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CASE REPORT

Companion or pet animals

Long-term outcome of a canine longitudinal patellar fracture treated with lag screw and pin

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Abstract

We report a rare case of a 4-year-old, female, mixed-breed dog with a longitudinal patellar fracture of the left hindlimb. Orthopaedic examination revealed pain, swelling and crepitus in the patella. Stifle radiography and computed tomography confirmed a longitudinal patellar fracture with lateral displacement of the fragment. A lateral parapatellar approach was chosen to assess the stifle joint. Intraoperative findings were consistent with the diagnostic imaging findings, with an additional partial tear of the quadriceps tendon at the fracture location. The fracture was treated using a 2 mm lag screw combined with a 1.25 mm K-wire, and the partial quadriceps tendon tear was repaired with a locking-loop suture. Despite a soft tissue injury due to temporary external coaptation treated conservatively, recovery was uneventful, and lameness gradually decreased, remaining lameness-free from postoperative Week 7. The dog finally returned to full activity without recurrence of lameness during long-term follow-up (422 days).

BACKGROUND

The patella is the largest sesamoid bone in dogs and plays a key role in the extension of the stifle joint.[1] It is located between the insertion tendon of the quadriceps femoris muscle proximally and the patellar ligament distally. Due to its superficial location and the high tensile force to which it is exposed, the patella is prone to trauma. Nevertheless, traumatic fractures of the patella are quite uncommon in both veterinary and human medicine.[2,3] Most patellar fractures encountered in veterinary practice are transverse, resulting in significant tensile forces across the fracture line and breakdown of the extensor mechanism.[4–6] This often leads to a high rate of complications, including implant failure, refracture and delayed union or nonunion of the patella. Although several case reports and series exist on transverse or comminuted patellar fractures, literature on longitudinal patellar fractures in dogs is sparse and limited to a single case report.[4–7] This report describes the presentation, surgical fixation and long-term outcome (14 months) of a canine longitudinal patellar fracture.

CASE PRESENTATION

A 4-year-old, athletic, female mixed-breed dog (weight 23 kg; body condition score 5/9) was referred from a local veterinary clinic to the surgical department of the small animal clinic at Justus-Liebig-University Giessen for left hindlimb lameness. According to the owner, the patient had experienced trauma from a collision of the left hindlimb with a lawn sprinkler 1 week prior. There was no history of comorbidity or orthopaedic disease. Initial conservative treatment by the local veterinarian with non-steroidal anti-inflammatory drugs did not lead to improvement; hence, the local veterinarian decided to take x-rays of the left hindlimb, which revealed a patellar fracture.

INVESTIGATIONS

General clinical examination revealed no abnormalities. The dog was bright and alert, and vital parameters were within the reference ranges. On orthopaedic examination, the patient exhibited non-weight-bearing lameness (5/5) of the left pelvic limb, and mild muscle atrophy was detected. Palpation and manipulation of the stifle joint revealed pain, moderate swelling and crepitus at the patellar level. No external injuries were observed. The cranial drawer and tibial compression tests were negative, and no obvious joint instability was detected. Besides the patellar findings, no other abnormalities were detected during the orthopaedic examination. Moreover, the blood parameters were within normal limits.

The dog was hospitalised overnight and treated with methadone (0.2 mg/kg intravenously [IV] every 4 hours; Comfortan, Dechra), and surgery was planned for the next day.

The patient underwent general anaesthesia induced with diazepam (0.5 mg/kg IV; Solupam, Dechra), methadone (0.3 mg/kg IV; Comfortan, Dechra), ketamine (0.2 mg/kg IV; Ketamin, Medistar DK Pharma) and propofol (2 mg/kg IV; Narcofol, CP Pharma). Intubation was performed with a 10.5 mm cuffed endotracheal tube, and anaesthesia was maintained with isoflurane (2%; Isofluran CP, CP Pharma) delivered in 33% oxygen. Additionally, lumbosacral epidural anaesthesia was performed with methadone (0.2 mg/kg; Comfortan, Dechra) and mepivacaine (2 mg/kg; Scandicain, Aspen Germany). Orthopaedic re-examination under general anaesthesia revealed no additional findings. Before surgery, orthogonal radiographs of the left stifle joint were obtained, showing a longitudinal fracture line running through the patella with lateral and medial dislocation of the fragments. Additionally, there was a circular, homogeneously increased volume of soft tissue, particularly cranial to the knee joint and patella. The articular soft tissue shadow of the knee joint was moderately increased in volume (Figure 1).

