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Dr. Eric Ledbetter
DVM, DACVO
Cornell University College of Veterinary Medicine

Ocular Manifestations of Systemic Infectious Diseases in Dogs and Cats

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Ocular Manifestations of Systemic Infectious Diseases in Dogs and Cats

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February 1st, 2025
Eric C. Ledbetter, DVM, DACVO
Cornell University, College of Veterinary Medicine,
Ithaca, NY, USA

Learning Objectives

1. To be familiar with the systemic infectious diseases that can produce ocular lesions in dogs and cats.
2. To discuss the major infectious diseases associated with ocular manifestations in dogs and cats, including basic pathophysiology and clinical ocular lesions.

Outline

1) General Concepts
2) Infectious disease
    a. Algal infections
    b. Bacterial infections
    c. Fungal infections
    d. Parasitic infections
    e. Rickettsiales infections
    f. Viral infections

1) General Concepts

Ocular lesions are frequently observed with systemic infectious diseases. Many different infectious diseases directly or indirectly affect the eye. Systemic infections may be associated with numerous and diverse ocular conditions including blepharitis, orbital disease, extraocular myositis, lacrimal adenitis, conjunctivitis, keratitis, scleritis, anterior uveitis, vitritis, chorioretinitis, optic neuritis, meningitis, and encephalitis.

2) General Concepts

a) Algal Infections

Protothecosis is most commonly caused by infection with *Prototheca bovis* or *Prototheca wickerhamii*. These organisms are unicellular saprophytic algae that lack chlorophyll. Ocular lesion occur in >50% of dogs with disseminated protothecosis, typically concurrent with gastrointestinal and central nervous system clinical signs. Ocular lesions are most commonly bilateral and may include vitritis, multifocal or diffuse chorioretinitis, panuveitis, and exudative retinal detachments. Multifocal, white, subretinal infiltrates are characteristic. Vison loss in dogs may result from the ocular lesions or central nervous system disease. During histopathologic evaluation of ocular tissues, pyogranulomatous or mononuclear inflammation with intralesional algae are observed.

b) Bacterial Infections

A variety of systemic bacterial infections can result in ocular disease, including general bacteremia/septicemia, bacterial meningoencephalitis, and some specific systemic bacterial infections (i.e., brucellosis, borreliosis, bartonellosis, and leptospirosis).

Canine brucellosis results from infection with the Gram-negative bacterium *Brucella canis*. The bacteria penetrate mucous membranes and produce a chronic bacteremia that distributes the organism to multiple tissues. A variety of concurrent systemic issues are possible with brucellosis, but many dogs with *Brucella*-associated ocular disease are otherwise subclinical for the infection. Anterior uveitis, vitritis, chorioretinitis, and endophthalmitis are most often observed in dogs with brucellosis. Brucellosis ocular lesions are frequently unilateral and associated with intraocular hemorrhage.

Lyme disease results from infection with the tick-borne spirochete *Borrelia burgdorferi*. Most exposed dogs and cats in endemic areas remain subclinical for the infection. The frequency of ocular lesions in infected animals is currently unclear. Reported ocular lesions associated with Lyme disease through potential direct mechanisms include conjunctivitis, anterior uveitis, corneal edema, retinal hemorrhages, chorioretinitis, retinal detachments, and extraocular myositis. Reported indirect lesions associated with Lyme disease (induced by glomerulonephritis and systemic hypertension) include uveal hemorrhages, retinal hemorrhages, and retinal detachments.

Bartonella spp. are Gram-negative, facultative intracellular bacilli. These bacteria are transmitted by arthropod vectors. There are currently >30 species and subspecies of *Bartonella*. *Bartonella* are highly adapted to their reservoir hosts, where they produce chronic or relapsing intraerythrocytic bacteremia. Cats are the reservoir host for *Bartonella henselae* and *Bartonella clarridgeiae*. Canids are the reservoir host for *Bartonella vinsonii* subsp. *berkhoffii*. Infection in reservoir hosts is typically subclinical and most clinical disease occurs in "accidental" hosts. *Bartonella* spp. have a tropism for vascular endothelium and can produce vasculitis. The frequency of ocular lesions in infected animals is currently unclear. Reported ocular lesions associated with bartonellosis in dogs and cats include blepharitis, conjunctivitis, keratitis, anterior uveitis, hyphema, retinal detachment, and chorioretinitis.

