

Case Report

OSTEOSARCOMA OF THE ULNA WITH PULMONARY METASTASIS IN *AGAPORNIS ROSEICOLLIS*

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Abstract

Osteosarcoma (OSA) is a malignant bone neoplasm of mesenchymal origin characterized by the proliferation of osteoblasts, being considered rare in birds. This paper discusses a rare occurrence of osteosarcoma in a wing with pulmonary metastasis in a *Agapornis roseicollis*, with a history of prostration and a drooping left wing for two days. Radiographic examination revealed findings indicative of an aggressive bone lesion in the proximal third of the left ulna, and signs of a pathological fracture in the ipsilateral radius. Additionally, a focal nodular lesion was identified in the left pulmonary field within the coelomic cavity. Cytological examination of the wing neof ormation revealed signs of infiltrative, non-encapsulated malignant neoplastic proliferation of osteoblasts, consistent with a malignant mesenchymal neoplasm. Three days later, the patient died, and post-mortem and histopathological examinations of the lesions were consistent with OSA in the wing associated with pulmonary metastasis. Due to the scarcity of data regarding this theme, the present report could be useful for veterinarians.

Key Words: birds, exotic pets, imaging diagnostic, neoplasia

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CASE PRESENTATION

A 12-year-old male *Agapornis roseicollis* was presented to the veterinary hospital with a history of prostration, hyporexia, and left-wing drooping for two days, with noticeable asymmetry between the wings upon inspection. The bird had another contact of the same species, housed separately, with no reported abnormalities. Both birds were fed a diet consisting of vegetables and commercial feed. The owner provided informed consent for the publication of all materials obtained during veterinary care.

On physical examination, a cutaneous nodular lesion was observed adjacent to the medial region of the left wing, specifically at the proximal third of the ulna. The nodule was reddish, firm, and measured approximately 1×1 cm. It was adhered to underlying tissues, showed signs of ulceration, and exhibited both central and peripheral alopecia, but without secretion (Fig. 1).



Figure 1. Clinical presentation of a single ulcerative nodule with signs of peripheral and central alopecia, without discharge, located on the left wing of an *Agapornis roseicollis*.

The patient was referred for radiographic evaluation, which revealed an aggressive bone lesion in the proximal third of the left ulna, characterized by a predominantly mineral radiopaque neoformation measuring approximately 1.4×1.1 cm. Additionally, findings compatible with a fracture line in the proximal third of the radius were observed, associated with signs of bone resorption, suggestive of a pathological fracture (Fig. 2). Evaluation of the coelomic cavity revealed a well-defined soft tissue radiopaque nodular structure located in the left pulmonary field, measuring approximately 0.2×0.2 cm, along with multiple mineral radiopaque structures in the ventricular region (Fig. 3).

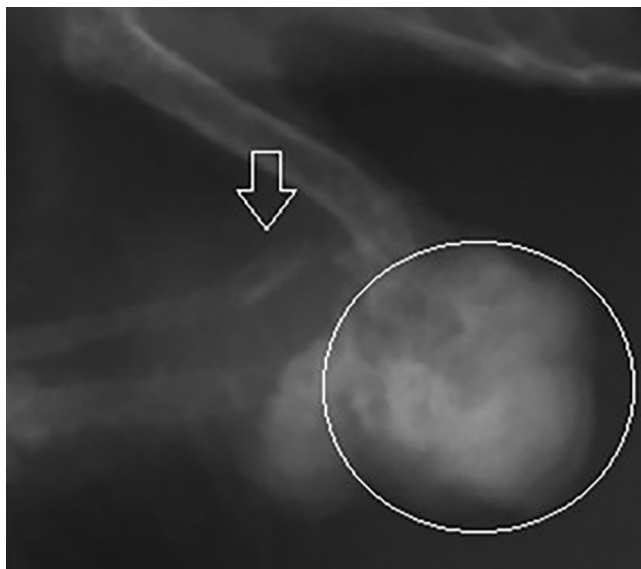


Figure 2. Mediolateral radiographic projection of the left thoracic limb. An aggressive bone lesion is evident in the ulna, associated with an adjacent mineral-opacity mass (circled), and a pathological fracture in the radius (white arrow).