Further diagnostic tests included computed tomography (CT) of the affected stifle joint (16-slice multidetector, helical, Somatom Emotion 16; Siemens Healthineers). The patient was placed in dorsal recumbency, and images were acquired with a slice-thickness of 0.75 mm. CT images were visualised with multiplanar reconstruction using commercially available image processing software (Horos; The Horos Project, horosproject.org). Apart from a more distinct displacement of the lateral fragment, CT revealed no additional findings (Figure 2).

TREATMENT

After diagnostic imaging, the patient was transferred to the operating room and placed in dorsal recumbency. The affected limb was clipped, aseptically prepared and draped using the hanging-limb technique. Amoxicillin–clavulanic acid (20 mg/kg IV; AmoxClav, Hexal) was administered as a perioperative antibiotic 30 minutes before the first skin incision and then every 90 minutes.

A lateral parapatellar approach centred on the patella was selected. Subcutaneous tissues and the fascia were dissected until visualisation of the cranial patellar surface, allowing examination of the patella and femoropatellar joint. After dissecting the skin and subcutaneous tissue, intraoperative findings revealed a moderate haematoma underlying the fascia lata at the patellar level. Following the dissection of the fascia in this area, the patella was identified, and a longitudinal midbody fracture of the patella, without additional fragments, was detected. An inspection of the quadriceps tendon revealed a partial tear at the same level as the fracture (Figure 3).

For anatomical reconstruction of the fracture, the stifle joint was brought into full extension, and small pointed bone reduction forceps were placed over the medial and lateral margins of the patella for reduction of the fracture gap. Two 2.0 mm glide holes were drilled perpendicular to the fracture line into the lateral fragment, and two corresponding 1.5 mm thread holes were drilled through the medial patellar fragment using a 1.5 mm drill sleeve. A depth gauge was used to determine the screw length, and two 2.0 mm self-tapping screws with washers were placed and tightened. After tightening the screws, good apposition and interfragmentary compression were achieved; however, intraoperative manipulation of the stifle joint revealed crepitus, and inspection of the medial aspect of the femoropatellar joint through a medial arthrotomy showed both implants were in contact with the articular surface of the trochlear groove. The distal screw was changed to a shorter screw to avoid contact with the articular surface, whereas the trajectory of the proximal screw did not allow for the insertion of a screw of a length that avoided contact with the articular surface and simultaneously secured a sufficient amount of bone stock. Owing to this circumstance, combined with the limited availability in the proximal region of the patella for securing an implant, a 1.25 mm threaded K-wire was placed in the mediolateral direction instead of the screw. Repeated intraoperative manipulations of the stifle joint showed no remaining crepitus or regular range of motion. The partial tear of the quadriceps tendon was treated with a locking-loop suture using 2-0 polydioxanone (PDS II, Ethicon). The medial arthrotomy was closed with 0 polydioxanone (PDS II, Ethicon) using a vest-over pants technique, whereas the lateral arthrotomy remained open. The surgical site was thoroughly lavaged with sterile physiological saline, and the remaining tissue was closed routinely. Postoperative orthogonal left stifle joint radiographs showed satisfactory apposition of the patella, with only a small remaining radiolucent line representing the fracture gap (Figure 4).

For postoperative partial immobilisation of the left stifle joint, external coaptation was performed using a modified Robert–Jones bandage. No complications occurred during the procedure and general anaesthesia. The patient was hospitalised for 2 nights and received intravenous fluid therapy (2–4 mL/kg; Sterofundin ISO, B. Braun Vet Care) and methadon (0.1 mg/kg IV every 4 hours; Comfortan, Dechra) as needed for the first 24 hours postoperatively, along

LEARNING POINTS/TAKE-HOME MESSAGES

- Traumatic longitudinal patellar fractures can be successfully treated through surgical stabilisation with a lag screw and K-wire with excellent long-term outcomes.
- Leaving parts of the patellar retinaculum open may reduce tensile forces at the fracture site, and longitudinal patellar fractures probably have a favourable outcome compared to other fracture configurations, owing to differences in anatomic forces.
- Decisions regarding the necessity and use of external coaptation in the form of bandages should be made in individual cases and critically questioned because of the potential complications.
- Although no long-term complications occurred in this case, further research and a larger number of such cases are required to provide more in-depth information on prognosis.

