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Case Report—

Giant Cell Tumor of the Bone in a Scarlet Macaw (*Ara macao*)

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SUMMARY. A 6-mo-old female scarlet macaw (*Ara macao*) was presented after a 2-mo period of anorexia and weakness. The bird was reluctant to fly 1 wk before referral due to a painful left wing. Physical examination revealed a firm swelling around the left shoulder. On radiographs, the diaphysis and proximal metaphysis of the left scapula were radiolucent. Computer tomography revealed an osteolytic process, suggestive of a bone tumor, affecting the left scapula. Cytology of a fine needle aspiration biopsy of the mass showed erythrocytes, a proliferation of spindle-shaped mesenchymal cells, and multinucleated giant cells (osteoclasts) suggestive of a giant cell tumor. The left wing, including the scapula, was amputated. The bird showed a fast recovery but died 1 hr later. Findings during the pathological examination were compatible with shock due to blood loss. The shoulder process was characterized as a giant cell tumor. To our knowledge, this is the first complete report of a giant cell tumor of the bone in a bird.

RESUMEN. *Reporte de Caso*—Tumor de células gigantes en el hueso de una guacamaya roja (*Ara macao*).

Una guacamaya roja (*Ara macao*) de seis meses de edad fue referida luego de un periodo de dos meses de anorexia y debilidad. El ave presentaba renuencia a volar desde una semana antes de ser referida, debido a dolor en el ala izquierda. El examen físico reveló un proceso inflamatorio firme alrededor del hombro izquierdo. La diáfisis y la metáfisis proximal de la escápula izquierda se observaron radiolúcidas en las radiografías. Una tomografía computarizada reveló un proceso osteolítico afectando la escápula izquierda, sugiriendo la presencia de un tumor de hueso. La citología de una biopsia obtenida mediante aspirado con aguja fina mostró eritrocitos, una proliferación de células mesenquimales fusiformes y de células gigantes multinucleadas (osteoclastos) sugiriendo la presencia de un tumor de células gigantes. Se amputó el ala izquierda incluyendo la escápula. El ave mostró una recuperación rápida pero murió una hora mas tarde. Los hallazgos durante el examen patológico fueron compatibles con shock debido a pérdida de sangre. El proceso del hombro se caracterizó como un tumor de células gigantes. En nuestro conocimiento, este es el primer reporte completo de un tumor de células gigantes en el hueso de un ave.

Key words: giant cell tumor, psittaciforme

Abbreviations: ABC = aneurismal bone cyst; CT, computerized tomography; GCT = giant cell tumor of bone; H&E = hematoxylin and eosin; MGC = multinucleated giant cell

Giant cell tumor of bone (GCT) is a rare benign lesion that arises mainly in the metaphyseal and epiphyseal area of long tubular bones (9,18). In humans, there is a slight female predisposition, and the tumor commonly occurs in the third and fourth decade of life (2,19). GCTs have variable characteristics from indolent, static tumors to locally aggressive lesions associated with significant bone destruction and soft tissue extension (6). Also, a small percentage of GCTs develops hematogenic metastasis, principally to the lung (2,19).

Histologically, these tumors are composed of mononuclear ovoid and spindle-shaped cells associated with giant cells and macrophages (3,12,19). The histological appearance of a GCT was recently described in a cat with extra skeletal metastases. In this immunohistochemical study, three defined cell populations in the GCT, all of mesenchymal origin, are described, i.e., spindle-shaped tumor cells resembling fibroblastic cells, round mononuclear cells resembling macrophages, and multinucleated giant cells that seem morphologically similar to osteoclasts (8).

Giant cell tumors can be classified according to the Enneking staging system (6) for benign bone tumors: stage 1, a latent lesion that is biologically stable; stage 2, an active, slow growing lesion that is confined within the bone; and stage 3, locally aggressive with soft tissue extension.

In humans the treatment of choice for patients with resectable tumors is surgery. Stage 1 GCT can be treated successfully with intralesional curettage (20,21,27). Stages 2 and 3, recurrent lesions or GCT of nonsalvageable bones, can be treated with wide resection and reconstruction. Radiotherapy is also an option in cases where complete excision or curettage cannot be performed (tumors of spine or sacrum) or for aggressive (lung metastasis) or multiply recurrent GCTs (7).

In domestic animals, GCT is a rare primary neoplasm (25). It has been described in cats in the tibia, femur, ulna, and radius (1,8,11). It also has been described in the humerus of a dog (15).

GCT in domestic animals has been described as a well-vascularized tumor of both mononuclear and multinucleated cells (22). In veterinary medicine, there is a lack of information about the clinical and pathological aspects of GCT due to the small amount of cases described. The aim of the present case report is to describe the clinical, radiological and histopathological aspects of a giant cell tumor in a scarlet macaw (*Ara macao*).

MATERIALS AND METHODS

Case report. A 6-mo-old female scarlet macaw was presented to the Division of Avian and Exotic Animal Medicine (Faculty of Veterinary Medicine, Universiteit Utrecht, Utrecht, the Netherlands) after a 2-mo

Fig. 1. Ventrodorsal radiograph showing the lack of definition of the right scapula and the soft tissue swelling of left shoulder.

