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Fractures and Treatment Methods in Wild Avians

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ABSTRACT Predatory avians are indispensable and important elements in the continuity of natural balance. The richness of Turkey in various natural resources, its geographical location due to the migration routes, the abundance of water, habitat and the favourable climatic conditions facilitate the life of these animals. Fractures are an important problem in wild avians as well as in pets. Wing and extremity fractures are the most common problems observed in avians. The study material is the fractured extremity cases of 75 predatory wild avians. All 75 cases included in the study were selected from closed extremity fractures. Our treatment protocol involved cage rest, external coaptation and internal fixation. It has been considered that emergency intervention, external coaptation, an adequate time of hospitalization increase the success rate of operative intervention.

Keywords: *Animals, Fracture Fixation, Raptors, Wild*

ÖZ

Vahşi Kuşlarda Kırıklar ve Tedavi Yöntemleri

Yırtıcı kuşlar doğal dengenin devamlılığında vazgeçilmez önemli unsurdurlar. Ülkemizin çeşitli doğal kaynaklarındaki zenginliği, coğrafik konumu, göç güzergâhı üzerinde bulunması, su ve habitat bolluğu ve uygun iklim koşulları bu hayvanların yaşamını kolaylaştırmaktadır. Kırıklar, evcil hayvanlarda olduğu gibi yabani kuşlarda da önemli bir sorundur. Kanat ve ekstremite kırıkları kuşlarda gözlenen en yaygın problemlerdendir. Çalışma materyalini 75 adet yırtıcı kanatlı yaban hayvanında ekstremite kırıkları oluşturmaktadır. Çalışmaya dâhil edilen 75 adet vakanın tamamı kapalı ekstremite kırıklardan seçilmiştir. Tedavi protokolümüzü kafes istirahati, eksternal koaptasyon ve internal fiksasyon oluşturmuştur. Genel durumu stabil hale getirme esnasında yapılan işlemler, acil müdahale, operasyon sonrası bölgenin lokalizasyonuna göre uygun bir eksternal koaptasyon ve yeterli sürede hospitalizasyon ile operatif müdahalenin başarı oranını arttırdığı kanısına varılmıştır.

Anahtar Kelimeler: *Vahşi hayvanlar, Yırtıcı Kuşlar, Kırık sabitlenmesi*

INTRODUCTION

Predatory avians are indispensable and important elements in the continuity of natural balance. Avians, like every living creature, provide significant contributions to nature. The depletion of such species of animals will lead to the destruction of the balance of the nature (Kibar and Bumin 2006). The richness of Turkey in various natural resources, its geographical location, its location on the migration route, the abundance of water, habitat and the favourable climatic conditions facilitate the life of these animals. Despite 437 species of avians have been identified in Turkey, it is thought that the figure is over 500.

The lake Van basin has an undamaged nature and 1/5 (418,560 hectares) of wetlands in Turkey. Recent research shows that the number of avians living in the lake Van basin have increased up to 213, and as ornithological investigations become widespread, it is thought that this number can reach up to 300 (Aslan et al. 2009; Ünsaldı and Ünsaldı 2012). Fractures are an important problem in wild avians as well as in pets. Wing and extremity fractures are the most common problems observed in avians (Muller and Nafeez 2015).

In avians, the risk of fracture formation can be occured as a result of injury or shotgun fire. Fractures created by firearms can be in any of the bones, and they are more serious for the animals because they also damage the soft tissues (Harold 1941). Wing fractures can be occurred during flaying and they usually happen as a result of collisions. For example, it can occur during migration or colliding with other objects such as trees, walls, windows, and automobiles (Harold 1941, Scheelings 2014, Aslan et

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al. 2018). Fractures in the legs can be caused by traps prepared for the animal, or by the avians' jamming their legs in between the wire of their cage. In young avians, fractures can also occur as a result of falling from their nest (Harold 1941; Westfall and Egger 1979).

