**Unusual 3 tumor cases in zoo animals: Malignant Schwannoma, Combined Hepatocellular and Cholangiocellular Carcinoma and Carcinoid Lung Tumor**

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**Introduction and objectives**

Case of tumors are common in canines amongst the animals and are well studied histologically and immunohistochimically [1]. The case of tumors from wild life in free range or in captivity are not recorded systematically or not studied as that of domesticated canine. Many tumors are recorded from the wild animals in captivity. We present the few unusual tumors of zoo animals from Korea with their immunohistochemistry study. The prevalence of these tumors is very rare in canines as well as in humans.

**Materials and methods**

**Case 1.** A 20-year-old male American buffalo (Bison bison bison) received for necropsy. The animal showed no apparent clinical sign except a wound on the left side of the neck. A whitish mass measuring 5 x 6 x 30 cm associated with the wound was presented on the neck. There was mild hydrothorax and the lung showed multiple whitish nodules of various sizes. Metastatic nodules in heart, liver, stomach, intestine, and kidneys were seen.

**Case 2.** A 26-year-old male polar bear received for necropsy revealed large multiple nodules on the liver with one big primary tumor nodule. Other lesions were ascitis and decreased subcutaneous and renal fat.

**Case 3.** A 14-year-old female Black spider monkey (Ateles paniscus) received for necropsy revealed multifocal firm, coalescing pulmonary nodules (av. 2.0 x 1.5 x 1.0 cm) in lungs. Some of nodules were poorly demarcated as absceses. Other significant gross lesions were diffuse ulcerative and hemorrhagic gastritis. Small intestine and some portions of the large intestine also had some mucosal hemorrhages. There were no visible lesions in any of the other organs.

The organ samples were collected, fixed in 10% buffered formalin and embedded in paraffin. Sections at 4 μm were stained with haematoxylin and eosin. Serial sections from the organs were examined immunohistochemically using the avidin-biotin-peroxidase complex procedure for the tumor markers to know the origin of tumors.

**Results**

**Case 1.** Histopathological examination of the major growth from skin and nodules in all other organs revealed unencapsulated, well differentiated mass composed of fusiform cells that form whorls and bundles. Nuclei were pleomorphic and hyperchromatic with few mitotic figures. Immunohistochemical reactions showed positive reaction with only S-100 and negative results for vimentin, CK, actin, SMA, CD4 and HMB45 helped to diagnose as a malignant schwannoma.

**Case 2.** Histopathologically, the tumor mass and nodules were composed of moderately differentiated intermingled patches of hepatocellular carcinoma and cholangiocellular carcinoma. The hepatocellular component showed a thick trabecular growth pattern of hepatocytes. The cholangiocellular component showed tubular or pseudoglandular structures of multiplying bile duct epithelium. The areas of hemorrhages and necrosis were infrequent. The neoplastic cells were pleomorphism with pleomorphic, hyperchromic nuclei. Staining with alcian blue confirmed the mucin in glands of cholangiocellular component. Immunohistochimistrcally, cholangiocellular component was positive for cytokeratin, vimentin, α-SMA and CEA. The hepatocellular component was also positive for all mentioned except CEA. This tumor was diagnosed both histologically and immunohistochimically as a combined hepatocellular and cholangiocellular carcinoma in polar bear.

**Case 3.** Histopathologically, round to ovoid tumor cells showed solid nested pattern within a thin fibrovascular stroma. Ribbon or festoon-like pattern at the periphery of the mass. The tumor cells contained lightly amphiophilic cytoplasm with regularly sized, spherical, centrally placed nuclei with scanty mitotic figures. Immunohistochemical staining showed that the tumor cells were positive to Cytokeratin, Chromogranin, Synaptophysin and negative to CD56. The tumor was diagnosed as neuroendocrine / carcinoid tumor of lung.

**Discussion**

Diagnosis of schwannoma in animals is facilitated by distinctive fine morphological characteristics and immunohistological properties, particularly immunolabelling of S-100 protein [2]. The combined hepatocellular and cholangiocellular carcinoma of hepatic origin are very rare in dogs as in humans. The similar structure was described in dog earlier [3]. Wild animals and non human primates kept in captivity in zoos or in parks enjoy a long life devoid of the stresses and dangers experienced by their co-species that are living in the wild environment. These animals in spite of the presence of these neoplasms were able to live for a ripe old age. Such a long life of existence in the wild would have been impossible due to predation and other inherent dangers.

**References**