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TREATMENT OPTIONS FOR TRAUMATIC LESIONS OF THE ARTICULATIO CUBITI IN CATS: A RETROSPECTIVE STUDY

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Abstract. The aim of this study was to evaluate treatment options for traumatic lesions of the articulatio cubiti in cats. A total of 18 cats of both sexes, varying breeds and ages, were brought to the clinic with elbow joint lesion. Condylus humerii fracture was determined in 11 cats, supracondyler humerus fracture in 1, Monteggia lesion in 5, and articulatio cubiti luxation in 1. Together with condylus humerii fracture, a distal diaphyseal humerus fracture was determined in 2, distal humerus fracture in 1, and metaphyseal humerus fracture in 1. In the treatment of the lesions, the following were used: splint and bandage in 1 case, the combination of Kirschner wire and cerclage wire in 8 cases, K-wire alone in 2 cases, cortical screw in 1, K-wire+cerclage wire+cortical screw in 1, K-wire and cortical screw in 1, cortical screw and cerclage wire in 1, Steinmann pin+K-wire+cerclage wire in 1, paraosseous clamp and stabilisation with cerclage wire in 1, and plate + cortical screw + cerclage wire in 1. After the completion of the postoperative follow-up period, functional healing was determined to have been obtained in 16 cats, and the other 2 could not be followed up postoperatively.

Keywords: *Articulatio cubiti, cat, lesion, trauma, treatment.*

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1. Introduction

Various traumatic lesions are seen very frequently in cats. The most common traumatic lesion is fracture, followed by soft tissue damage and joint injuries (Fossum, 2012).

Lesions of the elbow joint ligaments can be evaluated as joint luxation, intra-articular fractures, and traumatic lesions of the articulatio cubiti in open joint fractures. Whatever the type of lesion in the joint, disruption of the joint integrity or structure causes osteoarthritis and functional loss of the joint (Montavon *et al*., 2009). To be able to avoid permanent damage, joint lesions in cats must be treated quickly. It should be aimed to minimise wear and stress than can occur in the joint surface of abnormalities in the joint integrity associated with trauma (Piermattei *et al*., 2006).

Condylus humerii fractures may be unicondylar or dicondylar. These types of fractures can be due to several causes, ranging from severe trauma such as traffic accidents to mild trauma such as sudden jumping or falling. In some studies, it has been reported that 88-90% of unicondylar fractures occur as a result of minor traumas. The majority of dicondylar fractures result from severe trauma. Whether unicondylar or dicondylar, as these fractures are related to the joint, obtaining full anatomic reduction is of great importance in the treatment. It is important that the rigid fixation to be

applied allows early weight-bearing. It must not be forgotten that in comparison with unicondylar fractures, the reduction and fixation of dicondylar fractures is more difficult (Tomlinson, 2003).

The lateral humerus of the condylus humeri is the section most damaged by traumatic effects, and condylus fractures occur most often in this section (Denny & Butterworth, 2000; Fossum, 2012; Piermattei *et al.*, 2006). This situation is due to the fact that body weight first transfers from the caput radius which is articulated with the epicondylus lateralis humeri and the anatomic position of the epicondylus lateralis (Fossum, 2012).

Due to the structure and presence of periarticular muscular and ligamentous structures, fractures of the epicondylus medialis humeri have been reported at a lower rate than in the distal humerus or proximal radius. Luxation of the elbow joint in cats is not a very frequently encountered condition, and the effect of direct or indirect forces on the region results more in periarticular or articular fractures. As the tendency for fracture formation in the anatomic structures of this region is higher than the tendency for luxation of the cubiti joint, Monteggia lesions occur, which are fracture and dislocation together (Dassler & Vasseur, 2003; Denny & Butterworth, 2000; Williams *et al*., 2020).

More than 50% of traumatic cubiti luxations are associated with collateral ligament ruptures. In many traumas, the fracture may be in the form of avulsion by rupturing of the insertion of the flexor and extensor muscles together with the humeral condylus (Dassler & Vasseur, 2003). Although there are recent studies of dogs which have evaluated the long-term results of closed and open reduction techniques applied in the treatment of traumatic elbow joint luxations (Sajik, 2016), there are few studies of cats (Williams *et al*., 2020).

