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RESEARCH ARTICLE

Evaluation of Conservative Treatment or Osteosynthesis in the Treatment of Cats with Metacarpal and/or Metatarsal Fractures: A Retrospective Study

Halil Caltiner, Iremsu Satici, Mustafa Arican*

Selçuk University, Faculty of Veterinary Science, Department of Surgery, Konya, Türkiye

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*marican@selcuk.edu.tr

Metacarpal ve/veya Metatarsal Kırığı Bulunan Kedilerin Tedavisinde Konservatif Sağaltım veya Osteosentez Uygulamasının Değerlendirilmesi: Retrospektif Çalışma

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Öz

Amaç: Sunulan çalışmada, kedilerde travma kaynaklı metacarpal (MC) ve/veya metatarsal (MT) kemik kırıklarının tedavisinde uygulanan konservatif tedavi ve osteosentez yöntemlerinin avantajlarını, dezavantajlarını ve postoperatif sonuçları değerlendirmektir.

Gereç ve Yöntem: Araştırma, 2022 ve 2023 yılları arasında farklı ırklara, cinslere ve yaşlara sahip elli iki kedinin, metacarpal ve/veya metatarsal kemik kırıklarıyla başvurduğu bir örneklemeyi kapsamaktadır. Bu vakaların kırk altısına konservatif tedavi uygulanırken, geriye kalan altı vakaya ise osteosentez uygulandı.

Bulgular: Konservatif tedavi uygulanan grupta, 29 vaka (%63,04), 6 haftalık muayenede topallık belirtisi göstermeyerek, sorunsuz bir iyileşme sergiledi. Buna karşılık, geriye kalan 17 vakada (%36,96) 6 haftalık kontrolde hafif topallık görüldü. On iki aylık kontrolde, 43 vaka (%93,47) sorunsuz bir yürüyüş sergilerken, sadece 3 vakada (%6,53) ara sıra hafif topallık yaşandı. Öte yandan, osteosentez uygulanan kediler arasında, 2 vaka (%33,3) komplikasyonsuz bir iyileşme gösterirken, 4 vakada (%66,6) postoperatif sorunlar ortaya çıktı. Komplikasyonsuz bir vakada (%50), 6 haftalık muayenede hafif topallık belirlenirken, diğer vakada (%50) ara sıra hafif topallık görüldü. On iki aylık muayenede ise tüm vakalar sorunsuz yürüyüş sergiledi.

Öneri: Konservatif tedavi, MC ve MT kırıklı kedilerde beklenen iyi sonuçları elde etmek için hem tek başına hem de osteosentez uygulamalarının başarısız olduğu durumlarda kullanılabilen bir yöntemdir. Ancak, çalışmada incelenen cerrahi vakaların sınırlı olması, bulguların geneli üzerinde kısıtlamalara neden olmaktadır.

Anahtar kelimeler: Kedi, Konservatif sağaltım, Metacarpal kırıklar, Metatarsal kırıklar, Osteosentez

Abstract

Aim: This study aims to assess the merits, drawbacks, and postoperative outcomes associated with conservative treatment and osteosynthesis methods employed in managing metacarpal (MC) and/or metatarsal (MT) bone fractures resulting from trauma in cats.

Materials and Methods: The research encompassed a sample of fifty-two cats of varying breeds, genders, and ages, all presenting with metacarpal and/or metatarsal bone fractures between 2022 and 2023. Conservative treatment was administered in 46 cases, while osteosynthesis was applied in the remaining 6 cases.

Results: In the group treated conservatively, 29 cases (63.04%) exhibited no signs of lameness at the 6-week examination, indicating a successful recovery with unimpeded mobility. In contrast, mild lameness was observed in the remaining cases (36.96%) at the 6-week check-up. Upon reassessment at the 12-month examination, 43 cases (93.47%) demonstrated unimpeded walking, with only 3 cases (6.53%) experiencing occasional mild lameness. Conversely, 2 cases (33.3%) showed a complication-free recovery among the cats undergoing osteosynthesis, while postoperative issues emerged in 4 cases (66.6%). In one complication-free case (50%), mild lameness was noted at the 6-week examination, and in the other case (50%), occasional mild lameness was observed. Importantly, all cases exhibited uneventful walking during the 12-month assessment.

Conclusion: Conservative treatment proves to yield favorable outcomes in cats, both independently and when osteosynthesis applications fall short. However, the limited number of surgical cases examined in the study constrains the findings' generalizability.

Keywords: Cat, External coaptation, Metacarpal fractures, Metatarsal fractures, Osteosynthesis .