In the healing of fractures, endosteal and periosteal callus play a role together. However, endosteal callus contributes more to the healing of pneumatic bone fractures (Ünsaldı and Ünsaldı 2012). In primary fracture healing, there is a direct healing in the bone without any callus formation, through havers system. In the occasions of achieving perfect reduction and rigid fixation, callus formation is minimal (Doneley 2016). In avians, a large part of the callus is formed in the intramedullary canal (Bush 1977). Endosteal callus formation is the most important stage of fracture healing. This formation is occured rapidly in the exposed bones and provides a rigid support (Bush 1977; Doneley 2016). In cases where appropriate stability of the fractured tips cannot be achieved, periosteal callus formation is observed (Doneley 2016). Fractures, in which rigid fixation is achieved, heal within 3 weeks. In avians, the diameters of the bones in relation to the air sacs are quite wide (Bush 1977; Bennett and Kuzma 1992). Avian bones are fragile due to their fine structure and high calcium content (Bush 1977; Bennett and Kuzma 1992; Goody et al. 2012). Many bones in the distal extremity are covered only with tendons and skin (Bennett and Kuzma 1992). Fractures are usually open (62%) and fragmented, due to the thin and fragile nature of the bones and the small amount of soft tissue support. These factors often cause damage to the fragments and regional vascularization (Mathews et al. 1994; Doneley 2016).

Radiology is a useful method for monitoring the healing process of fractures. Radiographs are taken at the 2nd, 4th, 6th, and 8th weeks on post-operative period day 0 to evaluate radiographic integrity, synostosis and remodelling of the callus formation. Since the fracture management in avians is an important clinical problem, successful fracture treatment requires accurate diagnosis and effective management (Tunio et al. 2014). Methods such as cage rest, external coaptation, internal and external fixation, plate and cerclage wire are used widely and routinely in avian extremity fractures (Ünsaldı and Ünsaldı 2012; Muller and Nafeez 2015). Small-sized avians can heal with cage rest, without the need for any fixation, in the treatment of non-load bearing bone fractures such as the shoulder girdle (coracoid, clavicle and scapula) and pelvis fractures. Furthermore, in dislocated fractures, or at minimal separation, a good recovery can be achieved by restricting the movement of avians by cage rest and appropriate analgesia (Helmer and Redig 2006; Jones 2013). External coaptation is an inexpensive, easy and effective method for the immobilization of some fractures. Since the application is usually rapid, short-term anaesthesia is sufficient. Splint applications, figure-of-8 bandage, and sandwich bandage applications are common methods of coaptation. Sandwich bandages are particularly beneficial in tibiotarsus/tarsometatarsus or phalangeal fractures of small-sized avians. The figure-of-8 bandage can be completely wrapped around the body, as well as covering only the relevant extremity (Helmer and Redig 2006; Jones 2013).

Wing Bones (Humerus, Ulna, Radius, Metacarpal)

The humerus is a long bone in the pneumatic structure and is connected to the clavicular air sacs. Fractures can be repaired with single or multiple intramedullary pins. The natural curvature in the structure of the humerus allows the pins to exit proximal near the shoulder region or close to the elbow at the distal, without involving the joints (Forbes 1998). In ulna-radius bones, 30% of fractures occur only in ulna, only 10% in radius and 60% in both. In avians with ulna or radius fractures, cage rest is sufficient alone (supported or unsupported) when displacement is in negligible levels. When internal fixation is needed, usually the intramedullary pin alone is sufficient. If the fracture occurs in both bones, the pin is often placed only in the ulna (Forbes 1998). Metacarpal bones are weak in terms of soft tissue that protects and provides blood support. It is more likely to have open fractures after trauma. For all these reasons, the success rate of fixation is lower than other bones. As the reduction can be achieved easily, the sandwich bandage is suitable for closed stabilization (Dar et al. 2015).

Pelvic extremity (Femur, Tibiotarsus)

The femur is a pneumatic bone. The number of intramedullary pins to be applied varies according to the localization of the fracture. Tibiotarsus bone fractures are the most common fractures. Since the medullar cavity narrows at the distal end of the cavity, intramedullary pin application with cerclage will be sufficient to its treatment (Forbes 1998). Steinman pin is the most commonly used pin type in internal fixation and is widely used in the treatment of tibiotarsal fractures (Jones 2013).

In this study, it was aimed to evaluate the first interventions, fixation methods, external coaptation methods, postoperative care and the rates of release and rehabilitation of the avians.

