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SUBCUTANEOUS XANTHOMATOSIS IN A GREAT WHITE PELICAN (*PELECANUS ONOCROTALUS*)

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Abstract: A great white pelican (*Pelecanus onocrotalus*) was referred for assessment of a subacute-onset, nonpainful swelling located in the pectoral region. Physical examination revealed a firm, round, well-circumscribed subcutaneous mass approximately 10 cm in diameter. Cytological evaluation of a fine needle aspirate of the mass was consistent with a mesenchymal tumor. The mass was excised, and a diagnosis of xanthomatosis was made based on histopathologic results. Avian xanthomatosis is a nonneoplastic condition of unknown etiology. Possible causes of this condition include trauma, metabolic or nutritional disorders. Similar lesions were not observed in the nine conspecifics that were fed the same diet and housed in the same enclosure. To our knowledge, this is the first report of xanthomatosis in the family Pelecanidae.

Key words: Avian xanthomatosis, cytology, pelican, *Pelecanus onocrotalus*, subcutaneous mass, xanthoma.

BRIEF COMMUNICATION

Xanthomas are nonneoplastic yellow nodules composed of lipid-laden macrophages, giant cells, cholesterol clefts, and fibrous tissue.[2,9] They are not true neoplasms but can be locally invasive.[9] In birds, cutaneous xanthomas are typically observed in the cervical region, the wattles, the back, the distal wings, the sternum, the feathered skin over the tibial region, or around the uropygial area.[7,9] Other reports include periarticular xanthomatosis,[1] periosseous xanthogranulomatosis,[7] an oral xanthoma,[8] a conjunctival xanthoma,[10] atypical xanthomatous neoplasia,[3] and tracheal xanthogranulomatosis.[6] The great white pelican (*Pelecanus onocrotalus*) is widely distributed in eastern Europe, Asia, and Africa. The present study describes a case of xanthomatosis affecting the sternal subcutis of a great white pelican. To our knowledge, xanthomatosis has not been previously reported in Pelecanidae.

A 2.5-yr-old captive male great white pelican was referred for assessment of a gradual onset, nonpainful, firm swelling located in the pectoral region and a 10-day history of partial anorexia. The pelican was obtained from the previous owner six mo earlier. At that time, a routine physical examination was unremarkable, except for an old healed fracture of the left tarsus. The previous owner fed the pelican day-old chicks and pieces of chicken carcasses, predominantly viscera. During the last 6 mo, the pelican lived in a large, open, enclosure with nine conspecific, pinioned pelicans and was fed fresh fish on a daily basis.

On presentation, the pelican had a body condition score of 3 out of 5 and a body weight of 9.1 kg. A firm, round, well-circumscribed mass approximately 10 cm in diameter was detected subcutaneously in the pectoral region. Differential diagnoses included an abscess, a hematoma, a neoplasm, and a granulomatous reaction to a foreign body or a parasite. No other abnormalities were noted on physical examination. A fine needle aspirate of the mass was collected for cytology and microbiology by use of a 23 ga, 25-mm needle attached to a 10-ml syringe. Aerobic and anaerobic cultures failed to produce any microbial growth after 7 days. Cytologic examination (Fig. 1) revealed anaplastic cells ranging from triangular to polygonal or fusiform in shape. The cells showed marked anisocytosis and cytoplasmic basophilia. The nuclei exhibited marked anisokaryosis, large nucleoli, anisonucleosis, and often had immature, uncondensed chromatin. Multinucleated cells were often present with aligned nuclei. No microorganisms were identified. Cytologic evaluation led to speculation of a mesenchymal tumor. Due to the chains of nuclei, a leiomyosarcoma or rhabdomyosarcoma was suspected.

Because of its size and the suspicion of a malignant neoplasm, the mass was surgically

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excised. Anesthesia was induced and maintained with isoflurane (Forane, Baxter Healthcare Corporation, Deerfield, Illinois 60015, USA). The mass ($12 \times 8 \times 8$ cm) was removed via an elliptical skin incision and careful dissection from the surrounding subcutaneous tissue layers. During surgery, multiple smaller nodules that were undetectable by palpation were found extending ventrally from the principal mass. All four visible masses were completely excised. The total length of the four masses was 22 cm and the total weight was 973 g. Grossly, the masses were bright to tan-yellow, and they had a well formed blood supply. A 2-cm hematoma was present on the external surface of the 12-cm mass. On cross section, the masses were comprised of a yellow, friable, gelatinous tissue with necrotic and fibrous areas interspersed. Samples were collected and stored in a 10% buffered formalin solution for histopathology, processed routinely, and stained with hematoxylin and eosin. The skin was closed with an absorbable polydioxanone 3-0 suture (PDS, Ethicon Inc., Somerville, New Jersey 08876, USA). The patient recovered uneventfully from anesthesia. The pelican was treated with 80 mg/kg amoxicillin/clavulanic acid (Synulox, Pfizer Animal Health, Sandton 2146, South Africa) intramuscularly once daily for 5 days and carprofen 4 mg/kg (Norocarp, Norbrook Laboratories Limited, Newry, BT35 6PU, Northern Ireland) intramuscularly once daily for 3 days.