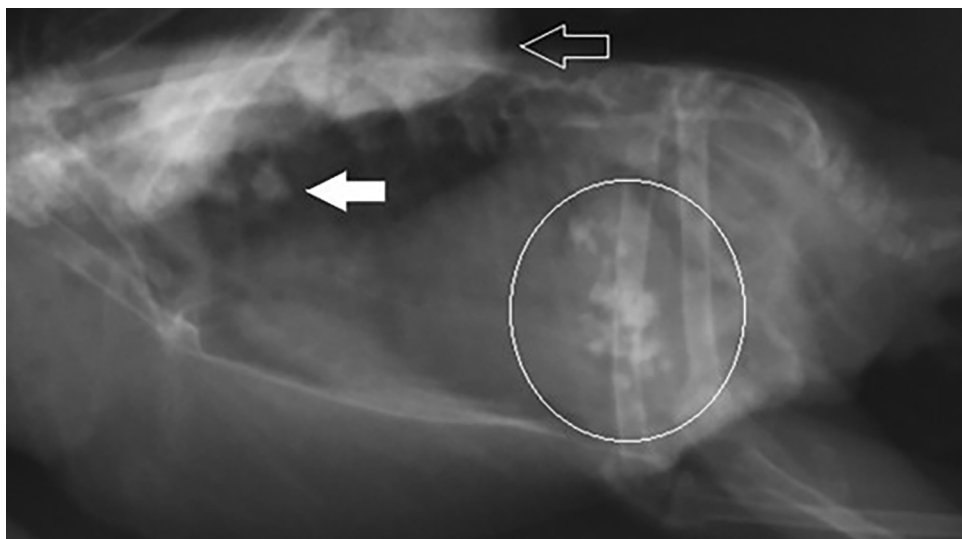


Figure 3. Right laterolateral projection of the coelomic cavity showing a soft tissue-opacity nodule (filled arrow), multiple mineral-opacity structures in the region of the ventricular topography (circled), and the distal aspect of the neoplastic mass in the left thoracic limb (unfilled arrow).

Following the radiographic examination, the patient was discharged with a prescription of gabapentin (3 mg/kg) and dipyrone (25 mg/kg) for pain management, with a

follow-up appointment scheduled for the following day for cytological analysis of the wing mass. Upon return, fine-needle aspiration was performed, and the sample was stained using a rapid panoptic method. The sample revealed atypical spindle-shaped cells, arranged individually, with mildly basophilic and well-defined cytoplasm, an oval eccentric nucleus with punctate chromatin, and multiple prominent nucleoli. Additionally, malignancy criteria such as anisocytosis, anisokaryosis, and moderate to marked cellular pleomorphism were observed, as well as karyomegaly (Fig. 4). Based on the macroscopic appearance of the lesion, along with the findings from the radiographic and cytological examinations, osteosarcoma was considered the primary differential diagnosis. The previously prescribed treatment was maintained, and a follow-up appointment was scheduled in seven days for therapeutic planning.

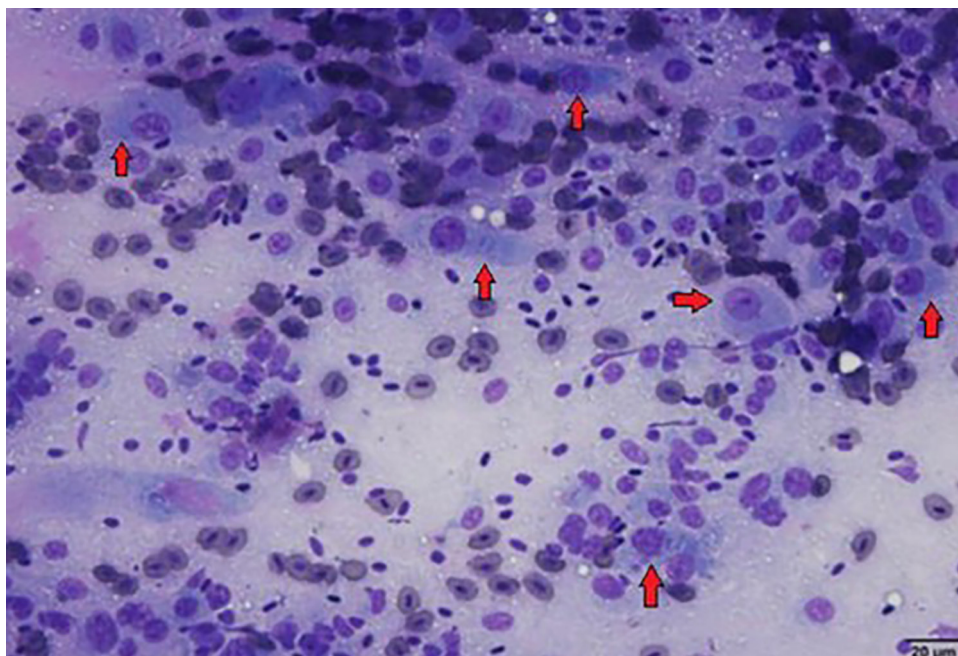


Figure 4. Cytological evaluation obtained by fine-needle aspiration (FNA), stained with rapid panoptic stain, showing individually distributed neoplastic mesenchymal cells with fusiform, well-defined, basophilic cytoplasm; eccentric nuclei with stippled chromatin and multiple prominent nucleoli (arrows). Findings are consistent with a malignant mesenchymal neoplasm.

