Vision loss can occur gradually or manifest acutely in dogs, but acute and complete blindness can be particularly devastating. The abrupt nature of this blindness is very disconcerting for all involved and pet owners may make hasty conclusions and decisions.

The diagnostic approach to these patients should include:
1. **Ophthalmic history** identifying the onset and duration of blindness, degree of blindness (as perceived by the owner), other signs of disease, and medication regimen
2. **Vision assessments**, including menace response, visual placing, and “maze” tests, that confirm whether the patient is blind
3. **Causative lesion localization** by pupillary light reflex examination of the eye, potentially with ocular ultrasound, blood pressure measurement, electrophysiologic testing, specifically electroretinogram.

**HISTORY**
A thorough general and ophthalmic history is crucially important to the investigation of blindness because differential diagnoses can be quite different depending upon the onset and duration of the deficits.

The history should determine:
- Whether vision loss is partial or complete.
- Whether vision loss is acute or has been developing gradually: Did the dog have functional vision yesterday, but blindness today or has it been gradually losing vision and now is completely blind?
- When signs of vision loss developed: Did signs of vision loss manifest yesterday or 2 months ago?
- Whether the appearance of the eye has changed. If so, when was this change noted? This information is important because, in many instances, the physical appearance of the eye may change over time.
- Systemic signs of disease are present, or whether a systemic problem has been previously diagnosed. Note that many systemic diseases (eg, infectious disease, lymphoma, hypertension) may initially be recognized by their ophthalmic manifestations.
- What medications the patient receives/has received, both chronically and more recently, including inadvertent administration/ingestion. For example, has the dog recently received or ingested ivermectin?

**VISION ASSESSMENT**
As the history is being gathered, confirmation of vision—or the lack thereof—should be performed. Note that some patients—those with neurologic disease and aged animals with cognitive dysfunction—may behave as if they are visually impaired even though their visual systems are functional.

**Menace Response**
Vision requires functioning central and peripheral ophthalmic systems, and may be roughly assessed with a menace response. The menace response test is performed by making
a menacing gesture with the hand toward the patient’s eye. Take care not to touch the vibrissae or cause excessive air currents, both of which stimulate the sensation of touch rather than sight, potentially inducing a false-positive result.2 If the animal can see, it should blink or move its head away from the stimulus.

**Cotton Ball Test**

The patient’s vision can be further evaluated by noting its response to cotton balls (or some such noiseless, scentless object) tossed into the visual field or observing the visual placing reaction.

**Visual Placing Reaction**

Visual placing is assessed most easily in small patients that are able to be held. For this test, the patient is held in the examiner’s arms so that the forelimbs dangle freely. The dog is moved slowly toward a table or other elevated flat surface. As the limbs approach the edge of the table/flat surface, if visual and able to respond, the dog will raise its limbs in order to step onto the table. If the dog does not see the table, it will not raise its limbs, allowing them to bump into the edge.

**Maze Test**

In patients with suspected blindness, an obstacle course or “maze test” may be used to determine whether vision is present.

Traffic cones, foam cylinders, or even examination room furniture, such as chairs and waste cans, suffice, although elaborate mazes may be constructed for standardized testing. The dog should be placed at the opposite end of the maze from its human companion, who is asked to call the dog’s name only once, which keeps the dog from following voice cues in order to maneuver.

Vision should be evaluated in normal light and then dim light (after dark adaptation) and obstacles should be adjusted between tests to avoid memorization and mapping. To assess night vision, dim the ambient illumination until you can barely distinguish the room furniture and maze course obstacles. Normally sighted dogs have better developed night vision than humans; therefore, the patient should be able to see the maze obstacles better than the examiner.3

**LESION LOCALIZATION**

The next step in the evaluation of the blind patient is to determine where the causative lesion is located. Is the patient blind because something is obscuring the visual axis, such as pigmentary keratitis, corneal edema, or a cataract? Or is the patient blind because the retina or central nervous system is at fault?

**Pupillary Light Reflex**

The size of the pupils and the direct and consensal (response in the fellow, non-stimulated eye) pupillary light reflexes (PLRs) are very important for lesion localization (Figure 1).2 These assessments should be performed with a bright light in a dimly lit room.

The PLR evaluates:
- Rapidity of pupillary light response
- Extent of miosis
- Ability to maintain miosis to constant light stimulation.

The consensual pupillary reflex is normally equal to the direct.

The PLRs require integrity of retinal neural cells, optic nerves, optic chiasm, optic tracts, midbrain (Edinger-Westphal nucleus), and parasympathetic fibers via the oculomotor nerve, ciliary ganglia, and the iridal sphincter musculature, but integrity of the cerebral cortex is not required (Figure 2). The reflex is,

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**Eye Evaluation**

For the menace response, cotton ball test, and visual placing reaction, each eye should be evaluated separately by covering each in turn and testing the exposed eye.

