

Successful Treatment of Olecranon Fracture with Tie-in External Fixator in a Cat

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Abstract

In this case report, a 4-month-old male British shorthair cat was brought with lameness, swelling in the forelimb, and loss of appetite following a fall from a height. On the orthopedic examination, pain, lameness, abnormal mobility, local sensitivity, crepitation, and deformation findings were observed in the forelimb. Clinical and radiologic examinations revealed a fracture of the proximal left olecranon. The fracture was treated with an external fixator (ESF). Clinical and radiological controls were performed on the 10th, 21st, 30th, and 45th postoperative days. The External fixator was removed on the 62nd postoperative day under sedation. This case report aimed to contribute to the literature by presenting the successful treatment of an olecranon fracture in a 4-month-old young cat using an ESF.

Keywords: Cat, cubiti, elbow joint, feline, ulna.

Bir Kedide Olecranon Kırığının Tie-in Eksternal Fiksator ile Başarılı Sağaltımı

Öz

Bu olgu sunumunda, 4 aylık, erkek, British shorthair ırkı bir kedi yüksekten düşme sonrası ön bacakta topallık, şişlik ve iştahsızlık şikayetleri ile getirildi. Ortopedik muayenede ön ayakta ağrı, topallık, anormal hareketlilik, lokal hassasiyet, krepitasyon ve deformasyon bulguları gözlemlendi. Klinik ve radyolojik incelemelerde sol olecranonda avülsiyon kırığı tespit edildi. Kırık eksternal fiksator ile tedavi edildi. Ameliyat sonrası 10, 21, 30 ve 45. günlerde klinik ve radyolojik kontroller yapıldı. Eksternal fiksator ameliyat sonrası 62. günde sedasyon altında çıkarıldı. Bu olgu sunumunda, 4 aylık genç bir kedide olecranon kırığının eksternal fiksator ile başarılı tedavisi konusunda literatüre katkıda bulunulması amaçlandı.

Anahtar kelimeler: Kedi, cubiti, dirsek eklemi, ulna.



Introduction

The olecranon is the most proximal part of the ulnar bone and consists of the tuber olecranon, the anconeal process, and the proximal part of the trochlear articular notch. The triceps brachii muscle adheres to the olecranon process of the ulnar bone and helps the elbow joint to extend and bear the weight of the extremity (Paul et al., 2021).

Olecranon fractures can be extra-articular or intra-articular and in both cases, the bone fragment is displaced proximally by the triceps muscle pull. This type of fracture is usually seen in young dogs. Olecranon fracture requires special attention and extra care; if not treated appropriately, it may result in delayed nonunion, often leading to functional disuse of the limb. The main problem with this fracture is that the fractured segments are displaced by the traction of the triceps muscle (Şen & Sağlam, 2012; Şen et al., 2015; Sarierler & Kibar Kurt, 2021).

Olecranon fracture can be repaired by applying different techniques such as pin and external fixation or tension band or tension band and lag screw combination or Kirschner wire (K- wire) and tension band combination. Among these, the tension band technique is commonly used in the repair of olecranon fractures and provides adequate stabilization as well as immediate weight-bearing of the limb. The basic principle of tension banding is to counteract the tensile forces acting along the fracture site and convert them into compressive forces (Paul et al., 2021).

The application of external skeletal fixator (ESF) made of lightweight epoxy material rods for fracture repair is used in veterinary orthopedics. Lower cost, mechanical durability, greater versatility, reduced operating time, and simplified application techniques have made epoxy external fixators increasingly preferred over both internal and external fixation techniques (Kurt & Sen,

2022). The aim of this study was to present an alternative method for the intervention of olecranon fractures with the application of tie-in type external fixation, which has not been previously applied in cat proximal olecranon fractures.