Two days later, the patient was found at the bottom of the cage in respiratory distress, alongside another bird that had not previously shared the same enclosure. The environmental change was justified by the need for maintenance in the patient's original enclosure, requiring relocation to another space already occupied by another specimen. A possible altercation between the birds was considered. Consequently, the follow-up appointment was moved forward, during which the patient exhibited severe dyspnea. As an initial measure, oxygen therapy was administered, however, the animal

succumbed to a cardiopulmonary arrest. The carcass was submitted for necropsy and histopathological evaluation using hematoxylin and eosin staining.

During the necropsy, a focal nodule was identified in the pulmonary parenchyma. Histopathological analysis revealed an infiltrative neoplastic cellular proliferation with multifocal distribution in the pulmonary parenchyma, composed of mesenchymal cells with eosinophilic, elongated cytoplasm, large nuclei ranging from round to oval with loosely arranged chromatin and prominent nucleoli (Fig. 5), exhibiting marked atypia, mitotic figures, and associated with extensive multifocal mineralization. Additionally, diffuse pulmonary hemorrhage and congestion were observed.

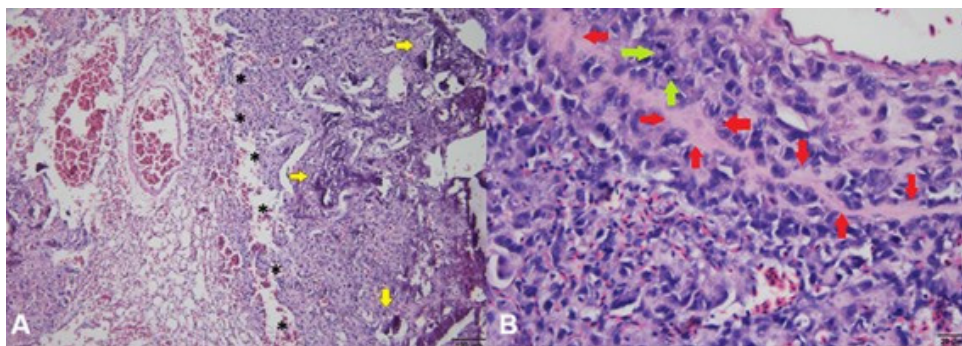


Figure 5. Histopathological evaluation of lung with osteosarcoma metastasis, stained with hematoxylin and eosin. **(A)** Pulmonary parenchyma showing infiltrative neoplastic cell proliferation with marked atypia and nodular pattern, associated with multifocal mineralization (yellow arrows). Transition between pulmonary parenchyma and neoplastic cell proliferation is visible (asterisks). (Scale bar = 100 μ m / 10 $\times$ objective). **(B)** Higher magnification revealing elongated to spindle-shaped cells with poorly defined, eosinophilic cytoplasm and round to oval nuclei with loosely arranged chromatin and prominent nucleoli. Mitotic figures (green arrows) are also observed, along with mature osteoid matrix among the neoplastic cells (red arrows). (Scale bar = 20 μ m / 40 $\times$ objective)

Histopathological examination of the affected limb revealed an infiltrative, non-encapsulated malignant neoplastic proliferation of osteoblasts, arranged in multidirectional bundles interspersed with delicate fibrovascular stroma, occasionally forming a compact and hyper-eosinophilic osteoid matrix, as well as a well-differentiated chondroid matrix. The neoplastic cells exhibited abundant eosinophilic and elongated cytoplasm, large round to oval nuclei with loose chromatin, and prominent nucleoli. Marked anisocytosis, anisokaryosis, and nuclear pleomorphism were also observed (Fig. 6).

Based on the clinical history and radiographic findings, a neoplastic process in the left wing with possible pulmonary metastasis was suspected. However, when considering only the lesion in the affected limb in isolation, osteomyelitis could be considered a differential diagnosis, particularly due to the radiographic appearance of an aggressive bone lesion. Given these aspects, the importance of cytological and histopathological examinations for diagnostic confirmation is highlighted. Cytology allowed the identification of neoplastic mesenchymal cells exhibiting malignancy criteria, while

histopathology, performed postmortem, revealed alterations consistent with OSA associated with pulmonary metastasis.

