoor cage rest for four weeks prior to being reexamined. Over this period, there had been no improvement in the lameness, and repeat clinical examination again revealed right medial patellar luxation, this time with significant soft-tissue swelling medial to the stifle joint.



(a) (b)

Figure 1: (a) Mediolateral view of the right stifle joint. Osteophytes (solid arrows) present on the trochlear ridge, femoral condyles, and tibial plateau and enthesophytes (dashed arrows) present on the fabellae and poles of the patella are likely secondary to medial patellar luxation. (b) Craniocaudal radiographic view of the right stifle, again demonstrating osteophytosis of the femoral condyles and tibial plateau (solid arrows), and enthesophytosis of the fabellae and patella (dashed arrows), along with medial patellar luxation. Reproduced from the BSAVA Manual of Rabbit Surgery, Dentistry and Imaging, edited by F. Harcourt-Brown and J. Chitty, with the permission of BSAVA Publications.

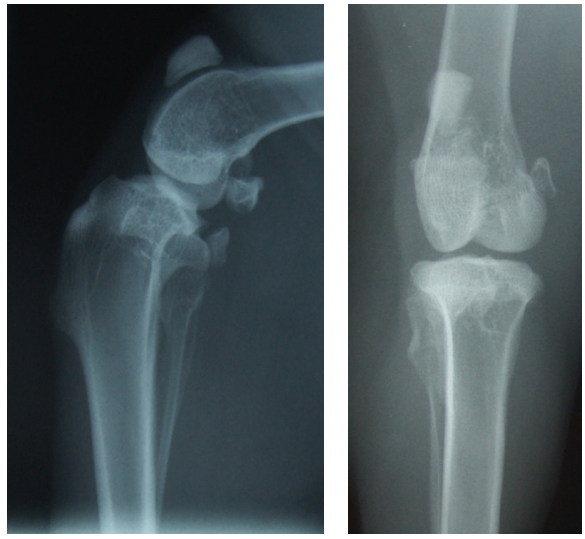
The rabbit was then referred to the Queen's Veterinary School Hospital for further investigation and treatment. On presentation, the patient was bright, alert, and in reasonable body condition, although poorly muscled around the hindquarters. Orthopaedic examination and manipulation of the stifle joint confirmed right medial patellar luxation, soft-tissue swelling particularly localised to the medial aspect of the joint, and a mild stifle joint effusion. The luxation was classified as grade-2 according to the clinical examination findings [9]. A grade-1 medial luxation of the left patella was elicited on left stifle extension; no lameness was associated with this finding.

Light preanaesthetic sedation was achieved with buprenorphine (20 μg/kg), and anaesthesia was induced with a combination of medetomidine (0.2 mg/kg) and ketamine (10 mg/kg), all injected intramuscularly. A 4 mm cuffed endotracheal tube was placed for delivery of oxygen and isoflurane to maintain anaesthesia following induction. A 22 G intravenous catheter was placed into the marginal ear vein for perioperative fluid therapy (lactated Ringer's solution at 10 mL/kg/hour), and for subsequent injections of meloxicam (0.1 mg/kg) and cefradine (15 mg/kg) each given once during surgery.

Standard radiographic views (mediolateral and craniocaudal) of both stifles were taken once the patient was anaesthetised. Radiographic findings included an increased soft-tissue opacity in the cranial compartment of the right stifle joint with loss of definition of the parapatellar fat pad, consistent with stifle joint effusion. Marked osteophytosis of the femoral trochlear ridge, femoral condyles, and tibial plateau and enthesophytosis of the fabellae and patellar poles were evident (Figures 1(a) and 1(b)). The patella was displaced medially (Figure 1(b)). The radiological diagnosis was degenerative joint disease of the right stifle with medial patellar luxation. No radiographic abnormalities were seen in the left stifle (Figures 2(a) and 2(b)).

Manual manipulation of both stifle joints was performed in an attempt to elicit a cranial or caudal draw, indicative of concurrent cruciate ligament rupture. No craniocaudal instability was detected in either limb. Synoviocentesis of the right stifle joint with subsequent cytological examination demonstrated low cellularity of the synovial fluid; 95% of the nucleated cell population comprised mononuclear cells and 5% neutrophils. No bacteria were visualised. The sample was deemed normal synovial fluid [10].

