# Avian Ophthalmology, Part 2: Review of Ophthalmic Diseases

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## Introduction

Much of the literature focusing on the etiology and management of avian ophthalmic disease is in the form of individual case reports or small case series. Several excellent reviews of the ophthalmic diseases of raptors, laboratory avian species, and production birds are available.[1-6] In Part 2 of this report, documented observations and investigations of avian ophthalmic disease are reviewed, with a focus on companion and aviary birds.

## Congenital Abnormalities

Developmental abnormalities affecting the eye have been infrequently reported in companion birds. Cryptophthalmos refers to a condition in which the eyelid skin is continuous over the orbit, and in the extreme form, a ciliary margin is not visible. Varying degrees of partial cryptophthalmos have been reported in four cockatiels *(Nymphicus hollandicus)*.[7] Attempts at surgical creation of a palpebral fissure were unsuccessful in these birds, with the tissue returning to the preoperative state within months. In a 6-month-old cockatoo *(Cacatua* species), a congenital cause was considered for symblepharon present between the third and upper eyelids, with lagophthalmos and exposure keratitis resulting.[8] A permanent partial lateral canthorrhaphy brought resolution of the keratitis. Chronic ocular discharge has been reported in a white (umbrella) cockatoo (C. *alba)* with choanal atresia and associated improperly draining nasolacrimal ducts.[5] Ec-tropion and exposure keratopathy have been reported in cockatiels.[5]

## Infectious and Inflammatory Diseases

Viral, bacterial, fungal, protozoal, and parasitic diseases cause ocular lesions in a variety of avian species. Disease presentation can be variable (Fig. 1), as such agents can produce local ophthalmic disease only or ocular manifestations that result from systemic infection. In addition to physical examination and blood tests, diagnostic information may be generated from cytologic examination and culture (bacterial, fungal, and viral) of affected tissues and histologic examination or electron microscopy of biopsy specimens. Molecular biologic tests to detect target antigen or DNA have been developed for a variety of microbial agents affecting birds.

**Viral infections**

Avian poxvirus is a prevalent cause of ocular disease in a variety of companion bird species.[9-14] Many strains of the virus exist that are adapted to various avian hosts, but all are considered to be variants of *Poxvirus avium.*[15] Portals of entry include the skin and the alimentary and respiratory tracts. The initial ocular lesions of avian poxvirus are most commonly seen 10-14 days after infection and include epiphora and blepharitis. Corneal ulcers are common and may progress to perforation. Twelve to 18 days after infection, dry, crusty scabs form around the eyelid margins and can obliterate the palpebral fissure. Secondary bacterial or fungal infections may exacerbate clinical signs, and concurrent oral lesions can make eating difficult, resulting in subsequent wasting. Poxvirus is contagious, and epomitics have been reported in aviaries and quarantine stations.[10] The diagnosis is confirmed on his-topathologic examination by identifying intraepithe-lial vesicles, epidermal hyperplasia, and eosinophil-ic intracytoplasmic inclusions. Treatment with topical and systemic antibiotics is supportive and directed toward secondary infections. Gentle cleansing of the periocular area to remove encrusted discharge should be followed by applying a broad-spectrum ophthalmic antibiotic ointment. Removal of the crusted pox scabs should be avoided, as the underlying tissue will bleed. In the early stages of disease, vitamin A therapy has been clinically effective in decreasing the severity of infection.[13] Sequelae of pox infection include eyelid cicatrix and secondary chronic keratitis from mechanical abrasion or exposure; symblepharon; uveitis; cataract; enophthalmos; phthisis bulbi; and chronic epiphora from nasolacrimal punctal occlusion.

**Figure 1.** A pionus *(Pionus* species) parrot with periocular feather loss, blepharospasm, and serous ocular discharge. After the bird was anesthetized for ophthalmic examination, severe ulcerative keratitis was evident and was presumed secondary to trauma.

Ophthalmic manifestations of other viral infections have been described. Reticuloendothelial virus has been implicated in the pathogenesis of orbital lymphosarcoma in an Indian peafowl *(Pavo crista-tus).*[16] A papillomalike virus was demonstrated by electron microscopy in biopsy specimens from an African grey parrot *(Psittacus erithacus)* with nodular proliferative blepharoconjunctivitis and associated cutaneous lesions.[17] Papovavirus inclusions were demonstrated in the eyelids of budgerigars *(Melopsittacus undulatus)* with blepharitis.[18] An outbreak of conjunctivitis and respiratory distress was described in Australian finches, in which viral particles with the

ultrastructural characteristics of cytomegalovirus were identified in affected tissues.[19] Adenoviruslike inclusions were identified in the inflamed conjunctiva and the kidneys of white-masked lovebirds *(Agapornis personata)* that were euthanatized during an epomitic.[20] As with poxvirus infection, therapy for other viral diseases remains supportive. Isolating sick birds from healthy individuals is recommended, and any new bird should be quarantined before introducing it to a cagemate or into an aviary. Vaccination remains controversial.