Histologically, the masses all had variably thick fibrous connective tissue capsules and fibrovascular connective tissue septae. All four masses consisted mainly of disrupted, partially mineralized and necrotic adipose tissue infiltrated by small numbers of heterophils, cholesterol clefts, and extravascular erythrocytes (mainly in the center of the masses). Two masses contained variable amounts of mucinous matrix (Fig. 2A) populated by scant to numerous stellate cells, a few of which had large bizarre nuclei (Fig. 2B) and small numbers of hemosiderin-laden macrophages. A few small aggregates of lymphocytes and plasma cells were scattered throughout most masses. The hematoma contained variable mixtures of fibrous connective tissue and lysed erythrocytes, as well as moderate numbers of histiocytes, melanin-rich macrophages, and multinucleate giant cells, mixed with smaller numbers of heterophils and moderate amounts of fibrin. A histopathologic diagnosis of xanthomatosis was made. No changes were made in the diet or in the management of the pelican. The mass did not recur in the following 2 years.

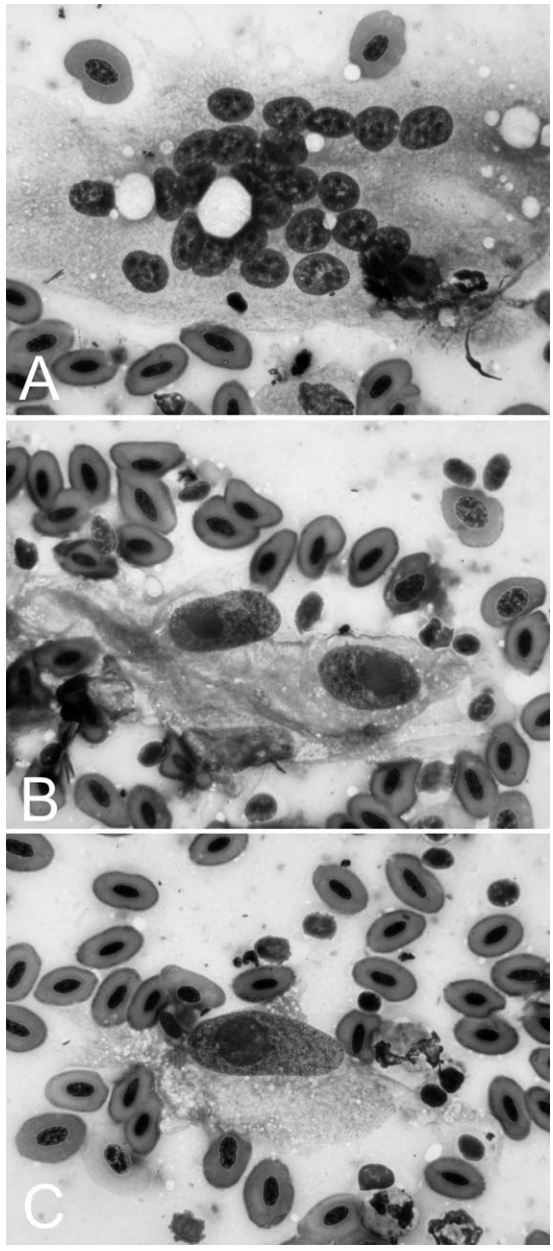

Figure 1. Cytology of a fine needle aspirate of a mass located in the pectoral region of a great white pelican. Diff-Quick, ×1,000. **A.** Large multinucleate giant cell. **B.** Large anaplastic mesenchymal type cells. **C.** Mesenchymal cell with giant nucleus and giant, bizarre nucleolus.

Differential diagnosis for large soft to semisoft tumors of the skin and subcutis of birds includes lipoma, xanthoma, fibrosarcoma, and myelolipoma. Avian xanthomatosis is a condition of uncertain etiology.[2] Abnormal lipid metabolism is