In the absence of any other significant abnormalities, the rabbit's right hind limb lameness was considered to be due to the medial right patellar luxation. As the lameness had failed to improve with rest and conservative management, surgical therapy was initiated. A lateral parapatellar approach to the right stifle joint was made [11] with medial dislocation of the patella. Examination of the cruciate ligaments following arthrotomy confirmed these structures to be intact. Osteotomies were made using an X-acto saw (Veterinary Instrumentation) axial to each trochlear ridge to create a triangular-shaped osteochondral wedge, which was temporarily removed from the trochlea [12]. Two further osteotomies were then performed, parallel to the initial osteotomies, and a thin "V"-shaped piece of subchondral bone was removed. The osteochondral wedge was replaced, and the patella was repositioned in the groove. Lateral imbrication of the joint capsule was carried out using metric size-3 polydioxanone (PDS II, Ethicon) in an interrupted modified mayo mattress-suture pattern. The fascia lata was imbricated in a similar fashion prior to closure of the subcutaneous tissues using metric-2 poliglecaprone (Monocryl, Ethicon) in



(a) (b)

Figure 2: (a) Mediolateral view of the contralateral left stifle joint. (b) Craniocaudal radiographic view of the left stifle joint.

a simple continuous pattern. An intradermal suture layer, also using metric-2 poliglecaprone, was used to attain cutaneous apposition, and skin glue was applied to avoid the need for transcutaneous sutures. Postoperative radiographs were not taken because no surgical implants had been placed and due to the concern over the length of anaesthesia and associated hypothermia in this species.

The patient's blood glucose was monitored closely during the anaesthetic and in the recovery period, until the patient was eating well by himself. Whilst being hospitalised, analgesia was provided by administration of buprenorphine (20 μg/kg q8 hrs, IM) and meloxicam (0.1 mg/kg q24 hrs, PO). By twelve hours after surgery, the rabbit was starting to use the limb normally, the incision site looked good, and swelling was minimal. Whilst being hospitalised, the rabbit developed a muco-purulent left ocular discharge consistent with conjunctivitis. Ophthalmic examination also revealed bilateral cataract formation. Treatment with topical ketorolac and gentamicin was initiated at an eight-hour frequency and continued for five days. Forty-eight hours after admission, the rabbit was discharged from the hospital. Instructions were given to implement three weeks of cage rest at home and to continue with ten days of meloxicam (0.1 mg/kg q24 hrs, PO) for analgesia.

At a recheck appointment two days after surgery, the rabbit was using the limb well, and there was evidence of normal incisional healing. Three months later, the continued normal use of the limb was reported with no signs of recurrent lameness, leg locking, or reluxation. At six months following surgery the rabbit represented with right stifle swelling; examination confirmed the patella to be in place. One week later, left stifle swelling had also developed. An anti-inflammatory steroid injection was administered by the referring practice, and no further diagnostics pursued. One year following surgery, due to persistence of right stifle swelling, repeat examination of the rabbit was carried out—this time, patellar reluxation was detected. Further surgery was declined. The patient was managed conservatively until the client elected for euthanasia twenty months after surgery due to recurrent lameness in the right hind limb.

3. Discussion

In this case report, wedge recession sulcoplasty for unilateral medial patellar luxation resulted in the resolution of clinical signs for six months following surgery. However, bilateral stifle swelling subsequently developed, and reluxation of the right patella was documented one year postoperatively.

Reluxation of the patella is a known complication of surgical correction in dogs, along with wound dehiscence, septic arthritis, impaired stifle extension, wedge migration, and degenerative joint disease [2, 13]. One study reported an 18% frequency of postoperative complications following surgical correction of patellar luxation in dogs, with an 8% frequency of reluxation [14]. Surgical correction was not attempted in a previous case report describing clinically significant patellar luxation in a rabbit [8] due to the authors' concerns about the possibility of recurrence. However, the frequency of reluxation following surgery was found to be lower in dogs weighing less than 20 kg compared with those of larger sizes, and when the sulcoplasty technique was employed [14], both of which suggest that this management modality may be indicated for the rabbit species. Whilst some authors [15, 16] advocate the use of soft-tissue reconstruction techniques alone in the treatment of grade-1 and -2 luxations, failing to overcome skeletal malformations through application of soft tissue reconstruction techniques in isolation is reported to be the main cause of poor surgical outcomes for patellar luxation in dogs [17]. Following application of the sulcoplasty technique in the rabbit reported herein, potential alternative reasons for ultimate failure of the surgical technique include inadequate depth of the groove created by osteotomy, the presence of an underlying congenital tibial alignment abnormality which was not overcome by sulcoplasty alone,

and an underlying stifle condition causing joint capsule swelling.

