Magnetic Resonance Imaging of a Canine Eye with Melanoma

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(Received 28 May 2004/Accepted 14 September 2004)

ABSTRACT. An 8-year-old Beagle dog had exophthalmos of the left eye for the last two past months. On ophthalmoscopy, the intraocular lesion could not be evaluated due to the opacity of the cornea. Ultrasonography revealed that the eyeball was distorted in shape and shifted in position, however, the precise lesion could not be identified. On magnetic resonance (MR) imaging, the lesion was observed as hyperintense on T1-weighted and hypointense on T2-weighted images, similar to those reported in human melanoma. The lesion was histologically diagnosed to be malignant intraocular melanoma. Though this is only a case report, canine ocular melanoma may show the similar characteristic MR images as in human uveal malignant melanoma.

KEY WORDS: canine, intraocular melanoma, MR imaging.

Intracocular, orbital, and adnexal neoplasias are not rare in dogs. Melanocytic tumors are particularly common and are usually the primary neoplasia in dogs while less frequent in cats [12]. Other primary and/or secondary ocular tumors reported in dogs include papilloma, squamous cell carcinoma, lymphoma, hemangioma, transmissible venereal tumor, retinal blasticoma, adenocarcinoma, seminoma, and glioblastoma [11]. Ocular neoplasia is often diagnosed in dogs with chronic eye problems. These patients may have lesions of the corneal opacity, edema, or buphthalmus, which may make difficult to evaluate the intraocular structure by slit lamp or ophthalmoscopy. Recently, there have been reports in human medicine that melanoma shows characteristic images specific to melanoma on magnetic resonance (MR) imaging when compared to other intraocular tumors [3, 7, 9, 13, 20].

In this report, we describe MR images of uveal melanoma in a dog.

An 8-year-old male Beagle dog with two-months' duration of exophthalmos of the left eye was referred to the Veterinary Medical Center at the University of Tokyo. This dog had initially been diagnosed with glaucoma, however, the treatment for glaucoma had not improved the condition. The patient also had signs of anorexia, depression and weight loss.

The affected eye was blind, and the menace reflex, pupil light reflex (PLR), and dazzle reflex were lost, while the consensual light reflex to the opposite eye still remained. Slit lamp biomicroscopy (Portable Slit Lamp SL-14, Kowa, Tokyo, Japan) revealed a protruded structure in the ventral iris, attaching to the endothelium of the cornea. The cornea was almost entirely opaque, therefore, intraocular structures could not be evaluated by indirect ophthalmoscopy (IO-

CTV II, Neitz, Tokyo). Intraocular pressure (IOP) measured by applanation tonometry (Tono-Pen™ XM, Mentor®, O&O, Inc., Norwell, MA, U.S.A.) was 37 mmHg. In the right eye, the menace reflex, PLR and dazzle reflex were normal, however, consensual light reflex was absent.

On ultrasonography (Ultrasonic Scanner EUB-655, Hitachi, Tokyo) with a probe of 7.5 MHz placed on the cornea, the eyeball was distorted to a golf-like shape and shifted toward the nasal side. There was a hypoechogenic and unhomogeneous structure in the anterior chamber. Color Doppler ultrasonography could not demonstrate blood vessels, indicating the lesion might be avascular. The lens was displaced toward the vitreous. The echo level of this deeper portion was similar to that of the lens, but the precise structure was not clear on ultrasonography.

MR imaging using a 0.3 Tesla unit (MR-7000 AD/ AIRIS, Hitachi Medical Co., Tokyo) was conducted under isoflurane (Forane®, Abbott Japan, Osaka) and oxygen anaesthesia with preanesthetic intramuscular administration of midazolam (Dormicum®, Yamanouchi, Tokyo) (0.1 mg/kg) and butorphanol (Stadol®, Bristol Pharmaceuticals K.K., Tokyo) (0.2 mg/kg). The dog was placed in dorsal recumbency with its head positioned in a phase array knee coil. Fast-spin echo sagittal MR images of each eyeball were obtained with T1-weighted and T2-weighted image pulse sequences. Interleaved slices with 3 mm thickness were used. T1-weighted transverse images of the eyeball along the optic nerve were obtained with and without an intravenous administration of gadolinium-diethylenetriaminepenta-acetic acid (Ga-DTPA) dimeglineum (Magnebist®, Shering, Osaka, Japan) at a dose of 0.15 mmol/kg.

T1-weighted images revealed an intraocular mass with hyperintensity from the anterior chamber to the fundus near the optic disk. The mass occupied one-third of the ventral intraocular space, pushing the lens toward the dorsal side without luxation (Fig. 1). On T2-weighted images, a hypointense mass was located in the same intraocular space
Fig. 1. Sagittal T1-weighted MR image of the left eye. T1-weighted images were obtained with TR=700 msec and TE=20 msec. Note the intraocular mass with hyperintensity from the anterior chamber to the fundus near the optic disk. The mass occupied one-third of the ventral intraocular space, pushing the lens toward the dorsal side without luxation.

