Treatment of traumatic elbow luxation and radius fracture with non-rigid transarticular external fixation and paraosseous clamp cerclage in a cat

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ARTICLE INFO

Article History
Received : 07.08.2022
Accepted : 06.07.2023
DOI: 10.33988/auvfd.1158729

Keywords
Cat
Dislocation
Elbow
External fixation
Paraosseous clamp cerclage

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How to cite this article: Uygur S, Doğan A, Qoti F, Yıldız-Doğan M, Bumin A (2024): Treatment of traumatic elbow luxation and radius fracture with non-rigid transarticular external fixation and paraosseous clamp cerclage in a cat. Ankara Univ Vet Fak Derg, 71 (3), 365-369. DOI: 10.33988/auvfd.1158729.

ABSTRACT

An 8-year-old, female, neutered mixed-breed cat presented with traumatic elbow luxation and radius fracture due to high-rise syndrome. According to the anamnesis, the trauma had occurred 10 days prior. Therefore, the patient was treated with an open reduction technique. The reduction of the elbow joint was performed with the cerclage transarticular external fixation (CTEF) method. Fixation of the radius fracture was performed using the paraosseous clamp cerclage method. The follow-up time for the patient was 1 year, and the functional outcome was considered fair due to humero-ulnar ankylosis of the elbow joint with 110° of extension. In this case report, post-operative long-term clinical and radiographic results were not as desired. This can be explained by the inability to perform surgery at the desired time, the severity of the trauma, and cartilage damage. However, further cases are required to determine whether this procedure is optimal for the treatment of traumatic elbow luxation in cats.

Traumatic elbow dislocation is a relatively rare orthopedic disorder observed in cats and dogs (1, 6, 8, 13). The strong collateral ligaments and the presence of the anconeal process which interlocks into the olecranon fossa ensure the inherent stability of the elbow joint while the elbow joint is in extension (2, 5, 8, 13). Elbow dislocation occurs when the elbow is flexed to 45° or less at the time of trauma (2). Luxation occurs usually in the lateral direction because the medial epicondyle of the humerus is larger than the lateral, and the medial articular surface slopes distally (1-3, 6, 8). Also, the medial collateral ligament is weaker than the lateral collateral ligament and has a thin insertion; All those causes result in this predisposes to lateral luxation (1, 8).

Elbow dislocation can be treated using either closed or open reduction technique. Closed reduction usually gives successful results in acute cases. It has been reported that open reduction is indicated in cases where closed reduction cannot be performed or instability is present despite the reduction (1, 3, 5, 6, 8, 13).

Many methods, such as rigid external fixation, have been described in the operative treatment of elbow dislocation. Rigid external fixators provide joint alignment and necessary stability during the repair of supporting structures. However, rigid joint immobilization causes decrease in synovial fluid production, cartilage stiffness, and range of motion (ROM). It also causes to muscle atrophy, the development of degenerative joint disease, and intra-articular adhesions (9, 12). The non-rigid transarticular external fixation method promotes the healing process while minimizing the effect of joint immobilization on joint homeostasis and

cartilage metabolism (12). In this study, the non-rigid transarticular external fixation method and its results are reported.

An 8-year-old female, neutered mixed-breed cat, weighing 4 kg, was referred for lameness in the left front limb due to high-rise syndrome. After clinical and radiographic evaluation, luxation of the elbow joint and transverse fracture of the proximal diaphyseal radius were detected (Figure 1). According to the anamnesis, the trauma had occurred 10 days prior with a concurrent fracture of the radius. Therefore, the patient was treated with an open reduction technique.