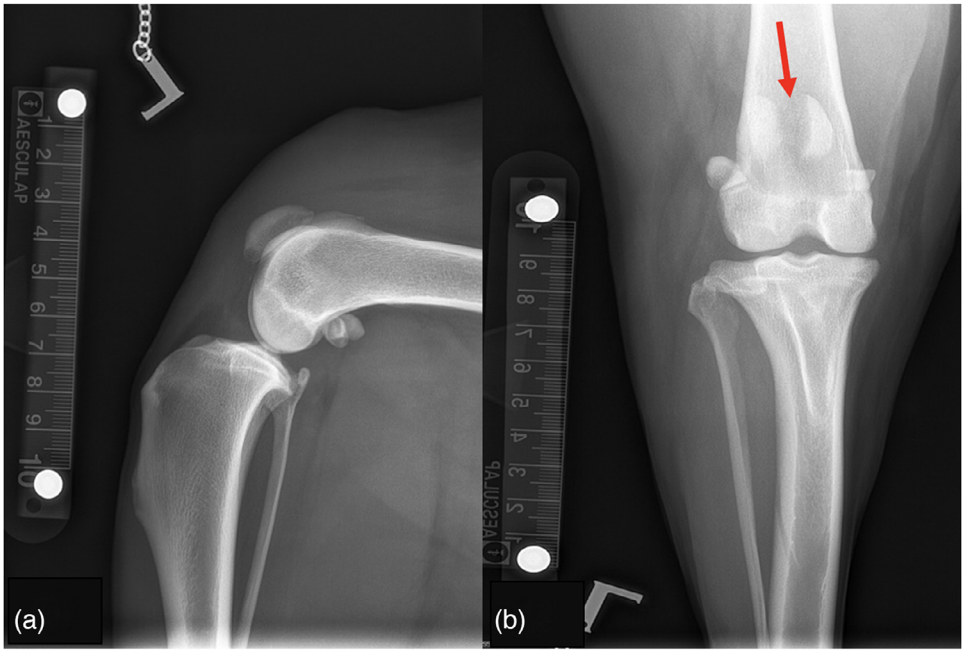

FIGURE 1 Preoperative mediolateral (a) and craniocaudal (b) projections of the left stifle joint. Running midbody through the patella there is a longitudinal fracture line (red arrow) with dislocation of the two fragments laterally and medially. The volume of the soft tissue is circular homogeneously increased, particularly cranial and proximal to the knee joint and the patella. The articular soft tissue shadow of the knee joint is moderately increased in volume.

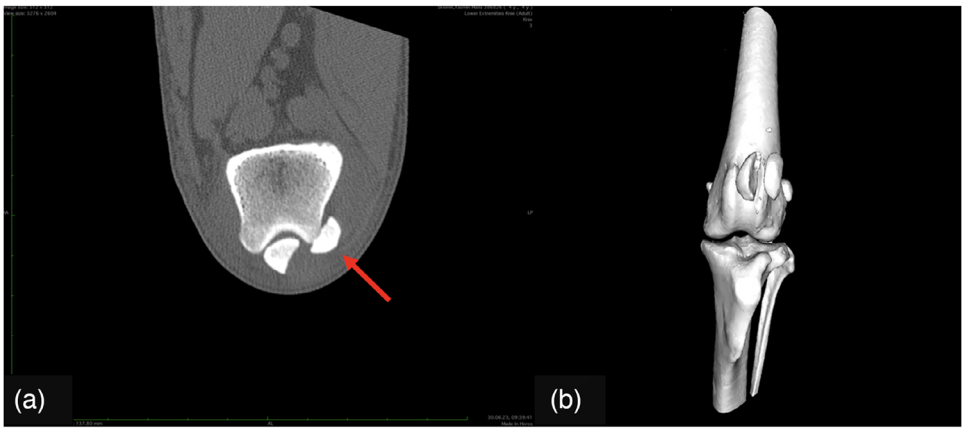

FIGURE 2 Dorsal plane (a) and three-dimensional (b) computed tomography reconstruction of the patellar fracture with marked displacement of the lateral fragment (red arrow).