**Dark adaption**

is the adjustment of the eye to low light intensities, involving reflex dilation of the pupil and activation of the rod cells in preference to the cone cells.
therefore, subcortical and should be considered an evaluation of the integrity of the retina and optic tracts, not of vision. In general, in dogs with vision impairment, when PLRs are (Table 1):
• Absent or diminished: The lesion is likely located in the retina or optic nerve.
• Intact: The lesion often obscures the visual axis or interferes with the cortical processing of visual information.

Examination of the Eye
Because the eye can often be visualized to the level of the posterior segment (in its normal state), a complete ophthalmic examination can provide a rapid and accurate diagnosis for many ophthalmic diseases (Table 2).

During the ophthalmic examination, keep in mind the general causes of vision loss:
• Lesions that prevent light from reaching the retina in a focused (non-scattered) manner
• Lack of response by the retina to light stimulation
• Inability of the optic nerve and tracts to transmit the electrical response of the retina
• Inability of the occipital cortex to process the information supplied by the eyes and optic pathways.

Lesions obscuring the visual axis are often relatively easy to diagnose and may develop slowly or rapidly. Table 3, page 22, provides a list of ocular lesions that may present as an acute onset of vision loss.

Because vision can potentially be restored with appropriate management, rapidly developing cataracts, corneal ulcers, severe uveitis, intraocular hemorrhage, and anterior lens luxation should be considered urgent or emergent depending on severity. Acute glaucoma should always be considered an emergency.

A thorough fundic examination is the next step if the:
• Anterior segment (ie, cornea, anterior chamber, and lens) appears normal
• Anterior segment abnormalities found are not severe enough to account for the degree of vision loss noted.

Often, if the retina or optic nerve is affected, the pupil is dilated, making pharmacologic mydriasis unnecessary.

Optic Nerve
The optic nerve should be thoroughly examined for evidence of disease or inflammation.

Keep in Mind During PLR
Remember, PLRs are affected by the psychological state of the animal, room illumination, age, many topical and systemic drugs, and the intensity of the light stimulus.

If an animal is highly nervous or frightened, the pupils may be dilated and respond poorly to low-intensity light. However, with acclimation or a strong light source, this effect is minimized.

Older animals may exhibit slow and incomplete PLRs resulting from atrophy of the iris sphincter muscle. This response is common in small dogs, especially poodles. The pupil margin may have an irregular or scalloped appearance or an irregular pupil shape, referred to as dyscoria (Figure 3).

FIGURE 3. Iris atrophy in a Yorkshire terrier has resulted in mydriasis and an incomplete pupillary light reflex. Note the scalloping of the pupil margin and the holes in the temporal iris stroma. This aged individual also has an immature cataract.
### TABLE 2.
**Acute Blindness: Diagnostic Approach**