Cefazolin sodium 20 mg/kg i.v (Eqizolin®, Tüm-Ekip, Turkey) was administered for antibiotherapy. For premedication, 0.1 mg/kg diazepam (Diazem®, Deva, Turkey) and 6 mg/kg propofol (Propofol® 1%, Fresenius, Turkey) were administered for induction. Anesthesia was maintained with 2% isoflurane (Isoflurane USP®, Piramal Critical Care, USA) in oxygen. For analgesia, before the surgery, sc injection of 0.1 mg/kg morphine HCl (Morphine®, Galen, Turkey) and 0.1 mg/kg sc meloxicam (Bavet Meloxicam®, Bavet, Turkey) were administered for the first 3 days after the surgery. Intraoperative analgesia was managed with a constant-rate infusion (CRI) using a combination of saline, ketamine (Ketasol® 10%, Richter Pharma AG, Austria), butorphanol (Butomidor® Sanovel, Turkey), medetomidine (Domitor®, Pfizer, Finland) (100 ml + 12 mg + 4.8 mg + 0.04 mg, respectively).

During the surgery, the elbow joint was exposed with the caudo-lateral surgical approach. Complete rupture of the medial collateral ligament (MCL) was detected. A 1.5 mm Kirschner wire was placed transcondylar to the humerus and bilaterally in the olecranon. After the reduction of humeroulnar articulation, the elbow joint was extended to 140° and Kirschner wires were fixed together with a 0.4 mm cerclage wire. The cerclage wires were adjusted in tension to prevent re-luxation of the elbow joint. The radius fracture was fixed with the paraosseous clamp cerclage method using 1 mm Kirschner wires and 0.4 mm cerclage wire, and a reduction of caput radii was performed. Since a tear of the annular ligament was detected, the ulna was fixed to the radius with a 2.0 x 16 mm cortical screw then the surgical field was closed in a routine manner. After the surgery, the hemogram tube's rubber stoppers were placed with the cerclage wire in the middle of the Kirshner wires. Post-operatively, the elbow joint flexion degree was measured as 30 ± 5°, and the extension angle was 150 ± 5° (Figure 2).

