Diagnosis of postretinal blindness caused by intracranial disease in three dogs

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Abstract: In this report, we provide clinical information on the diagnosis of postretinal blindness in veterinary ophthalmology. We have diagnosed three dogs with postretinal blindness (bilateral in one case and in the left eye in two cases). The electroretinogram results were normal and the optic axis was relatively clear in all cases. Our findings indicate that the reason for the blindness in these dogs was an intracranial lesion. Fundus photography did not reveal any significant changes, except in the optic disc. A normal optic disc, an optic disc that appeared to be smaller than that in the other eye, and a severely hyperemic and edematous optic disc were seen in cases 1, 2, and 3, respectively. On magnetic resonance imaging, two dogs had optic chiasm lesions (one a tumor, one inflammation) and the remaining dog had inflammation in the right optic tract and occipital lobe even though bright flash electroretinograms were normal. Magnetic resonance imaging and electroretinography can be used as diagnostic tools for detection and localization of central nervous system lesions in the visual pathways.

Key words: Postretinal blindness, magnetic resonance imaging, electroretinography, visual pathways

1. Introduction

There are four main locations and causes of blindness: lesions that produce opacification of the ocular media, lesions that cause failure of the retina to process images, lesions that interrupt transmission of the message along the visual pathways, and lesions that cause failure of final processing of the image on the visual cortex (1,2). Systematic diagnostic tests should be performed to determine the cause of blindness. A medical history and complete physical and ophthalmic examinations are usually the first steps (1). Routine electroretinography (ERG) is also important for assessment of retinal function. When there is no abnormality in the eye and the ERG is normal, it is possible that blindness originates somewhere along the afferent visual pathway. Therefore, additional tests are needed for blindness caused by central nervous system (CNS) lesions, including neurologic examination, routine laboratory investigations, and analysis of cerebrospinal fluid. Visual evoked potentials (VEPs) are used to evaluate the visual pathway from the retina to the visual cortex (3) and can detect brain wave signals from the visual cortex induced by a light stimulus. VEPs are not painful (3); however, the waveform and timing of VEPs are variable, and dogs are often uncooperative, so sedation or general anesthesia is needed (4). Therefore, it is difficult to record VEPs in dogs for practical reasons (3). In these cases, clinicians can perform intracranial magnetic resonance imaging (MRI) without VEP examination. More advanced imaging techniques, such as MRI, are necessary to confirm the exact location and reach a prompt presumptive diagnosis (1). MRI offers substantial advantages over radiography, ultrasonography, and computed tomography because it is a more sensitive diagnostic technique with minimal risk to the patient (5). Therefore, in cases where systematic diagnostic tests, including full ophthalmic and ERG examinations, do not reveal a significant lesion as a cause for blindness, intracranial MRI examination would be strongly recommended. However, little information is available regarding clinical signs, ophthalmic examination results, or other tests for postretinal blindness in domestic animals (1,5–11).

The purpose of this report is to describe the results of ophthalmologic, neurologic, ERG, and MRI examinations in three dogs with postretinal blindness as the only neurologic deficit.

2. Case history

Case 1 was a 5-year-old, 5-kg, castrated male mixed-breed dog that had loss of vision in the left eye and circling. Case 2 was a 9-year-old, 6.9-kg, castrated male Shih-Tzu dog that had loss of vision in the left eye with a negative menace response, dazzle reflex, and direct pupillary light re-

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148
Case 3 was a 5-year-old, 2.8-kg, intact female Maltese dog with bilateral vision loss and regular seizures. This dog showed intermittent incoordination and overreacted when her owner tried to touch her head after her loss of vision.

Complete physical and ophthalmic examinations were performed in all cases. The ophthalmic examinations included a Schirmer tear test I, slit-lamp biomicroscopy (Hawk Eye, Dioptrix, France), applanation tonometry (Tono-Pen Vet, Reichert Technologies, Depew, NY, USA), indirect ophthalmoscopy, and retinal photography (Genesis-D, Kowa, Nagoya, Japan). For neurologic examination, the menace response, dazzle reflex, and pupillary light reflex were evaluated. Eyes with no vision underwent ERG examination without sedation or anesthesia with a bright flash system (10 cd s/m², mini-Ganzfeld photopic test; RETI port, Roland Consult, Brandenburg a.d. Havel, Germany). Patients with suspected postretinal blindness underwent cranial MRI under general anesthesia at an animal diagnostic imaging center (Ian Animal Diagnostic Imaging Center, Seoul, Korea) with a 0.2-T permanent magnet system (Esaote Vet-MR Unit, Esaote Biomedica SpA, Genova, Italy). Hematology and biochemistry investigations were performed in all cases. Thoracic radiography was performed to check the thoracic cavity and to confirm the size of the endotracheal tube required for inhalational general anesthesia during planned cranial MRI examination. Schirmer I tear tests were normal (range: 16–20 mm/min). All dogs had normal intraocular pressure (range: 15–18 mmHg). The results of the neurologic examinations are shown in the Table. There were no abnormal hematologic or biochemistry results. There were no specific findings on ophthalmic examination. The retina and optic disc appeared normal bilaterally in case 1 (Figure 1). This dog was fully vaccinated and lived indoors. He did not have any other symptoms except vision loss in the left eye and circling. A Marcus Gunn pupil was observed in both eyes in case 2; there were no specific ophthalmic findings in this dog, except that the left optic disc was somewhat smaller than the right (Figure 2). Similarly, there were no specific findings in case 3, except that the right optic disc had severe hyperemia and edema and the left optic disc had mild hyperemia and edema (Figure 3). This dog was also fully vaccinated and did not have a history of infection or trauma. Her loss of vision was sudden, after which she experienced regular seizures. All ERG results were normal (Figures 1–3). MRI examination revealed hyperintense lesions in the right occipital region and midbrain on transverse T2-weighted images in case 1 (Figure 4) that suggested a diagnosis of meningoencephalomyelitis and a midbrain mass. In case 2, the intensity in the left portion was higher than that in the right portion in the region of the optic chiasm on a transverse T2-weighted image. Idiopathic optic neuritis was suspected. There was a homogeneous contrast-enhancing mass in the optic chiasm on sagittal postcontrast T1-weighted images in case 3; a hyperintense lesion was seen in the white matter as well as a mass in the optic chiasm region on transverse T2-weighted images. The tentative diagnosis in this dog was meningoencephalomyelitis with a mass in the optic chiasm. After MRI examination, both case 1 and case 2 were euthanized when brain lesions were confirmed. Case 3 died after receiving 3 months of immunosuppressive treatment at a local hospital following her diagnosis. Her symptoms had improved slightly after steroid therapy was started and she could see for a couple of weeks; however, her symptoms deteriorated rapidly thereafter.