<table>
<thead>
<tr>
<th>DIAGNOSIS</th>
<th>VISION LOSS</th>
<th>PLR</th>
<th>VISUAL AXIS</th>
<th>FUNDUS</th>
<th>OTHER DIAGNOSTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior lens luxation</td>
<td>Acute or chronic</td>
<td>Impaired, depending on position of lens and IOP</td>
<td>Obscured</td>
<td>Visualization of fundus may be limited</td>
<td>Measure IOP; consider ocular ultrasound</td>
</tr>
<tr>
<td>Chorioretinal inflammation</td>
<td>Acute or chronic; depending on degree of involvement and severity</td>
<td>Normal or abnormal, Variably affected, anterior uveitis may be present concurrently</td>
<td>Tapetal hyporeflectivity</td>
<td>Pursue systemic inflammatory/neoplastic disease workup</td>
<td></td>
</tr>
<tr>
<td>Cortical disease</td>
<td>Acute or chronic</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Pursue electrophysiologic testing, MRI/CT, CSF analysis, systemic inflammatory/neoplastic disease workup</td>
</tr>
<tr>
<td>Corneal ulcers/perforation</td>
<td>Acute or chronic; depending on position of iris and degree of anterior uveitis present</td>
<td>Normal or abnormal, Obscured</td>
<td>Visualization of fundus may be limited</td>
<td>Consider corneal culture and cytology; evaluate for concurrent anterior uveitis</td>
<td></td>
</tr>
<tr>
<td>Diabetic cataracts</td>
<td>Acute or chronic</td>
<td>Normal</td>
<td>Obscured</td>
<td>Visualization of fundus may be limited</td>
<td>Measure IOP; evaluate for lens-induced anterior uveitis</td>
</tr>
<tr>
<td>Glaucoma (acute)</td>
<td>Acute</td>
<td>Abnormal (mydriatic)</td>
<td>Obscured</td>
<td>Visualization of fundus may be limited</td>
<td>Evaluate for concurrent ocular conditions (eg, uveitis, lens luxation) that would indicate that glaucoma is secondary</td>
</tr>
<tr>
<td>Glaucoma (chronic)</td>
<td>Acute or chronic</td>
<td>Abnormal (mydriatic)</td>
<td>Variously affected, optic nerve recessed or atrophic</td>
<td>Pursue systemic inflammatory/neoplastic disease workup</td>
<td></td>
</tr>
<tr>
<td>Intraocular hemorrhage</td>
<td>Acute or chronic, depending on etiology</td>
<td>Normal or abnormal, Obscured</td>
<td>Visualization of fundus may be limited</td>
<td>Consider systemic blood pressure and ocular ultrasound</td>
<td></td>
</tr>
<tr>
<td>Ocular neoplasia</td>
<td>Acute or chronic</td>
<td>Normal or abnormal</td>
<td>Varially affected</td>
<td>Pursuit IOP; Consider ocular ultrasound and measure IOP</td>
<td></td>
</tr>
<tr>
<td>Optic neuritis (acute)</td>
<td>Acute</td>
<td>Abnormal</td>
<td>Usually normal, unless there is concurrent anterior uveitis</td>
<td>Optic nerve raised, swollen, or hemorrhagic (optic disc); may be unremarkable if retrobulbar optic nerve is solely affected</td>
<td>Pursue MRI/CT, CSF analysis, systemic inflammatory/neoplastic disease workup + neurologic examination</td>
</tr>
<tr>
<td>Optic neuritis (chronic)</td>
<td>Acute or chronic</td>
<td>Abnormal</td>
<td>Usually normal</td>
<td>Optic nerve recessed or atrophic</td>
<td>Pursue electrophysiologic testing, MRI/CT, CSF analysis, systemic inflammatory/neoplastic disease workup</td>
</tr>
<tr>
<td>Progressive retinal atrophy</td>
<td>Gradual onset</td>
<td>Normal or abnormal</td>
<td>Usually normal; cataracts often develop over time</td>
<td>Tapetal hyperreflectivity</td>
<td>Consider genetic testing in purebred dogs</td>
</tr>
<tr>
<td>Retinal degeneration</td>
<td>Gradual onset (usually)</td>
<td>Abnormal</td>
<td>Usually normal</td>
<td>Tapetal hyperreflectivity, retinal vascular attenuation</td>
<td>Complete ophthalmic examination and history (Toxins? Antibiotics? Medications? Historical ophthalmic disease?)</td>
</tr>
<tr>
<td>Retinal detachment</td>
<td>Acute</td>
<td>Abnormal</td>
<td>Usually normal, unless there is hemorrhage or anterior segment involvement</td>
<td>Retina edematous, displaced anteriorly; hemorrhage may be present; visualization of fundus may be limited</td>
<td>Consider ocular ultrasound; measure systemic blood pressure; consider systemic/vascular/inflammatory/neoplastic disease workup</td>
</tr>
<tr>
<td>Retinitis</td>
<td>Acute</td>
<td>Abnormal</td>
<td>Usually normal</td>
<td>Normal</td>
<td>Pursue electrophysiologic testing</td>
</tr>
<tr>
<td>SARDS</td>
<td>Acute</td>
<td>Normal or abnormal</td>
<td>Normal</td>
<td>Initially normal; tapetal hyperreflectivity and vascular attenuation develop over time</td>
<td>Pursue electrophysiologic testing</td>
</tr>
<tr>
<td>Uveitis (severe)</td>
<td>Acute</td>
<td>Abnormal (miotic)</td>
<td>Obscured</td>
<td>Visualization of fundus may be limited</td>
<td>Evaluate for presence of concurrent ophthalmic disease (cataract); measure IOP; consider systemic inflammatory/neoplastic disease workup</td>
</tr>
</tbody>
</table>

CSF = cerebrospinal fluid; CT = computed tomography; IOP = intraocular pressure; MRI = magnetic resonance imaging; PLR = pupillary light reflex; SARDS = sudden acquired retinal degeneration syndrome
If the optic nerve is raised, swollen, or hemorrhagic, optic neuritis is a likely diagnosis. A variety of infectious or inflammatory diseases and neoplastic processes may result in optic neuritis, which usually manifests with an acute onset of marked vision loss. Once diagnosed, neurologic evaluation should be pursued as other neurologic deficits often are present concurrently.

Conversely, if the optic nerve is recessed or atrophic, the changes present are chronic. This condition can occur due to damage from chronic glaucoma, retinal degeneration, or chronic optic neuritis. Optic nerve disease carries a guarded to poor prognosis for vision return.

**Retina**

Examination of the retina should include both the tapetal and non-tapetal regions and the retinal vasculature. The appearance of the tapetal fundus should be carefully evaluated, particularly its reflectivity.

