A Case of Canine Primitive Neuroectodermal Tumor (PNET)

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ABSTRACT. A 2-year and 6 month-old, female, Golden Retriever showed circling behavior and seizure. By magnetic resonance imaging (MRI) examination, a mass was found on the surface of the left cerebral hemisphere, invading to the left temporal muscle. The skull bone between them was destroyed. The dog was euthanized and necropsied. Histologically, the mass contained a lot of undifferentiated anaplastic cells, forming Homer-Wright rosettes and pseudopalisading patterns. Thus, the case was diagnosed as primitive neuroectodermal tumor (PNET).

KEY WORDS: brain neoplasm, canine, primitive neuroectodermal tumor (PNET).

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Primitive neuroectodermal tumor (PNET) and medulloblastoma are the most undifferentiated neoplasms of the nervous system which contain neoplastic cells with a very primitive nature of both neuronal and glial cells. The concept of PNET was first proposed for the cerebral tumor of children that showed poorly differentiated morphology in the human medical field [5]. After that, PNET has been applied to all embryonal neuroectodermal tumors including neuroblastoma, ependymoblastoma, medulloblastoma and retinoblastoma [10]. At the present, PNET is applicable to the primitive tumors which arise in the extracerebellar nervous system and can not be morphologically distinguished from medulloblastoma in the cerebellum [9]. In animals, PNET has been reported in a monkey [7], a cattle [12] and dogs and cats [13].

In this paper, we describe details of histopathological nature of the PNET observed in the cerebrum of a young dog. To our knowledge, this is the first report on the PNET observed in the dog, as an original paper with pictures.

A 2-year and 6-month-old, female, Golden Retriever showed depression, circling behavior and walking disturbance. She was referred to a veterinary hospital, and abnormal behaviors and seizure were observed at that time. Though temporary recovery had been obtained by administration of corticosteroid, and she could walk again even with left circling, the sight-loss of the right eye was observed. Then she came to the Veterinary Medical Center of the University of Tokyo for further examination. By magnetic resonance imaging (MRI) examination, a mass was found on the surface of the left cerebral hemisphere, invading to the left temporal muscle (Fig. 1). The skull bone between brain and the muscle lesions was destroyed. The dog was euthanized because of the poor prognosis and necropsied soon after death.

At necropsy, a grayish white-colored mass (4 × 2 × 2 cm) was found on the left temporal surface of the cerebrum, invading to the left temporal muscle (Fig. 2). The skull bone

at the lesion was destroyed. The cut surface of the mass was grayish white, and several yellow-colored necrotic foci scattered in the mass. The border between the tumor mass and normal cerebral tissue was not clear (Fig. 3). No lesions were observed in other organs.

All the collected organs were fixed in 10% neutral-buffered formalin. Paraffin sections (2–6 μm) were stained with hematoxylin and eosin (HE). Histologically, the tumor mass consisted of small round- to spindle-shaped anaplastic cells which had clear nuclei with prominent nucleoli and poor cytoplasm. Mitotic figures were frequently found in the tumor. In some parts of the mass, tumor cells were arranged to form Homer-Wright rosettes (Fig. 4a) or pseudopalisading patterns (Fig. 4b).

Immunohistochemistry was done using rabbit antibodies against S-100 (Dako, Carpinteria CA, U.S.A.), glial fibrillary acidic protein (GFAP, Dako), neuron specific enolase (NSE, Dako) and keratin wide spectrum screening (Dako) and mouse monoclonal antibodies against vimentin (Boehringer Mannheim, Mannheim, Germany), neurofilament (NF, Dako), synaptophysin (Boehringer Mannheim) and chromogranin A (Dako). The tumor cells exhibited immunoreactivity only to the antibody against vimentin (Fig. 5).

Formalin-fixed neoplastic tissues were also processed for electron microscopy. Ultrastructurally, neoplastic cells had prominent nuclei and scanty cytoplasm with few organelles and did not exhibit any neuroblastic and/or glioblastic properties, indicating that the cells were poorly differentiated.

With reference to the latest human WHO classification of nerve tumors [6], the present cerebral lesion was diagnosed as PNET because Homer-Wright rosettes and pseudopalisading patterns were observed. PNET is also reported in animals such as monkey [7], cattle [12] and dog and cat [13]. Experimentally induced PNET in transgenic mice, JC papovavirus-infected hamsters and ethylnitrosourea-administered rats are additionally reported [3, 15].

In the study dealing with seven cases of canine and feline

Fig. 1. MRI of the present case. A mass is found in the left cerebral hemisphere, invading to the left temporal muscle (white area).

Fig. 2. Gross appearance of the brain from the upper side. An irregular shaped mass is observed on the surface of the left cerebral hemisphere, invading to the left temporal muscle.

Fig. 3. Cut surface of the mass. The border between the tumor and normal cerebral tissues is not clear. Arrow heads indicate destroyed skull bone.

Fig. 4. The tumor cells are arranged to form Homer-Wright rosettes (a) or pseudopalisading pattern (b). (a): bar= 20 μ m, (b): bar= 50 μ m. HE stain.

PNET [13], though no detailed observation was described in it, tumor cells of all seven cases were positive for vimentin, two for GFAP, one for both GFAP and NF, and one each for GFAP, actin and synaptophysin. Thus, it is considered that some PNETs exhibit neuronal and/or glial cell properties, but others do not because of their poorly differentiated nature.

The same tendency is also observed in the canine cerebellar medulloblastoma [11, 14]. In our case, tumor cells did not exhibit any immunoreactivity to neuronal and glial cell markers. This may be due to the poorly differentiated nature of the tumor cells. In addition, electron microscopy revealed that the tumor cells were anaplastic and similar to those of

Fig. 5. The tumor cells exhibit immunoreactivity to the antibody against vimentin. bar= 15 μ m.

human PNET [1, 8].

In the present case, the mass was found both inside and outside of the skull with bone destruction. Some brain neoplasms are known to invade outside of the skull with bone destruction [4], and the present case first exhibited neuronal signs without showing extracranial changes. This case was, therefore, thought to arise in the cerebrum and invade outside of the skull. However, as PNET is reported to arise not only in the central nervous system but also in the peripheral [2], the possibility that the present tumor arose in the peripheral nervous system around the skull and invaded into the cere-

brum with bone destruction can not be excluded.

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