Examination of the Ocular Fundus

Part 1: Normal Appearance & Light Responses

The ocular fundus is the part of the eye seen through the pupil with an ophthalmoscope. The appearance of the ocular fundus can be better understood if you remember that you are looking into a layered structure composed of the vitreous, retina, optic disc, retinal pigment epithelium, choroid, and sclera.

Normal Appearance

The fundus is divided into 2 regions: tapetal (reflective region of dorsal fundus) and nontapetal (surrounding the tapetal fundus and occupying the ventral fundus). The fundus also includes the retinal vessels and optic disc (or optic nerve head) (Figure A).

The tapetal fundus is a cellular region of the anterior choroid in carnivores located between the retinal pigmented epithelium and the large vessel layers of the choroid (Figure B). Depending on the age and breed of dog, it may be gray, blue, green, yellow, orange, or red. In cats, it is yellow or green. In both dogs and cats, the tapetal fundus is blue until 6 to 10 weeks of age. Larger sized animals generally have a larger tapetal fundus and vice versa.

In dogs, the optic disc may be in the tapetal or nontapetal fundus (depends on the size of the tapetum). Short-coated dogs tend to have a sharp tapetal boundary between the superior tapetal fundus and inferior nontapetal fundus; long-coated dogs have an irregular boundary. In cats, the optic disc is small and circular and located in the tapetal region. A region of increased acuity, called the area centralis, is found in the central fundic region of both dogs and cats, dorsolateral to the optic disc.

In dogs, the optic disc is myelinated, with the degree of myelination varying to give an irregular, circular, or triangular shape. The disc color is white or pink and a dark central spot is a remnant of the embryonic hyaloid artery. The disc may be surrounded by a pigment ring (choroid) or an area of hyperreflectivity (conus tapetum). The myelin may extend into the nerve fiber layer on the inner surface of the retina. Such myelin will block the light from reaching the rods and cones. A cat’s optic disc lacks myelin to give it a round shape and may be surrounded by a hyperreflective ring (conus).

The nontapetal fundus occurs in 2 different colors: In dogs and cats with dark-colored irises, it is a dark brown/black color due to melanin within the retinal pigment epithelium (RPE) (Figure C). In dogs and cats with light-colored irises (especially in animals with light-colored coats), the nontapetal fundus may be less pigmented, allowing choroidal blood vessels to be seen (tigroid fundus) (Figure D). Dogs and cats with heterochromia iridis have little pigment in the fundus and choroidal vessels are seen against the white sclera (subalbinotic fundus).

The retinal vasculature in dogs usually consists of 3 or 4 major venules (dorsal, ventromedial, ventrolateral) and up to 20 arterioles. While arterioles may be tortuous, venules are straighter. Venules form an incomplete to complete

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ple anastomotic circle on the surface of the optic disc. Cats have 3 venules and 3 major arterioles (narrower and more tortuous than those of dogs) that leave the periphery of the optic disc.

Examining the Fundus

Complaints concerning visual capacity or ability present a major diagnostic problem for veterinarians. Except in cases of complete blindness, it is extremely difficult to define a specific level of visual capacity. Careful and systematic ophthalmic examination is the most effective and objective means available to determine the absolute presence or absence of significant visual disability in an animal with ocular pathology. While ophthalmic examination may define ocular lesions in animals, their significance in terms of the animal’s ability to see is often uncertain. Vision tests in animals are necessarily empirical; however, there is at present no means of truly objectively and quantitatively assessing vision or visual disability in an animal that is not overtly blind. Maze testing in light and dark conditions, observation of dogs following a laser pointer, and evaluation of the behavior of the dog or cat in an unfamiliar environment can provide some information about the animal’s visual capability.

Since a blue-eyed cat has no pigment in the non-tapetal area, the large orange choroidal vessels can be seen. Retinal vessels are red.

STEP BY STEP FUNDIC EXAMINATION: LIGHT RESPONSES

Pupillary Light Reflex

The fundic examination begins with evaluating the size of the pupils and testing the direct and consensual pupillary light reflexes (PLR). Pupillary reflexes to light are tested early in the examination so the pupils can be dilated for evaluation of the lens and fundus. The PLR (direct and indirect) evaluates the integrity of the retina, optic nerve, midbrain, oculomotor nerve, and iris sphincter muscle. Stimulation of one eye results in the constriction of both pupils. The PLR is valuable in testing potential retinal function in eyes with severe corneal opacity, but is not a true test of vision.

PLR testing should be done with a bright light (See Box) in a dimly lit room (A). The reflexes are affected by the psychic 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 (eg, bright penlight). However, with acclimation or a strong light source, this effect is minimized. Older animals may exhibit slow and incomplete PLR resulting from atrophy of the iris sphincter muscle. This is common in small dogs, especially poodles. The pupillary margin may have an irregular or scalloped appearance; incomplete iris atrophy may result in an irregular pupil shape. The rough appearance of the pupil margin in Figure B indicates iris atrophy and can reduce the degree of constriction from light stimulation. Nuclear sclerosis and some small cataracts are also present.

What You Will Need

One of the following:
- Bright penlight
- Otoscope without speculum
- Transilluminator
- Ophthalmoscope

Left to right: direct ophthalmoscope, transilluminator head, and bright penlight

PLR = pupillary light reflex
Menace & Dazzle Responses

The use of close menace responses has traditionally been accepted as a fair estimate of whether an animal can see or not, among both lay individuals and veterinarians.

Making a quick, threatening motion toward the eye to cause a blink response and/or a movement of the head tests the menace response (A). This is a crude test of vision. Care should be taken to avoid creating air currents toward the eye or touching the whiskers in cats when performing this test; air currents can stimulate other sensory pathways that cause blinking or shying. The clarity of the cornea and lens and the contrast of the menacing object with its surroundings are important considerations in interpreting this response.

A positive menace response requires normal function of both peripheral and central visual pathways and therefore confirms some degree of visual capacity. However, by extrapolation from human optometry, a positive menace response from 2 feet away is likely to indicate simply that the animal’s visual acuity is at least 20/20,000 (ie, 100 times worse than the level recognized internationally in humans as legally blind—20/200). Thus, a positive or negative menace reflex should be interpreted with great caution.

PROCEDURE PEARL

Care should be taken to avoid creating air currents toward the eye or touching the whiskers in cats when performing this test; air currents can stimulate other sensory pathways that cause blinking or shying.

In addition, the animal patient should also quickly squint or “dazzle” when a bright light is abruptly shown close to the eye (B and C). The bright light causes a “pain” or photophobic response in relation to the potential amount of vision present. I believe that the dazzle reflex is a more reliable indicator of the potential for vision than the menace reflex and is particularly useful in situations in which complete cataracts, corneal scarring, and so forth are present to prevent this response.

Part 2 of this article, which will appear in an upcoming issue of Clinician’s Brief, will discuss the next steps in the examination of the ocular fundus—indirect and direct ophthalmoscopy.

See Aids & Resources, back page, for references, contacts, and appendices.

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