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Bilateral osteoma cutis in a Peach-Faced Lovebird (*Agapornis roseicollis*)

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ABSTRACT. An osteoma is an infrequent tumor documented in avian species. An adult female Peach-Faced Lovebird (*Agapornis roseicollis*) with a history of previous trauma was examined due to the presence of bilateral hard and yellowish-white masses in the radio-cubital humerus junction. Histopathological dermal examination revealed a non-neoplastic process of mesenchymal origin, characterized by the formation of well-differentiated trabecular bone, multiple areas of medullary bone and loose connective tissue and coagulation of the necrosis foci. Based on the histological findings and the medical history, the masses were diagnosed as bilateral secondary osteoma cutis. To our knowledge, this is the first report of this pathology with an acute course in this exotic pet bird. The previous trauma could be the initiating cause.

KEY WORDS: avian, ectopic bone tissue, exotic pet bird, trauma

Benign bone-forming tumors are an uncommon phenomenon in the broad group of different neoplasms [18]. The main types of neoplasms are osteomas and ossifying fibromas, but the distinction is often difficult to make, and the decision is sometimes arbitrary [24]. According to Woo *et al*. [37], the osteoma cutis is a non-neoplastic skin lesion composed of ectopic bone tissue. Osteomas or heterotopic ossifications are defined as benign masses that are smoothly contoured, slow-growing masses of protruding of monostotic, sclerotic bone-forming tumors at extraskeletal locations [9]. These tumors are comprised of dense accumulations of cancellous or compact bone with delicate intervening fibrovascular stroma [26]. The masses originate from the periosteal surface of bones, usually, those that form by intramembranous ossification [35], and consist mostly of essentially normal, mature, well-differentiated bone [7, 25, 32].

Histologically, osteomas consist of initially normal-appearing cancellous bone with marrow spaces that may become increasingly compact with time [30]. Soft tissue spaces between the bony trabeculae contain one or more centrally located small-caliber blood vessels, a sparse population of spindle cells and a moderately fibrillary connective tissue matrix within which adipose tissue and haemopoietic elements may be present [35].

This pathology affects a wide group of animals [24]. In avian species, osteomas are extremely rare in free-living and captive birds [17, 33, 35]. In this report, we describe the histological feature of osteoma cutis with an unusual bilateral location and an acute course in a Peach-Faced Lovebird (*Agapornis roseicollis*).

An adult female Peach-Faced Lovebird (*A. roseicollis*) with progressive growth masses in both wings at the level of radio-cubital humerus junction was delivered to Wild Animal Rescue and Rehabilitation Universidad Nacional de Colombia.

The owners reported that a month ago, the bird showed traumatic injuries in the areas where the masses appeared, because it had hit a hard surface while flying. The bird was housed in a cage with 1.0 m long × 1.0 m wide and 1.5 m high dimension, with natural substrate containing native vegetation and logs for perching. The diet consisted primarily of sunflower seeds and water.

On physical examination, the patient was alert, responsive and showed a docile temperament, 39.4°C body temperature, heart rate: 256 beats per min, respiratory rate: 80 breaths per min, pink mucous membranes and a body weight of 46.1 g.

The initial treatment protocol consisted of supportive care that included cleaning the affected areas with clorhedixine (Baxidin®, Basic Farm, Bogotá, Colombia), anti-inflammatory therapy with dexamethasone (Azium®, Intervet, Merck & Co., Inc., Kenilworth, NJ, USA) (0.5 mg/kg PO) and atropine (Atropina-Zoo®, Laboratories ZOO, Bogotá, Colombia) (0.04 mg/kg IM). Fine needle aspiration cytology, excisional biopsy, and x-ray were proposed as diagnostic plans, but, they could not be performed due to the fact that the bird did not respond to supportive care and died on the second day after admission.

Because of the sudden death of the bird, it was sent to be necropsied at the Avian Pathology Laboratory. The findings at

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necropsy were low body condition (3.5/9), areas compatible with self-mutilation with absence of feathers and loss of skin continuity on the left side of the body and the presence of firm masses in the left and right wings at the level of the phalanges of approximately 3.4 × 2.2 cm and 2.4 × 2.7 cm in size, respectively. Both protuberances were well circumscribed with hard consistency and white-yellow color (Fig. 1).

The findings at necropsy were lungs with gray areas, foamy exudate in the abdominal air sacs, liver with adhesions to the internal surface of the sternum, enlarged kidneys, and urate content in the ureters.

Samples from the lungs, the kidneys and the masses of the wings were collected and immediately fixed in 10% neutral buffered formalin and then decalcified in 10% nitric acid. Subsequently, these samples were embedded in paraffin, cut at 5 μm thickness and stained with hematoxylin and eosin (H&E) for histopathology. The histopathologic examination of the masses corresponded to skin that showed at the dermal level a non-neoplastic process of mesenchymal origin, characterized by active inflammatory changes with cellular infiltrations (Fig. 2A) and the formation of bone spicules and the presence of a large tissue extension corresponding to bone marrow with marrow adipose tissue of both myeloid and erythroid types (Fig. 2B). Random perivascular osteoblastic/osteocytic proliferation and lacuna formation (Fig. 2C–D) were also observed, with centripetal mineralized woven bone matrix deposition around the blood vessels of varying sizes, osteoclasts on the edges of the lesions, and a few foci of inflammation and necrosis in the bone marrow tissue.