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Introduction

A significant problem in dogs and cats is orthopedic conditions, particularly bone fractures (Arıcan, 2020; Ferrero et al., 2020; Hudson et al., 2020). They are usually the result of trauma, the most common of which are road traffic accidents and falls. (Harari, 2002; Lefman & Prittie, 2022). Metacarpal and metatarsal injuries are common in small animals following car crashes, falls, and kicks (Phillips, 1979; Lössein, 1982; Degasperi et al., 2007). Lower extremity injuries are diagnosed in 10% of cats with high-rise syndrome (Boudrieau, 2004). Gunshot wounds, bites, mowing, and trapping injuries have also been observed as causes (Lössein, 1982). Fractures of the metacarpals and metatarsals are common in cats. There is an almost equal distribution of metacarpal and metatarsal fractures, although a trend towards a higher incidence of metacarpal fractures has been reported (Manley, 1981; Muir and Norris, 1997). One report found that the metacarpal and metatarsal represented 8.1 % of canine fractures and 3.3 % of feline fractures (Phillips, 1979). Fractures of the metacarpal and metatarsal bones are classified according to their location (e.g., base or proximal end of the bone, shaft, or diaphysis; head or distal end of the bone). Avulsion fractures of the base occur most often on the second and fifth bones because of their ligamentous insertions (Fossum, 2018). Often, clinicians are conflicted about using open reduction or external bandages. In particular, It must assess the ischaemia that can occur after surgery and the damage it can cause. However, hyperflexibility is also seen as a complication of a dislocated fracture. For this reason, clinicians are divided into two groups. Some recommend conservative treatment. Others recommend surgery. They may result from a direct blow or force to the paw or hyperextension injuries (Fossum, 2018). Most fractures are transverse or oblique (Lösslein, 1982; Muir and Norris, 1997). The most common involvement is in the mid to distal metacarpal or proximal metatarsal (Muir and Norris, 1997 ; De La Puerta et al., 2008). Fractures of the metacarpals and metatarsals are often open due to the lack of surrounding soft tissue (Seibert et al., 2011). There is little evidence-based medicine supporting this, although recommendations have been made on the optimal treatment and management of metacarpal and metatarsal fractures (Wernham and Roush, 2010).

Management options for metacarpal and metatarsal fractures include external fixation with various types of splints and various surgical procedures (Manley, 1981; Lösslein, 1982; Muir and Norris, 1997; Okumura et al., 2000; Arıcan, 2020) such as plating (von Werthern et al., 2000), intramedullary nailing (Benedetti et al., 1986) and dowel pinning (Karslı, 2022; Zahl et al., 2007). There is conflicting evidence regarding how these fractures should be treated. However, there is agreement on the conservative management of slightly displaced fractures of a single bone. Surgical treatment is recommended (Wind, 1976; Early and Dee, 1980; Manley, 1981; Lösslein, 1982; Anderson et al., 1993 ; Muir and Norris, 1997) in cases where more than two bones are fractured and when the main weight-bearing third and fourth metacarpal and metatarsal bones are involved.
This study aims to evaluate the advantages, disadvantages, and postoperative results of conservative treatment or osteosynthesis methods in treating metacarpal and/or metatarsal bone fractures resulting from trauma in cats.

Material and Methods

Data

Fifty-two cats of different breeds, sexes, and ages presenting with metacarpal and/or metatarsal fractures (Table 1) were admitted and evaluated to the Small Animal Clinic between 2022 and 2023. Metacarpal (Table 2) and metatarsal fractures (Table 3) were treated with two options. External coaptation treatment was performed in 46 cases, and surgical procedures were performed in 6 cases (Table 4). Cats were excluded from the study if there was any orthopedic condition/injury besides the metacarpus and metatarsus fracture under investigation (Figure 1 and 2) or any medical condition likely to affect mobility. Patients who were willing to undergo surgery and use anaesthetics for external coaptation were included. Permission was obtained from the clients before the application and information was given. The study was carried out with the permission of Selcuk University, Faculty of Veterinary Medicine, Animal Experiments Local Ethics Committee dated 02.11.2023 and numbered 2023/124.

Clinical examination

The primary symptoms of a cat with metacarpal and/or metatarsal fractures were unilateral or bilateral severe lameness and inability to use the affected limb. Clinical examination revealed pain, deformity, crepitation, and limited or abnormal movement of the affected limb. The patients were called for post-treatment examination after one week- 6 weeks. On twelve months, information was collected by phone from the animal owners for the cases.