with robenacoxib (1.7 mg/kg every 24 hours orally [PO]; Onsior, Elanco) and amoxicillin–clavulanic acid (12.5 mg/kg every 12 hours PO; Synulox, Zoetis). Additionally, trazodone hydrochloride (10 mg/kg every 12 hours PO; Trazodon-neuraxpharm, Neuraxpharm) was initiated in the hospital and maintained for 3 weeks to enhance the behavioural calmness of the dog during the immediate postoperative period. The Robert–Jones bandage was changed before the discharge of the patient and then every 3–4 days until the first postoperative radiographic assessment. The owners were instructed to pay attention to strictly limit the activity of the dog for the first 4 weeks, with short-leash walks for micturition and defecation. Robenacoxib (1.7 mg/kg every 24 hours PO; Onsior, Elanco) and amoxicillin–clavulanic acid (12.5 mg/kg every 12 hours PO; Synulox, Zoetis) were prescribed for 14 and 10 days, respectively, to manage postoperative pain and prevent postoperative infection.

OUTCOME AND FOLLOW-UP

Orthopaedic re-examinations and radiographs were performed at 3, 5, 7, 12 and 32 weeks after surgery. The orthopaedic examinations were performed by the same surgeon, and radiographs were interpreted by a board-certified radiologist. At each visit, a complete clinical orthopaedic examination was performed, and lameness was scored from 1 to 5. Thigh muscle mass was subjectively assessed and interpreted compared to the uninjured leg.

Three weeks postoperatively, the patient showed lameness grade 2/5 with marked muscle atrophy of the affected limb. At

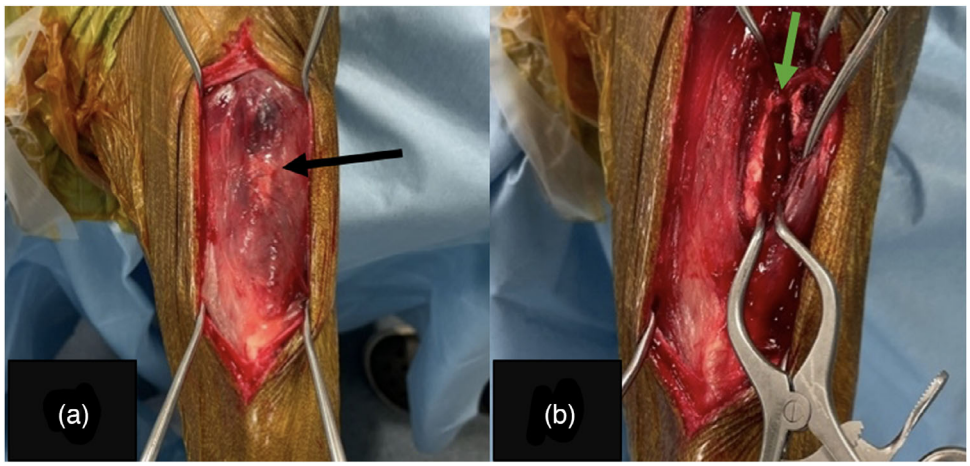

FIGURE 3 Intraoperative images taken following lateral parapatellar approach to the left stifle. Intraoperative findings revealed a moderate haematoma underlying the fascia lata at the level of the patella and a partial tear of the quadriceps tendon (black arrow) at the same level as the fracture (a). Following dissecting the fascia in this area, the patella was identified and a longitudinal midbody fracture of the patella (green arrow) without any signs of additional fragments was detected (b).