Osteoma cutis is an osseous metaplasia, one type of ectopic ossification of fibrous connective tissue [12, 23]. Osseous metaplasia indicates an alternative differentiation of fibroblast-like cells into osteoblasts producing osteoid components [23]. Therefore, the metaplastic bone formed by this process develops directly from soft connective tissue.

The diagnosis of osteoma cutis does not pose diagnostic difficulty [4]. However, ossifying fibroma, fibrous dysplasia and osteosarcoma are characterized by bone replacement and were all included in the differential diagnosis. Ossifying fibroma and fibrous dysplasia are benign, intraosseous, proliferative fibro-osseous lesions characterized by replacement of normal bone by a fibrous matrix with various degrees of mineralization and ossification [34]. Given the acute clinical course, in this case, the likelihood of osteosarcoma was considered. This pathology is a primary malignant tumor of mesenchymal tissue with the production of woven anaplastic osteoid, scant and poorly organized [32, 35], rapidly progressive and painful [36]. However, the tumor showed no evidence of active invasion or metastasis. Furthermore, there was only mild polymorphism and nuclear atypia in the proliferating cells with few findings indicating division. In this case, these differential diagnosis were ruled out on the basis of bony proliferation well circumscribed mineralized masses, characterized by mature, well-differentiated bone in the cutis.

Osteoma affects a wide group of domestic and wild animals. The pathology seems to have been affecting animals for a long time. Hampe *et al*. [19] reported an osteoma in the skull of a fossil balaenopterid whale from the Pliocene. Among avian species, osteomas are extremely rare [1, 2, 6, 14, 16, 17, 33, 35]. Although, osteoma have been described in a male of Peach-Faced Lovebird (*A. roseicollis*) by Hidalgo & Paulsen [20] with a significant bony proliferation in the skull, in the cranioventral aspect of left ear, between the ear and the beak, in the literature there is no report of osteoma affecting the skin in this species.

In birds, the body location of osteomas has been recorded with origins in the scapula, humero-radial joint [3], kidney [6], nostrils [8], sternum [11], tarsometatarsus [14], proximal radius [17], skin [21], elbow joints [22], skull [20, 27], foot cushion [27], and infraorbital arch [28]. The cutaneous bilateral location of the masses in humerus radio-ulna junction in this report is unusual.

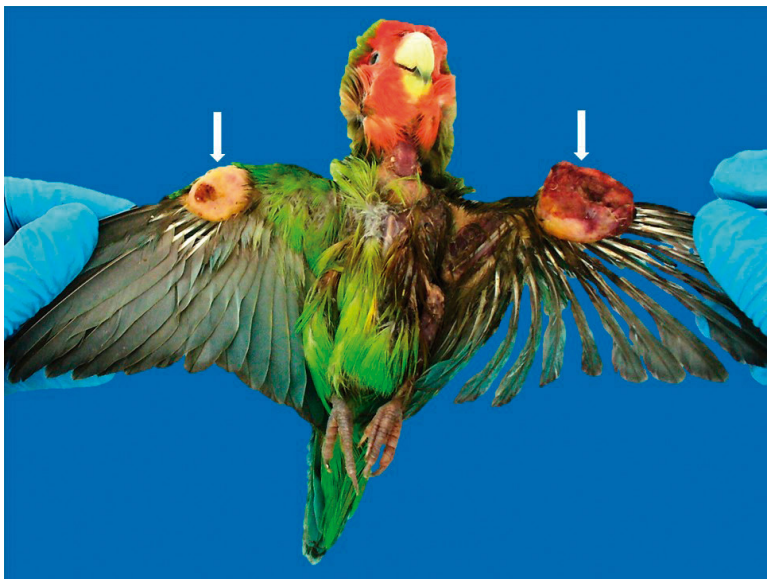

Fig. 1. Bilateral cutaneous masses at the ulnar radius humerus junction (arrows) with feather loss and evidence of self-mutilation.