Lameness scoring

A score of 0 meant that the cat was able to perform the activities without any difficulties; a score of 1 meant that the cat had slight and occasional difficulties performing the activities; a score of 2 meant that the cat had slight but frequent difficulties performing the activities; a score of 3 meant that the cat had significant and permanent difficulties performing the activities; and a score of 4, the highest score, meant that the cat was unable to perform the activities (Yap et al., 2015).

Radiological examination

The cats' radiological examinations (Sp-HF-4.0 Ralco Spain;

Table 1. All cases shown with age, sex, affected bones and type of fracture

Case No	Breed	Age	Sex	Metacarpal Fracture	Metatarsal Fracture
1	British Fold	9 Month	Female	+	
2	British Fold	1 Year	Male	+	
3	Tuxedo	2 Year	Female	+	+
4	Tabby	3 Year	Female	+	+
5	Mixed	11 Month	Female	+	
6	Tabby	1,5 Year	Male	+	
7	Tabby	4 Year	Male		+
8	Tabby	1 Year	Male	+	
9	British Fold	5 Year	Female	+	
10	Ankara	3 Year	Male	+	
11	Norwegian Forest Cat	8 Month	Female	+	
12	Chinchilla	8 Month	Male	+	
13	Tabby	1,5 Year	Male	+	
14	Tabby	11 Month	Female	+	
15	Mixed	8 Month	Female	+	
16	British Fold	8 Month	Male	+	
17	British Fold	10 Month	Male	+	
18	Mixed	2 Year	Male	+	
19	British Fold	3 Year	Female	+	
20	Mixed	1,5 Year	Female	+	
21	Scottish	2 Year	Female	+	
22	Ankara	3 Year	Male	+	
23	Scottish Fold	2 Year	Male	+	
24	Mixed	2,5 Year	Male	+	
25	Scottish Fold	6 Month	Female	+	
26	British Fold	1 Year	Male	+	
27	Scottish Fold	4 Year	Female	+	
28	Mixed	1 Year	Male	+	
29	Scottish Fold	1,5 Year	Female	+	
30	Mixed	3,5 Year	Female	+	
31	Mixed	1,5 Year	Male	+	
32	British Fold	2 Year	Male	+	
33	Scottish Fold	2 Year	Male	+	
34	British Fold	1 Year	Male	+	
35	Yellow Cat	11 Month	Male	+	
36	Scottish Fold	5 Month	Female	+	
37	Persian	7 Month	Male	+	
38	British Fold	8 Month	Female	+	
39	Scottish Fold	10 Month	Female		+
40	Tabby	1 Year	Female	+	
41	Scottish Fold	1 Year	Male	+	
42	Mixed	1,5 Year	Female	+	
43	Tabby	1,5 Year	Female	+	
44	Tabby	1 Year	Male	+	
45	British Fold	2 Year	Male	+	
46	Siamese	1,5 Year	Male	+	
47	Tabby	1 Year	Female	+	
48	Tabby	3 Year	Male		+
49	British Fold	1,5 Year	Male	+	
50	British Fold	2 Year	Male	+	
51	Mixed	2,5 Year	Female	+	
52	British Fold	2 Year	Male	+	

Table 2. Metacarpus fractures shown with affected limb and all fractured bones

Case	Left metacarpal (MC)	Right metacarpal (MC)
1		II, III, IV and V
2		III and IV
3		III and IV
4		III, IV and V
5		III and IV
6		IV and V
8	III and IV	
9	III and IV	IV
10	IV	
11	III	
12		III, IV and V
13	IV	IV
14	III and IV	
15	II	II
16	IV	IV
17	III	
18	III and IV	II, III, IV and V
19		III and IV
20	III	III and IV
21	III	
22	IV	
23	II, III and IV	
24		II, III, IV and V
25	II, III, IV and V	II, III, IV and V
26		IV
27	IV	
28		IV
29	III, IV and V	
30		IV
31	IV	IV
32	III and IV	IV
33		IV
34	II, III, IV and V	II, III, IV and V
35	IV	
36		II, III, IV and V
37	III	
38	IV	II, III, IV and V
40		III and IV
41	III and IV	
42	IV	
43		IV
44		II and III
45	III, IV and V	III, IV and V
46	IV	III and IV
47		IV
49		IV
50	III and IV	
51	III and IV	IV
52	III, IV and V	II, III, IV and V

Table 3. Metatarsus fractures shown with all fractured bones

Case	Left metatarsal (MT)	Right metatarsal (MT)
3	II, III, IV and V	
4		II and III
7		II, III, IV and V
39	II	
48	II, III, IV and V	

Table 4. Cases which Surgical procedure performed

Case	Metacarpal bones	Metatarsal Bones
4	-	+
7		+
18	+	
19	+	
46	+	+
48		+

Imago, Abbiategrasso, Milano; Regius Model Konica, Minolta) were performed on pre-op and post-op. X-rays were taken in the craniocaudal position and mediolateral position.