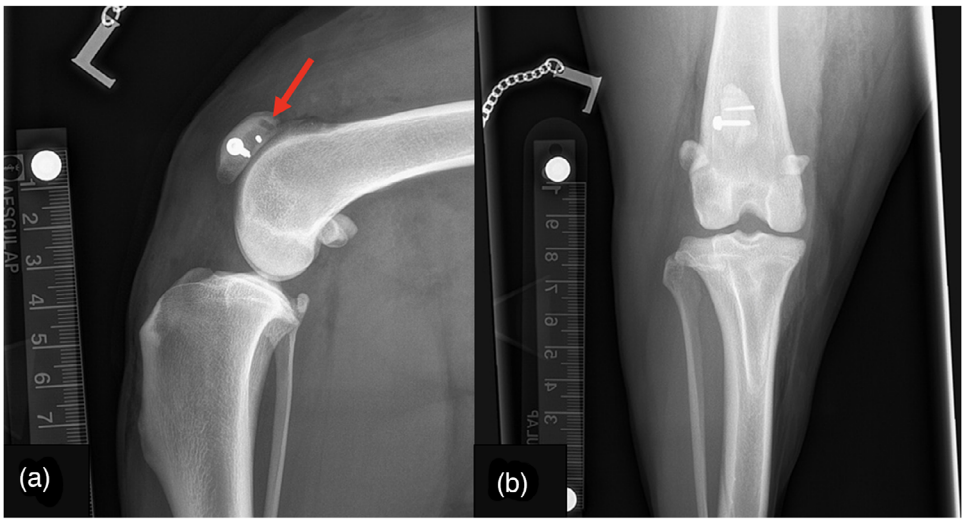

FIGURE 4 Postoperative mediolateral (a) and craniocaudal (b) projections of the left stifle joint. Radiographs are showing good apposition of the fragments with only a small radiolucent line representing the remaining fracture gap. Proximal to the pin, a sharply defined unoccupied drill hole (red arrow) is projected due to the initial inadequately positioned proximal screw.

the level of the calcaneus, a reddened area with a diameter of 2 cm and a central 5 mm spot showing early signs of demarcation were observed, leading to the decision to stop external coaptation therapy. Radiography revealed no abnormalities with the implants or fragments in situ. The owners were instructed to enforce activity restrictions. At 5-week follow-up, the dog still presented with lameness grade 2/5; however, muscle atrophy of the left thigh seemed regressive. Radiographs were consistent with the previous ones. The calcaneal lesion was slightly progressive, with a necrotic area of approximately 1 cm, and was treated conservatively with local wound therapy at home. The owner was instructed to slightly increase the activity level to 10-minute walks on the leash thrice daily. At the 7-week follow-up, orthopaedic examination showed only moderate lameness (1/5) of the left hindlimb, with further improvement in muscle atrophy. Radiographs showed that the implant and patella were in unremarkable positions, and the calcaneal lesions healed completely. The owners were told to start professional rehabilitation therapy and increase the duration of the leash walk to 5 minutes every 2 weeks.

At the 3-month follow-up after surgery, the dog was lameness-free, and only mild muscle atrophy was detected compared to the uninjured limb. Examination of the left stifle joint and patella revealed unremarkable findings. Radiographs showed no changes in the position of the implant or patella, with the beginning of fracture site healing. The owner was instructed to gradually increase the activity on the leash for another 6 weeks and then proceed with the first walk off-leash.

The last re-examination was performed 32 weeks post-operatively. The dog returned to normal activities without any restrictions. Orthopaedic examination was unremarkable, without any subjective difference in thigh muscle mass between the two sides. Radiography showed progressive healing of the fracture site, with only mild signs of stifle joint effusion and degenerative changes at the patella (Figure 5). The owner was instructed to perform normal activities

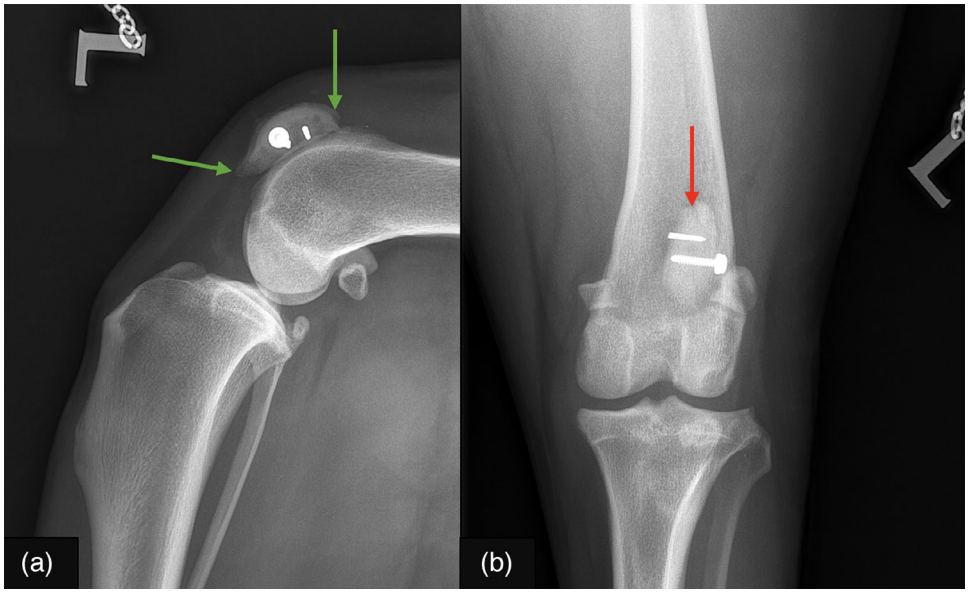

FIGURE 5 Mediolateral (a) and craniocaudal (b) projections of the left stifle joint 32 weeks postoperative. At the patella there is a moderate development of osteophytes (green arrows) with decent joint effusion. The fracture gap shows progressive healing and is increasingly filled with bone-dense material (red arrow).