The aim of this study was to evaluate the treatment options for traumatic lesions of the articulatio cubiti in cats.

2. Material and Method

A total of 18 cats of both sexes, varying breeds and ages, were brought to the clinic with the complaint of not being able to use the affected extremity and as a result of clinical and radiological examinations were diagnosed with elbow joint lesion. In the treatment of these cases, in addition to the routine soft tissue and orthopaedic surgical sets, Kirschner wires (K-wire) of varying thicknesses and lengths, Steinmann pins, cortical screws, mini bone plates and cerclage wires were used.

A detailed anamnesis was taken from the owner before the animal was clinically examined. By making a detailed systemic examination, the general condition was evaluated. In all cases, after ensuring that the general condition was stable, two-way radiographs were taken of the affected extremity in the anteroposterior (A/P) and mediolateral (M/L) positions. Preoperative planning was made by evaluating the radiographs. Food was withdrawn 8 hours before the operation, and water was restricted at 4 hours, then the animals were admitted for surgery.

Premedication was administered as an intramuscular injection of 35µg/kg medetomidine hydrochloride (Domitor®, Zoetis), then 10-15 mins later, general anaesthesia was provided with intramuscular ketamine HCL 10% (Ketasol® 10%, Richterpharma) at a dose of 4-5 mg/kg. When necessary, a maintenance dose was administered during the operation.

Following general anaesthesia, routine preparation was applied to the operation region, which was bordered with sterile cloths.

Approach:

In cases applied with a lateral approach, a skin incision was made from the distal third of the humerus, extending to 4-5 cm distal of the joint by directing it cranial of the epicondylus lateralis. After dissecting subcutaneous tissue, the deep fascia of the cranial border of the m. triceps brachii was incised. An incision was made to the intermuscular septum between the m. extensor carpi radialis and the m. extensor digitalis communis. The incision was continued proximally as far as the periosteal origin of the m.extensor carpi radialis. To be able to expose the joint capsule and the condylus lateralis, the muscle was retracted in the cranial direction. The joint capsule was incised in an "L" shape and the condylus lateralis was reached.

To reach the condylus medialis medial of the humerus, the skin and subcutaneous tissues over the disto-medial of the bone were incised. Subcutaneous fat tissue was bluntly dissected, then after retracting vessels and nerves, the region was reached.

An incision was made from the lateral of the condylus humeri to reach the proximal radius, and the incision was advanced as far as the proximal third of the radius. Subcutaneous tissues and fascia in the region were dissected. By separating the m. extensor digitalis lateralis and the m.ulnaris lateralis, the proximal radius was exposed.

The skin and subcutaneous tissue in the caudoproximal of the ulna were incised. To be able to expose the bone surface, the m. flexor digitalis profundus and m. flexor carpi ulnaris were retracted. The trochlear notch was exposed by retracting the m. flexor carpi ulnaris origin to the edge.

Postoperative care:

To treat the fracture in a case with non-dislocation of the condylus humerus (case no.1), a splinted bandage was applied together with rest in a cage. The splint and bandage were removed after 21 days, and the owner was instructed to limit the cat's movements for a further 10-day follow-up period. Clinical and radiological follow-up examinations were made at certain intervals. All the cases that were operated on were administered broad spectrum antibiotics for 7 days postoperatively.

The cases were called to the clinic for clinical and radiographic follow up on postoperative days 10, 21, 30, and 45. After clinical examination, radiographs were taken in the A/P and M/L positions. Skin sutures were removed on postoperative day 10, and the splinted bandages providing extra support were renewed until removal on postoperative day 21.

With the exception of cerclage wires, all the other implants were removed after 45-55 days. As case no. 7 could not be followed up, the implants could not be removed, and in case no 17, the implants could only be removed on postoperative day 61.