Generalized tapetal hyperreflectivity (excessively shiny tapetal appearance) indicates retinal thinning and degeneration, which can be associated with:

- Gradual onset of vision loss, as found with progressive retinal atrophy (PRA)
- Acute onset of vision loss, as found with sudden acquired retinal degeneration syndrome (SARDS)

Dogs with PRA generally lose night vision first, followed by decreasing day vision and then complete blindness. In both advanced PRA and SARDS, vascular attenuation and diffuse tapetal hyporeflectivity develop; a dog with SARDS, though, has a normal fundus initially and becomes acutely blind. Physical evidence of retinal degeneration (tapetal hyporeflectivity and vascular attenuation) develops over time in SARDS patients.

Tapetal hyporeflectivity (dull tapetal appearance) is seen with chorioretinal inflammation. Since much of the retina must be inflamed for obvious vision loss to be present, diagnosis is often easily made by fundus examination.

**Ocular Ultrasound**

If the fundus cannot be visualized due to vitreal hemorrhage or inflammation, an ocular ultrasound should be performed to assess for conditions that result in ocular hemorrhage: retinal detachment and ocular neoplasia.

**Blood Pressure Measurement**

If retinal detachment is identified—either by fundus examination or by ultrasound—or if posterior segment hemorrhage is present, systemic blood pressure should be measured. As a result of increased hydrostatic pressure in the vasculature, systemic hypertension can cause fluid accumulation in the subretinal space, which displaces the retina into the vitreal chamber, resulting in retinal detachment. If the fundus cannot be visualized due to vitreal hemorrhage or inflammation, an ocular ultrasound should be performed to assess for conditions that result in ocular hemorrhage: retinal detachment and ocular neoplasia.

**Electrophysiologic Testing**

If the fundus appears normal and the animal is avisual, especially if vision loss was acute, consider the following retinal conditions:

- SARDS (as hyperreflectivity occurs over time)
- Retinitis (typically immune-mediated)
- Cortical disease
- Retrobulbar optic neuritis (optic disc appears normal but retrobulbar optic nerve is affected)

These conditions can usually be differentiated with PLRs and electrophysiologic testing. Abnormal PLRs are typically associated with retinal or optic nerve disease and normal PLRs with cerebral cortical disease.

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**TABLE 3.**

**Lesions Obscuring the Visual Axis & Resulting in Acute Blindness**

<table>
<thead>
<tr>
<th>Lesions Obscuring the Visual Axis &amp; Resulting in Acute Blindness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior lens luxation</td>
</tr>
<tr>
<td>Corneal ulcers or perforation</td>
</tr>
<tr>
<td>Diabetic cataracts</td>
</tr>
<tr>
<td>Glaucoma (^a)</td>
</tr>
<tr>
<td>Intraocular hemorrhage</td>
</tr>
<tr>
<td>Severe uveitis (^b)</td>
</tr>
</tbody>
</table>

\(^a\) Generally manifests with episcleral injection, corneal edema, and mydriasis

\(^b\) Recognized by presence of episcleral injection, corneal edema, aqueous flare, fibrin, and miosis

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**CARYN E. PLUMMER**

Caryn E. Plummer, DVM, Diplomate ACVO, is an associate professor in comparative ophthalmology at University of Florida College of Veterinary Medicine, where she also serves as chief of the comparative ophthalmology service. Her research interests include corneal wound healing and glaucoma, and she has lectured extensively—both nationally and internationally—on many topics associated with clinical veterinary ophthalmology and animal models of ophthalmic disease, especially glaucoma. Dr. Plummer received her DVM from University of Florida; then she completed an internship in small animal medicine and surgery at Michigan State University and a residency in comparative ophthalmology at University of Florida.
Electroretinogram
Sometimes a normal PLR is present with retina and optic nerve disease, even if the animal is avisual. An electroretinogram (ERG) can be used to differentiate vision loss due to retinal disease (abnormal ERG result) from vision loss due to disease of the optic nerve or cerebral cortex (normal ERG result).  

Further Diagnostic Testing
Animals with cortical or optic nerve blindness should be evaluated with:
• Magnetic resonance imaging or computed tomography
• Cerebrospinal fluid analysis
• Generalized workup for systemic inflammatory or neoplastic diseases.
  In addition, a normal ophthalmic examination should prompt consideration of the central nervous system as the primary site of disease, especially when the PLRs are normal.

IN SUMMARY
Acute vision loss in the dog is generally considered an emergency and warrants prompt evaluation by a veterinarian to confirm vision loss, localize the causative lesion, and institute therapy. In some cases, prompt medical treatment will result in return of vision. Delayed care carries a poor prognosis for sight and may delay diagnosis of a significant systemic condition.

ERG = electroretinogram; PLR = pupillary light reflex; PRA = progressive retinal atrophy; SARDS = sudden acquired retinal degeneration syndrome

References