Leptospira spp. are Gram-negative, aerobic spirochetes. There are multiple species and >250 serovars recognized. Leptospirosis is transmitted between hosts by direct or indirect contact and is maintained in nature by subclinical wild and domestic mammal reservoirs. Bacteria penetrate mucous membranes or damaged skin. A bacteremia then disseminates the organism to multiple tissues, including the kidneys, liver, central nervous system, and eyes. Ocular lesions are relatively uncommon in animals with leptospirosis, but may include conjunctivitis, scleritis, anterior uveitis, iris hemorrhages, hyphema, chorioretinitis, panuveitis, retinal detachments, and conjunctival or uveal icterus.

c) Fungal Infections

The systemic mycoses include infection with *Blastomyces dermatitidis*, *Coccidioides immitis*, *Histoplasma capsulatum*, *Cryptococcus neoformans*, and other opportunistic fungi (e.g., *Acremonium*, *Aspergillus*, *Candida*, *Sporothrix*). Systemic mycosis may result in hematogenous or direct optic nerve spread of fungi to the eyes. Systemic fungal infections are frequently associated with ocular lesions in companion animals. These lesions may include blepharitis, orbital cellulitis, conjunctivitis, keratitis, anterior uveitis, chorioretinitis, retinal detachments, and optic neuritis. The ocular lesions of systemic mycosis may occur with or without other overt systemic clinical abnormalities.

As the eyelids are modified skin, any fungal dermatologic disease can result in blepharitis (i.e., dermatophytosis). These eyelid fungal infections may present with or without concurrent generalized dermatologic disease.

d) Parasitic Infections

Toxoplasma gondii is an obligate intracellular protozoan parasite. *Toxoplasma* is a common etiology of ocular disease in cats and a relatively rare cause in dogs. Ocular signs of toxoplasmosis may include keratitis, anterior uveitis, chorioretinitis, extraocular myositis, scleritis, vitritis, and optic neuritis.

Ocular larva migrans (migration of *Toxocara canis* larvae) is associated with focal chorioretinal granulomas. Intraocular filariasis may occur in dogs with *Dirofilaria immitis* infection.

Ophthalmomyiasis is the ocular migration of fly larvae from the order Diptera. *Cuterebra* spp. larvae are most commonly reported in companion animals. There are three primary types of ophthalmomyiasis in dogs and cats: 1) ophthalmomyiasis externa: extraocular migration, 2) ophthalmomyiasis interna anterior: intraocular migration through anterior segment, 3) ophthalmomyiasis interna posterior: intraocular migration through posterior segment. Ophthalmomyiasis externa is associated with blepharitis, conjunctivitis, keratitis, or orbital cellulitis/abscess. Ophthalmomyiasis interna anterior may produce anterior uveitis, anterior chamber fibrin, and hyphema. Ophthalmomyiasis interna posterior is associated with distinct wandering, curvilinear retinal tracks with retinal hemorrhages, edema, and chorioretinitis if acute.

Any parasitic dermatologic disease can result in blepharitis (e.g., demodectic mange, sarcoptic mange). These eyelid infections may present with or without concurrent generalized dermatologic disease.

e) Rickettsiales Infections

Rickettsiales is an order of obligate intracellular Gram-negative pleomorphic bacteria. Many are transmitted by arthropod vectors. Rickettsial pathogens of dogs/cats include: *Ehrlichia canis, Anaplasma platys*, *Anaplasma phagocytophila*, and *Rickettsia rickettsii*. Clinical infections are common in dogs and uncommon in cats. Ocular disease with Rickettsiales infection is classically a “hemorrhagic uveitis”. Specific ocular lesions may include anterior uveitis, chorioretinitis, panuveitis, retinal detachment, and optic neuritis. Hemorrhages are common in the conjunctiva, iris, anterior chamber, vitreous, or retina. Rarely, orbital cellulitis or necrotizing scleritis is observed. Ocular lesions result from thrombocytopenia, vasculitis, and hyperviscosity.

f) Viral Infections

Canine distemper virus is a morbillivirus that infects both epithelial and neural tissues. It characteristically produces conjunctivitis, lacrimal adenitis (with resultant keratoconjunctivitis sicca), multifocal chorioretinitis, and optic neuritis in dogs.

Infectious canine hepatitis (either natural infection with canine adenovirus-1 or less commonly from the modified-live virus used for vaccination) may be associated with viral infection of the corneal endothelium and uvea with subsequent immune-mediated lesions including corneal edema (“blue eye”) and anterior uveitis.

Feline immunodeficiency virus is a lentivirus associated with a variety of ocular lesions that result from direct viral affects and secondary infections or immune-mediated disease. These lesions may include conjunctivitis, anterior uveitis, pars planitis, lens luxation, retinopathy, and uveal lymphoma.

The primary mechanisms of ocular disease associated with the infection by the retrovirus feline leukemia virus include oncogenesis, myelosuppression, immune-mediated, and direct neurotoxic viral effects. Feline leukemia virus infections are associated with retinal dysplasia, uveitis, uveal lymphoma, and spastic pupil syndrome.

Feline infectious peritonitis is a disseminated pyogranulomatous vasculitis. Ocular lesions are more common with the “dry” form of the disease and may include anterior uveitis, hyphema, chorioretinitis, retinal hemorrhages, retinal detachment, retinal perivascular exudates, and optic neuritis.

In utero infection with feline panleukopenia virus may result in retinal dysplasia in cats.