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Research Article

Retrospective Study of Beak Deformities in Birds

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Abstract

The aim of this study was to determine the type of lesions in birds referred to the clinic with the complaint of beak deformity, the potential presence of the lesions among the bird species, and the possible causes of the lesions and to report what treatment should be applied. Twenty-six individuals from several bird species with broken beaks and abnormal beak deformities were presented to our clinics. Different forms of beak deformities were observed, and the causes of some of the lesions were determined as unknown. Beak lesions in wild birds were mostly traumatic fractures, whereas cage birds had parasitic infections and abnormal beak elongation due to nutritional disorders. Treatment protocols appropriate for each case, severities of the lesions, underlying causes, and species of the birds were determined.

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Retrospective Study of Beak Deformities in Birds

Özet

Bu çalışmanın amacı, gaga deformitesi şikayeti ile kliniğe sevk edilen kuşlarda lezyon tiplerini, kuş türleri arasında lezyonların olası varlığını ve nedenlerini belirlemek ve hangi tedavinin yapılması gerektiğini bildirmektir. Gagasında kırık ve anormal gaga deformiteleri olan çeşitli kuş türlerinden 26 hasta kliniğimize getirildi. Farklı şekillerde gaga deformiteleri görüldü ve bazı lezyonların nedenlerinin bilinmediği belirtildi. Yabani kanatlılardaki gaga lezyonlarının çoğunlukla travmatik kırıklar, kafes kuşlarında ise parazitik enfeksiyonlar ve beslenme bozukluklarından dolayı anormal gaga uzaması şeklinde olduğu belirlendi. Gaga bölgesine, lezyonun ciddiyetine, altta yatan nedene ve kuş tipine uygun tedavi protokolleri belirlendi.

Key Words: *Gaga, kuş, deformite, kırık, tedavi.*

Introduction

The beak replaces lips and teeth for birds and forms the entrance to the oral cavity (Gelis, 2006). An avian beak consists of living and nonliving tissues like a nail and continues to grow throughout the life of the animal. The beak is formed by the maxillary and mandibular jaw bones which are covered with a light keratin sheath called rhamphotheca (Soons et al., 2010; Worell, 2013). The maxillary rhamphotheca is also called rhinotheca, and the mandibular rhamphotheca is also known as gnathotheca (Worell, 2013).There are many blood vessels and nerve endings in the proximal part of the beak, which makes it very sensitive to bleeding and cause severe pain when injured unlike the apex of the beak (Worell, 2013). Birds use their beaks to prey, groom, eat, construct a nest (wild birds), hold on to perches, stay in balance during movement, and defend themselves. This structure tends to grow constantly. Depending on the species, a bird's beak grows from one to three inches (1 inch=25.4mm) per year and is eroded by various environmental interactions such as eating, rubbing, and scraping on hard objects (Worell, 2013). However, in case of beak fractures or deformations all these activities are affected, resulting in the bird's overall health and nutritional status impairments and even death (Jones et al., 2015). Avian beak deformities may be either congenital or result from (Speer and Powers, 2016) genetic mutations, traumatic injuries, infectious diseases (viral, bacterial or parasitic), nutritional deficiencies and imbalances (e.g., hypovitaminosis A), neoplasia, problems during incubation, and the inadequate wearing of the rhinotheca (Altan et al., 2016, Purificacao, 2019).

The aim of this study was to undertake a long-term retrospective analysis of the causes and the findings of beak deformity of birds that were brought to Istanbul University Veterinary Faculty clinics for clinical evaluation and treatment between 2017 and 2019.

Material and Method

Material

The materials of the study were consisted of 26 birds, i.e, one African gray parrots, one Conure parrot, one Amazon parrot, two Sultan parrots, 13 Budgerigars, two Canaries, and five wild Songbirds (Hoopoe, Finch, Shepherd, Pigeon, and Sparrow), which were brought to our clinics with beak fractures and deformities. The ages of all the birds were determined to be adult. Sex determination could not be as certained in any of the birds.