Fig. 2. CT showing the tumoral destruction of left scapula (A), left humerus (B), coracoid (C), and clavicula (D).

period of anorexia and weakness. The bird was reluctant to fly 1 wk before presentation due to a painful left wing.

On physical examination, the bird was weak and very thin with a body weight of 747 g. A cold, hard swelling was palpated in the caudal part of the left shoulder. Hematology was normal and plasma biochemistry showed a slight elevation of β-globulins of 7.8 g/liter (reference range 4.8–6.8 g/liter).

Radiographs (Philips Super-100CP; Philips Medical System, Eindhoven, the Netherlands) and Computer Tomography (Philips Secura; Philips Medical System, Eindhoven, the Netherlands) were performed under isoflurane anesthesia. Lateral and ventrodorsal radiographs revealed a large soft tissue mass in the region of the left shoulder and scapula and an almost complete destruction of the scapula (Fig. 1). On computed tomography (CT) images (Fig. 2), an expansive osteolytic lesion of the scapula was found of approximately $4 \times 3.5 \times 2.7$ cm, compatible with a primary bone tumor.

A fine needle aspiration biopsy was performed under isofluorane anesthesia. Cytological examination showed multinucleated giant cells (osteoclasts), mesenchymal cells, and erythrocytes. Due to the young age of the bird and the localization and aggressive characteristics of the tumor (stage 3), we decided to perform an intracapsular amputation of the left wing including left scapula.

The scarlet macaw was premedicated with butorphanol (1 mg/kg) (Torbugesic®, Fort Dodge Animal Health, Naarden, the Netherlands) and carprofen (4 mg/kg) (Rymadil®; Pfizer Animal Health, Capelle a/d IJssel, the Netherlands) intramuscularly 15 min before surgery. Next, the bird was induced with isoflurane 4% and intubated. Monitoring consisted of capnography, electrocardiography, and measurement of the cloacal temperature. The bird received intravenous fluids via the brachial vein at a rate of 3 ml/kg/hr. A bair hugger (Bair Hugger®; Arizant Healthcare, Eden Prairie, MN) was used to maintain body temperature.

The bird was positioned in right lateral recumbence. The left wing was bandaged up to the elbow joint, and the feathers were plucked from the humerus, left shoulder, and thoracic girdle region and subsequently prepared for aseptic surgery. A circular incision was made around the shoulder with an extension over the scapular region. The superficial and deep pectoral muscles were severed using radiosurgery. The scapula and tumor were identified and freed from the thoracic wall by blunt dissection. Major vessels were ligated using absorbable suture material and nerves were cut with a scalpel blade no. 11. Hemostasis was controlled by bipolar radiosurgery. The wing was exarticulated in the shoulder joint and the humerus, scapula, and tumor were detached from the coracoid and clavicular bones. During the dissection of the tumor on the thoracic wall, the thorax and clavicular air sac were opened, but they were adequately closed using sutures and thrombin gel foam. The muscles and subcutaneous layer were closed using 3/0–4/0 polyglactin 910 (Vicryl™; Ethicon, Norderstedt, Germany) suture material, and the skin was closed using 4/0 poliglecaprone 25 (Monocryl™; Ethicon) sutures. The bird recovered from anesthesia and was left in an incubator with oxygen for postoperative recovery. Unfortunately, the bird died after 1 hr.

RESULTS

At necropsy, based on fat and muscle stores, the bird had a poor body condition. The liver was slightly enlarged. The scapular lesion consisted of hyperemic, partly firm and partly necrotic tissue with multifocal hemorrhages. No other specific changes were noted. Tissue samples from the proventriculus and ventriculus, lung, liver, spleen, and process of the scapula were fixed in 4% phosphate-buffered formalin, embedded in paraffin, cut at 4-μm sections, and stained with hematoxylin and eosin (H&E).

Histologically, fibrosis with lymphocytes and plasma cells was present in the tunica propia between the proventriculus and gizzard. There was edema and hemorrhage in the parabronchial lumen. The spleen was hyperplasic. Periportal fibrosis with slight bile duct proliferation was present in the liver. There was focal ballooning and necrosis of hepatocytes with some granulocytic reaction.