MATERIALS and METHODS

The study material is the fractured extremity cases of 75 predatory wild avians brought to Van Yuzuncu Yil University Wild Animals Protection and Rehabilitation Directorate. All 75 cases included in the study were selected from closed extremity fractures (Table 1).

Table 1. Animal species

Species	Number
Owl	15
Eagle	19
Falcon	14
Vulture	10
Hawk	17

Our treatment protocol involved cage rest, external coaptation and internal fixation (Table 2). The predatory avians brought to the clinic were recorded, and the anamnesis information was taken as far as possible. The animals were first subjected to the general examination, in order not to cause further trauma, and to determine whether there were any other problems that could lead to life-threatening injuries. For shock therapy, dexamethasone at 0.5 mg/kg and balanced fluid electrolyte at 50-85 mL/kg doses were administered. Until the animal's medical condition was stabilized, temporary support was applied to the fracture site and the animal was hospitalized in a warm, dim and quiet environment. Prior to fracture evaluation and treatment, all avians were awaited to become medically stable. Extremities of stabilized predatory avians were evaluated for neurological disorders, fractures, and dislocations.

Table 2. Treatment methods

Treatment Methods	Numbers
Cage Rest	20
External coaptaion	32
İnternal fixation + external coaptaion	23

As a result of the radiological examination, the treatment method to apply was determined through the evaluation of the fracture. The feeding of the avians was ceased 6 hours prior to the operation. All avians were anesthetized with isoflurane. The induction was done with a gas mask, with a mixture of 5% isoflurane and O_2 (1-1.5 L/min). Immediately after the induction, endotracheal intubation was performed. An endotracheal tube (2.5-4 mm in diameter) without cuff was used for intubation. Anaesthesia was maintained with a mixture of 1.5-2.5% isoflurane and O_2 (1-1.5 L/min). During the operation, heater pads were used to prevent hypothermia.

Figure-of-8 bandages and sandwich bandages were applied in non-dislocated wing fractures (Fig 1). For the dislocated fractures, after the reduction using Steinman pins and cerclage wire, external coaptation was applied (Fig 2). Splint and sandwich bandage applications were performed in non-dislocated fractures of the pelvic extremity (Fig 3). Splint and sandwich bandage treatments were performed after reduction of the dislocated fractures of the pelvic extremity with Steinman and cerclage wire.

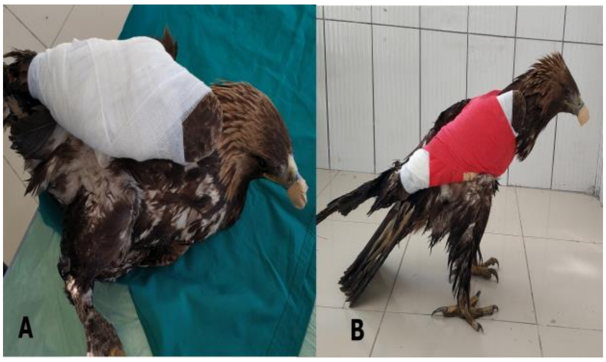

Figure 1 (A-B). Figure-of-8 bandage in eagle

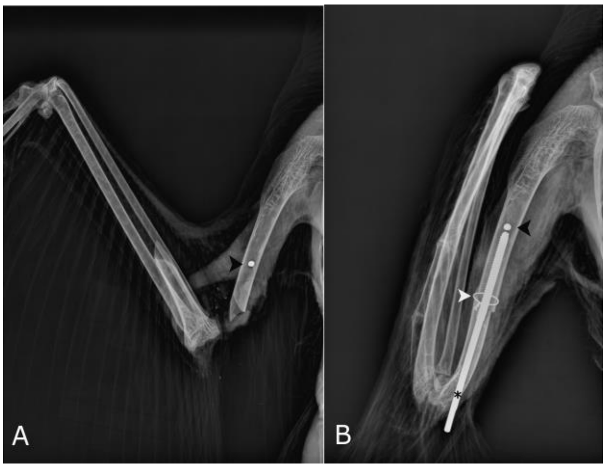

Figure 2 (A-B). A. Distal fracture of humerus due to the firearm injury. Black arrow: shotgun pellet. B. Postoperative radiographic image. White arrow: cerclage wire practice. Asterisk (*): Intramedullary pin

