A Case of Anaplastic Meningioma in a Dog

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(Received 1 November 2004/Accepted 11 July 2005)

ABSTRACT. A tumor sized in 2.0 × 2.0 × 2.5 cm developed in the cerebellum of a female Beagle was pathologically investigated. Histopathologically, the tumor grew by compression and partially by infiltration into the adjacent cerebellar parenchyma. There were a large number of necrotic lesions and proliferation of collagen fibers. The tumor cells had oval nucleus showing cellular atypia and a high mitotic index. The tumor cells were reacted with vimentin antibody on immunostain. Electron microscopic examination revealed the tumor cells interdigitated with cytoplasmic processus where the desmosomes developed on cell junction. This tumor was diagnosed as anaplastic meningioma, which is rarely observed in dogs.

KEY WORDS: anaplastic type, canine, meningioma.

Intracranial tumors have been reported to occur most frequently in dogs among domestic animals [1, 4, 7, 12]. Meningiomas are the most common and, derived from meningotheial cells in the arachnoid granulation [3, 4, 12]. Meningiomas have several histologic variants and their biologic behavior is almost similar except anaplastic, atypical or malignant meningioma, that develops less commonly in dogs [2, 5]. This paper presents histopathological, immunohistochemical and ultrastructural features of anaplastic meningioma arising in the cerebellum of a dog.

The dog was a 10 years old female Beagle weighing 10 kg. Initially, the clinical signalments included marked left wryneck, nystagmus, wobbling gait and cheerlessness. Five months later, the dog showed vomiting, loss of consciousness, rigor, anal relaxation, decreased body temperature and bradycardia. MRI examination revealed a tumor in the left lateral cerebellum (Fig. 1). Despite of the treatment with steroid, the dog’s condition gradually deteriorated. When the dog lost appetite and thermoregulation, the dog was euthanized by pentobarbital.

Autopsy revealed that a gray-brownish tumor with a solid appearance sized 2.0 × 2.0 × 2.5 cm in the left lateral of the cerebellum. The cranial bone and dura mater over the tumor were intact. The surface of the tumor was irregular. A disappearance of sulcus was noted. The cut surface after formalin fixation showed an expansive growth of a tumor well demarcated from the cerebellar parenchyma (Fig. 2). The changes in other organs included a dilatation of the right ventricle with rough aortic and pulmonary valve, an accumulation of foamy fluid in the bronchus, edema in the whole lungs and partial emphysema peripherally in the lobes of lung, a hematoma the size of 1 cm in the ventral extremity of spleen, hyperplastic nodules in size to 2 mm and 5 mm diameter in the right adrenal cortex, and cicatrization of the right kidney. There was no metastasis grossly.

Histologically, the tumor consisted of large pleomorphic cells that proliferated in sheets or in nests surrounded by a moderate amount of fibrous tissue (Fig. 3). The cell border was indistinct and the cells often formed syncytium. The tumor cell had large pale or dark nuclei with a distinct nucleolus and eosinophilic cytoplasm. The N/C ratio was high. There were some mitoses, 2 per high power field. In some areas, the tumor showed incomplete concentric whorl formation and angiomatous proliferation with a few prominent blood vessels (Fig. 4). Multifocal areas of necrosis and calcified lesions were often observed (Fig. 5). The tumor cells infiltrated in nest into the adjacent parenchyma of the cerebellum (Fig. 6). Fibrous stroma around the nests of tumor cells was shown by Masson trichrome stain, but reticular fibers were not proved by the silver impregnation method between tumor cells and around a cluster of cells.

In the immunohistochemical examination, the tumor cells were reacted to vimentin while they were negative to glial fibrillary acidic protein (GFAP), neuron specific enolase (NSE), S-100, AE1/AE3 cytokeratin and neurofilament protein.

Electron microscopy revealed that the tumor cells interdigitated with cytoplasmic processus where the desmosomes developed on cell junction (Fig. 7). There were few cell organelles such as mitochondria and endoplasmic reticulum in the cytoplasm, but some intermediate type filaments were observed.