without restrictions. For long-term follow-up (14 months after surgery), the owner was asked to complete the Liverpool Osteoarthritis in Dogs (LOAD) questionnaire.[8] The LOAD-Score was 2, which was consistent with the owner's statement that the dog was sound and had no mobility problems.

DISCUSSION

Longitudinal patellar fractures in dogs are extremely rare, with current knowledge limited to a single case report in which treatment was performed with a single lag screw, leading to a good outcome.[7] This report provides valuable additional information for the treatment of such cases and to document long-term outcomes (14 months). Most patellar fractures in the dog are characterised as transverse or comminuted.[3,4,6,9,10] These fractures are typically caused by direct trauma, though they can also occur as secondary complications following tibial plateau levelling osteotomy surgery.[5] While longitudinal patellar fractures in cats are also less frequent and based on a traumatic origin, majority of patellar fractures are transverse and usually part of the patellar fracture and dental anomaly syndrome, which was previously reported as knees and teeth syndrome.[11,12] In contrast to dogs, these fractures are generally characterised as insufficiency or stress fractures without any relevant previous trauma and often are accompanied by persistent deciduous teeth with concurrent skull or jaw problems and in some cases also by non-traumatic fractures of other bones.[13–15] However, sometimes underlying bone abnormalities like osteochondrosis or disorders of the patellar secondary ossification centres are assumed, similar to the findings in human medicine.[3,10,16,17] For the treatment of patellar fractures in dogs, several surgical methods have been described, including using pins and tension band constructs, whereas the ideal fixation method should always be chosen individually based on the fracture configuration.[3,6,7,10,18] Another possible treatment option that can be considered a salvage procedure, especially when the fracture site cannot be reconstructed owing to comminution and complexity, is partial patellectomy, in which up to one-third to half of the patella can be removed with a satisfactory clinical outcome.[9,19,20] While surgical intervention is generally recommended for transverse patellar fractures due to the tensile forces involved, conservative treatment can be considered for cases with non-displaced to minimally displaced fragments with preserved stifle joint extensor mechanism and minimal or absent clinical signs.[9,21,22] For longitudinal patellar fractures in human medicine, conservative treatment is favoured when the degree of displacement is up to 2 mm.[23] A displacement of more than 2 mm is considered a criterion for surgical intervention in human medicine, as larger gaps increase the risk of osteoarthritis and poor outcomes.[24] Although there are no data available for veterinary medicine in this regard, we considered this guideline reasonable and used it to support our decision to undergo surgery.

The diagnosis of patellar fractures is typically made through a clinical orthopaedic examination and orthogonal radiographs of the stifle joint in two planes. In this case, we also performed a CT of the affected knee. This decision was based on findings from human medicine, which indicate that 88% of patellar fractures involve the distal pole, identified in only 44% of cases using radiographs, leading to a change in the treatment plan in 49% of cases.[25] Given the young age, athletic lifestyle and severe lameness of the dog in combination with a displacement greater than 2 mm, we decided to proceed with surgical stabilisation to achieve the best possible outcome and decrease the risk of secondary osteoarthritis. Owing to the longitudinal nature of the fracture, we opted against treatment with pins and tension bands and chose stabilisation using a lag screw and pin. This treatment regimen, alternatively using two lag screws, is also employed in human medicine for this fracture configuration. The only reported case of longitudinal patellar fracture in dogs was similarly treated using a single lag screw without an additional pin.[7] The difference in surgical

approach compared to transverse fractures arises from biomechanical differences and differences in the forces acting between the two fracture types.