Case Description

A 4-month-old, 1.75 kg male British Shorthair cat was brought to Aydın Adnan Menderes University Faculty of Veterinary Medicine, Department of Surgery, with a complaint of lameness in the left forelimb. In the anamnesis, it was learned that the patient had fallen from a height 2 days ago. The first emergency intervention was performed in a private veterinary clinic immediately after the fall. Physical examination revealed a body temperature of 38.1 °C, respiratory rate of 40/min, heart rate of 90 beats/min, normal color of mucous membranes, dehydration degree: 2%, Capillary Refill Time: 1 s, and normal size of submandibular lymph nodes. An orthopedic examination revealed pain during flexion and extension movements, abnormal mobility, local sensitivity, crepitation, and loss of function in the elbow. Laboratory examinations revealed no abnormality and all values were within physiological limits. Two-way X-ray images of the left forelimb were taken in anteroposterior (A/P) and mediolateral (M/L) positions, revealing a proximal fracture in the left olecranon (Figure 1). The operation was planned 24 hours after the evaluation of the radiographs. The patient was not given food until 12 hours preoperatively and water until 6 hours preoperatively. The operation site was prepared for surgery, including the upper and lower joints of the bone where the fracture was located.

Following disinfection of the area with routine asepsis-antisepsis methods, induction was performed with 10 mcg/kg medetomidine hydrochloride (Domitor, 1 mg/1 mL, Zoetis®, İstanbul, Türkiye) intravenously (IV) and

propofol (propofol, 10 mg/mL, Polifarma[®], Tekirdağ, Türkiye) at 2 mg/kg IV. The patient was oro-tracheally intubated and then maintained with isoflurane (2% Isoflurane[®] USP, USA) (Kumandas et al., 2019). Sterile drapes surrounded the operation site. A skin incision was made over the lateral elbow and the fracture fragments were exposed. Two Kirschner wires (K-wires) were retrogradely inserted into the ulna. One K-wire was applied transversally

distal to the fracture fragment. The 2 K-wires which were placed to the olecranon were bent to the lateral and medial to the point where they would come together with the ends of the transversally inserted pin. The ends of the wires were attached with epoxy material (Kurt & Sen, 2022). The incision site was closed with simple interrupted sutures using 2-0 monofilament atraumatic (GMD[®], İstanbul/Türkiye) suture material (Figure 2).

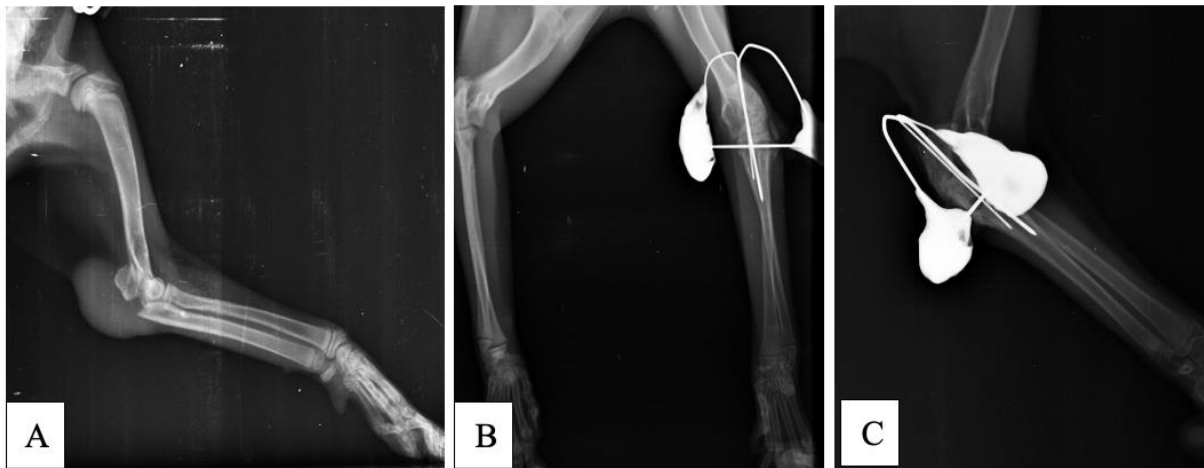


Figure 1. Preoperative M/L (A), postoperative A/P (B), and M/L (C) X-ray images of the patient.