Figure 3. A. Radiographic image of the tibial fracture. B. Radiographic image after external coaptation

In the cases, for which the operation was decided, the feathers were completely torn off to 2-3 cm away from the area to be operated, and the region was prepared with 10% Povidone solution. During the operation, 10 ml of 0.9% NaCl and 5% dextrose were administered intravenously following subcutaneous administration of the 20 ml/kg lactated ringer solution. In the humerus fractures, the corresponding wing was placed in the lateral position to remain on top. The pin, which was removed from the proximal fragment by using the retrograde method, was advanced onto distal epiphysis following reduction. The operated wing was allowed to immobilize using the figure-of-8 bandage, after giving a mid-level flexion position.

In radius-ulna fractures, the animal was placed on the table in the sternal position. The wing was opened, and the dorsal approach was used to reach the ulna bone. Two cm longitudinal incision on the skin was made in order to easily approach between the radius and the ulna in the craniodorsal direction. Musculus extensor metacarpi ulnaris, musculus extensor metacarpi radialis, musculus extensor digitorum communis and fascia were retracted, so that ulna was exposed. After intramedullary pin application in ulna fractures, immobilization was achieved by wrapping the wing with the figure-of-8 bandage (Fig 4).

Table 3. Fracture localizations and numbers

Bones	Number
Humerus	7
Antebrachium	34
Metacarpus	9
Femur	6
Tibotarsi	20
Tarsometatarsi/ Phalanges	13

In tibiotarsal fractures, the animal was placed on the table in the lateral position, with the corresponding extremity underneath. A medial approach was performed to reach the tibiotarsal bone. An incision of 4 cm in length was performed on the skin. To reach the fractured bone ends, the muscle layers were carefully separated. The intramedullary pin was directed, first in a retrograde way and then to the proximal fragment with a drill at slow speed (<150 rpm). After the fracture tip was appropriately reduced, the pin was advanced to the end of the medullary canal of the distal tibiotarsus (Table3).

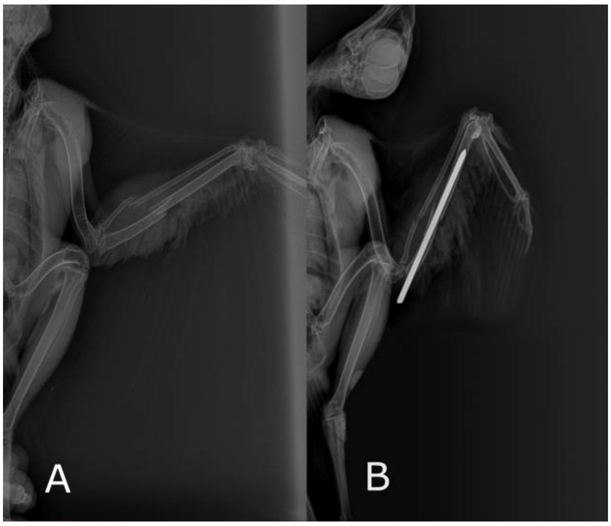

Figure 4 (A-B). A. Fracture in radius-ulna bone. B. Intramedullary pin practice in ulna

The muscle layer was sutured with 4/0 polyglycolic acid material and skin was sutured with 2/0 polyglycolic acid material and simple interrupted suture technique was used.

Post-operative care

Immediately after the operation, the nonsteroidal anti-inflammatory-analgesic effective butorphanol tartrate was administered subcutaneously at a dose of 0.2 mg/kg for the control of pain. Against infections, the enrofloxacin injection solution was administered intramuscularly at a dose of 10 mg/kg twice daily for 7 days. The operation area was closed with a sterile wound pad. The applied figure-of-8 bandage and skin sutures were removed on the 12th day of the operation. Clinical findings of healing began to be observed in the third week. The pins were removed on the 28th day.

RESULTS

Clinical and radiographic examination revealed that 15% of the cases were gunshot injuries and 85% of the cases were of other traumatic causes. Of the fractures in the limbs, 52% occurred in the wings, 40% in the pelvic limb, and 8% fractures were in the other than limbs.