3. Results

The study included a total of 18 cats of various breeds; 2 Ankara (case nos. 1, 3), 1 Persian (case no. 4), 12 mixed breed (case nos. 2, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 18), 2 Siamese (case nos. 12, 17) and 1 Scottish fold (case no. 13). The sex distribution of the cats was 7 female and 11 male. The details of the breed, age, sex, lesions, implants used in treatment and the treatment results of the study animals are shown in Table 1.

Table 1. The breed, age, sex, lesions, implants used in treatment and the treatment results of the cases

Case No	Age	Sex	Breed	Lesion	Treatment	Results
1	1 Years	F	Ankara	Condylus Humerii Fracture	Splinted Bandage	Functional healing obtained.
2	10 Months	M	Mixed breed	Condylus Humerii Fracture	Kirschner wire+ Cerclage wire	Joint stiffness was determined in the affected joint. Functional healing obtained.
3	5 Months	M	Ankara	Condylus Humerii Fracture	Kirschner wire+ Cerclage wire	Functional healing obtained.
4	2 Years	F	Persian	Supracondylar humerus Fracture	Kirschner wire	Functional healing obtained.
5	4 Months	M	Mixed breed	Condylus Humerii Fracture+ Distal Diaphyseal Humerus Fracture	Kirschner wire+ Cerclage wire	Functional healing obtained.
6	6 Months	M	Mixed breed	Condylus Humerii Fracture	Cortical screw	Functional healing obtained.
7	2 Years	M	Mixed breed	Monteggia Lesion	Kirschner wire+ Cerclage wire+ Cortical screw	Could not be followed up.
8	10 Months	F	Mixed breed	Condylus Humerii Fracture+Distal Humerus Fracture	Kirschner wire+ Cortical screw	Restriction in joint movement. Functional healing obtained.
9	3 Years	F	Mixed breed	Condylus Humerii Fracture	Kirschner wire+ Cerclage wire	Functional healing obtained.
10	2 Years	M	Mixed breed	Monteggia Lesion	Kirschner wire+ Cerclage wire	Functional healing obtained.
11	7 Months	F	Mixed breed	Condylus Humerii Fracture+Humerus metaphyseal fracture	Kirschner wire+ Cerclage wire	Functional healing obtained.
12	3 Years	M	Siamese	Art. Cubiti Luxation	Cerclage wire+ Cortical screw	Stiffness in the joint. Restriction in joint movement. Long-term results unknown.
13	2,5 Years	M	Scottish Fold	Condylus Humerii Fracture	Kirschner wire	Functional healing obtained.
14	1,5 Years	M	Mixed breed	Condylus Humerii Fracture	Kirschner wire+ Cerclage wire	Functional healing obtained with normal extension angle and limited flexion angle.
15	2 Years	F	Mixed breed	Condylus Humerii Fracture+ Distal Diaphyseal Humerus Fracture	Steinmann Pin + Kirschner wire + Cerclage wire	Restriction in joint movement. Functional healing obtained.
16	1 Years	M	Mixed breed	Monteggia Lesion	Kirschner wire+ Cerclage wire	Restriction in joint movement. Functional healing obtained.
17	5 Months	F	Siamese	Monteggia Lesion	Paraosseous clamp + Cerclage wire	Limited flexion and extension angles. Functional healing obtained.
18	1,5 Years	M	Mixed breed	Monteggia Lesion	Plate + Cortical screw + Cerclage wire	Functional healing obtained.

The lesions were determined as 11 (case nos. 1, 2, 3, 5, 6, 8, 9, 11, 13, 14, 15) condylus humerii fracture, 1 (case no. 4) supracondylar humerus fracture, 5 (case nos. 7, 10, 16, 17, 18) Monteggia lesion, and 1 (case no. 12) articulatio cubiti luxation.

Together with condylus humerii fracture, a distal diaphyseal humerus fracture was determined in 2 (case nos. 5, 15), distal humerus fracture in 1 (case no. 8), and metaphyseal humerus fracture in 1 (case no. 11).