External coaptation

External coaptation was performed with a PVC splint. It was used for sedation with propofol (Propofol-PF 1% 200mg/20ml, Polifarma, Istanbul) (Figure 3 and 4). All owners have been advised to keep their cats in the house until the healing process has been completed.

Surgical procedure

Medetomidin (0.04-0.08 mg/kg) (Domitor, Orion Pharma, Finland) were was administered before general anaesthesia. Anaesthetic was induced with propofol (2-4 mg/kg IV) (Propofol-PF 1% 200mg/20 ml, Polifarma, Istanbul) and maintained with sevoflurane (2.3-3.4%) (Sevoflurane-Baxter, Ankara) at 0.70% inspired oxygen. Cats were ventilated with an end-expiratory positive pressure of 5-7 cm H^2O (tidal volume 10 mL/kg, respiratory rate 18-20/min, target end-tidal CO^2 30-40 mmHg). Clinical assessment and blood and gas levels were continuously monitored. An incision was made over the dorsal surface of the third and fourth bones. Following the incision, dissection of subcutaneous tissue, elevating and retracting the extensor tendons to expose the fractures. A pin is inserted into the distal dorsal surface of the bone to prevent articulation (a high-speed drill is used to create a groove in the bone). The tip of the pin is blunted to prevent penetration of the opposite intact cortex. The pin is inserted through the slot into the proximal bone segment. The distal end of the pin is bent to prevent migration and facilitate removal (Figure 5A-C). The same procedure should be repeated for at least the third and fourth metacarpal and the metatarsal, respectively (Figure 6A-C). For 4 to 6 weeks, the fixation was protected with a splint or cast.

Results

Radiological examination results

Only metacarpal fractures were observed in 47 (90.38%) of the 52 cats included in the study. Bilateral metacarpal fractures were found in 15 (31.91%) of the 47 cats with metacarpal fractures only. Of the 47 cats with metacarpal fractures, 15 (31.91%) only had fractures on the left side. The remaining 17 cats (36.17%) only had metacarpal fractures on the right side. In 47 cats with metacarpal fractures, the total number of MC II fractures was 14 (11.76%), the total number of MC III fractures was 36 (30.25%), the total number of MC IV fractures was 53 (44.53%), and the total number of MC V fractures was 53 (44.53%). The total number of fractures was 16 (13.44%). Again, only metatarsal fractures were observed in 3 of the 52 cats (5.76%) included in the study. There were no cats with bilateral metatarsal fractures. Of the three cats with metatarsal fractures, 2 (66.66%) had a

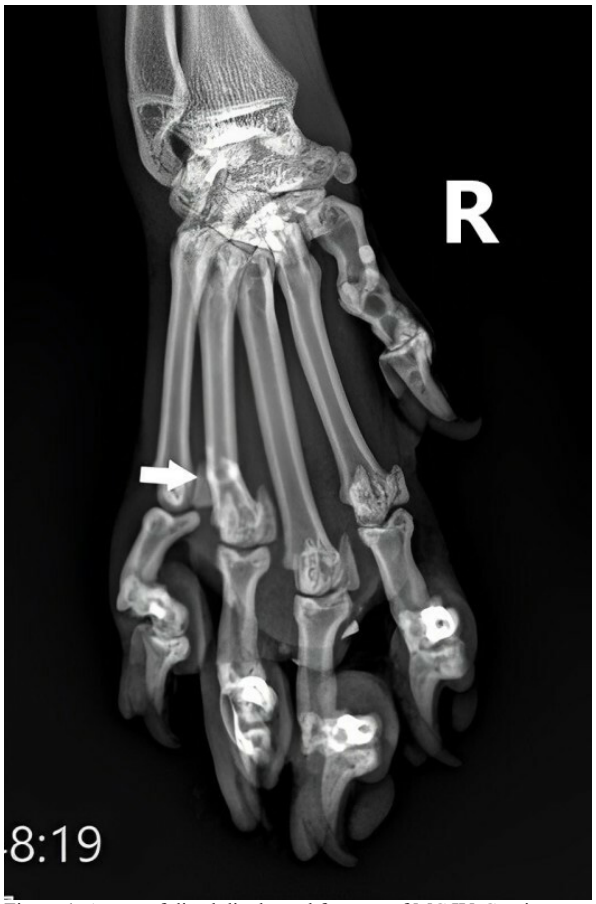

Figure 1. A case of distal diaphyseal fracture of MC IV. Cranio-caudal position (External coaptation group)