The lesion of the scapula consisted of proliferation of spindle-shaped stromal cells with numerous multinucleated giant cells (MGCs) and dense collagen (Fig. 3). The nuclei of the MGCs were similar to the nuclei of the stromal cells. There was very little mitotic activity; tumor cell nuclei showed slight pleomorphism and infiltrative behavior in adjacent pre-existent bone trabecula. Tumor cells (giant and mononuclear neoplastic cells) were seen adjacent to vascular channels and within blood vessels. These histological features are consistent with a GCT. The parabronchial hemorrhages

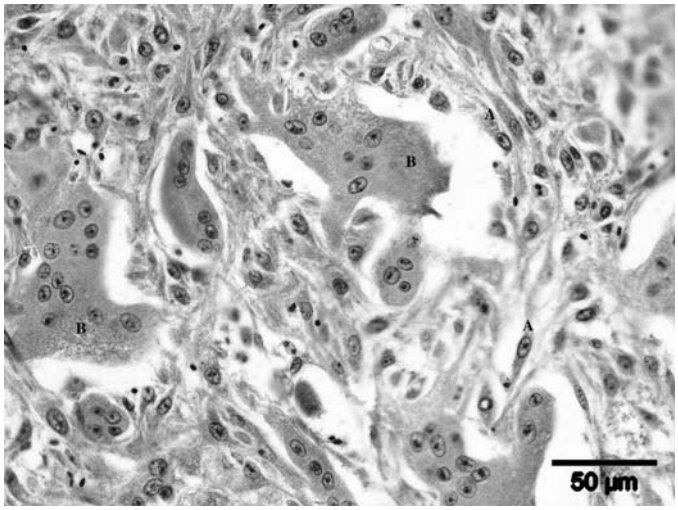

Fig. 3. Histology of left shoulder tumor showing spindle-shaped stromal cells (A) and numerous multinucleated giant cells (B) typical of a GCT. Bar = 50 µm (H&E).

and acute necrosis of hepatocytes may be due to hypoxia and shock, induced by the blood loss during surgery.

DISCUSSION

This article reports the first complete description of a GCT in an avian species. There is another report available about a GCT in a bird (24), but no specific information was published on this case.

In humans, benign GCT is a rare osteolytic tumor that occurs mainly in young adults at the epiphysis and is typified by numerous characteristic large giant cells. GCT also exhibits an slightly female predilection (2,19). The progression of the tumor is chronic, and symptoms are constant. Chronic pain in the region of the affected joint is worse at night and after activity. Decreased range of motion occurs late in the disease, as the tumor expands and distorts the end of the bone. The joint is normally not invaded. The bone will progressively expand to one side and overlying skin is stretched. Pathological fracture can occur late in the course of the disease when the cortical bone is destroyed.

The radiographic characteristics of GCT in humans are circumscribed radiolucent area in the epiphysis extending to the metaphysis, outward expansion and thinning of the cortex, absence of periosteal bone formation, multiple bone septae, cortical fractures, and rarely extension of the tumor in the joint.

In our case, the GCT was located in the diaphysis of the left scapula extending to the articular cartilage without new bone formation. The bone destruction was so extensive that it was difficult to identify the origin of the lesion, i.e., methaphysis or diaphysis. Based on radiographic and CT findings, the tumor can be considered a stage 3 lesion according to the classification from Enneking (locally aggressive with soft tissue extension) (6).

Differential diagnosis before histological examination of the tumor included aneurysmal bone cyst, giant cell tumor and high-grade intramedullary or classical osteosarcoma. Aneurysmal bone cyst occurs mainly in young humans (13), GCT occurs in the third and fourth decades of life (16), and osteosarcoma in dogs occurs mostly between 7 and 9 and less between 1 and 2 yr of age (14). Aneurismal bone cyst and GCT have a slight female predilection in men (17,19).

Classical osteosarcoma occurs mainly in the metaphysis of long bones and has specific radiographic characteristics, including a combination of lytic bone destruction, periosteal new bone formation, sclerosis, and often a mineralized soft tissue mass. Also, osteosarcomas are very high-grade malignant tumors with pleomorphic spindle cells and production of osteoid. Osteosarcoma was ruled out because osteoid was absent in our patient. Aneurismal bone cysts (ABCs) are benign, but they often rapidly expanding osteolytic multicystic lesions. ABCs also occur in young patients and mostly affect the metaphyseal region of long bones (5). ABCs are considered to be of reactive nature, and 50% of ABCs are secondary to trauma or to tumor-induced vascular anomalies. In 33% of ABCs, the pre-existing lesion can be identified of which the most common is the GCT (19–39%). Other less common precursor lesions of ABCs are osteosarcoma, fibrous dysplasia, fibroxanthoma, and fibrous histiocytoma. (13). An aneurismal bone cyst is usually a local circulatory disturbance leading to an increased venous pressure and the development of a dilated and enlarged vascular bed within the affected bone area (23). ABCs have been described recently in two psittacine species associated with previous trauma (10).

The histologic characteristics of ABCs are different from those found in our patient. ABCs are composed of blood-filled, anastomosing, cavernous spaces, separated by a cyst-like walls that are composed of fibroblasts, myofibroblasts, osteo-like giant cells, and osteoid and woven bone (4,17).

The cause of death in our patient was attributed to hypovolemic shock, probably due to the amount of blood lost during the surgery. Instead of surgery, intralesional curettage with adjuvant therapies such as phenol, polymethylmethacrylate, liquid nitrogen, and argon beam laser have been described for the treatment of GCT in humans (26). Unfortunately, intralesional curettage in humans has a high recurrence rate of 8–12%, and adjuvant therapies have not yet been described for the treatment of bone tumors in avian species.

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