3. Results and discussion
Postretinal blindness refers to vision loss with no ocular lesions, no ocular opacity, and normal retinal function although the lesion is in the afferent visual pathway (12). Postretinal blindness can be caused by optic chiasm, optic tract, lateral geniculate nucleus, optic radiation, and visual cortex lesions. In these cases, vision is often absent, but without any ocular abnormalities. ERG can be very important for assessment of the function of the eye in these pa-

Table. Results of neurological examination.

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<tr>
<th>Case</th>
<th>1</th>
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<tr>
<td>Eye</td>
<td>Left</td>
<td>Right</td>
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<tr>
<td>Menace response</td>
<td>-</td>
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<tr>
<td>Dazzle reflex</td>
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<td>Direct PLR</td>
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<td>Indirect PLR</td>
<td>†OD &gt; OS</td>
<td>†OS &gt; OD</td>
<td>†OD &gt; OS</td>
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* †OD > OS, reflex of left pupil when the light illuminates the right eye; ‡OS > OD, reflex of the right pupil when the light illuminates the left eye. PLR, pupillary light reflex.
Figure 1. Retinoscopic view bilaterally and the result of electroretinographic examination in case 1.
Figure 2. Retinoscopic view bilaterally and the result of electroretinographic examination in case 2.
Figure 3. Retinoscopic view bilaterally and the result of electroretinographic examination in case 2.
tients. If ERG fails to produce a normal retinal potential or the visual axis shows an abnormality of the eye because of a severe opacity, this may be the cause of the blindness, but if not, the cause may lie in the cranial component of the visual pathway. As mentioned earlier, VEPs can be used to evaluate the visual pathway from the retina to the visual cortex; however, it is difficult to record VEPs in dogs for practical reasons (13). Therefore, intracranial MRI is strongly advised in cases where systematic diagnostic tests, including full ophthalmic and ERG examinations, do not identify a significant lesion as a cause for blindness. Our three cases were dogs that were fully vaccinated, lived indoors, and had no history of infection or trauma. All the eyes with lesions developed sudden blindness, after which two of the dogs (cases 1 and 3) developed incoordination and seizures. Cases 1 and 3 showed optic neuritis upon examination of the fundus. After the brain lesions were confirmed, our tentative diagnosis was meningoencephalomyelitis. Granulomatous meningoencephalomyelitis (GME) was suspected in these two cases because GME is the most commonly reported cause of optic neuritis in dogs (5). However, neither of the owners consented to nec-

Figure 4. Findings of magnetic resonance imaging. A) A transverse T2-weighted image from case 1 showing hyperintense lesions in the right occipital region and midbrain. B) A transverse T2-weighted image from case 2 showing higher intensity in the left portion than in the right portion in the region of the optic chiasm. C) A sagittal postcontrast T1-weighted image from case 3 showing a homogeneous contrast-enhancing mass in the optic chiasm. D) A transverse T2-weighted image from case 3 showing a hyperintense lesion in the white matter and a mass in the optic chiasm region.
Intracranial MRI is the imaging modality of choice for detection and characterization of most CNS lesions affecting the visual pathways (12). In the three dogs described here, we confirmed that the function of the cone cells was normal in daylight during ERG examination. Although the function of the entire fundus cannot be ascertained using this examination, we could confirm that the retinal function was normal in the light at least. Therefore, intracranial visual pathway lesions were suspected because the patients had lost vision. To diagnose generalized outer retinal disease, which is often hereditary, it is necessary to use the standard canine ERG protocol recommended by the European College of Veterinary Ophthalmologists (3). However, in the present study, a very brief ERG protocol was used to confirm whether a retinal response was present or absent without sedation or general anesthesia. Using this examination, we confirmed that loss of vision was not caused by eye abnormalities in any of our three patients. Although this protocol is controversial, we used it to conduct examinations without general anesthesia because we only needed to determine whether or not the vision loss was caused by abnormal retinal function and because it is a simple noninvasive procedure. However, because of this, we could not properly evaluate the retina.

Intracranial MRI is the modality of choice for detection and characterization of most CNS lesions affecting the visual pathways (12). The lesions were detected in the occipital and midbrain region in case 1, right portion of the optic chiasm in case 2, and optic chiasm region in case 3. All lesions were in the visual pathway. The results of MRI examination demonstrated optic nerve enhancement and/or multifocal intracranial patchy contrast enhancement on MRI. In human medicine, multifocal intracranial patchy contrast enhancement on MRI raises suspicion for multiple sclerosis (14).

Dogs with blindness may have CNS disease rather than eye disease. Therefore, a neurologic cause needs to be considered as the reason for blindness. MRI and ERG examinations are useful diagnostic tools for detection and localization of CNS lesions in the visual pathways.

References