In the treatment of the lesions, the following were used: splint and bandage in 1 (case no. 1), the combination of K-wire and cerclage wire in 8 (case nos. 2, 3, 5, 9, 10, 11, 14, 16), K-wire alone in 2 (case nos. 4, 13), cortical screw in 1 (case no. 6), K-wire+cerclage wire+cortical screw in 1 (case no. 7), K-wire and cortical screw in 1 (case no. 8, Figure 1), cortical screw and cerclage wire in 1 (case no. 12), Steinmann pin+K-wire+cerclage wire in 1 (#15), paraosseous clamp and stabilisation with cerclage wire in 1 (case no. 17, Figure 2), and plate + cortical screw+cerclage wire in 1 (case no. 18, Figure 3).

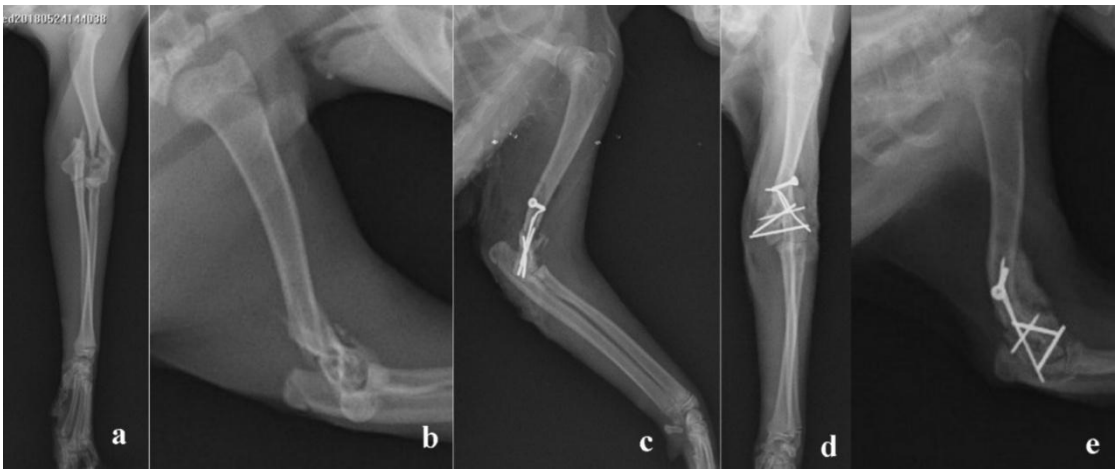

Figure 1. Case no 8 radiographs: **a** and **b.** preoperative, **c** and **d.** postoperative day 10, **e.** postoperative day 45

Figure 2. Case no 17 radiographs: **a** and **b.** preoperative, **c** postoperative day 30, **d.** postoperative day 61

