

What Is Your Diagnosis?

History

A 20-year-old, 0.9-kg female red-tailed hawk (*Buteo jamaicensis*) was presented to the Kansas State University Veterinary Health Center (Manhattan, KS, USA) for evaluation of severe respiratory distress. The bird had been housed at a nearby wildlife rehabilitation center for approximately 15 years and was used as a display and education animal. It had suffered trauma to the right wing as a young bird that made it non-releasable but had no other prior health issues. The bird lived in an enclosure with another adult red-tailed hawk and an adult rough-legged hawk (*Buteo lagopus*), both of which were healthy at that time.

According to the bird's caretaker, the hawk had become increasingly lethargic with a decreased appetite and reluctance to move over the preceding 8 weeks. On the morning of its presentation, the hawk had been found lying sternally recumbent on the floor of its enclosure, with open-mouth breathing. On presentation to the Kansas State University Veterinary Health Center, the bird was

markedly dyspneic, and an audible click could be heard on inspiration. Its body condition score was 1 out of 5, with marked wasting of the pectoral muscles. The oral cavity appeared normal, and no external lesions were appreciated, but very harsh lung sounds were detected on auscultation. Because of the bird's severe respiratory distress, advanced age, poor prognosis, and emaciated condition, euthanasia was elected. The bird was anesthetized with isoflurane delivered via face-mask, and then euthanatized with pentobarbital (1 mL/kg) in the left ulnar vein.

A gross necropsy was immediately performed, which revealed that both lungs were filled with white, firm material. No normal lung tissue was appreciated. All air sacs appeared grossly normal. The left ovary measured 3.1 cm × 1.9 cm, had a white color, and was firm with a cauliflowerlike appearance. The heart also had a white focus in the wall of the left ventricle. No other lesions were observed. Impression smears of the lung tissue were prepared (Figs 1 and 2), and all tissues were submitted for histopathologic examination.

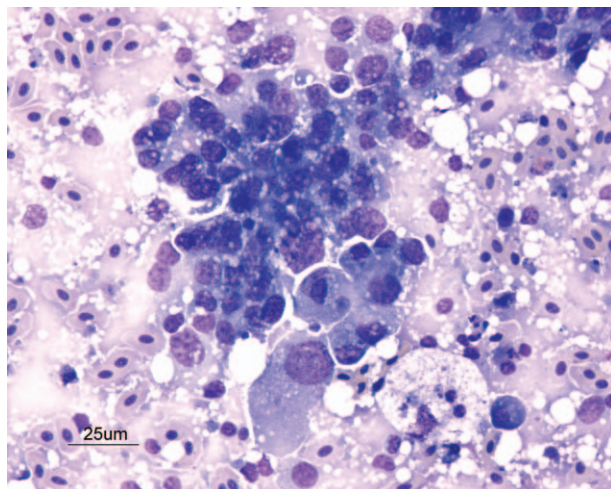


Figure 1. Photomicrograph of an impression smear of the lung of a red-tailed hawk euthanatized because of severe respiratory distress (Wright-Giemsa; ×400 oil).

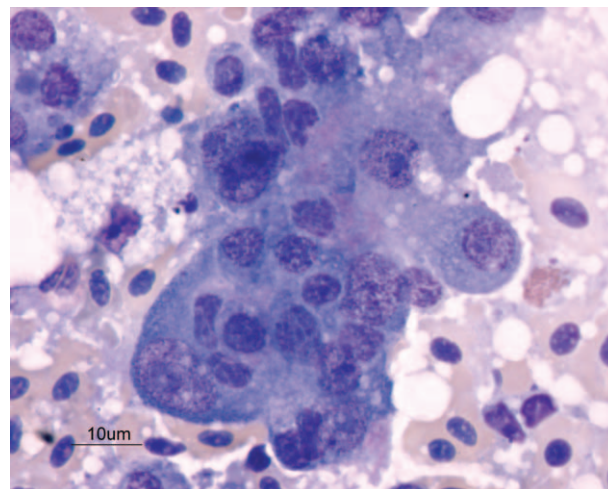


Figure 2. Photomicrograph of a second impression smear of the lung of the red-tailed hawk in Figure 1 (Wright-Giemsa; ×1000 oil).

Please review the clinical history and Figures 1 and 2 and make a list of differential diagnoses before continuing.