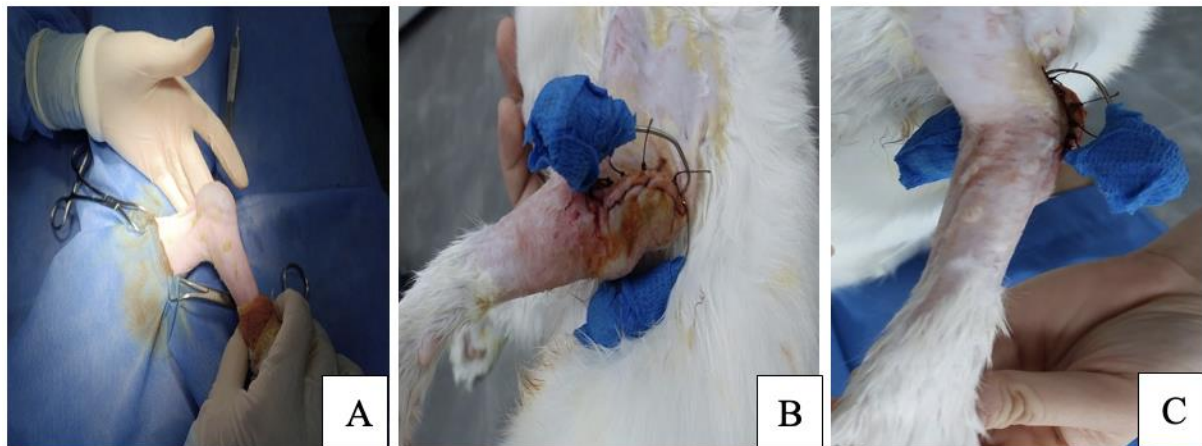


Figure 2. Preoperative view of the surgical site (A); (B) and (C) postoperative view of the implant material.

After the operation, the patient received cefazolin Na (20 mg/kg, 12h, Iespor[®], İ.E. Ulagay, İstanbul, Türkiye) intramuscularly (IM) for 7 days, meloxicam (2 mg/kg, 24h, Bavet Meloxicam[®], 5 mg/ml, İstanbul, Türkiye) subcutaneously (SC) for 3 days, and sucralfate (1 mg/kg, 12h, Antepsin[®], Bilim, Kocaeli,

Türkiye) orally for 3 days. To prevent pin site infections, the patient owner was advised to clean the pin site with 10% povidone-iodine (Biokadin[®], Adeka, İstanbul, Türkiye) at least twice a day and to wear an Elizabethan collar until the implants were removed. Functional use of the limb with full weight-bearing was

observed immediately after recovery from anesthesia. On day 62, the pins were easily removed under sedation (Figure 3). After the pins were removed, the patient continued to use

his extremity comfortably, and X-ray showed complete union of the fracture line.



Figure 3. Postoperative 62nd day, fixator removed callus formation can be seen in M/L (A) and A/P (B) X-ray images.

Discussion

Fractures of the antebrachium are common in small animals. In contrast, olecranon fractures are uncommon (Houlton & Dunning, 2005). Because most olecranon fractures are articular, anatomical reduction and internal fixation are usually required to counteract the tensile forces exerted by the triceps brachii muscle group, promote primary bone healing, mitigate the development of posttraumatic osteoarthritis, and optimize the probability of returning to pre-fracture limb function (Fox, 2012). Different techniques are used for the treatment of olecranon fractures in small animals. Tension band wiring and plate osteosynthesis are two techniques currently recommended by the *Arbeitsgemeinschaft für Osteosynthesefragen* (AO) Vet group for olecranon fracture repair (Paul et al., 2021). Proximal ulnar fractures may be articular or nonarticular. Nonarticular ulnar fractures in the proximal elbow joint are usually avulsion fractures of the olecranon. Because of the traction of the triceps brachii muscle group, tensile forces must be resisted when repairing

olecranon fractures. In this state there is anatomical reduction and internal fixation are usually required to counteract the tensile forces exerted by the triceps brachii muscle group, promote primary bone healing, reduce the development of posttraumatic osteoarthritis, and optimize the likelihood of return to function of the pre-fracture limb (Johnston & Tobias, 2018; Şen & Kaya, 2018; Şen & Sağlam, 2021).

In this case, 2 K-wires were inserted retrograde through the ulna, and another K-wire was inserted transversally to the distal fragment to counteract the tensile force of the triceps brachii muscle, and we combined this K-wire with the two previously applied K-wires with epoxy material. Stabilization of the olecranon osteotomy is usually achieved with 2 pins or K-wires and a tension band wire (Piermattei et al., 2006). In this case report, parallel to the other reports the epoxy-pin ESF application counteracted the tensile forces exerted on the fracture fragment by muscles, ligaments, and tendons and converted them into compressive forces. Compression of the fracture fragments reduces the width of the

fracture gap and promotes primary bone healing by supporting inter-fragment stability (Piermattei et al., 2006; Şen, 2018; Karşlı, 2022).