The normal volume of synovial fluid in the rabbit stifle has been reported to be 100 μL [18], and a grading system has been suggested for objective documentation of synovial fluid volume changes following the induction of degenerative joint disease in experimental rabbit models [18]. On initial presentation to the Queen's Veterinary School Hospital, the joint effusion would have been characterised as grade-1 (mild: fluid volume greater than normal but did not fill the stifle joint and did not pour out on arthrotomy). As the rabbit did not represent to the Queen's Veterinary School Hospital following surgery, no accurate comment can be made on the subsequent joint effusion that developed, but the fact that it became apparent bilaterally and persisted over a six-month period would be suggestive of degenerative joint disease progression [19] or another stifle disease.

Whilst degenerative joint disease is not commonly reported in pet rabbits, which might be due to lack of observed clinical signs rather than lack of occurrence [20], this species has been used extensively as an experimental model for degenerative joint disease development and to assess response to different treatment options [18, 21–24]. Studies have shown that degenerative joint disease in this species is associated with synovial effusion, synovitis, capsular fibrosis, meniscal tears, medial collateral and posterior cruciate ligament damage, and osteophyte formation [18, 25]. Osteophyte formation as part of degenerative joint disease progression in experimental models of unilateral cruciate ligament transection has been shown to be rapid [25] occurring within two weeks of surgical intervention.

A significant degree of degenerative joint disease was present in the right stifle of the rabbit at the time of presentation to the Queen's Veterinary School Hospital, two months following the reported onset of clinical signs. Degenerative joint disease is a recognised sequela of patellar luxation [16, 26], and it is associated with augmented pain and lameness. The radiographic findings associated with patellar luxation-induced degenerative joint disease are usually mild [26] unless concurrent joint diseases are present. In the absence of other diagnosed orthopaedic conditions, it was therefore somewhat unusual that the rabbit in this case report had such marked radiographic changes consistent with degenerative joint disease after just two months of clinical signs.

Although surgical correction does not inhibit degenerative joint disease development [13, 26], by permitting normalisation of joint loading and range of motion it reduces lameness and improves mobility and thus should be undertaken early in the disease process. The presence of joint effusion at six months after surgery would suggest that the rate of degeneration was high in this rabbit in spite of patellar correction. Possible suggestions for this include synovial inflammation following arthrotomy, trochlear cartilage damage [13], presence of concurrent undiagnosed joint pathology prior to surgery, and subsequent injury incurred in the same joint following surgery. Patellar luxation has been suggested to be a risk factor for cranial cruciate ligament damage, through increased strain on the ligament brought about by abnormal forces acting across the stifle joint [26]. Interestingly, swelling was also noted in the left stifle joint approximately six months after presentation even though this limb was not affected by clinically significant patellar luxation. It is possible that bilateral cruciate ligament rupture could have occurred, either as a result of trauma or secondary to degenerative changes in the ligaments themselves [27, 28].

One predisposing factor for the development of patellar luxation in this rabbit may have been its giant-breed signalment. Studies have shown that large-breed dogs have an increased susceptibility to developmental skeletal deformities due to their increased growth rates and differential calcium metabolism compared with smaller-breed dogs [29]. One might postulate that a rapid growth rate, and/or inadequate nutrition during growth, may have resulted in skeletal weakness or deformity (coxa vara, genu vara, and medial rotation of the tibia, e.g.) due to abnormal loading of the limbs against open physes which may support a developmental aetiopathogenesis of patellar luxation in the rabbit, as suggested for the dog [16].

4. Conclusion

This case report highlights the clinical significance of medial patellar luxation as a cause of hind limb lameness in the rabbit. The exact cause of the condition is unknown. This report demonstrates the application of trochlear wedge recession sulcoplasty in the rabbit species, which was temporarily successful in alleviating clinical lameness for six months postoperatively. The reason for ultimate failure of the technique in this case is not known, but it may be related to the concurrent joint effusions. As the rabbit is now established as the UK's third most popular mammalian pet, and breeding is likely to be intensified to meet consumer demand, one can postulate that the prevalence of orthopaedic conditions, such as patellar luxation [16], is likely to increase. Consequently, further studies into the prevalence and aetiopathogenesis of patellar luxation in the rabbit are required, and surgical techniques need to be adapted and refined for use in this species.

Conflict of Interests

The authors declare that they have no conflict of interests.

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