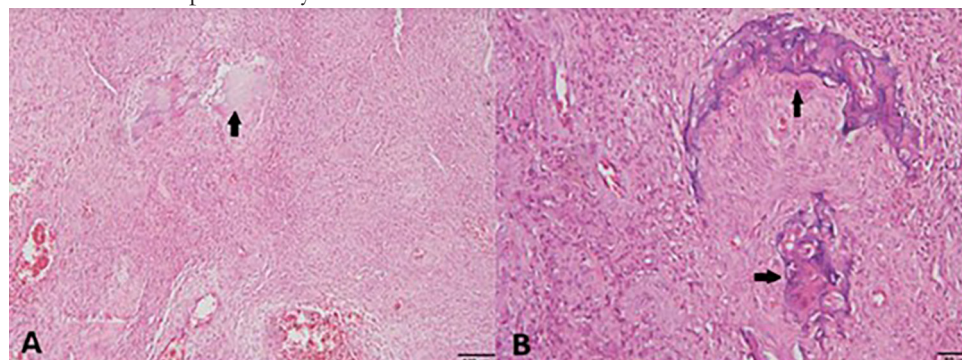


Figure 6. Histopathological evaluation of a neoplastic mass in the left ulna, showing a proliferative, nodular lesion stained with hematoxylin and eosin, consistent with a diagnosis of osteosarcoma. **(A)** Longitudinal section of the ulna showing dense, infiltrative malignant neoplastic cell proliferation arranged in multidirectional bundles, interspersed with delicate fibrovascular stroma and focal osteoid matrix (arrow). (Scale bar = 100 μ m / 10 $\times$ objective). **(B)** Higher magnification revealing elongated to spindle-shaped cells with abundant eosinophilic cytoplasm and round to oval nuclei with loose chromatin and prominent nucleoli. Marked anisocytosis, anisokaryosis, and nuclear pleomorphism are evident. Multifocal chondroid matrix also observed (arrow). (Scale bar = 50 μ m / 20 $\times$ objective).

DISCUSSION

This represents an atypical osteosarcoma presentation in an *Agapornis roseicollis*, with evidence of pulmonary metastasis. It is noteworthy that osteosarcoma in birds is considered a neoplasm of low occurrence and even rare; however, it is the most prevalent among primary bone tumors and most commonly affects the appendicular skeleton (Dittmer et al., 2012), consistent with the findings of the present report, in which the tumor was observed in the left thoracic limb, specifically in the proximal third of the ulna. Previous reports have documented its occurrence in long bones, such as the radius, humerus, femur, tibiotarsus, and tarsometatarsus, with a predominance in the proximal and distal regions of these bones (Filippich, 2004; Schmidt and Quesenberry, 1997). Additional sites where osteosarcoma have been identified in birds include the mandible, orbit, and intraocular region (Hartup and Steinberg, 1996; Fordham et al., 2010).

In various species, osteosarcoma tends to metastasize early and preferentially to the lungs, but this is not commonly observed in birds. Nevertheless, the association between the focal nodular neoplasm in the lung, identified via radiographic examination, and the histopathological findings of the present case enabled the characterization of pulmonary metastasis, revealing an atypical scenario in this species. Osteosarcoma in birds has a low metastasis development rate, and there is evidence supporting this aspect (Fordham et al., 2010; Liu et al., 1982). The radiographic findings at the primary site are consistent with an aggressive bone lesion. A bone lesion is considered

aggressive (Seiler and Thrall, 2024) with the discernment of one of these criteria: (1) cortical bone destruction, (2) active periosteal reaction, or (3) an indistinct transition zone between the lesion and normal bone. In the present report, all three criteria were observed. Another study describes a case of undifferentiated sarcoma in the same species, in the right thoracic limb, with radiographic findings like those observed in this report (Ruano-Feo et al., 2024).