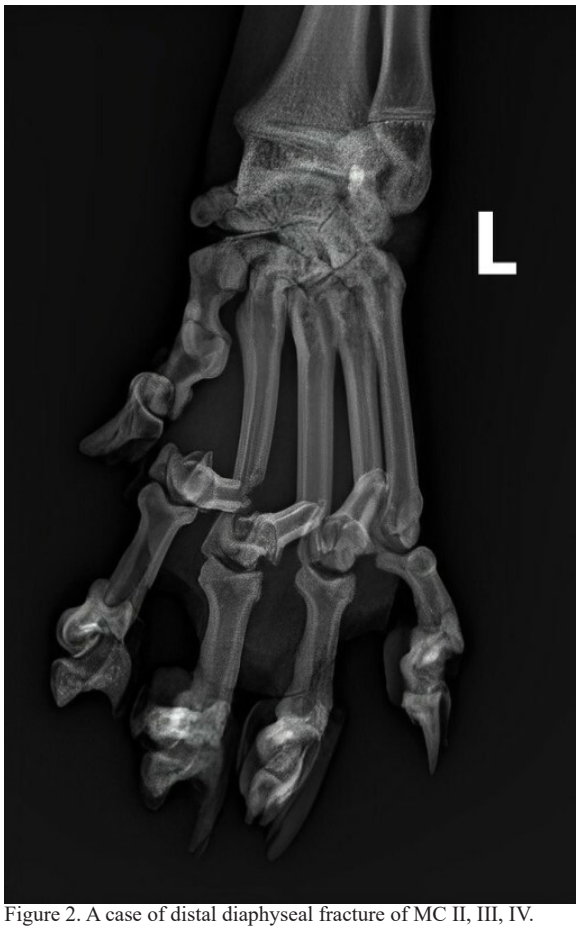

Figure 2. A case of distal diaphyseal fracture of MC II, III, IV. Cranio-caudal position (External coaptation group).

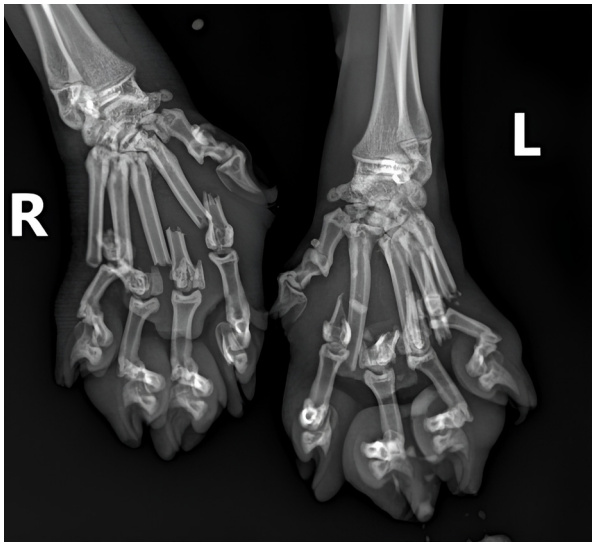

Figure 3. Multiple bilateral fractures, right MC II,III,IV,V and left MC II,III,IV,V treated with external coaptation

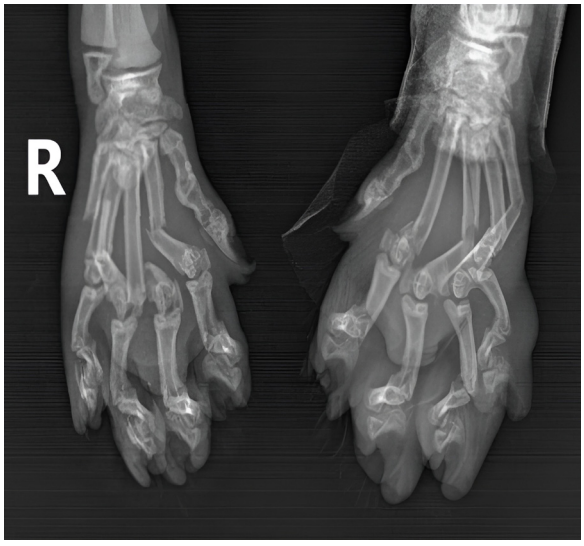

Figure 4. Multiple bilateral fractures, right MC II,III,IV,V and left MC II,III,IV,V treated with external coaptation

fracture on the left only, and 1 (33.33%) only had one on the right. The total number of MT II fractures (33.33%), the total number of MT III fractures 2 (22.22%), the total number of MT IV fractures 2 (22.22%), the total number of MT V fractures 2 (22.22%) were seen in the cases.