28% of the fractures in the wings were observed in the humerus, 50% in the radius-ulna and 22% in the metacarpal bones. Of the radius-ulna fractures, 56% were found to be on both of the bones, 28% on the ulna and 16% on the radius bone.

It was determined that 24% of the fractures in the pelvic extremity were found in the femur, 51% in the tibiotarsal bones and 25% in the metatarsal bones.

Clinical improvement was observed in 45 of 75 cases. Of the clinically healed animals, 18 showed functional improvement until they were left to nature again. 27 avians that cannot be released to the environment were included in the rehabilitation program in the centre.

DISCUSSION and CONCLUSION

Fracture is a common clinical problem in avians, and a successful fixation for a proper treatment is needed. Because of the unique anatomic structure of the avians' bones, options for fracture treatment are limited (Ahmed et al. 2013). In avians, fractures of the wing bones that occur due to firearm injuries and as a result of impacts on tree branches, electric wires or other obstacles are common (Aslan et al. 2009; Venugopal et al. 2014).

Due to the thin and fragile structure of the avians' bone cortex, pin or screw holding power is weak and they are reported to cause iatrogenic fractures (Degernes et al. 1998; Goody et al. 2012). In our study, iatrogenic fractures were rarely formed, especially when open reductions were attempted. Another problem with avian orthopaedics is that the size of the animal is small and the soft tissues in the distal extremities are weak (Degernes et al. 1998). In our study, fractures in the distal extremities were observed to heal later than in fractures in other areas that are rich in soft tissues.

Clinically, fractures in avians recover faster than those of in mammals (Bennett and Kuzma 1992; Dar et al. 2015). Well-aligned stable fractures show clinical improvement within 3 weeks (Bennett and Kuzma 1992; Venugopal et al. 2014). Generally, implants can be safely removed because radiographic evidence of callus formation is not detected and adequate stabilization is achieved (Bennett and Kuzma 1992). In our study, the removal time of the implants was determined to be 28 days on average.

In fracture treatment, cage rest is an inexpensive and easily applicable method. Since the affected knee joints are not restricted, the likelihood of ankyloses is low. However, in moving avians, un-stabilized fracture fragments cause the animal to become self-destructive, causing more tissue damage to the animal. However, in cage rest, excessive callus and slow recovery are the issues. As a result of defective bone union and overriding, extremity shortening may occur (Bennett and Kuzma 1992). In our study, it was observed that the clinical healing was slower than the other treatment methods at 20 avians treated with cage rest. In the treatment, 4 of the avians subjected to cage rest were released to the nature due to functional recovery.

In our study, figure-of-8 bandage and sandwich bandage applications among the external coaptation types were widely used. In the distal wing fractures, the desired clinical healing was achieved with sandwich bandage applications. Six of the animals treated with this treatment protocol were released back to nature, showing functional improvement.

Intramedullary pin application is also widely used in the treatment of avian fractures. Its application is easy and relatively cheap. However, this treatment cannot prevent rotational forces. Moreover, since the medullary channels of pneumatic bones are wide, a single pin is usually not sufficient (Muller and Nafeez 2015). In humerus diaphyseal midline fractures, the figure-of-8 bandage may not be sufficient for stabilization alone. External coaptation, which is applied to prevent rotations after internal fixation in metacarpal and pelvic extremity fractures, also accelerates healing. With adequate stabilization and immobilization, clinical stability can be achieved in 3 weeks in avian fractures (Orosz 2002; Goody et al. 2012; Venugopal et al. 2014; Dar et al. 2015). In our study, intramedullary pin and external coaptation were used in the treatment protocol, 8 avians were returned to the nature with functional recovery. In our study, the most favourable results in terms of recovery time were obtained in this protocol.

In our study, it was determined that fractures observed in wing bones due to trauma were observed more frequently than in other bones in predatory avians. It has been considered that stabilizing the general situation, emergency intervention, an adequate external coaptation following the operation depending on the localization of the fracture, and an adequate time of hospitalization increase the success rate of operative intervention.