Method

The examined patients were evaluated under the headings of traumatic beak fractures and abnormal elongation in beak and deformities. Information concerning the cause of the lesions, feeding and accommodation of the bird was obtained from the owners of the patients. Beak fractures were classified as simple fractures, depressive fractures, fractures with bone defects, and avulsion fractures according to their severity. For every patient with traumatic beak fractures, bleeding control, supportive and analgesic therapy and oral feeding were undertaken. Considering the patients' blood loss, lactated Ringer's solution (subcutaneous 4060 ml / kg / day) was given in a warm tub in a quiet place. After general condition stabilization, the wound area was carefully cleaned with isotonic, a vitamin-supported liquid feeding protocol was established, and the appropriate treatment method was selected for the patient. According to the condition of the fracture the treatment methods like reshaping or adhering the broken part of the beak were applied. Acrylic-based odorless adhesives were used to bond the beak fracture. A multivitamin complex was given daily in the drinking water (5 ml/100 ml water, Avisol Plus, Biyoteknik, Istanbul, Turkey) to support healthy beak elongation.

Abnormal elongation and deformities in beak were noted to be due to abrasion deficiency, knemidocoptes mites, nutritional deficiency, and chronic sinusitis. For the knemidocoptes in treatment, the ivermectin solution diluted 1:1 with isotonic was applied topically twice in three weeks until the crusts disappeared. In nutritional deficiencies, balanced commercial foods and multivitamin complex containing biotin are recommended, while silymarin (Milk Thistle, Solgar, USA) 100 mg/kg PO was prescribed for patients with hepatomegaly.

An empirically broad-spectrum antibiotic doxycycline (0.28 mg/mL) was applied to a patient with chronic sinusitis who had received amoxicillin (20 mg / kg PO) with drinking water (Medicamox oral suspantion, Medicavet, Istanbul, Turkey) for four weeks before being brought to our clinic. In cases where the upper beak was prolonged due to the lack of wear, only reshaping was applied using a small-edged Dremel for parrots, and clippers for budgerigars and canaries. In two budgerigars with beak deformity due to tumoral formations, only supportive treatment and reshaping were applied because the owners did not accept a biopsy procedure.

Results

This study consisted of a total of 26 bird cases (21 cages and five wild) brought to the clinical examination with the complaint of beak problems between 2017 and 2019. The clinical examination revealed traumatic beak fracture in nine birds, abnormal elongation in 15 and tumoral reasoned beak problems in two. The etiology of diseases was identified as malnutrition in three birds, knemidocoptes mites in six, trauma in nine, chronic sinusitis in one, and tumor in two. In the remaining five patients, the underlying causes could not be determined. Traumatic beak fractures were detected in all the wild birds (5/5) and 19.04% (4/21) of the cage birds, with abnormal elongation in the beak being71.4% (15/21) in cage birds. Abnormal elongation was detected in the upper beak in 11 birds and both in the lower beak and upper beak in four birds. The cause of abnormal beak elongation was malnutrition in three of 15 cage birds (one budgerigar, two African gray parrots (Figure 1), knemidocoptes in six (budgerigars) (Figure 2), chronic sinusitis (Figure 3) in one (cockatiel), and unknown in five (one budgerigar, two canaries, one cockatiel, and one amazon parrot). According to the traumatic beak fractures classification of Speer et al. (2016), the patients in the current study were grouped into simple fractures (3/9), depressed fractures (3/9), avulsion fractures (2/9) (Figure 4) and fractures with bone defects (1/9). Six cases with abnormal beak elongation were only reshaped, six were given an antiparasitic application and reshaped, two were given nutritional support and reshaped, and one was given sinusitis treatment. Of the 15 cage bird cases, only one case died and the remaining patients fully recovered. In the treatment of fractures, three cases were treated by adhesion to the broken beak and all patients showed improvement. Six cases were treated with self-releasing and reshaping, and after observing that there were no feeding problems due to the beak, three of the wild bird patients were released to nature, but three patients (two wild birds) died on the same day. As a result of the treatments applied while six patients died 20 patients recovered. Detailed information about the species distributions, diseases and treatments applied are presented in Table 1.