Of the 52 cats included in the study, 2 (3.84%) had both metacarpal and metatarsal fractures. In cats with both metacarpal and metatarsal fractures, MC III and MT IV were seen in 2 cats, on the right side only. Only one had a metacarpal V fracture. In the metatarsals, only the right MT

Table 5. External coaptation application results of 6th week and 12th month disability score of cats with excision arthroplasty.

Case No	Post-op 6 weeks	Post-op 12 months	Synostosis	Malunion
1	2	0	+	+
2	2	0	+	+
3	2	0	+	+
5	0	0	+	+
6	0	0		+
8	2	0	+	
9	2	0		
10	0	0		
11	0	0		+
12	0	0	+	+
13	0	0		
14	0	0	+	+
15	0	0		
16	0	0		+
17	0	0		
20	2	0		+
21	0	0		
22	0	0		
23	0	0	+	+
24	2	0	+	+
25	2	1	+	+
26	0	0		
27	0	0		
28	0	0		+
29	2	0	+	+
30	0	0		
31	0	0		+
32	0	0	+	+
33	0	0		
34	2	1	+	+
35	0	0		
36	2	0		+
37	0	0		
38	2	0		+
40	0	0		
41	0	0	+	+
42	0	0		
43	0	0		
44	2	0		
45	2	0	+	+
47	0	0		
49	0	0		
50	0	0	+	+
51	2	0	+	+
52	2	1	+	+

Table 6. Surgical procedure results of 6th weekand 12th month disability score of cats with metacarpal and/or metatarsal fractures

Case	Post-op 6 weeks	Post-op 12 months	Synostosis	Malunion
4	1	0		+
7	2	0	+	
18	1	0	+	+
19	1	0		+
46	1	0	+	+
48	3	0		+

II and MT III were found to be fractured in both cats. MT IV and V fractures were found only on the right side and in one cat.

External coaptation and clinical observation

Cats that underwent external coaptation had their bandages changed weekly following the first application. The extremity was examined at each bandage change. At the end of the fourth week, the bandage was removed, and not re-bandaged. In the group of cats who applied external coaptation, no lameness was observed in 29 cases (63.04%) at the six week examination, and their walking was found to be good. In the other 17 cases (36.96%), mild lameness was observed at the six week examination. At the twelve months examination of the same cases, there was no problem walking in 43 cases (93.47%), and occasional mild lameness was observed in only 3 cases (6.53%) (Table 5).

Surgical procedure and clinical observation

Cats that underwent surgery were bandaged after the operation. Following the first application, the bandage was renewed every week. While the bandage was being renewed, the extremity was reviewed. In 1 case, dermatitis was observed when the next bandage was removed after the first bandage was applied, and re-bandage was not applied. According to the owner's information, no movement restriction was observed during second of the post-operative examination. A radiographic examination showed that pins, which are used to reduce fractured bones, had immigrated. In the third week following the operation, pins were removed from the bones. The owner is advised to aggressively restrict movement after removal of pins from fractured bones. At twelve months, there was no lameness while moving and no pain while palpating (Table 6).

Discussion

Management of metacarpal and metatarsal fractures has been divided into conservative and surgical. The literature gives no evidence of the superiority of either approach for dogs and cats (Scott and McLaughlin, 2006). However, the publications regarding the management of metacarpal bone fractures have not been prospective, resulting in bias in the data. Surgically managed metacarpal bone fractures have not been shown in the published literature to have a better outcome than non-surgically managed cases for five years. However, in the few studies available, surgical management has been performed for the more severe injuries, while the conservatively managed fractures have been the less severe injuries. The literature remains unclear regarding the overall benefits of conservative versus surgical management of metacarpal bone fractures (Scott and McLaughlin, 2006; Gemmill & Clements, 2016).