REFERENCES

Ahmed T, Jalila A, Intan-Shameha A, Meng G, Shanthi G (2013). Histological evaluation of transverse fracture healing in pigeon (columba livia) ulna. Res. Opin. Anim. Vet. Sci., 3(10), 380-386.

Aslan L, Adizel Ö, Karasu A, Özkan C, Gençcelep M, Durmuş A, Akgül Y (2009). Van gölü havzasında 2006-2008 yılları arasında yabani kuşlarda yaralanma ve kırık olgularının tedavileri. Van Vet J, 20(2), 7-12.

Aslan L, Adizel Ö, Sancak T (2018). Treatment and rehabilitation of wild birds and mammals. Indian J Anim Res, 52(4), 623-627.

Bennett RA, Kuzma AB (1992). Fracture management in birds. J Zoo Wildlife Med, 23(1), 5-38.

Bush RM (1977). External fixation of avian fractures. J Am Vet Med Assoc, 171, 943-946.

Dar K, Mehraj-U-Din D, Sheikh A, Baba M, Dar S (2015). Surgical management of compound metacarpal fracture in black kite (milvus migrans): A case report. Inter J Vet Sci, 4(2), 101-103.

Degernes LA, Roe SC, Abrams C (1998). Holding power of different pin designs and pin insertion methods in avian cortical bone. Vet Surg, 27(4), 301-306.

Doneley B (2016). Avian medicine and surgery in practice: Companion and aviary birds. Taylor and Francis Group, Florida.

Forbes N (1998). Avian orthopedics. Vet Quart, 20(1), 69-70.

Goody A, Head J, Gianopoulos A, Liu S, Mccoy B (2012). A novel approach to tibiotarsal fracture management in the hawaiian nene. J Wildlife Rehab, 32(1), 7-10.

Harold BW (1941). Fractures among birds. Bird-Banding, 12(2), 68-72.

Helmer P, Redig PT (2006). Surgical resolutions of orthopedics disorders In: Clinical Avian Medicine, Harrison G, Lightfoot T (Ed), 761-774, Florida.

Jones R (2013). Fracture management in birds, https://www.vettimes.co.uk/article/fracture-management-in-birds/?format=pdf, Accessed: 15 January 2019.

Kibar M, Bumin A (2006). Yırtıcı kuşlarda ateşli silah yaralanması sonucu oluşan kırıkların değerlendirilmesi. 85 olgu (1998-2005). Kafkas Üniv Vet Fak Derg, 12(1), 11-16.

Mathews KG, Wallace LJ, Redig PT, Bechtold JE, Pool RR, King VL (1994). Avian fracture healing following stabilization with intramedullary polyglycolic acid rods and cyanoacrylate adhesive vs. Polypropylene rods and polymethylmethacrylate. VCOT, 7, 158-169.

Muller MG, Nafeez JM (2015). A new approach for tibiotarsal fractures in falcons with the fixex tubulaire type fessa system, Available at: https://www.falconhospital.com/media/1461/fractures-tibiotarsus-in-falcons-fessa.pdf, Accessed 14.07.2018.

Orosz SE (2002). Clinical considerations of the thoracic limb. Vet Clin North Am Exot Anim Pract, 5(1), 31-48.

Scheelings TF (2014). Coracoid fractures in wild birds: A comparison of surgical repair versus conservative treatment. J Avian Med Surg, 28(4), 304-308.

Tunio A, Jalila A, Meng CY, Shameha I (2014). Experimental fracture healing with external skeletal fixation in a pigeon ulna model. J Adv Vet Anim Res, 1(2), 58-64.

Ünsaldı S, Ünsaldı E (2012). Bir tavşancıl (Hieraaetus fasciatus)'ın parçalı sağ ulna kırığının kemik manşonla sağaltımı. Van Vet J, 23(1), 55-59.

Venugopal SK, Anoop S, Sherin BS, Philip SB, Prakash S, Bini J, Ashay PK (2014). Repair and management of fractured wing in an indian peafowl (pavo cristatus). MJVR, 5(1), 15-19.

Westfall ML, Egger EL (1979). The management of long bone fractures in birds. Iowa State University Veterinarian, 41(2), 81-87.