Meningioma is a tumor showing a variety of histological characters. It is classified into a large number of subtypes [3–5]. In this case, the clinical symptom had developed slowly, suggesting the tumor growth was not fast. In addition, MRI findings indicated an expansive growth with a clear border. From these observations, a benign meningioma was imaged on clinical diagnosis. However, the histological examinations showed a population of pleomorphic...
Fig. 1. MRI image. Sagittal image (a). Coronal image (b). Tumor with distinct border in the left lateral cerebellum (arrowhead).

Fig. 2. Grossly, a gray-brownish tumor with a solid appearance in the left lateral of the cerebellum (arrowhead) (a). The cut surface showing an expansive growth of the tumor with demarcated borders from the cerebellar parenchyma (arrowhead) (b).

Fig. 3. Histologically, the tumor is composed of large pleomorphic cells that proliferated in sheets or in nests surrounded by a moderate amount of fibrous tissue (a). HE stain, × 150. The tumor cells often form a syncytium with an indistinct cell border (b). HE stain, × 300.
Fig. 4. The tumor shows incomplete concentric whorl formation (arrowheads) (a, × 100) and angiomatous proliferation with a few prominent blood vessels (arrowheads) (b, × 150). HE stain.

Fig. 5. Multifocal areas of necrosis (*) (a, × 75) and calcified lesions (arrowheads) (b, × 150) are noted. HE stain.

Fig. 6. The nest of tumor cells infiltrates into an adjacent parenchyma of the cerebellum (arrowheads). HE stain, × 40.

Fig. 7. Electron microscopy showing the pleomorphic tumor cells with a scanty of the cell organelles (a) and desmosomes (arrowheads) (b). (a) bar = 2 μm. (b) bar = 500 nm.
cells, many focal necrosis and infiltration of the neoplastic cells into the adjacent parenchyma, obviously suggesting a malignant phenotype. Therefore, the tumor was diagnosed as anaplastic meningioma on the basis of WHO classification for domestic animals in which that is the only diagnosis for malignant meningioma [4].

According to WHO classification, meningioma in humans is classified into groups by its prognosis and by histological grade [3]. Although atypical meningioma and anaplastic meningioma are used for malignant meningioma interchangeably in veterinary field, they are correspondent to grade II and grade III respectively in human classification. In comparison with human cases, the criteria to differentiate atypical meningioma from anaplastic meningioma are still obscure in the domestic animals due to lack of grading for the clinical malignancy [4, 5]. For example, the 5-year survival rate and 10-year survival rate with anaplastic meningioma are 64.3% and 34.5% in human, respectively [8], whereas the survival rate is not clear in the present dog. Although it was reported a distant metastasis of anaplastic meningioma in dogs [11], no metastasis in this case suggested to be a similar biological behavior to human atypical meningioma [3].

Immunohistochemically, many meningioma are known to demonstrate a positive response to vimentin [1, 5, 13]. Our case was consistent with those in the previous reports. Some meningiomas have been known to express low and/or high molecular weight cytokeratins with fresh frozen-sections [5]. In this study, paraffin-embedded tissues were used for immunohistochemical examination and it failed to prove a cytokeratin expression. A variability of antibodies for cytokeratin and neural markers failed to characterize the tumor cells in the present study, although some reports mentioned a positive response on meningioma with neural markers [4].

Meningioma is more frequently observed in females as in this case [5]. Mandara and others suggested a relation of meningioma to estrogen and progesterone receptors [7]. However, it remains uncertain as to whether sex hormones are involved or not in the onset of the tumor.

In this case, the interdigitated cytoplasmic processus with desmosomes and intermediate filaments observed on electron microscope were critical to demonstrate the epithelial feature of the tumor cells leading to the diagnosis of meningioma [4, 5, 12, 13].

REFERENCES