In the transverse fracture configuration, the patella is subjected to strong tensile forces generated by the contraction of the rectus femoris and vastus muscle groups, which pass through the patella, leading to stifle joint extension. These tensile forces eventually caused the separation of the proximal and distal fragments. To counteract these forces, such fractures are traditionally treated using tension band constructs, which aim to convert tensile forces into compressive forces.[26]

Conversely, in the case of a longitudinal configuration, the fragments and implants are not subjected to the perpendicular tensile forces that occur during knee joint extension, but rather to shear forces that act more parallel to the fracture site. Tension forces, in this case, were primarily generated by the lateral and medial patellar retinaculum, which were transected during surgery. Because the patellar fragment was luxated laterally, most of the tensile force originated from the lateral aspect of the stifle, owing to the contraction of the soft tissues. To mitigate this, we opted to suture the lateral arthrotomy, leaving it open to reduce the tensile forces acting on the fracture site, as described in a case report of a longitudinal patellar fracture in a cat.[27] Thus, the remaining forces were primarily shear forces, which were successfully overcome with the implants used in this study, providing sufficient stability.

External coaptation is commonly used to support surgical fracture fixation in veterinary medicine, and has a complication rate of 63% in dogs and cats with soft tissue injuries.[28] In our case, complications occurred during bandaging in the form of soft tissue injury at the calcaneus. However, the injury healed without complications following local conservative treatment. An alternative method to completely immobilise the knee joint is a transarticular external fixator (TA-ESF), which has been successfully described in a single case report and a case series involving five dogs with patellar fractures as an augmentation of primary fixation.[6,10] Based on the different forces acting on longitudinal to transverse fractures of the patella, we ultimately decided against additional TA-ESF, as we were of the opinion that external coaptation in combination with internal fixation with screws and pins was sufficient to withstand the acting forces. Retrospectively, it is worth questioning whether the external coaptation was necessary, as in the only recorded case of a longitudinal patellar fracture in a dog, no additional immobilisation was performed, and no complications occurred.[7] Nevertheless, due to the active nature and temperament of the dog, we felt more secure with the additional temporary external coaptation, being aware of the potential complications.

In conclusion, we reported a rare case of a longitudinal patellar fracture in a mixed-breed dog treated with a lag screw and pin, resulting in an excellent long-term outcome. Despite some minor complications in the form of soft tissue injury following external coaptation, we encountered no complications such as implant failure, refracture of the patella, implant loosening or nonunion of the patella, and radiographs taken 32 weeks after surgery showed nearly complete healing of the fracture. The outcome of longitudinal patellar fractures may be favourable compared to transverse fractures due to the different fracture configurations and forces acting, which is supported by the good outcomes of the two documented cases (one dog and one cat) so far.[7,27] However, further research with a larger number of such cases is required to confirm this.

AUTHOR CONTRIBUTIONS

Max Weniger was the primary author and responsible for conceptualisation of the case report; data acquisition; drafting and revising the manuscript. **Christian Feichtenschlager** was the primary surgeon and gave input. **Niklas Linde** was responsible for data acquisition and case management. **Christine Peppler** drafted and revised the manuscript. All authors approved the final version submitted for publication.

CONFLICT OF INTEREST STATEMENT

The authors declare they have no conflicts of interest.

FUNDING INFORMATION

The authors received no specific funding for this work.

ETHICS STATEMENT

As the reported case is a clinical case and the case management was not changed in any way due to the publication of the report, an ethics statement is not applicable. Informed consent was obtained from the dog's owner