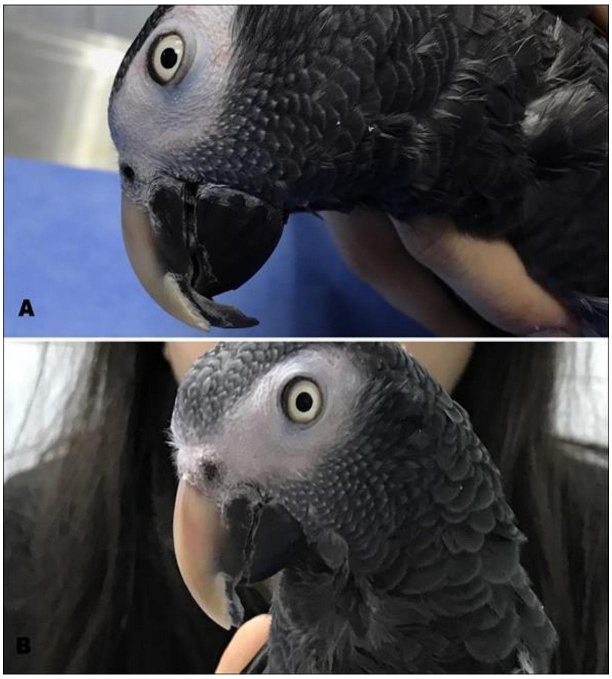

Figure 1. Case 9 (A)Double-layered upper beak (white arrow), but normal occlusion. (B) The same bird in A, after trimming of upper beak.

Figure 2. Case 4 Note the scaly surface of the upper beak,cere and periorbital area.

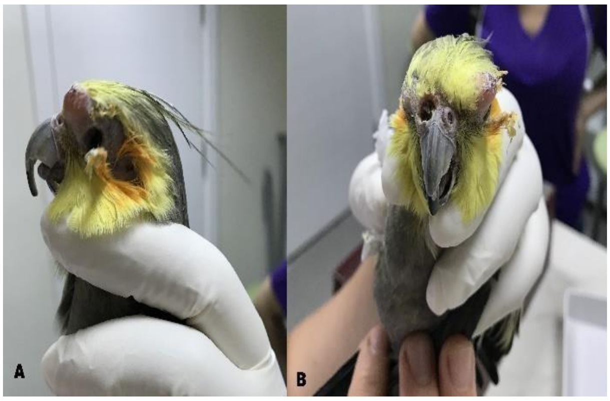

Figure 3. Case 8, Chronic sinusitis in a cockatiel.

Figure 4. Case 5, Traumatic avulsion of the maxillary beak in a budgerigar due to crow attack. A) The appearance of the wound on the cere. B) One month later, granulation tissue in the upper beak. Dullness and irregularity in the feathers of the bird that cannot preening and trimming with the help of the beak C) the part of the beak that grows back is smooth and healthy, and it has returned to its former form.

Tablo 1: Distribution of bird species and disease

Case no	Bird	Maxillary beak overgrowth	Mandibular beak overgtowth	Scissor beak	Maxillary beak fracture	Mandibular beak fracture	Etiology	Result	Treatment
1	Yellow-naped amazon *(Amazona auropalliata)*			x		x	unknown	recovered	Reshaped
2	Budgerigar *(Melopsittacus undulatus)*	x					knemidocoptes	recovered	Antiparasitic, reshaped
3	Sun conure *(Aratinga solstitialis)*				x		trauma	recovered	fixed with adhesive
4	Budgerigar *(Melopsittacus undulatus)*	x					knemidocoptes	recovered	Antiparasitic, reshaped
5	Budgerigar *(Melopsittacus undulatus)*				x		trauma	recovered	fixed with adhesive / supportive
6	Budgerigar *(Melopsittacus undulatus)*				x		trauma	ex	supportive
7	Budgerigar *(Melopsittacus undulatus)*	x					knemidocoptes	recovered	Antiparasitic, reshaped
8	Cockatiel *(Nymphicus hollandicus)*	x					cronic sinusitis	ex	Supportive, antibiotic
9	African grey parrot *(Psittacus erithacus)*	x					nutritional disorder	recovered	Supportive, reshaped
10	Budgerigar *(Melopsittacus undulatus)*	x	x				knemidocoptes	recovered	Antiparasitic, reshaped
11	Budgerigar *(Melopsittacus undulatus)*	x					knemidocoptes	recovered	Antiparasitic, reshaped
12	Budgerigar *(Melopsittacus undulatus)*	x					knemidocoptes	recovered	Antiparasitic, reshaped
13	Budgerigar *(Melopsittacus undulatus)*	x					nutritional disorder	recovered	Supportive, reshaped
14	Budgerigar *(Melopsittacus undulatus)*						tumor	ex	supportive
15	Budgerigar *(Melopsittacus undulatus)*						tumor	ex	supportive
16	Cockatiel *(Nymphicus hollandicus)*	x					unknown	recovered	reshaped
17	Budgerigar *(Melopsittacus undulatus)*				x		trauma	recovered	fixed with adhesive
18	Budgerigar *(Melopsittacus undulatus)*	x					unknown	recovered	reshaped
19	African grey parrot *(Psittacus erithacus)*	x					nutritional disorder	recovered	reshaped
20	Domestic pigeon					x	trauma	ex	conservative