Diagnosis

Cytologic examination of the lung imprint revealed large neoplastic cells that were round, oval, or polygonal (up to $\sim 40 \mu\text{m}$ in diameter), with round or oval nuclei, coarse chromatin patterns, one or more variably sized and prominent nucleoli, and light blue, often vacuolated (moth-eaten), cytoplasm (Figs 3 and 4). Numerous foamy macrophages (often containing pyknotic cell debris) and occasional plasma cells and heterophils were present. The background contained abundant erythrocytes, light blue necrotic cell debris with rare cholesterol crystals (indicative of cell breakdown), and clear spaces consistent with lipid.

On histopathologic examination, approximately 70%–80% of the pulmonary architecture was completely effaced. It was replaced by an infiltrative, unencapsulated, densely cellular neoplasm consisting of sheets and cords of cuboidal epithelium supported by fibrovascular stroma. The epithelial cells were often arranged into single-layered, small ductlike structures (Fig 5) that rarely contained small intraluminal papillary growths of epithelium. The epithelial cells had lightly eosinophilic cytoplasm and oval vesicular nuclei with centrally located nucleoli. There were 3 to 4 mitotic figures per $\times 400$ field and scattered foci of necrosis. In less affected areas of lung, cuffs of neoplastic epithelial cells and fibrovascular stroma surround-

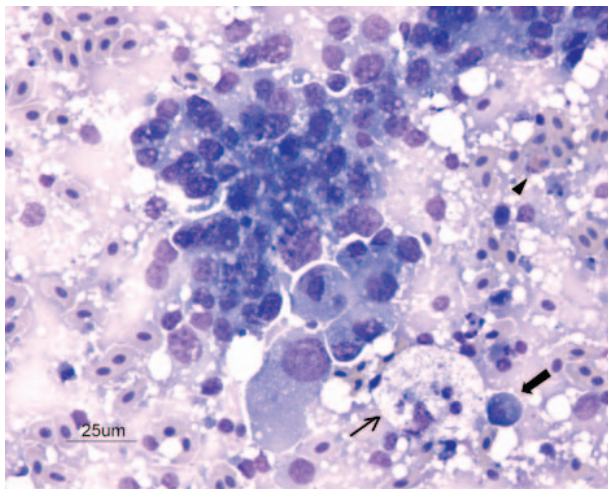


Figure 3. Same impression smear as Figure 1. Note the cohesive sheet of neoplastic epithelial cells (center) with inflammatory cells including a foamy macrophage containing cell debris (thin arrow), plasma cells (thick arrow), and heterophils (arrowhead). Numerous erythrocytes and cell debris are also present in the background (Wright-Giemsa; $\times 400$ oil).

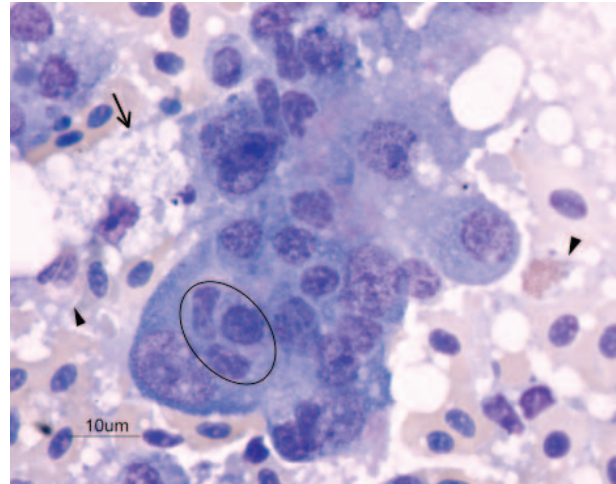


Figure 4. Same impression smear as Figure 2. Note the cohesive sheet of neoplastic epithelial cells (center); features of malignancy include moderate anisocytosis and anisokaryosis, increased nuclear:cytoplasmic ratios, nuclear molding (circled), and binucleated cells. Also shown are a foamy macrophage (thin arrow), 2 heterophils (arrowheads), and numerous erythrocytes in the background (Wright-Giemsa; $\times 1000$ oil).

ed scattered vessels. Large areas of the heart were replaced by neoplastic tissue identical to that in the lung.

The ovarian mass consisted of fibrovascular tissue, throughout which there were cords, islands, and solid sheets of cuboidal epithelium forming ductlike structures (Fig 6) that sometimes contained small intraluminal papillary growths. The