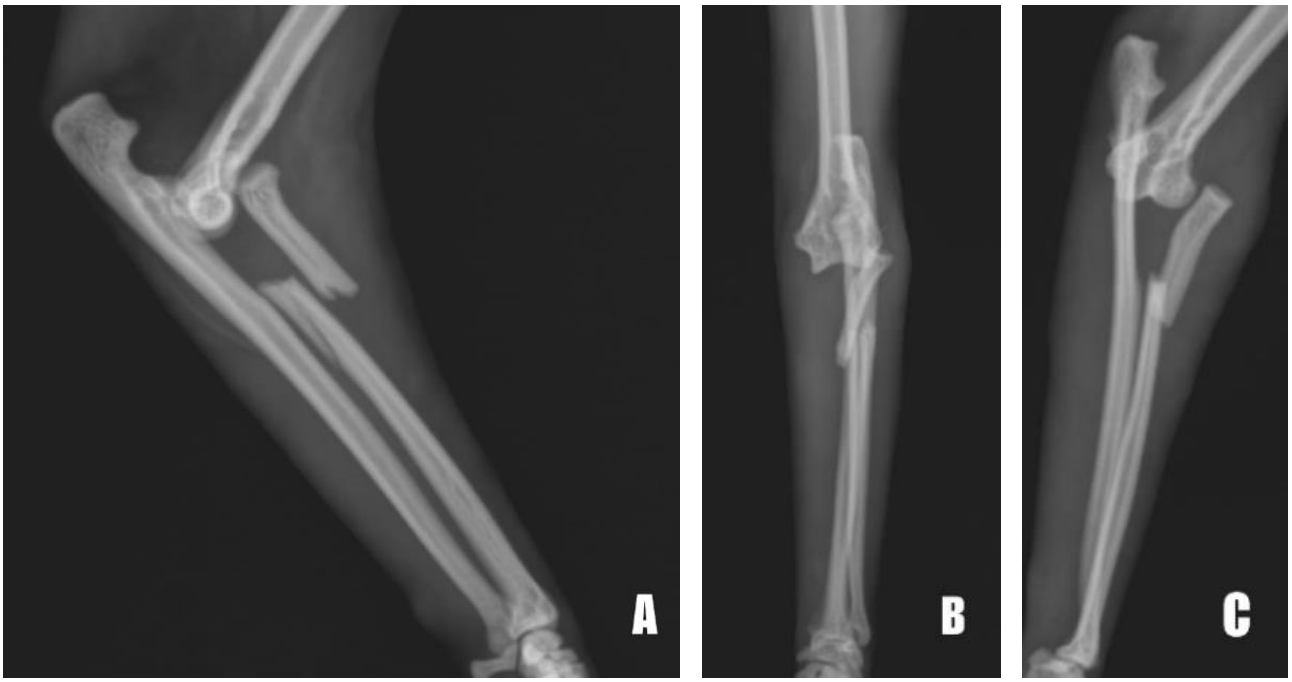

Figure 1. Preoperative radiographs of the left elbow joint.
A. M/L (Medio/lateral) radiography
B. Cr\Ca (Cranio/Caudal) radiography
C. Cr-M \ Ca-L (Cranio-medial / Caudo-lateral oblique) radiography.

DOI: 10.33988/auvfd.1158729

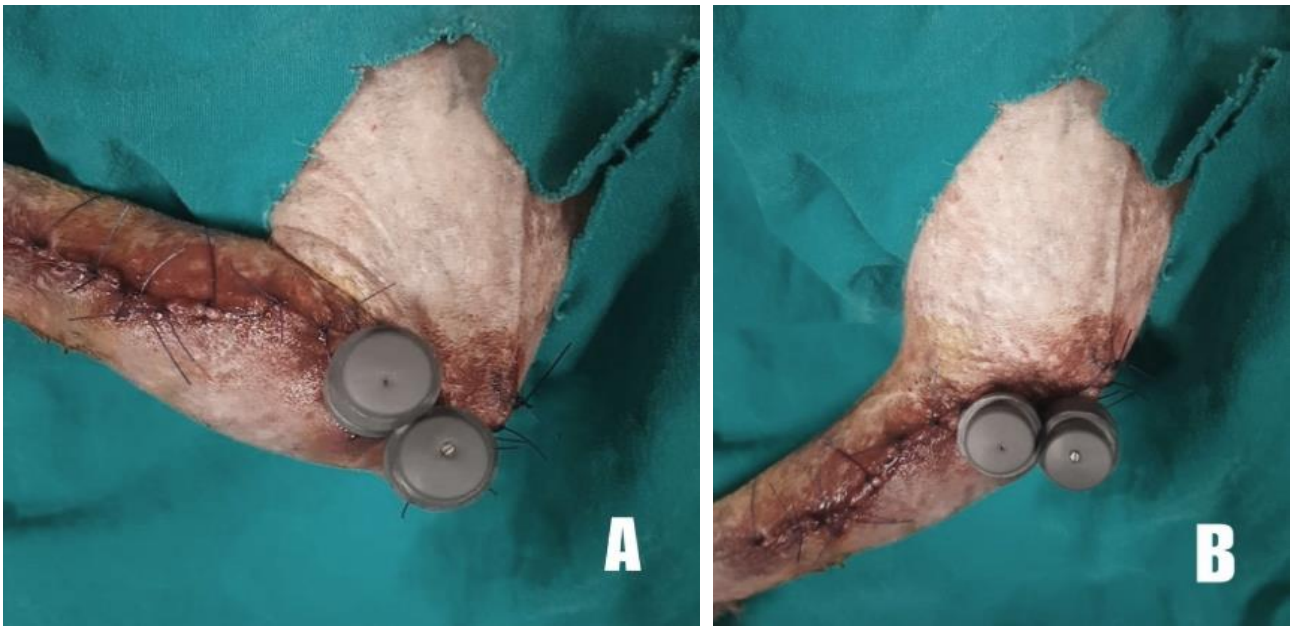

Figure 2. Postoperative view of the elbow joint.
A. 30 ± 5° flexion
B. 150 ± 5° extension.

Figure 3. Long-term radiographic follow-up at 1 year after surgery, radiographs show a bony ankylosis of the left elbow involving the humero-ulnar joint.
A. Immediately post-operative M/L radiography
B. 10 days postoperatively M/L radiography
C. 1 year postoperatively M/L radiography.