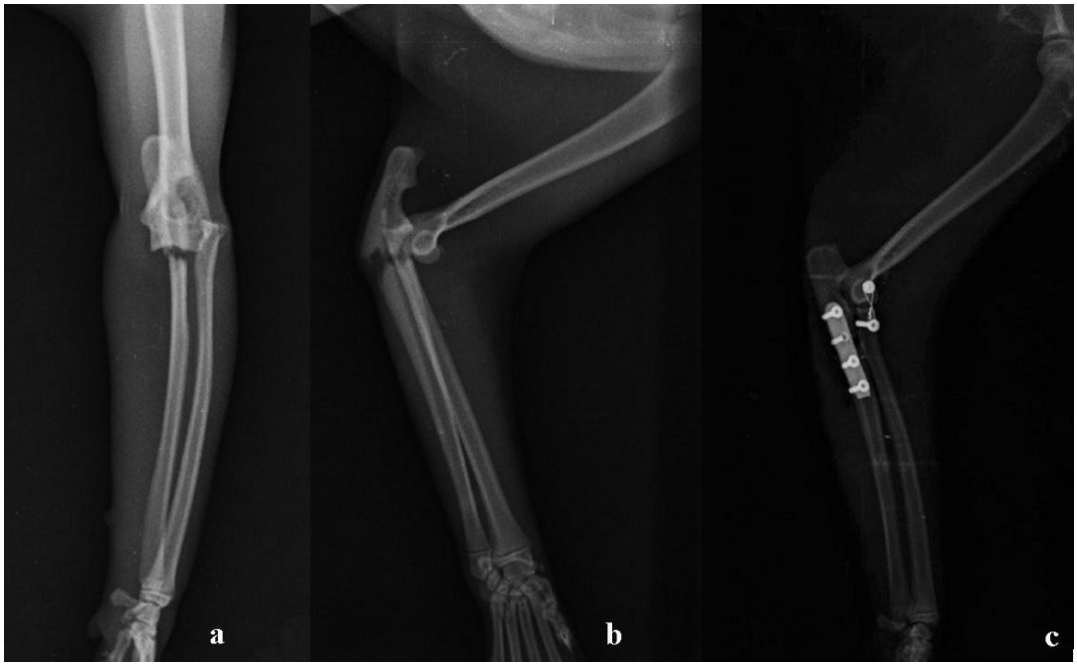

Figure 3. Case no 18 radiographs: **a** and **b.** preoperative, **c.** postoperative day 21

In case numbers 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 13, 14, 14, 16, 17, and 18, functional healing was observed after completion of the postoperative follow-up period. Case no. 7 could not be followed up. In case no. 12, joint stiffness and restricted joint movement were determined in the postoperative period, but long-term postoperative follow up could not be made of this case.

Of the cases that obtained functional healing, joint stiffness was determined in case no. 2, and limited joint range of movement was observed in case nos. 8, 14, 15, 16, and 17.

4. Discussion

In cases where there is a simple fissure or fragments are not displaced, there is no significant deformation in the bone, and especially in greenstick fractures in rachitic animals where there is no angulation in fragments, spontaneous recovery can be achieved without complications with rest in a large cage for at least two weeks (Aslanbey, 2002).

In one case of the current study (case no.1) with a non-dislocated fracture of the condylus humerus, a splinted bandage was applied with the recommendation of rest for 21 days in a cage. When the splint and bandage were removed after 21 days, movement restriction was continued for a further 10-day period. In the clinical and radiographic examinations at the end of this period, the animal was able to place weight on the affected extremity and functional healing was observed to have been achieved.

Fixation of supracondylar fractures with K-wire was first used in small and growing dogs. Compared to the use of plates, fixation with the cross pin method of K-wires has been found to have a less negative effect on both the bone and soft tissue (Mattern & Lewis, 2008). The prognosis is doubtful in bicondylar humerus fractures. Complications often develop such as fixation failure, re-fracture, and the development of post-traumatic osteoarthritis. In a previous study of surgically treated cats and dogs,

satisfactory results were reported in only 52% of the determined dicondylar humerus fractures (Mattern & Lewis, 2008).

A decrease in movement ability is observed postoperatively in condylar fractures, and these types of fractures require postoperative rehabilitation (Simpson, 2004). In the current study, 5 cases (case nos. 4, 5, 8, 11, 15) determined with condylus humerii fracture including the supracondylar region, benefitted from K-wires in treatment. In all of these cases, no finding was observed of local skin or subcutaneous damage in the postoperative clinical and radiographc examinations. However, in case nos. 8 and 15, when the supportive bandages were removed in the early postoperative period, mild angulation was determined to have developed in the condylus humerii because weight had been placed on the affected extremity. There was no need for further intervention in these cases and they were left for union. On postoperative day 45, all the cases could use the affected extremity, but in both of these cases there was observed to be limited range of joint movement.

5. Conclusion

Traumatic lesions of the articulatio cubiti are seen very frequently in cats. These lesions require treatment as soon as possible to be able to avoid permanent function loss and joint damage. The prognosis may be poor for intra-articular fractures including the condylus humerii. Therefore, in addition to full anatomic reduction of fragments and the selection of rigid fixation method, it must not be forgotten that postoperative care and follow up are also important.

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