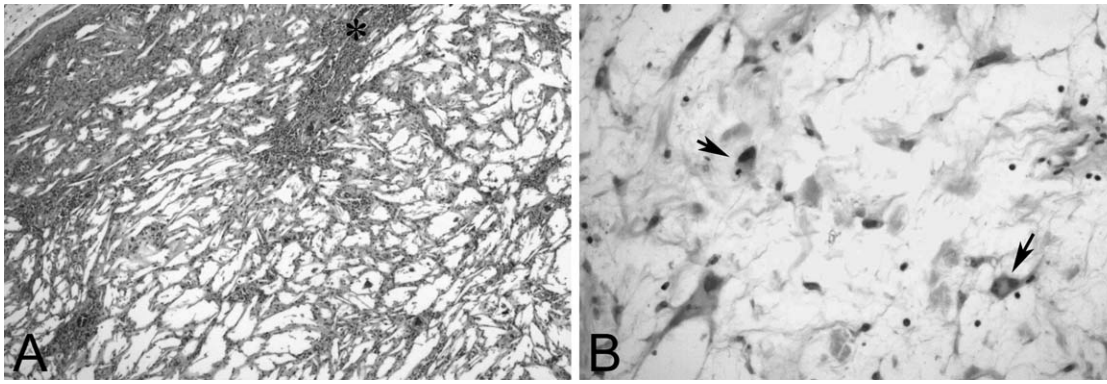

Figure 2. Photomicrographs of a portion of the mass excised from a great white pelican. **A.** Encapsulated mass with fibrovascular connective tissue septae (*) and necrotic adipose tissue containing large numbers of cholesterol clefts. Hematoxylin and eosin (H&E), ×40. **B.** Loose mucinous matrix containing stellate cells with large bizarrely shaped nuclei (arrows). H&E, ×400.

thought to contribute to the formation of xanthomas, and elevated serum cholesterol or other lipids are present in affected individuals.[4] In mammals, xanthomas may form secondary to primary or secondary hyperlipidemia, with high plasma concentrations of cholesterol or triglyceride-containing lipoproteins.[12] In birds, hypercholesterolemia and hypertriglyceridemia have been reported in a blue and gold macaw (*Ara ararauna*) affected by a conjunctival xanthoma and in a goose (*Anser anser*) diagnosed with xanthomatosis.[3,10] Unfortunately, hematology and serum chemistry were declined by the owner; thus, cholesterol levels of the pelican are unknown.

In poultry, Sanger and Lagace[9] found that xanthomatous lesions were histologically composed of giant cells, foamy macrophages, serous exudate and an increase in connective tissue. The disease was not transmitted by contact, by embryo inoculation, or through the eggs. No infectious agents were isolated. Therefore, it was suggested that fat-related toxic hydrocarbons in the feed may have led to the xanthomatous lesions observed.[9] The role of the diet in the development of xanthomatous lesions was investigated by a study performed on a strain of Japanese quail (*Coturnix japonica*) susceptible to dietary cholesterol-induced atherosclerosis.[2] In these quails, xanthomatous lesions developed after 4 wk of exposure to a high-cholesterol diet. Nevertheless, there was no significant correlation between plasma cholesterol and triglycerides concentrations, and xanthoma scores.[2] In the present case, the pelican had a remote history of inadequate meat-based diet but was on a fresh fish-based diet in the 6 months before the development of the masses.

This case of xanthomatosis was unusual in several aspects. First, the fine needle aspirate for these masses was evaluated and deemed compatible with a mesenchymal tumor, such as a leiomyosarcoma, whereas cytologic samples of xanthomatosis usually present a histiocytic inflammatory response with multinucleated giant cells and cholesterol crystals. Due to the absence of a neoplastic cell population in the histologic analysis of the tissues, the anaplastic cells observed in the cytologic examination were more probably cells with bizarre nuclei in the mucinous portions of the xanthomas, multinucleate macrophages or spindle cells, and as such reactive rather than neoplastic. Misdiagnosis of cytology from xanthomatous lesions has been reported when smears are performed on gastric xanthomas in humans.[5] In those cases, atypical xanthoma cells may be confused with signet-ring adenocarcinoma cells.[5] In addition, none of the nine conspecifics, fed the same diet and living in the same enclosure, presented similar lesions. In view of this finding, a concurrent traumatic etiology cannot be excluded. Tracheal xanthogranulomatosis has recently been reported in a hawk as a possible complication of trauma consecutive to repeated intubation.[6] In humans, xanthomas are characteristically distributed at sites subjected to pressure or minor trauma (elbows, knees, buttocks).[11] In this pelican, the lesions were located in the sternal region that is frequently subjected to pressure in ground-dwelling avian species. The weight of the pinioned bird, as well as a difficult access up a steep slope for feeding, may have contributed to the occurrence of repeated traumatic events in the sternal region. Although the external hematoma on the main xanthoma may support this hypothesis, the

absence of hematoidin or hemosiderin in the hematoma suggests that it occurred shortly before resection; thus, it seems more likely that the hematoma occurred after development of the masses. The melanin-rich macrophages in the hematoma may represent pigmentary incontinence in the overlying skin. Last, the large size of the main xanthoma was unusual.[3,7,10]

The natural diet of Pelecaniformes includes a variety of fish and crustaceans. Considering the possible dietary etiology,[2,9] dietary modifications can be used as an adjunctive therapy. In the present case, due to pelican's piscivorous habits, we elected to maintain the diet without changes. Nevertheless, no recurrence has been reported in the pelican over 2 years after surgery.

To our knowledge, there are no previous reports of xanthomatosis in pelicans. It should therefore be considered as a differential diagnosis in the case of subcutaneous mass development in these species.

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