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DISEASE IN WILDLIFE OR EXOTIC SPECIES

# Ovarian Teratocarcinoma in an Emu (*Dromaius novaehollandiae*): Histopathological and Immunohistochemical Characterization

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## Summary

A 17-year-old female emu (*Dromaius novaehollandiae*) was presented for clinical evaluation due to a 3-week history of anorexia and progressive weight loss. The emu died after sedation. At necropsy examination, the ovary and the majority of the oviduct were effaced by a multinodular cystic mass and accompanied by 6 l of coelomic effusion. Histopathology revealed a neoplasm composed of well-differentiated, poorly organized tissues derived from ectoderm, mesoderm and endoderm. Tissues within the neoplasm expressed glial fibrillary acidic protein, desmin and cytokeratins AE1/AE3, respectively, confirming the diagnosis of teratocarcinoma.



*Keywords:* emu; malignant teratoma; ovary; teratocarcinomatosis

A 17-year-old female emu (*Dromaius novaehollandiae*) was presented to the Texas A&M University Zoological Medical Service, College Station, Texas, USA, for a 3-week history of anorexia. The emu had been treated by the owner for a presumed gastrointestinal impaction with daily oral administration of mineral oil with no improvement of clinical signs. One day prior to presentation the emu became recumbent. On presentation the emu was alert, but was weak and having difficulty standing. On initial physical examination the emu was emaciated (body condition score: 1/5) and dehydrated. After standing on arrival, the emu became recumbent, unable to rise and dyspnoeic. The coelom was markedly distended with a fluid wave appreciated on ballottement. Celiocentesis was performed and revealed a yellow, cloudy transudate with no evidence of infectious organisms. Differential diagnoses included hepatic, renal, cardiac or reproductive disease. Complete blood count, serum biochemistry profile, abdominal fluid analysis and computed tomography (CT) scan were recommended and the bird was sedated with ketamine (4 mg/kg) and midazolam (0.2 mg/kg). Immediately after sedation, the emu developed respiratory distress and died.

Necropsy examination revealed 6 l of tan to yellow, translucent, viscous fluid containing strands and plaques of fibrin in the coelomic cavity. The ovary and the majority of the oviduct were effaced by a 40 × 23 × 9 cm multinodular mass composed of numerous solid, grey to light tan nodules and cysts filled with clear, viscous fluid (Fig. 1). On cross section, the nodules were pale tan to pink with areas of mineralization. Numerous similar nodules and cysts were implanted throughout the coelomic cavity.

Representative sections of all major organs and the neoplastic nodules were fixed in 10% neutral buffered formalin, processed routinely and embedded in

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Fig. 1. Teratocarcinomatosis in an emu. Note the numerous nodules and cysts throughout the coelomic cavity affecting the ovary, oviduct, mesentery and body wall as well as the coelomic effusion.

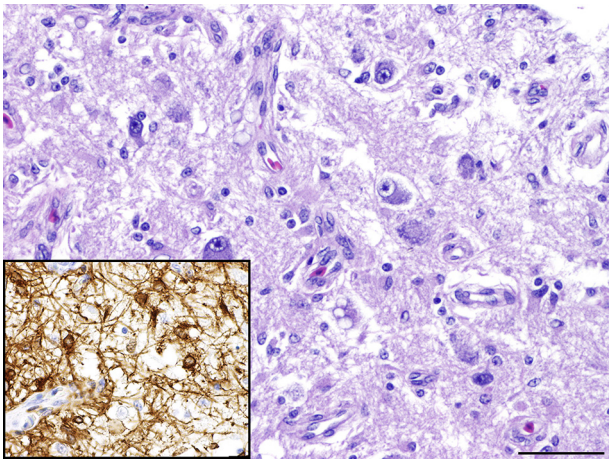

Fig. 2. Histopathological and immunohistochemical features of tissues originating from the ectoderm in an ovarian teratocarcinoma in an emu. HE. Bar, 20 µm. Inset: IHC for GFAP confirms the ectodermal origin of the tissue resembling brain.

paraffin wax. Sections (4 µm) were stained with haematoxylin and eosin (HE). Serial sections were also subjected to immunohistochemistry (IHC) using primary antibodies specific for glial fibrillary acidic protein (GFAP) (Biogen, Cambridge, Massachusetts, USA; 1 in 4,000 dilution), cytokeratins AE1/AE3 (CellMarque, Rocklin, California, USA; ready to use), desmin (BioCare, Pacheco, California, USA; 1 in 10 dilution), vimentin V9 (Biogen; 1 in 3,000 dilution) and S100 (CellMarque; ready to use). The reactivity of each antigen was 'visualized' following treatment with 3, 3′ diaminobenzidine tetrahydrochloride and sections were counterstained with haematoxylin. Sections for detection of cytokeratin, vimentin and GFAP IHC were pretreated with citrate heat antigen retrieval solution (BioGenex, Fremont, California, USA), while sections for detection of desmin were pretreated with reveal heat antigen retrieval solution (BioCare) and sections for detection of S100 received no antigen retrieval pretreatment.

Microscopical examination revealed that the neoplasm was composed of a mixture of well-differentiated tissues from the three embryonic germ cell layers: ectoderm, mesoderm and endoderm (Supplementary Fig. 1). The majority of the tumour was composed of ectoderm-derived tissues, primarily disorganized, but well-differentiated neural tissue, consisting mostly of neurons and occasional clustered glial cells embedded in an eosinophilic fibrillary meshwork (neuropil). Areas of neural tissue were occasionally lined by ependymal cells. Astrocytic processes of the neuropil were immunoreactive for GFAP (Fig. 2). Other ectoderm-derived tissues included squamous epithelium, scattered melanocytes and Herbst corpuscles. Mesoderm-derived tissues included smooth muscle, which expressed desmin (Fig. 3) and areas of well-differentiated cartilage and bone. Endoderm-derived tissues included ciliated columnar epithelium with goblet cells resembling respiratory or intestinal epithelium immunoreactive for cytokeratins AE1/AE3 (Fig. 4), sometimes lining large cystic spaces filled with mucinous material. No tissues were positive for vimentin or S100 antibodies. Based on the presence of tissues derived from all three germ layers and the extensive spread of the neoplastic cells throughout the coelom, malignant teratoma with carcinomatosis (teratocarcinomatosis) was diagnosed.

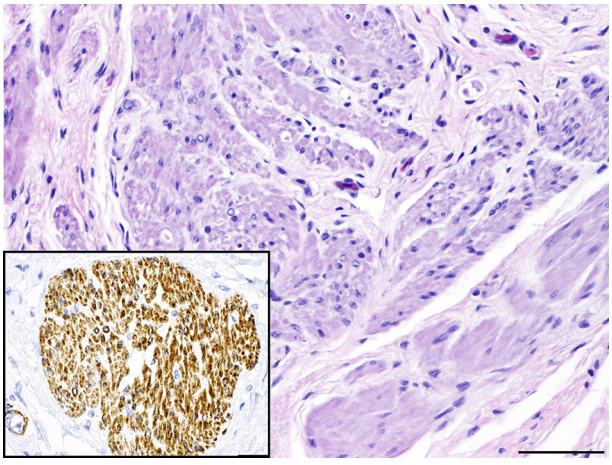

Fig. 3. Histopathological and immunohistochemical features of tissues originating from the mesoderm in an ovarian teratocarcinoma in an emu. HE. Bar, 20 µm. Inset: IHC for desmin confirms the mesodermal origin of the tissue resembling smooth muscle.