Olecranon fracture repair has a high complication rate of approximately 37% in dogs, including osteomyelitis, loss of reduction, and migration of K-wires (Paul et al., 2021). Since we applied an ESF in our case, there was no pin migration or loss of reduction that would cause early removal of the fixator. A recent report compared the standard tension band technique with circular external fixation for stabilization of olecranon osteotomies in dogs. Although the reduction accuracy and yield load were similar, the circular fixator provided greater initial stiffness and resisted a higher load. Possible advantages of the ESF method include the fact that fixation eliminates the need for external coaptation, provides unobstructed access for wound cleaning when necessary, and implants can be easily removed when no longer needed (Verpaalen et al., 2020). In this case report, weight-bearing started early, wound cleaning was easy, and the fixator was easily removed when fracture healing was completed.

With the ESF method we applied, the patient started to use his leg shortly after the operation, there was no need for bandage application after the tension band application, thus, muscle atrophy was not formed and complications such as bandage cuts caused by the bandage were not formed. In addition, the implants were easily removed without requiring invasive surgery. Tissue trauma during implant removal was also prevented. External fixation is an effective method to stabilize many fractures in veterinary orthopedics (Bakici et al., 2019; Gülaydın et al., 2019; Şen, 2020). Although careful attention to fixator selection and application principles is the best way to minimize complications, they can still occur. The vast majority of complications are superficial pin tract infection and subsequent

implant failure. However, prompt recognition of these complications and appropriate treatment will minimize their impact and ensure a successful outcome of fracture healing and normal limb function (Beever et al., 2018). In our case report, no complication such as pin site infection, and pin site cleaning was performed regularly to prevent this situation.

Conclusion

After the operation, the patient was able to use the extremity. Thus, no muscle atrophy was observed. At the same time, the materials used were easily removed after the fracture healing. Tie-in type external fixation has not been previously applied to feline proximal olecranon fractures. In this case presentation, a successful fracture union was obtained by utilizing the advantages of an ESF and avoiding the complications of internal fixator applications. Thus, an alternative method for intervention of olecranon fractures was presented.

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Ethical Statement

This study does not present any ethical concerns.

Author Contributions

Investigation: B.K.K.; E.S.A, A.A.; Material and Methodology: B.K.K.; E.S.A.; Supervision: B.K.K.; A.A.; E.A.; O.B.; Visualization: B.K.K.; E.S.A., A.A.; Writing-Original Draft: B.K.K.; E.S.A.; A.A.; Writing review & Editing: B.K.K.; E.S.A.; A.A.; O.B.

Conflict of Interest

The authors declared that there is no conflict of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

