Pathology in Practice

In collaboration with the American College of Veterinary Pathologists

History

A 24-year-old captive female common ostrich (*Struthio camelus*) was evaluated for sudden onset of left pelvic limb lameness, ataxia, and muscle weakness that progressed to frequent recumbency and later anorexia.

Clinical and Gross Findings

Upon clinical examination 2 days later and while being treated with meloxicam (0.75 mg/kg, PO, q 24 h), the bird appeared slightly ataxic with reduced ability to bear weight on the left pelvic limb. Apart from a marked increase of alkaline phosphatase activity (4,276 U/L; reference range,¹ 2 to 460 U/L), results for hematology and serum biochemical analyses were unremarkable. Radiography revealed multifocal, mildly radiodense areas along the vertebral column. The animal was then given butafosfan (500 mg), vitamin B12 (250 µg), calcium gluconate (10 mg/kg), anhydric sodium selenite (5 mg), and α-tocopherol acetate (125 mg) subcutaneously. The condition improved temporarily during the next 4 days but then decreased rapidly with recumbency unless forced to get up and with permanent dilation of the right pupil. At this point, the animal was anorexic, and euthanasia was elected due to the poor prognosis.

At necropsy, there were multiple randomly distributed, hard, well-delineated, yellow masses (up to 5 X 4 X 4 cm) in vertebral bodies along the vertebral column. The masses seemed to extend from the periosteal and endosteal surfaces with destruction and replacement of the surrounding spongy bone (**Figure 1**). Some of these masses appeared to slightly compress the spinal cord. Additionally, occasional hard, moderately well-delineated, yellow masses (up to 1 cm in diameter) were on the periosteal

Figure 1—Postmortem image of a portion of the vertebral column from 24-year-old captive female common ostrich (*Struthio camelus*) with sudden onset of left pelvic limb lameness, ataxia, and muscle weakness that progressed to frequent recumbency and later anorexia. Along the vertebral column are multifocal hard masses (arrows) that are well demarcated from the surrounding bone, and some of these masses are suspected to have compressed the spinal cord.

surface of the pelvic bones and in the endosteal surface of the medullary cavity of several long bones. In addition, there were 6 similar masses (up to 0.5 cm in diameter) in the coelomic cavity. These were attached either to the coelomic wall or free floating without visible connection to other organs. Several similar masses measuring up to 3 cm in diameter were present in the lungs, in the kidneys, and the pericardium. The brain and the spinal cord were macroscopically unremarkable.

The leaflets of the left atrioventricular valve and the aorta were also multifocally irregular and moderately thickened.

Formulate differential diagnoses, then continue reading.

Histopathologic Findings

All masses described earlier displayed histologically similar features. They were nonencapsulated, well demarcated, poorly cellular, and invasively growing. A large number of irregular, partially mineralized, eosinophilic extracellular matrix (osteoid)

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Figure 2—Photomicrographs of a section of one of the hard masses in the coelomic cavity (A) and a neoplastic embolus identified in the lumen of a lymphatic vessel located in the vicinity of the left arteria iliaca (B) of the ostrich described in Figure 1. A—Single (arrows) or small clusters (chevron) of neoplastic mesenchymal cells and rare multinucleated cells (arrowheads) are surrounded by a large amount of irregular, partially mineralized osteoid trabeculae (star). H&E stain; bar = 25 μ m. B—H&E stain; bar = 200 μ m.

trabeculae surrounded single or small clusters of neoplastic mesenchymal cells (**Figure 2**). These cells were stellate to slightly elongated with moderately distinct cell borders, displaying a small amount of homogeneous, slightly eosinophilic cytoplasm and an oval to reniform nucleus with finely stippled chromatin and a round, basophilic nucleolus. Anisocytosis and anisokaryosis were mild and there were no mitotic figures visible in 10 hpfs (400X). Occasional multinucleated neoplastic cells, as well as rare osteoclasts, a small number of adipocytes, and capillaries were visible within the osteoid. A neoplastic embolus with similar characteristics was also

Figure 3—Photomicrograph of the aortic wall of the ostrich described in Figure 1 showing severe, multifocal elastin degeneration in the tunica media of the aorta and concurrent mucinous degeneration (arrow). H&E stain; bar = 100 μ m. Inset—Highlights disrupted elastin fibers (arrowheads). Van Gieson stain; bar = 50 μ m.

identified in the lumen of a lymphatic vessel contiguous to the left arteria iliaca.

There was multifocal, minimal vacuolation of the white matter along the spinal cord. The optic and sciatic nerves and the eyes were unremarkable.

The tunica media of the aorta and several arterioles were moderately thickened due to a severe multilayered elastin fiber disruption, with intramural accumulation of mucinous material staining positive for alcian blue (mucinous degeneration; **Figure 3**). The lamina fibrosa of the left atrioventricular valve leaflets displayed similar changes.

Morphologic Diagnosis and Case Summary

Productive osteoblastic osteosarcoma of the vertebral column with metastasis to the pelvis, long bones, coelomic cavity, lung, kidney, and pericardium and moderate to severe, laminar arteriopathy and valvulopathy with elastin fiber degeneration and mucinous degeneration of the aorta, arterioles, and left atrioventricular valve leaflets in an ostrich.

Comments

Osteosarcomas are seldom described and poorly characterized in birds with regard to biological behavior, prognosis, metastatic rate, radiographic appearance, and associated biochemical changes.²⁻⁵ This form of neoplasia is likely rare in ratite birds.^{6,7} The occurrence of osteosarcomas in the axial skeleton has been previously reported in other avian species,⁵ even though in birds osteosarcomas are thought to be mostly associated with the appendicular system as

described in dogs and cats.^{2,4,8} In contrast to observations in domestic mammals,⁸ metastatic spread associated with osteosarcoma appears to be a rather unusual event in birds.^{2,4} In this case, several osteosarcomas were identified not only in the skeletal system, but also within the visceral organs and the coelomic cavity. Although the occurrence of a multicentric osteosarcoma cannot be excluded as a differential diagnosis in this case, the bigger size of the masses found along the vertebral column and the identification of a neoplastic embolus within a lymphatic vessel are compatible with a primary axial origin with concurrent metastatic spread. A reason for the presence of masses within the coelomic cavity without visible connection to other coelomic structures was not evident, and such a phenomenon has not been reported previously. Interestingly, the marked increase in alkaline phosphatase as detected in this ostrich represents a poor prognosis marker in dogs with osteosarcoma.⁸ However, the significance of this finding in birds is unknown. Although it appears that the clinically described lameness, ataxia, and weakness were likely secondary to spinal cord compression by neoplastic masses, only minimal changes were detected histologically. Because there were no metastases or other histologic changes identified in the brain, in the optic nerve, or in the eyes, the cause of the permanent dilation of the right pupil could not be identified.

The mucinous degeneration and elastin fiber degeneration of the tunica media observed in the aorta, in some arterioles, and in the left atrioventricular valve leaflets were compatible with an arteriopathy/valvulopathy. Similar lesions were described in several ratites from different orders ranging in age from 1 to 35 years. Mucinous degeneration of the aortic wall can lead to dissection and rupture both in male and female ostriches.^{6,9} Copper deficiency with consequent elastin disruption may play a role in this process, similarly to what is described in turkeys.⁹

In conclusion, we report a case of an osteosarcoma with concurrent widespread metastases in an ostrich, which additionally displayed lesions

compatible with arteriopathy in the aorta and arterioles and valvulopathy in the left atrioventricular valve leaflets.

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