	(Columba liviadomestica)							
21	House sparrow *(Passer domesticus)*			x		trauma	ex	supportive
22	Europian nightjar *(Caprimulgus europaeus*)				x	trauma	recovered	conservative
23	Hoopoe *(Upupa epops)*			x		trauma	recovered	supportive
24	Common chaffinch *(Fringilla coelebs)*			x	x	trauma	recovered	conservative
25	Canary *(Serinus canaria)*	x	x			unknown	recovered	reshaped
26	Canary *(Serinus canaria)*	x	x			unknown	recovered	reshaped

Discussion

The beak of a bird, also known as 'rostrum', is used for feeding, defense, climbing, mating, regulating body temperatures and finding and building nests. This structure differs in each bird species according to the environment and type of food. The beak has been shaped in a way to facilitate the feeding process of the animal (Gelis, 2006). While the beak, is usually covered with hard keratin and constitutes only the tip of the waterfowl, while the entire beak is relatively soft (Gelis, 2006).Psittacines have a prokinetic maxilla, a very strong beak that allows them to move their mandible and their maxilla independently (Gelis, 2006). In this way, the opening of the beak allows the development of the ability to place the food in the beak, as well as the cracking of seeds and nuts, and stretching and shock absorption, as well as other behaviors, such as pecking (Gelis, 2006).

Avian beaks can be directly or indirectly affected by many congenital or acquired factors.

Congenital deformities occur mostly in waterfowl and poultry, which are seen in the White Peking ducks in the form of short-maxilla shape and curvature changes, such as microchrome syndrome or 'scissors-beak' and prognatism that cause beak-specific malocclusion (Gelis, 2006). Scissor beak deformity is characterized by the lateral deviation of the premaxilla/maxilla and rhinotheca to the right or left. Irregular wear due to lateral beak deformity gradually worsens the beak and creates a scissor effect. These lesions are common developmental beak disorders in parrots, especially in young cockatoo and macaw, but it can also affect pigeon and other predatory species (Speer and Powers, 2016). The causes of both conditions are not fully known. However, possible causes may include genetic and malnutrition, vitamin and/or mineral imbalances, insufficient or excessive dietary protein during development, infectious diseases, and sinusitis infections (Gelis, 2006). Scissor beak deformity can generally be corrected. Both upper and lower beaks can be reshaped with a rotary tool or nail clipper. Since the beak grows continuously, repeated reshaping needs to be taken overtime depending on the severity of the deformation. Acquired deformities can develop secondary to musculoskeletal components or any disease that damages rhamphotheca. It is a consequence of the abnormal development of musculoskeletal beak structures during the bird's development, and its etiology is not fully understood, but is thought to be complex, variable, and multifactorial (Speer and Powers, 2016). They can be broadly classified as traumas (damage to the germinal layers of the beak), nutrition deficiencies (embryonic deficiencies of biotin, folic acid or pantothenic acid), diseases (overgrowth of the beak associated with liver disease), and infections (viral, bacterial, parasitic or fungal) (Gartrell et al., 2003). Beak problems can be easily visible, but the underlying cause maybe hidden. In this study, five of the cases brought with the complaint of beak problems were wild birds, and all of the lesions were traumatic while 21 cases were cage birds and excessive beak growth was in 15 cases, trauma-induced fractures in four, and neoplasia in two. It was determined that excessive growth in the beak was caused by chronic sinusitis in one case, lack of balanced nutrition in three cases, and parasitic infection in six, and the cause could not be determined in five cases. Scissors beak deformity, known as excessive beak elongation among Amazon parrots, was encountered in one case and the beak reshaping process was applied. No evidence of mandibular prognathism was found in any of the birds in this study.