- Bakici, M., Karsli, B., & Turan Cebeci, M. (2019). External skeletal fixation, *International Journal of Veterinary and Animal Research*, 2(3), 69-73.
- Beever, L. J., Giles, K., & Meeson, R. L. (2018). Postoperative complications associated with external skeletal fixators in dogs. *Veterinary and Comparative Orthopaedics and Traumatology*, 137-143. <https://doi.org/10.1055/s-0038-1627477>
- Fox, D. B. (2012). Radius and ulna. In K. M. Tobias & S. A. Johnston (Eds.), *Veterinary Surgery: Small Animals* (1st ed., pp. 760-784). Elsevier Saunders.
- Gülaydın, A., Sarierler, M., & Bozkan, Z. (2019). Treatment of proximal tibial fracture of a calf by using linear external fixator. *Turkish Journal of Veterinary Research*, 3(2), 81-84. <http://www.dergipark.gov.tr/tjvr>
- Houlton, J. E. F., & Dunning, D. (2005). Perioperative patient management. *AO Principles of fracture management in the dog and cat*. Thieme, New York, USA, 1-25.
- Johnston, S. A., & Tobias, K. M. (2018). *Veterinary Surgery Small Animal* (S. A. Johnston & K. M. Tobias, Eds.; 2nd ed.). Elsevier.
- Jones, S. C., Lewis, D. D., & Winter, M. D. (2015). Fluoroscopic-assisted olecranon fracture repair in three dogs. *Case Reports in Veterinary Medicine*, 2015. <https://doi.org/10.1155/2015/542842>
- Karslı, B. (2022). Evaluation of the Treatment of feline metacarpal and metatarsal fractures using dowel pinning technique, *Van Veterinary Journal*, 33(1), 1-5. <https://doi.org/10.36483/vanvetj.986259>.
- Kumandas, A., Çinar, M., Pekcan, M., Elma, E., Karsli, B., & Pekcan, Z. (2019). The effects of propofol and sevoflurane anaesthesia on lipid peroxidation and the antioxidant system in Angora Goats. *International Journal of Veterinary and Animal Research*, 2(1), 16-19.
- Kurt, K., & Sen, B. B. (2022). Treatment of orthopedic problems with epoxy-pin external fixator in cats and dogs. *International Journal of Veterinary and Animal Research*, 5(2), 60-65. <https://doi.org/10.5281/zenodo.7020344>
- Muir, P., & Johnson, K. A. (1996). Fractures of the proximal ulna in dogs. *Veterinary and Comparative Orthopaedics and Traumatology*, 9(2), 88-94. <https://doi.org/10.1055/s-0038-1632509>
- Paul, T., Biswas, S., Bristi, S. Z. T., Sarker, D., Yadav, S. K., & Das, B. C. (2021). Repair of olecranon fracture in a dog with pinning and tension band wiring techniques first case report in Bangladesh. *Veterinary Sciences: Research and Reviews*, 7(2). <https://doi.org/10.17582/journal.vsr/2021.7.2.129.133>
- Piermattei, D., Flo G., & DeCamp, C. (2006). Brinker, Piermattei, and Flo's handbook of small animal orthopedics and fracture repair. Saunders/Elsevier.
- Sarıerler, M., & Kibar Kurt, B. (2021). Kedi ve köpeklerde ekstremite lerin radyografik muayenesi: Temel prensipler. *Türkiye Klinikleri Veterinary Sciences-Surgery-Special Topics*, 7(2), 95-102.
- Şen, İ. (2018). Köpeklerde karşılaşılan mandibula kırıklarının sağaltımında akrilik eksternal fiksasyon tekniğinin klinik ve radyolojik değerlendirilmesi. *Veteriner Hekimler Derneği Dergisi*, 89(1), 67-73.
- Şen, İ., & Kaya, Ü. (2018). Köpeklerin diyafizer tibia kırıklarının interlocking pin kullanılarak sağaltımı. *Veteriner Hekimler Derneği Dergisi*, 89(2), 49-57. www.veteriner.org.tr/tr/dergi
- Şen, İ., & Sağlam, M. (2012). Evcil karnivorlarda karşılaşılan antebrachium kırıkları ve sağaltım sonuçlarının klinik ve radyolojik değerlendirilmesi. *Veteriner Hekimler Derneği Dergisi*, 83(1), 59-64.
- Şen, İ., & Sağlam, M. (2021). Treatment outcomes of using paraosseous clamp and cerclage stabilisation technique in long bone fractures of cats: A retrospective study. *Ankara Üniversitesi Veteriner Fakültesi Dergisi*, 68(1), 47-52. <https://doi.org/10.33988/auvfd.695818>
- Şen, İ., Sağlam, M., & Kibar, B. (2015). Kedilerde karşılaşılan radius-ulna kırığının sağaltım sonuçlarının klinik ve radyolojik değerlendirilmesi. *Veteriner Hekimler Derneği Dergisi*, 86(2), 25-33.
- Şen İ. (2020). Treatment of Tibial Fractures with the Use of Interlocking Nail and Acrylic External Fixator Combination in Dogs. *Turkish Veterinary Journal*, 2(1), 1-6.
- Verpaalen, V. D., Lewis, D. D., & Porter, E. G. (2020). Use of combined transarticular pinning and external skeletal fixation for the reduction and stabilization of multiple metatarsophalangeal luxations in a cat. *Journal of Feline Medicine and Surgery Open Reports*, 6(1). <https://doi.org/10.1177/2055116920904465>