Fig. 2. Sagittal T2-weighted MR images were obtained with TR=4500 msec and TE=119 msec. Note the hypointense mass at the same intraocular space as in T1-weighted images.

Fig. 3. Sagittal contrast T1-weighted MR image under intravenous administration of Ga-DTPA. Note the irregular enhancement with the clear enhancement of the circumference and slight, non-uniform enhancement in the ciliary mass.

Contrast T1-weighted images delineated the non-uniformly enhanced area occupying the entire circumference of the ciliary body (Fig. 3). In addition, the left eye protruded from the orbit without the occupied orbital lesion, indicating buphthalmos. Fine needle aspiration was performed from 3 mm behind the limbus using a 26G subcutaneous needle for cytology. Cytology revealed numerous melanocytes with slight anisokaryosis in the cytoplasm, leading to the tentative diagnosis of melanoma.

The affected eye of the dog was enucleated. Grossly, a black-colored intraocular mass was located from the anterior chamber to the vitreous. This large heavily pigmented mass developed from the ciliary body and/or iris, and extended to the anterior chamber, which caused the shift of the lens to the opposite site as shown in the MR images. On histopathology, tumor cells were found to have invaded the ciliary body and the sclera posterior to the limbus, with additional infiltration into the cornea and the posterior portion of the Descemet’s membrane, choroid and intrascleral vessels. In the posterior ocular segment, numerous tumor cells invaded the layers between the sclera, and the delimitation from the sclera was not clear (Fig. 4). From the results above mentioned, the diagnosis was malignant melanoma with secondary glaucoma, possibly because of obstructed aqueous outflow pathway by accumulated or invaded malignant cells. The patient is still alive without recurrence or metastasis 2 years after the operation.

Anterior uveal melanomas are the most frequent intraocular tumor in dogs [6, 18]. Canine melanomas typically
Fig. 4. Histological findings of the choroidal scleral area (H-E stained section, × 40). In the posterior ocular segment, numerous tumor cells invaded the layers of the sclera (S), and the delimitation from the sclera was not clear.

originate from the ciliary body and iris, and are often coupled with glaucoma, anterior segment inflammation, or epibulbar extension [1, 8]. In contrast, human melanomas usually arise in the posterior choroid and are coupled with visual disturbance or retinal detachment [5, 17]. Most of the canine melanomas are locally invasive [4], and the incidence of metastasis of the tumor arising from the anterior uvea is low [1, 2, 15, 19], though there has been a canine case report describing anterior uveal melanoma with widespread metastasis [14]. Another report indicated a metastatic rate to be less than 4% in the ocular melanoma of dogs [1]. In human uveal melanomas, the risk factors for extraorbital metastasis include increased size of the intraocular mass, rupture of Bruch’s membrane, and eventually, retinal invasion and filling within the vitreous cavity, as tumor cells spread into the orbit through draining of the subretinal fluid [16]. Therefore, reliable assessment of the size and location of the intraocular tumor may be quite important in predicting the prognosis in canine ocular melanomas as in human ocular melanomas.

In this patient, ophthalmoscopy and ultrasonography could delineate part of the melanoma, however, MR revealed the size and location of the lesion much more clearly. In addition, the lesion was observed as hyperintense on T1-weighted and hypointense on T2-weighted images in this case. Woodruff et al. reported that human ocular melanoma is observed as a hyperintense lesion on T1-weighted images and a hypointense lesion on T2-weighted images [20]. Other authors have also reported the same MR findings for human melanoma [7, 9, 13].

This characteristic signal intensity is thought to be due to the paramagnetic effect of stable free radicals in the melanin [3, 7], as well as due to the products of acute and chronic hemorrhage. These findings may suggest that the effect of melanin within canine melanoma on the signal intensity is quite similar to that of human melanoma and that this characteristic signal intensity may be used as an indicator to differentiate canine ocular melanoma from other ocular tumors.

Nishino et al. compared MR images between four malignant uveal melanomas and three choroidal hemangiomas under intravenous administration of Ga-DTPA. The results indicated remarkable or slight enhancement on T1-weighted images in choroidal hemangioma but no significant enhancement in uveal melanoma. They speculated that T1-weighted images appeared hyperintense in malignant uveal melanomas, resulting in poor or masked enhancement by Ga-DTPA [10]. In our case, enhanced T1-weighted images under Ga-DTPA administration revealed only irregular enhancement at the circumference of the ciliary body. Accordingly, Ga-DTPA enhanced T1-weighted MR imaging may not be useful in diagnosing ocular melanoma in dogs.

In conclusion, canine ocular melanoma may show the same characteristics on MR images as human uveal malignant melanoma, though this is only one case report. Further research is needed to establish differential diagnostic imaging using MR imaging in canine ocular melanoma.
REFERENCES