In the present study, both options were offered to the clients, the advantages and disadvantages of these options were explained, and information was given about the possible prognoses. The clients also made their treatment choices. According to the choice of clients, external coaptation was used in 46 cases, and surgical procedure was used in 6 cases. External coaptation was also used in cases where all metacarpals were fractured, and the success rate was 93,47%. In the present study, 6 cases were treated by surgical procedure. In these cases, fractures and dislocations occurred in all bones. One of the cases had postoperative complications, and the success rate was 83,34% in all. According to the study by Roselló et al. (2022), the success rate found in our study is lower than the data in the literature: %93,54. This result can be partly attributed to the small number of cases. In the present study, the success rate of the surgical procedures (82%) was close to that of Degasperi et al. (2007). In Yeh et al (2021), 93% of surgical procedures were successful, which is higher than in our study. The success of clinical assessment depends on the type of fracture. Therefore, some studies show differences. Metacarpal fractures were more common than metatarsal fractures in the patients in this study compared to other studies in dogs (Muir and Norris, 1997; Kapatkin et al., 2000) and cats (Lösslein, 1982). One possible explanation is that cats are more likely to land on their forefeet after falling (Whitney and Mellhaff, 1987; Zahn et al., 2007), which was more frequent in our study population. As has been reported in cats and dogs (Kapatkin et al., 2000; Zahn et al., 2007), the weight-bearing MC III and IV were fractured in over 74% of our patients. Our patients fractured MC IV in 44% and MC III in 30%.

Similar results were reported by Zahn et al. (2007). As the cat's forelimb lies on its back during extension and on its back during flexion (Caliebe et al., 1991), the change from maximum extension to flexion during flexion during impact could overload MC IV, causing the paw to twist due to its length.

Figure 5. 5a: Left MT II, III, IV fractures, craniocaudal position. 5b: Medio-lateral position. 5c: Intramedullary treatment with Kirschner wires.

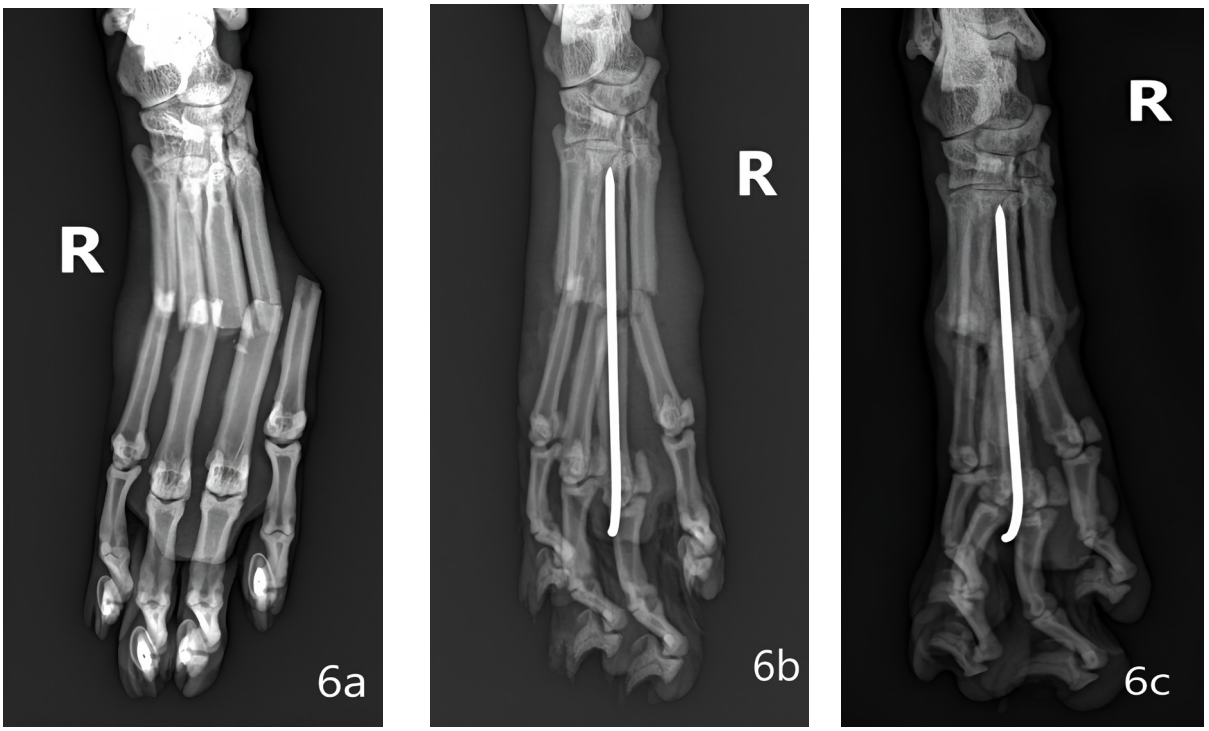

Figure 6. 6a: Right MT II, III, IV, V fractures, craniocaudal position. 6b: MT IV intramedullary nailing 1 day after surgery. 6c: MT IV intramedullary nailing 6 weeks after surgery.