The fixator was removed on the 10th postoperative day, and the flexion angle of the elbow joint was measured as 45 ± 5° and the extension angle 140 ± 5°. The patient was reassessed 4 weeks postoperatively, and the flexion angle was measured as 65 ± 5°, the extension angle as 125 ± 5°. The last postoperative follow-up examination occurred 1 year after surgery. A humero-ulnar ankylosis of the elbow joint with 110° of the extension was observed (Figure 3 and Figure 4).

Traumatic elbow dislocation is an uncommon orthopedic disorder observed in cats and dogs (1, 3, 6, 8, 13). Direct and indirect forces applied to the elbow typically cause articular or periarticular fractures rather than luxations. Elbow dislocation is frequently the result of vehicle trauma and is thought to result from the indirect effect of rotational forces (3). Even though luxation can occur in the lateral or medial direction, more than 90% of luxations occur laterally (1-3, 6, 8).

Various open techniques have been described for the treatment of elbow dislocations. However, better results are obtained if the joint is stable after closed reduction (1). A dislocated elbow should be reduced as soon as possible under general anesthesia. The Campel test should be performed to assess collateral stability after closed reduction. Open reduction should be considered if the joint cannot be reduced or if instability is evident after closed reduction (1, 3-6, 8, 13). However, the requirement for surgical intervention when only mild instability follows reduction is also controversial (11). In this case report, open reduction was preferred since the patient was