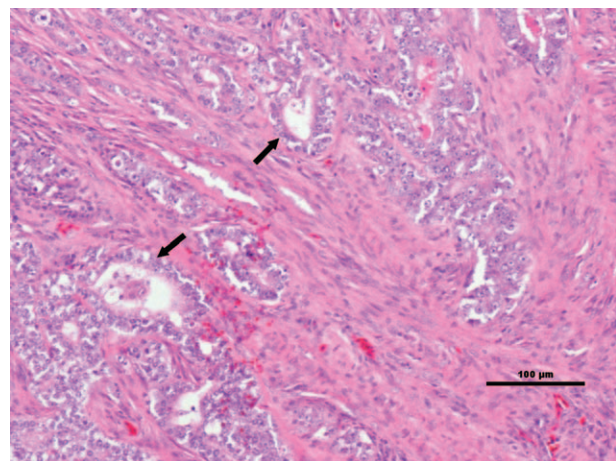


Figure 5. Photomicrograph of lung of the red-tailed hawk in Figure 1. The normal parenchyma has been replaced by cords of neoplastic cuboidal epithelium forming single-layered ducts (arrows) supported by fibrovascular stroma (hematoxylin and eosin; bar = $100 \mu\text{m}$).

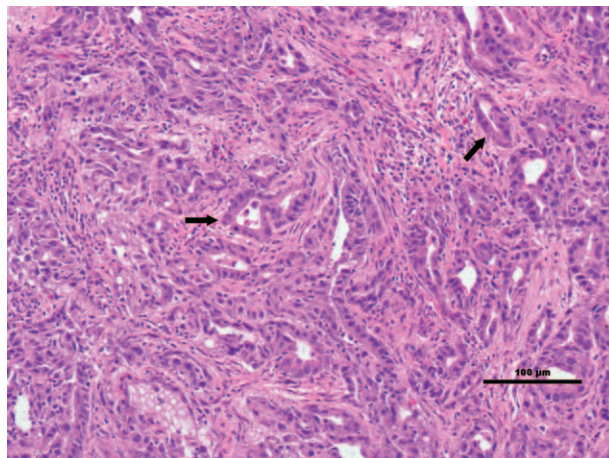


Figure 6. Photomicrograph of ovarian mass of the red-tailed hawk in Figure 1. The normal parenchyma has been replaced by cords of neoplastic cuboidal epithelial cells forming single-layered ducts (arrows) supported by fibrovascular stroma (hematoxylin and eosin; bar = 100 μm).

morphologic features of the ovarian, pulmonary, and cardiac neoplasms were the same. The features were compatible with an ovarian adenocarcinoma.

Comments

Ovarian adenocarcinoma is a common tumor of birds and is frequently reported in domestic poultry and budgerigars (*Melopsittacus undulatus*).¹⁻³ It is most common in birds greater than 2 years of age and has been extensively studied as a model for human ovarian neoplasia.⁴ This tumor type arises from the epithelium of the ovary and commonly metastasizes to other organs, including the intestines, pancreas, and lung.^{2,5} Tumor cells spread to other abdominal organs by direct implantation, and the abdominal organs of affected birds are often covered in neoplastic cells.^{4,6} Metastasis to the lungs occurs by a vascular route rather than direct implantation, since contact is prevented by the air sacs.² The close proximity of the ovary to the vena cava facilitates this vascular spread.⁴ Venous blood containing tumor cells flows from the ovary into the right ventricle and the pulmonary blood vessels, thereby seeding the lungs with neoplastic cells.²

Ovarian adenocarcinoma has the typical gross appearance, as seen in this case, of white, cauliflowerlike lesions. Determining if the neoplasm originates from the oviduct or the ovary can be difficult because of the proximity of the structures

and the propensity of the cells to implant on nearby structures.^{4,7} Often by the time neoplasia is diagnosed, both structures are involved.⁴ In the early stages of disease before the tumor has spread, it may be possible to identify eosinophilic cytoplasmic granules of ovalbumin, which are characteristic of oviductal tumors.⁴

Clinical signs associated with ovarian adenocarcinoma vary based on the affected organs. Common clinical signs are egg retention, persistent breeding behavior, and ascites.^{7,8} This neoplasm has also been reported to cause unilateral paralysis due to sciatic nerve entrapment.¹ In this case, the clinical signs were not related to the primary neoplasm but to the metastases to the lungs. Neoplastic tissue had completely replaced normal lung architecture, obstructing gas exchange and leading to severe dyspnea in this hawk. Prognosis for ovarian adenocarcinomas is grave because of the high rate of metastasis.

This case was submitted by **Katie W. Delk, DVM**, and **James W. Carpenter, MS, DVM, Dipl ACZM**, from the Department of Clinical Sciences, and **Kate Pennick, MS, DVM, Lisa Pohlman, DVM, MS, Dipl ACVP**, and **Jerome Nietfeld, DVM, MS, PhD, Dipl ACVP**, from the Department of Diagnostic Medicine/Pathobiology, College of Veterinary Medicine, Kansas State University, Manhattan, KS 66506, USA.

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