Synostosis was approximately 50% more common in cats that were coapted than in those that were not, regardless of treatment type (Zahn et al., 2007). It was suggested that the number of fractures was a reflection of the severity of the trauma. Synostoses were seen mainly in the proximal region of the bones, and it could be believed that this is because the bones are closer together therefore limited in their movement. After external coaptation, malunion occurred in approximately 60% of cats with fractures of all metacarpals. The incidence of malunion decreased when the dislocation was not severe.

However, IM pinning after bone fragment distraction is reliable for treating metacarpal and metatarsal fractures in cats (Zahn et al., 2007). Fracture healing complications may or may not involve lameness (Degasperi et al., 2007). The present study's success rate was 85% in cases in which intramedullary pins were used. However, this rate may have been influenced by the small number of cases. Bone plates, interfragmentary compression due to delayed screw insertion screws, intramedullary (IM) nails, and cerclage wire are commonly used techniques for internal fixation of the metacarpal and metatarsal fractures in dogs (Dee et al., 2005). Because of the small size of the metacarpal and metatarsal bones in cats, many surgeons are reluctant to use open reduction, internal fixation and external coaptation instead. Therefore, literature on conservative management of metacarpal and metatarsal fractures in cats is sparse (Anderson, 1993). The results were similar to those of this study (Degasperi et al., 2007; Zahn et al., 2007), synostosis occurred in approximately one-third of all metacarpal and metatarsal fractures that were repaired with external coaptation. In general, it was of no apparent clinical significance. It seemed to be due not only to surgical trauma but also to the initial injury.

Fractures of the metacarpals can be managed by external coaptation with a cast or splint if only one or two of the metacarpals have been broken, as the remaining intact bone tends to act as an internal splint (Denny and Butterworth, 2008). Because they carry most of the weight, the two middle toes on each foot are called the "weight-bearing" toes. The two outer toes on each foot do not carry as much weight and are referred to as the 'non-weight bearing' digits. Fractures involving only the non-weight-bearing digits tend to cause less lameness in the animal than fractures involving the weight-bearing digit.

Metatarsal and metacarpal fractures can be classified as 'open' or 'closed', depending on whether the skin's surface is damaged during the injury. Open breaks are more likely to become infected and cause more complications than closed breaks. Because there is little soft tissue covering these bones, open fractures of the feet are common. According to Denny and Butterworth (2008), if all four metacarpals are fractured, internal fixation using pins or Kirschner wires is appropriate, with the two axial metacarpi +/- the abaxial metacarpi being stabilized. Thus, conservative management may be considered in cases of minimal displacement fractures or fractures of two or fewer metaphyseal bones. For displaced fractures or when more than two bones are broken, surgery is recommended. Current indications for surgical reduction of metacarpal and metatarsal fractures include fractures of the main load-bearing bone (third and fourth metacarpals and metatarsals), fractures of the metacarpals or metatarsals both, significant displacement or comminution, open fractures, joint impingement, large impingement, large races and working dogs (Manley, 1981; Muir and Norris, 1997; Piermattei and Flo, 1997; Rosselló et al., 2022).

Conclusion

The external coaptation technique has shown promising results in using metacarpal and/or metatarsal fractures, both as a direct treatment method and as a rescue method if the surgical procedure worsens with complications. The surgical procedure provides positive results for the treatment, considering its complications. In case of complications, external coaptation application completes the treatment. The success rate of external coaptation applications gives significantly positive results. The small number of cases was considered as a limitation of the study. Increasing the total number of cases and surgical procedures may be beneficial in achieving better results.

Malunions involving angulation, rotation, or shortening can be effectively treated surgically, but stiffness reduction surgery is less predictable. In treating metatarsal and metacarpal fractures, the surgeon should be aware of the wide range of available treatment options and select the most appropriate treatment for the condition of each individual patient.

Fractures of the mid-foot and mid-calf usually heal well without long-term effects on the cat, but they can cause abnormal foot function if not treated properly. It was thought that fixation of the third and fourth bones, especially the weight-bearing bones, would be sufficient. Lameness, paw swelling, inability to bear weight on the paw, and pain should therefore be monitored postoperatively. The most important limitations of this study are the small number of surgical cases and the lack of variety of surgical procedures used.

Conflict of Interest

The authors do not have any potential conflicts of interest to declare

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Ethical Approval

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