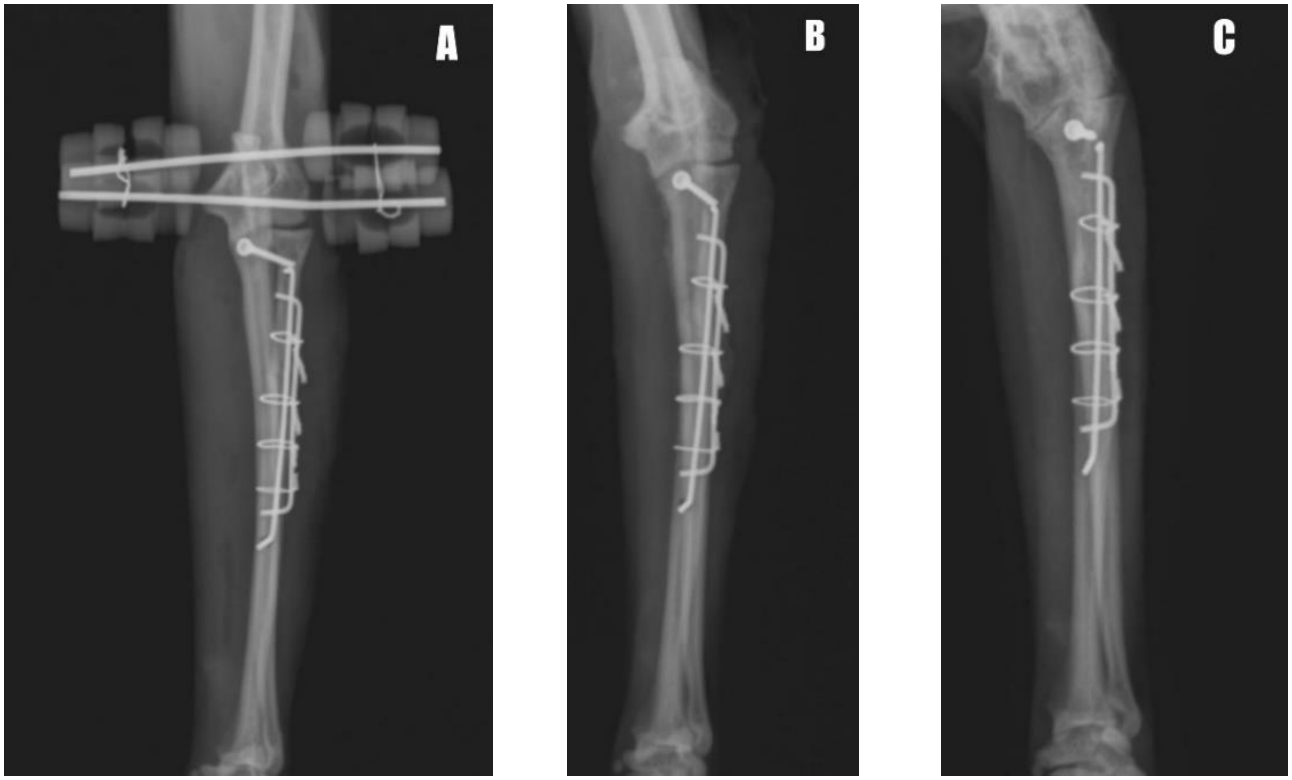

Figure 4. Long-term radiographic follow-up at 1 year after surgery, radiographs show a bony ankylosis of the left elbow involving the humero-ulnar joint.

A. Immediately post-operative Cr/Ca radiography
B. 10 days postoperatively Cr/Ca radiography
C. 1 year postoperatively Cr/Ca radiography.

presented 10 days after trauma and radius fracture detected accompanying the elbow dislocation.

Treatment options for traumatic elbow dislocation include closed and open reduction. Immobilization of the joints for at least 2 weeks is recommended to prevent reluxation, and therefore external coaptation is often used. When joint immobilization is applied for more than 2 weeks, it causes to joint stiffness and degenerative joint disease (7, 9). On the other hand, continuous passive movement is recommended during the postoperative care period (9, 10). In studies using elastic transarticular external fixator (ETEF) in the treatment of elbow dislocation, rigid bars were used in the first days until the post-operative swelling decreased, then the bars were replaced with elastic bands (9, 12). In this study, only cerclage wires were used as a bar until the fixator was removed and no complication had occurred, such as reluxation.

Although cats and dogs have a similar collateral ligament anatomy, the cat's anconeal process is relatively smaller than that of dogs. In spite of this, one study reported that after transection of the collateral ligaments (CLs), feline elbows luxated significantly less consistently than canine elbows (3, 11). A biomechanical study of canine elbows reported that elbows retain their original stiffness after MCL section. The same study reported that suture repair failed in all elbows after MCL section. Therefore, external coaptation or external fixation is recommended for the elbow joint after MCL repair (3, 11). Nonetheless, the importance of CL deficiency in traumatic elbow dislocations is still discussed (11). In this case report, a complete rupture of MCL was detected, but it has not been repaired. After the reduction of the articulatio humeroulnaris, CTEF was applied and the ulna was fixed to the radius with a cortical screw. Pin tract drainage or pin loosening, which is frequently encountered in the external fixators, was not observed in this study due to the short-term use of the external fixator.

Recent studies have reported varying degrees of osteoarthritis as a result of open or closed reduction. Although ROM decreased in these patients, it was reported that patients tolerated it well (1, 4). The patient was reassessed 10 days postoperatively. Mild osteoarthritis and decresed ROM were observed. The last postoperative follow-up examination occurred 1 year after surgery. A humero-ulnar ankylosis of the elbow joint with 110° of the extension was revealed. There was a obvious lameness on the left thoracic limb, especially while running. However, the elbow joint was pain free, and the

patient continued with its daily activities without any obvious limitation.

In this case report, the post-operative long-term clinical and radiographic results were not as expected. To the best of our knowledge, the long-term fair clinical outcome with the development of elbow osteoarthritis, could be explained by the inability to perform surgery at the desired time, the severity of the trauma, and cartilage damage. However, further cases are required to determine whether this procedure is optimal for the treatment of traumatic elbow luxation in cats.

Financial Support

This research received no grant from any funding agency/sector.

Conflict of Interest

The authors declared that there is no conflict of interest.

Author Contributions

SU is the primary author who planned, designed the writing of the work, and supervised all procedures. FQ, MY-D, and AD contributed to case management and manuscript preparation. AB contributed to manuscript review and editing.

Data Availability Statement

The data supporting this study's findings are available from the corresponding author upon reasonable request.

Ethical Statement

This study does not present any ethical concerns.

Animal Welfare

The authors confirm that they have adhered to ARRIVE Guidelines to protect animals used for scientific purposes.

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