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REFERENCES

1. Evans HE, Lahunta A. The skeleton. Bones of the pelvic limb. Sesamoid bones of the stifle joint. In: Miller's anatomy of the dog. 4th ed. Amsterdam: Elsevier Saunders; 2013. p. 147–48.
2. Larsen P, Court-Brown CM, Vedel JO, Vistrup S, Elsoe R. Incidence and epidemiology of patellar fractures. Orthopedics. 2016;39:e1154–58.
3. Langley-Hobbs SJ. The patella, fabella and popliteal sesamoids. In: Gemmill TJ, Clements DN, editors. BSAVA manual of canine and feline fracture repair and management. 2nd ed. Gloucester: British Small Animal Veterinary Association; 2016. p. 353.
4. Cruciani B, Gagnon D, Freire M, Montasell X. Excellent long-term clinical outcome in a young athletic dog following surgical complications of a comminuted patellar fracture and patellar ligament rupture. Can Vet J. 2021;62:945–50.
5. Rutherford S, Bell JC, Ness MG. Fracture of the patella after TPLO in 6 dogs. Vet Surg. 2012;41:869–75.
6. Sprocatti M, Kvale E, Solano M. Combined internal fixation and transarticular external skeletal fixation to treat traumatic patellar fractures in five dogs. N Z Vet J. 2022;70:119–27.
7. Betts CW, Walker M. Lag screw fixation of a patellar fracture. J Small Anim Pract. 1975;16:21–25.
8. Walton MB, Cowderoy E, Lascelles D, Innes JF. Evaluation of construct and criterion validity for the 'Liverpool Osteoarthritis in Dogs' (LOAD) clinical metrology instrument and comparison to two other instruments. PLoS One. 2013;8:e58125.
9. Piermattei DL, Flo GL, DeCamp C. Fracture of the femur and the patella. In: Piermattei DL, Flo GL, editors. Brinker, Piermattei, and Flo's handbook of small animal orthopedics and fracture repair. 4th ed. Philadelphia, Pennsylvania: Saunders; 2006. p. 557–60.
10. Cabon Q, Cachon T. Surgical treatment of a bilateral patellar fracture in a young adult dog. Vet Rec Case Rep. 2016;4:e000312.
11. Langley-Hobbs SJ, Brown G, Matis U. Traumatic fracture of the patella in 11 cats. Vet Comp Orthop Traumatol. 2008;21(05):427–33.
12. Langley-Hobbs S. Patella fractures in cats with persistent deciduous teeth—knees and teeth syndrome (KaTS). Companion Anim. 2016;21(11):620–25.
13. Reyes NA, Longley M, Bailey S, Langley-Hobbs SJ. Incidence and types of preceding and subsequent fractures in cats with patellar fracture and dental anomaly syndrome. J Feline Med Surg. 2019;21(8):750–64.

14. Langley-Hobbs SJ, Ball S, McKee WM. Transverse stress fractures of the proximal tibia in 10 cats with non-union patellar fractures. Vet Rec. 2009;164(14):425–30.
15. Howes C, Longley M, Reyes N, Major AC, Gracis M, Fulton Scanlan A, et al. Skull pathology in 10 cats with patellar fracture and dental anomaly syndrome. J Feline Med Surg. 2019;21(8):793–800.
16. Palierne S, Palissier F, Raymond-Letron I, Autefage A. A case of bilateral patellar osteochondrosis and fracture in a cat. Clinical and histological findings. Vet Comp Orthop Traumatol. 2010;23:128–33.
17. Oohashi Y, Koshino T, Oohashi Y. Clinical features and classification of bipartite or tripartite patella. Knee Surg Sports Traumatol Arthrosc. 2010;18:1465–69.
18. Chau L, Wilson L. Patella fracture repair using multiple fixation modalities in a dog. VCOT Open. 2021;04:e5–e11.
19. Bright SR, May C. Arthroscopic partial patellectomy in a dog. J Small Anim Pract. 2011;52:168–71.
20. White RA. Bilateral patellar fracture in a dog. J Small Anim Pract. 1977;18:261–65.
21. Tomlinson J. Fractures of the patella. In: Johnson AL, Houlton JEF, Vannini R, editors. AO principles of fracture management in dogs and cats. 1st ed. Davos Platz, Switzerland: Georg Thieme Verlag; 2005. p. 305–10.
22. Kowaleski MP, Boudrieau RJ, Pozzi A. Stifle joint. In: Tobias KM, Johnston SA, editors. Veterinary surgery small animal. 1st ed. Amsterdam: Elsevier; 2012. p. 991–93.
23. Fehske K, Berninger MT, Alm L, Hoffmann R, Zellner J, Kösters C, et al. Current treatment standard for patella fractures in Germany. Unfallchirurg. 2021;124:832–38.
24. Carpenter JE, Kasman RA, Lee ML, Goldstein SA. Biomechanical evaluation of current patella fracture fixation techniques. J Orthop Trauma. 1997;11:351–56.
25. Lazaro LE, Wellman DS, Pardee NC, Gardner MJ, Toro JB, Macintyre NR 3rd, et al. Effect of computerized tomography on classification and treatment plan for patellar fractures. J Orthop Trauma. 2013;27:336–44.
26. Schatzker J. Manual of internal fixation: techniques recommended by the AO-ASIF Group. 3rd ed. Berlin: Springer-Verlag; 1991.
27. Herndon GD. Complete longitudinal patellar fracture in a cat: a rare case. Can Vet J. 2017;58:387–90.
28. Meeson RL, Davidson C, Arthurs GI. Soft-tissue injuries associated with cast application for distal limb orthopaedic conditions. A retrospective study of sixty dogs and cats. Vet Comp Orthop Traumatol. 2011;24:126–31.

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