Many beak deformities are caused simply by nutritional deficiencies, especially methionine, pantothenic acid, riboflavin (B2 vitamin), D vitamin, biotin, and calcium. If these are absent from the bird's diet; then, proper beak development does not occur, and the beak tends to bend and soften. For example, malnutrition and vitamin A deficiency cause significant beak deformities in the chicks of the hand-fed African gray parrot (Psittacus erithacus). Nutrition with high fat content can cause liver disease, obesity, and scaly beaks in birds. Furthermore, liver disease can lead to the disruption of amino acid metabolism (effective in keratin formation), metabolic bone disease, abnormal bone growth, and potentially developmental beak deformities. Patients diagnosed with liver disease (x-ray and biochemistry profile) and malnutrition have rhinothecal overgrowth characterized by intraluminal bleeding. Timely treatment can rapidly eliminate defects. In addition, diet regulation, feeding the bird with a suitable diet, and beak correction often eliminate these symptoms over time (Gelis, 2006; Speer and Powers, 2016). In our study, beak elongation due to malnutrition was observed in two African gray parrots and one budgerigar, and the beak was reshaped.

The traumatic lesion is one of the most common cause of the beak diseases. Trauma occurs when birds hit hard objects, such as windows and cars or fall from the roost, are attacked by the cage mate or other animals, or get stuck between the cage bars. Since beak sharpening is limited, the traumatic injuries of this organ are more common in captive predators. These injuries can cause beak cracks, severe wounds, fractures of the rostral part of rhinotheca, partial or total avulsion of the beak. Traumatic beak avulsion is somewhat more common in psittacine birds and waterfowl. In psittacine birds, injury is almost always caused by the attack of another psittacine bird (Speer and Powers, 2016). Acute traumatic beak injuries are a matter of emergency in birds, as they cause severe bleeding and provide easy access for different pathogens (Crosta, 2002). Therefore, in case of trauma, urgent intervention is needed, including stopping bleeding, providing fluid therapy, and reducing shock, providing analgesia, and preventing infection. In this process, necessary nutritional support should be provided for the patient to protect the beak from further damage and allow it to grow again (Wheler, 2002). Depending on the affected area, the degree of damage, type of bird, and feeding pattern, the preferred method of repairing the beak varies. Avulsions occurring in a distal third of the beak have a possibility of regeneration in short-beaked birds (such as budgerigars), or in some parrots, they can be adapted with appropriate wound care, supportive care, and analgesia treatment without the requirement of surgical intervention. Periodic gnathotheca restorative procedures may be required on the opposite side of the affected beak due to insufficient keratin wear. Surgical intervention is required in other species, such as ostriches (Struthio camelus), in which beak growth stops in adulthood, or bird species such as Ramphastidae and storks, which may have difficulty in self-feeding (Crosta, 2002). In these birds, the beak prosthesis should be placed surgically. Acrylic prostheses can be used temporarily to provide beak function and appearance until new keratin growth occurs.

However, in permanent injuries, since these prosthetic beaks perform poorly, they need to be remodeled, replaced every three to six months or reapplied regularly. Rhamphothecal fractures can be stabilized with tissue adhesives, such as cyanoacrylate. More serious fractures may require surgery by remodeling techniques with intramedullary pins, Kirshner wires, sutures, epoxy, or acrylic adhesive resins, depending on the type of bird andlocation of the injury or fracture. Some affected birds require assisted feeding, and even an esophagostomy tube during the initial healing period (Speer and Powers, 2016). In this study, traumatic beak fractures were detected in nine of the 26 cases, five of which were wild birds and four were cage birds. The fractures were classified as simple in three of nine birds, depressed in three, avulsion in two, and bone defect in one. All the beak lesions in the wild birds were traumatic fractures. It was learned from the pet owners that the beak fractures of the cage birds developed after hitting hard objects or being attacked by another bird. In the treatment of fractures, three cases were treated with broken beak and six with self-releasing and reshaping. Three cases had been attack by another bird. Three birds died shortly after the same initial treatment was applied. In our study, failure to achieve hemostasis in one patient (Case 6) was considered as the most important factor that resulted in the patient's condition becoming critical. Prosthesis was not considered, as it was a member of cases 5 and 17 psittasis and adapted to self-feeding in a short time (within five days). The areas with avulsion were left to heal in case 5 without surgical intervention. Vitamin support and regular wound care were provided to achieve healthy beak growth. A previous study showed that in the case of beak damage, biotin (50 μg/kg daily for two to three months) could increase regrowth rates by oral administration (Wheler, 2002). Therefore, to achieve this in the current study, a multivitamin containing biotin was selected for the treatment of cases 5 and 17. In another study, a captured adult female American Kestrel with missing maxilla, was compared with other captured adult female American Kestrel. The results revealed that the furcular fat and pectoral muscle score were similar but the mass was 100 g, which was lighter than that of the other females (Iko and Dusek, 2011). In our cases, since the manual feeding of soft food is sufficient to meet the bird's metabolic energy demands, no dramatic weight loss was observed in these lesions seen in cage birds.

