Usefulness of advanced MR imaging in the canine and feline intracranial tumors

Abstract of Doctoral Thesis

Masae Wada

Graduate School of Veterinary Medicine and Life Science

Nippon Veterinary Life Science University

The purpose of this study is to evaluate the usefulness of advanced MR imaging in canine and feline intracranial tumors. In the present study, the MRI data of canine and feline with intracranial tumors obtained each definitive histopathological diagnosis were used. The obtained advanced MR imaging sequences included diffusion weighted imaging, diffusion tensor imaging, MR spectroscopy, and perfusion weighted imaging.

Diffusion weighted imaging (DWI) was performed in 35 cases and evaluated using apparent diffusion coefficient (ADC) and the ADC ratio, which is a relative value obtained by dividing the tumor ADC value by those of the contralateral normal-appearing white matter. As a result, in intratumoral regions, feline meningiomas and canine histiocytic sarcomas showed significantly lower ADC ratios compared to canine meningiomas. This finding is compatible with the actual clinical picture of histiocytic sarcomas and feline meningiomas. The ADC ratio for gliomas in this study was similar to the previous canine reports, and the ADC ratio for bone tumor was also identical to that of humans. In peritumoral areas, the lowest ADC ratio was observed in feline meningiomas, that was likely to be resulted from the strong displacement of the surrounding normal brain tissue by the tumor. However, the peritumoral ADC ratio in this study was not helpful to differentiate invasion in peritumor, and between vasogenic edema and cytotoxic edema.

Diffusion tensor imaging (DTI) was performed on 36 cases and evaluated using fractional anisotropy (FA) and FA ratio, as with ADC. The intratumoral FA ratio suggests that feline meningioma and bone tumor are relatively solid tumors, and that canine and feline gliomas have variable directions of diffusion. In peritumoral areas, FA ratios of histiocytic sarcomas and gliomas were lower than those of canine and feline meningiomas. It is suspected that histiocytic sarcomas and

gliomas would be infiltrating and/or destroying the surrounding brain parenchyma while meningiomas compress surround tissues without nerve damage. In addition, the vasogenic edema was suggested in the peritumoral region with T2-weighted hyperintense for histiocytic sarcomas.

Magnetic resonance spectroscopy (MRS) of thalamus in normal dogs and cats were measured at first, and then those results were used as the reference values for the following comparative MRS study of 15 cases with intracranial tumor. Creatine and N-acetyl-L-aspartate were reduced in all tumors. Choline was elevated in association with active cell proliferation in histiocytic sarcoma and glioma. However, the marked choline peak seen in human meningiomas was not observed in feline meningiomas in this study. As with human gliomas, elevated lipid and lactate were observed in canine gliomas in this study, this finding suggests the possibility that MRS is useful for grading of glioma.

Perfusion weighted imaging (PWI) is a sequence to assess cerebral blood volume, cerebral blood flow, and mean transit time. The comparison of infusion rate (IR) 1 ml/sec and 4 ml/sec was investigated using normal dogs and cats at first. In some brain regions, there were some significant differences among the difference of IR. Then, each parameter of PWI in 10 cases with intracranial tumors was evaluated. Those results suggested that the lesions may be underestimated at low IR as known in human medicine. Also, it was challenging to assess tumor invasion or edema in the peritumoral region with PWI.

As mentioned above, this study suggests the combination of these advanced MR imaging techniques has the possibility to differentiate intracranial tumors in veterinary patients as well as human medicine. Further studies with more case accumulation would establish the noninvasive diagnosis of intracranial tumors using advanced MR imaging.