Examining the Feline Fundus

Kerry L. Ketring, DVM, DACVO All Animal Eye Clinic Whitehall, MI

New instrumentation for examination of the fundus has made this procedure readily available, cost effective and much easier for the general practitioner. The next step is the recognition of the many variables in the appearance of the normal feline fundus. And lastly, practitioners need to know when the structures of the fundus are abnormal and what those abnormalities mean.

Normal ocular fundus of the cat

One general statement that can be made concerning the fundus of the cat is that there is less variation in location and shape of the optic nerve, coloration of the tapetum and appearance of retinal vessels between individuals than you find in the canine. Also cats have far less inherited and congenital diseases involving the fundus than dogs.

The fundus of the eye refers collectively to the optic papilla or disk; retinal vasculature, including primary and secondary veins and arterioles; the tapetum lucidum; and the nontapetum nigrum. The retina extends anteriorly to its termination at the ora ciliaris retina. This is the junction of the nervous tunic (pars nervosa) and the pars plana of the ciliary body.

The optic disk is gray, circular and approximately 1 mm in diameter. Usually the optic disk is found totally in the tapetum. The disk is depressed slightly below the surface of the retina. Myelination of the optic disk is scant in cats compared with dogs, and seldom extends beyond the lamina cribrosa or cribiform plate. On rare occasion, it does extend from the disk in the nerve fiber layer. The myelin will appear gray to white; it may completely obscure the optic disc, physiological cup and some retinal vessels and will radiate from the disk as an irregular sunburst often referred to as medullary rays.

On close examination, the surface of the disk will appear sieve-like in the normal cat. This is the normal appearance of the lamina cribrosa in the sclera and is seen because of the scant myelin. Also, fine lines may be seen radiating from the disk. These are the axons of the ganglion cells that make up the nerve fiber layer (second most inner layer of the ten retinal layers) and optic nerve. It is frequently surrounded by a darker circle of tapetum, usually green. A complete or partial peripapillary conus is often present manifested as a tapetal hyperreflective area.

The physiological cup comprises the entire optic disk in the cat unlike in the dog. The optic pit is a small depression in the central portion of the physiologic cup and is a vestige of the embryonic hyaloid canal and artery. This appears as a gray or black spot in the center of the disk. This is not always obvious in the cat.

The tapetum is a multi-cell layer located deep to the retinal pigmented epithelium and is actually the inner layer of the choroid. It is located in the dorsal half of the fundus, triangular in shape. The tapetum does not extend to the peripheral retina, and it is surrounded by the nigrum.

The tapetal cells do not contain pigment but selectively resorb and reflect different light waves, resulting in the apparent color. The tapetum is dark at birth and gradually changes to gray shades before becoming blue and reaching its mature color at approximately 16 weeks of age. As the cat matures, the tapetum will take on the adult color.

The function of the tapetum is questionable. It has been suggested that it is an aid to vision in dim light by reflecting the light back through the retina. Tapetal hypoplasia and aplasia are less common in cats compared to dogs. When present, these individuals have no detectable visual deficit

On close examination of the tapetum, small black or brown spots may be seen intermixed with the normal tapetal color. This has been referred to as beadiness or stippling and is especially prominent at the peripheral tapetum. One explanation for this has been the thinning of the tapetum, resulting in the presence of choroidal pigment.

The tapetum in the cat is larger, thicker and reflects light more brilliantly than in the dog. This may account for reports that cats see better than dogs in very dim light. The color of the tapetum is frequently yellow or green. As in the dog, the color changes as the nigrum is approached.

The nigrum in the cat is usually brown or black but may be reddish or gray. In albinoid cats and Siamese, choroidal pigment may be lacking, resulting in the appearance of choroidal vessels. Focal tapetal hypoplasia is not uncommon in the Siamese. In these cases, red streaks known as tigroid fundus, will be seen and must be differentiated from retinal hemorrhage.

There are usually three primary retinal veins that originate from the margins of the disk and extend dorsal, ventrotemporal and nasoventral. The dorsal and ventrotemporal veins tend to arch temporally. The primary veins branch as they approach the peripheral retina.

The retinal arterioles are smaller in caliber and brighter red than the primary veins. Three arterioles usually leave the margins of the disk in association with the primary veins. The arterioles may be intertwined with the veins. Other arterioles originate independent of an associated vein. Frequently, a light streak can be seen in the center of the vein. This is a normal reflection from the internal limiting membrane overlying the surface of the vessel. The retinal vessels are present in the nerve fiber layer of the retina.

Histologically, the cat has an area centralis. This area is located approximately 1.5 disk diameters above the optic disk and about three disk diameters temporal to the disk. This area is relatively void of blood vessels and is frequently a darker green than the surrounding tapetum. This is an area of increase cone density and visual acuity.

The nigrum occupies the largest proportion of the fundus oculi. It is found ventrally and completely surrounds the tapetum. The color of the tapetum may be black, dark brown, gray or various shades of red. The color is determined by the amount of pigment in the retinal pigmented epithelium and the choroidal pigment.

In the nontapetum, a reflection may be seen similar to that from the surface of a lake. This is a normal phenomenon and is believed to be the reflection of light off the internal limiting membrane of the retina.

Interpretation of some abnormalities of the fundus

Vascular		
Lipemia	lipid metabolic defects	
Attenuated vessels	retinal atrophy/degeneration, anemia	
Dilated vessels	polycythemia, hyperproteinemia	
Tortuosity	cardiovascular disease	
Hemorrhage	multiple layers and etiologies	
Tapetal Reflectivity		
Diffuse hyperreflectivity	retinal atrophy, retinal detachment with disinsertion at ora	
Focal hyperreflectivity	chorioretinopathy	
Decrease or dull reflectivity	edema, i.e. active retinitis/detachment	
Optic Disc	coloboma, glaucomatous cupping atrophy, hypoplasia, papilledema, optic neuritis	
Hemorrhage		
Subretinal	large, dark, retinal vessels visible over hemorrhage; retina may be elevate	
Intraretinal	deep, small, circular	
Intraretinal nerve fiber layer	flame shape, follows and may obscure vessels; may extend over disc	
Pre-retinal	between retina and vitreous face; frequently circular with RBC settled	
	inferiorly i.e. boat hemorrhage obscures view of retinal components	
Vitreous hemorrhage	difficult or impossible to view retina and may settle inferiorly; varies with degree	
Retinal Detachments	may be small focal detachments referred to as bullous detachments; may be total detachment with or without disinsertion of the retina at the ora ciliaris retina; depending on associated hemorrhage and exudate, the retinal vessels may not be visualized; retinal vessels may go in and out of focus in the detached area	

Chorioretinitis versus Chorioretinopathy

	(active)	(inactive)
Borders of lesion	poorly demarcated	sharply defined margins
Detail	blurred	sharp
Tapetal	hyporeflective, gray to pink	hyperreflective with pigmented border
Nontapetal	gray to white	depigmented, clumping