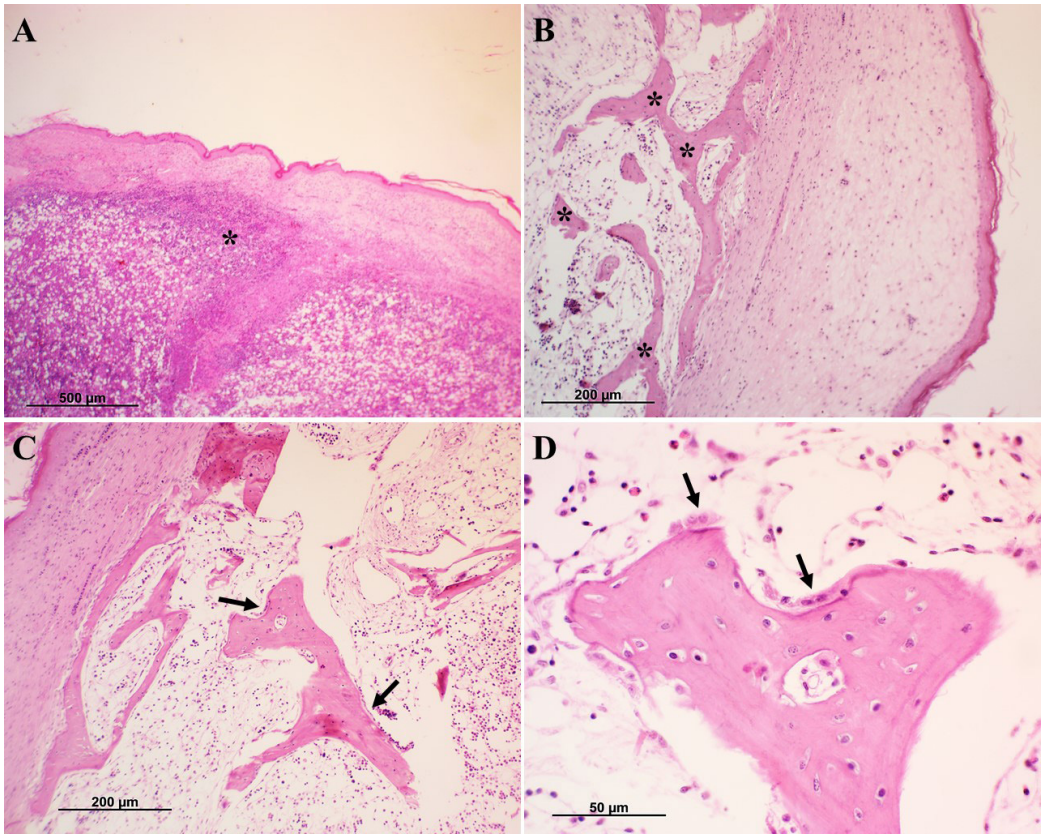

Fig. 2. Histology of the osteoma. (A) Active inflammatory changes with cellular infiltrations (asterisks) in skin. (B) Ontogenetic changes in the skin (asterisks) with bone tissue accumulation compatible with osteoma cutis. (C) The dense compact bone is composed of trabeculae bone that contains elliptic osteocytes, lined by osteoblasts (arrows) and separated by a dense fibrous stroma. (D) Bone lined by osteoblasts (arrows) and separated by a dense fibrous stroma in higher magnification. Hematoxylin and eosin stain.

Additionally, the etiology is uncertain given that historical information such as age, breed, sex, and trauma often cannot be accurately determined [8, 11]. There are two proposed mechanisms for formation of lesions of osteoma cutis, a disordered embryologic process in which normal mesenchymal cells that are destined to differentiate into osteoblasts are present in the wrong location (hamartoma); and a metaplastic process, in which normal extraskeletal mesenchymal cells are stimulated to become osteoblasts by external factors [5, 13, 15, 31]. In the present case, the pathogenesis of the osteoma was obscure. However, according to reports by the owners, possibly a traumatic origin was considered the most likely cause, regardless of the exact process, so recurrence of the lesion may be preventable by avoiding humerus radio-ulna junction trauma.

Histopathologically the main feature that distinguishes primary osteoma cutis from secondary is that there are no co-existing lesions related to the bone [37]. The literature suggests some additional histopathological criteria [10] and states that primary osteoma cutis consists of mature, lamellar bone with a Haversian system located in the deep dermis without an apparent cause. In contrast, secondary osteoma cutis consists of osteoid and/or woven bone and is associated with concurrent lesions, such as inflammation or scars. The lesion in the bird described here is compatible with a secondary type.

According to Cardoso *et al*. [8], based on histopathological features, osteomas can be divided into three stages including growing, sclerotic and mature. In this case, the histopathological pattern was similar to the growing osteoma, with well-formed bone trabeculae bordered by well-differentiated osteoblasts.

The location of the osteoma reported in this article, apart from disfiguring can interfere with the capacity of flight either by the weight of the masses or by the decrease in the amplitude of the wings. However, there was no evidence of problems associated with flight as reported by the owners. Possibly due to the bilateral size of the cutaneous osteoma and with progress in mass growth, the flight could be affected. In most cases, the clinical characteristics of the osteomas demonstrate slow but progressive growth for months [35].

Many tools for antemortem diagnosis are available for osteoma cutis detection. Diagnosis is usually best achieved with a combination of findings from physical examination, histopathologic examination, and imaging techniques such as radiographs and computed tomography [29]. However, the excisional biopsy is the strategy of choice.

In conclusion, we described the clinical appearance and histopathologic findings of secondary bilateral osteoma cutis in an exotic pet Peach-Faced Lovebird (*A. roseicollis*) which had an acute course and an unusual location. To our knowledge, this

pathology has not been previously reported affecting the skin of birds. Osteoma cutis should be considered as a differential diagnosis with a history of severe trauma and subsequent acute inflammatory processes.

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