Other studies have reported osteosarcoma in different bird species, such as *Gallus domesticus* (Dittmer, et al., 2012), *Cacatua galerita* (Hastain et al., 2024), and *Streptopelia risorii* (Lamb et al., 2014), with the latter involving the tibiotarsus and possible pulmonary metastasis. In all cases, the radiographic findings were compatible with aggressive bone lesions. Some authors describe morphological characteristics in Wright-Giemsa-stained cytological aspirates like those observed in this study, including isolated cells, spindle to oval-shaped basophilic cytoplasm, eccentrically located nuclei with stippled chromatin, multiple prominent nucleoli, and malignancy criteria such as marked anisocytosis and anisokaryosis (Ruano-Feo et al., 2024; Hastain et al., 2024). However, these findings are morphologically consistent with sarcomas and may be suggestive of osteosarcoma, though confirmation is not possible. Notably, were identified plasmacytoid-like features, such as an eccentrically located nucleus and a perinuclear clear area, in cytopathological aspirates (Hastain et al., 2024). However, these findings were not observed in this study.

Some studies observed histological characteristics in specimens of *Streptopelia risoria* and *Cacatua galerita*, respectively (Hastain et al., 2024; Lamb et al., 2014), like those described in this study. These include the infiltrative proliferation of malignant neoplastic osteoblasts forming dense multidirectional bundles of spindle-shaped eosinophilic cells associated with focal osteoid matrix deposition. In the present report, immunohistochemistry (IHC) was not required for the definitive diagnosis of osteosarcoma, as the histological presentation was sufficient. However, in cases where independent cellular morphology is insufficient for diagnostic confirmation, antibodies used for IHC in dogs and cats may not exhibit cross-reactivity with avian tissues and should be evaluated independently for each bird species (Robat et al., 2017). The production of matrix by neoplastic cells varies, highlighting the subclassifications of osteosarcoma into osteoblastic, chondroblastic, and fibroblastic types. However, this subclassification was not applied in this study due to the lack of morphological characterization studies in the species in question.

Several therapeutic options exist for canine osteosarcoma, with amputation followed by chemotherapy – typically carboplatin or doxorubicin – offering improved survival compared to surgery alone. Limb-sparing palliative radiotherapy has also been reported (Szewczyk et al., 2014). Although treatment was not initiated in the present case, current recommendations for avian osteosarcoma similarly include amputation followed by chemotherapy. Doxorubicin, carboplatin, and pamidronate have been employed (Doolen, 1994; Filippich, 2004; Mayer et al., 2009; Reavill, 2004). One case in *Amazona aestiva aestiva* achieved complete remission following surgical debulking

and administration of doxorubicin (Doolen, 1994). Given the increasing popularity of birds in the pet market, the demand for clinical care has steadily risen. This trend underscores the need for new perspectives and further research in the field, particularly considering the current scarcity of studies focused on exotic pets.

Authors' contributions

FSFS was responsible for the interpretation of the radiographic examination and for drafting the manuscript. DBP and SDG were involved in the clinical management of the case. KHLP and GFM contributed to the cytological and histopathological analyses. LDRP performed a review of the case. ILSS and ALA supervised the clinical management and contributed to the critical revision of the manuscript.

Competing interests

The authors declare that they have no competing interests.

Ethical statement

The owner of the animal was fully informed about all premortal and postmortal procedures that were to be conducted. Written informed consent was obtained prior to the procedures, in accordance with ethical standards and institutional guidelines.

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OSTEOSARKOM ULNE SA METASTAZOM U PLUĆIMA KOD *AGAPORNIS ROSEICOLLIS*

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Kratak sadržaj

Osteosarkom je maligni neoplastični proces koštanog porekla koji nastaje iz mezenhimalnih ćelija i karakteriše se proliferacijom osteoblasta. Smatra se retkim kod ptica. U ovom radu opisana je pojava osteosarkoma kosti krila sa metastazom na plućima kod jedinke vrste *Agapornis roseicollis*, koja je imala istorijat klonulosti i spuštenog levog krila tokom dva dana. Radiografski pregled je pokazao nalaze koji ukazuju na agresivnu koštanu leziju u proksimalnoj trećini leve ulne, kao i znake patološkog preloma u ipsilateralnom radijusu. Pored toga, u levom plućnom polju unutar celomske duplje uočena je fokalna nodularna lezija. Citološki pregled neoformacije na krilu pokazao je znake infiltrativne, neinkapsulisane maligne neoplastične proliferacije osteoblasta, u skladu sa malignim mezenhimalnim tumorom. Tri dana kasnije, pacijent je uginuo, a postmortalni i histopatološki pregledi lezija potvrdili su dijagnozu osteosarkoma na krilu sa metastazom na plućima. Zbog oskudnih podataka o ovoj temi, ovaj prikaz slučaja može biti koristan za veterinare.

Ključne reči: ptice, egzotični ljubimci, imidžing dijagnostika, neoplazma