A number of neoplasms related to the beak have been identified. As with other parts of the body, neoplasms can develop in beak in varying shapes and sizes. These lesions appear in the form of erosion, discoloration, and swelling. They cause the beak and surrounding tissue to deteriorate. These lesions have been rarely reported in birds such as budgerigars, other psychotic and Passerine. Fibrosarcoma, squamous cell carcinomas, and malignant melanomas are the most common neoplasms of the beak. According to their location and time of detection, they can be surgically removed (Worell, 2013). Surgical amputation may be indicated in aggressive neoplasms of beak tissue (Speer and Powers, 2016). In our study, very large beak tumors were found in two budgerigars, but since the owners did not accept biopsy, the tumor type was not determined, and the patients were only given supportive treatment.

Rhinitis and chronic sinusitis have been associated with permanent defects in the adjacent germinative layers of the upper beak or rhinotheca (Raidal and Butler, 2001). Antibiogram tests provide broad diagnostic value to identify some bacterial and/or fungal pathogens, specific antibiotics that can be used (Speer and Powers, 2016). If an antibiogram is not possible or if drug selection must be administered before test results are known, then, historical data can be used to select an empirical drug (Flammer, 2006). In case 8, the malformation on the cere and beak was so severe that the applicability of treatment was unlikely to save the patient, and the bird died as expected in the following days.

Many bacterial, viral (psittacine beak and feather disease, bird pox), parasitic (facial mites) and fungal pathogens can directly infect bird beaks, causing secondary problems in the beak or infect another part of the bird's body. Of these, knemidocoptes, which is a latent infection until stress factors occur. Knemidocoptes are mites that affect unfeathered skin in birds, causing proliferative, spongy like typical lesions and thickening of the skin, and if the mites are not identified and eliminated, the damage can be potentially life-threatening (Toparlak et al., 1999). The mites not only affect the beak, but also the bruise, periorbital area and feet around the nostrils and legs. Mites penetrate the hair follicles, skin folds, and epidermis, causing sac-like cavities and producing secondary sacs in the commissure of the beak. Skin and rhamphotheca can cause hyperkeratotic and pitted or honeycomb appearance. This may cause hyperkeratotic or honeycomb appearance on the skin and rhamphotheca Advanced lesions can cause severe disruption of rhamphotheca. In chronic and advanced cases, the germinal layer of the rhinothecal and gnathotheca epithelium, rhamphotheca is disrupted and permanent beak deformities occur. Mites burrowing into the germinal layer of the beak can damage growth, especially in the upper beak (Abou-Alsoud and Karrouf, 2016). This infection is common in small songbirds and psittacine birds, such as budgerigars, kakarikis, and Neophema. Budgerigars of all ages can be affected, but the disease is most common in young birds and young adults. Diagnosis is made by the direct visualization of the skin and microscopic examination or rhamphothecal scraping. Avermectins, such as ivermectin and moxidectin, are often recommended for the common treatment of knemidocoptes spp., often at seven-day to 10-day intervals. Ivermectin can be administered orally or topically to the lesions. In a study, one and two spot-on applications of moxidectin were found to be similarly effective (Toparlak et al., 1999). Weekly topical application of 0.05 mL of 1 mg/mL solution was effective in eliminating mites in budgerigars within two weeks. Systemic treatment is recommended for birds with severe or general infections. This condition was observed in six budgerigars in our study. In some of the cases, it was seen that the disease progressed rapidly, since a wrong diagnosis was made and the patient was not treated earlier. However, ivermectin treatment was successfully administered, and beak elongation was corrected without malformation.

Conclusion

At the beginning of the most common beak diseases in cage birds, knemidocoptes parasite infections caused beak elongation and trauma beak fractures. According to the affected species, beak elongations were more common in budgerigars, and the reason for this was due to knemidocoptes parasite infection and topical ivermectin application was very successful. In wild birds, the most common trauma beak fractures were seen. In beak fractures, it was observed that the emergency intervention hemostasis was very important and the mortality rate was high in birds due to the fact that both traumatic shock and hemostasis could not be achieved in a short time after trauma. African gray parrots were also found to have excessive beak elongation due to malnutrition.

Conflict of Interest

The authors declare that there is no conflict of interest.

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