**Bacterial infections**

Conjunctivitis, keratitis, blepharitis, uveitis, and periocular inflammation associated with sinusitis are common manifestations of bacterial infections. Staphylococcal blepharitis and keratoconjunctivitis
were diagnosed in a large group of Amazon parrots newly introduced to Japan.[21] In parrots, chlamydial keratoconjunctivitis has been observed as a local infection as well as in association with generalized chlamydiosis.[22] *Mycoplasma gallisepticum*[23-24] and *Haemophilus paragallinarum*[24] were isolated from house finches *(Carpodacus mexicanus)* with conjunctivitis. Topical fluoroquinolone and oral tyiosin tartrate therapy was reportedly effective in clearing *M. gallisepticum* from affected birds.[25] A *Haemophilus-like* bacteria was isolated from the conjunctiva of a cockatiel with unilateral blepharitis and severe conjunctivitis.[26] *Mycoplasma* species has been proposed to cause conjunctivitis in cocka-tiels,[27] and is frequently associated with upper and lower respiratory disease. Mycobacterial infection was associated with keratitis in a Maximilian's (scaly-headed) parrot *(Pionus maximiliani),*[28] retro-orbital inflammation in a yellow-naped Amazon parrot *(Amazona ochracephala auropalliata)*[29] and blepharitis in a red-lored Amazon parrot (A. *autumnalis).*[30] Chronic infraorbital sinusitis and periocular swelling was associated with *Nocardia asteroides* infection in another red-lored Amazon parrot.[31] Bilateral supraorbital abscesses developed in an orange-winged Amazon parrot (A. *amazonicd)* with sinusitis.[32] *Pseudomonas aeruginosa* was isolated from the choana and the supraorbital abscess. Uveitis was a component of coagulase-positive *Staphylococcus* species septicemia in a lovebird.

Antimicrobial therapy may be effective in birds with bacterial infection, provided, the appropriate agent is used and the bird is amenable to therapy (topical, systemic, or both). Sinus infections may be cleared if treated early; however, chronic sinusitis is more problematic and sinus drainage and lavage may be necessary. This technique has been described elsewhere.[33]

**Mycotic infections**

Ophthalmic manifestations of respiratory or disseminated mycotic disease have been reported in companion and aviary birds. Intraocular and orbital disease associated with disseminated cryptococcosis in a salmon-crested (Moluccan) cockatoo *(Cacatua moluccensis)* was verified at necropsy.[34] Gray-white comeal and conjunctival lesions were observed in psittacine birds with *Candida albicans* infection.[35] Opportunistic fungal infections may complicate traumatic injuries to ocular tissues (Fig. 2).

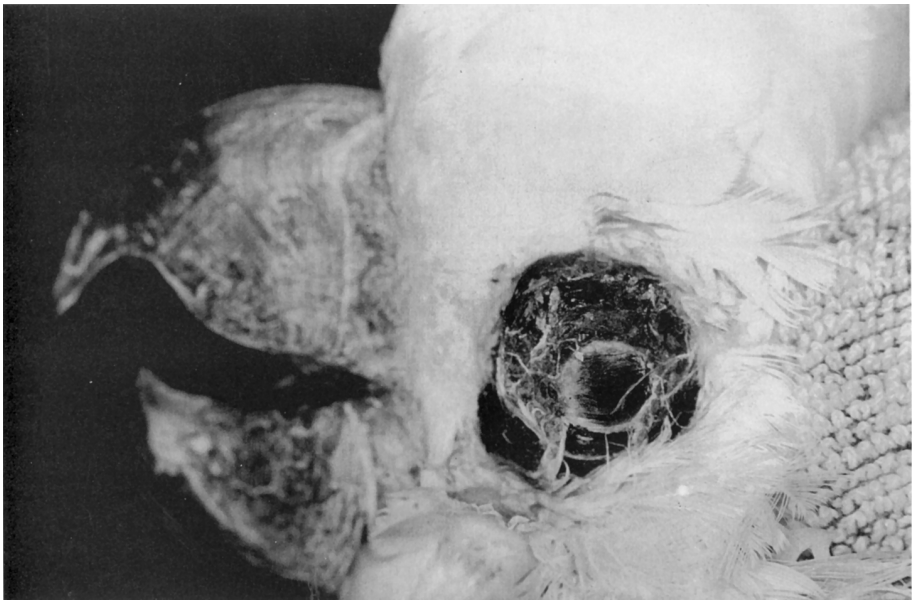

**Figure 2**. A cockatoo with a traumatic ocular proptosis complicated by a secondary infection with *Aspergillus* species. Enucleation was curative.

**Protozoa**

*Toxoplasma gondii* was identified in the ocular and central nervous system tissues of blind canaries *(Serinus canaria).*[36] Ocular lesions included cho-roiditis, retinal detachment, optic neuritis, and peri-orbital myositis.

**Parasites**

Infestations with *Knemidokoptes pilae* mites may cause proliferative and hyperplastic scaly lesions in the periorbital area and on the beak, vent, and legs.

Selective immunosuppression and genetic predisposition may be associated with infection.[5] Mites can be demonstrated in skin scrapings. Ivermectin therapy (diluted 1:8 in propylene glycol and administered at 200 p-g/kg subcutaneously or orally) is usually curative.[27]

Several nematodes have been reported to infect the periocular tissues of companion and aviary birds. A quickly moving translucent worm was detected between the globe and the nictitating membrane of a young adult Senegal parrot *(Poicephus senegalus)* with a history of unilateral blepharo-spasm and mild conjunctivitis.[37] One drop of 0.125% demecarium bromide, a cholinesterase inhibitor, was used to kill the worms, which were then extracted from the conjunctival fomix by flushing with sterile saline. These worms were identified as *Thelazia* species, and flies are considered to be intermediate hosts. *Oxyspirura* species nematodes may cause conjunctivitis, chemosis, and periocular pruritus in infected birds. The parasite, within its intermediate host the cockroach, is ingested by the bird, after which the larvae migrate from the crop to the esophagus and eventually to the conjunctival fomix by the nasolacrimal duct. *Oxyspirura* nematodes were demonstrated in wood partridges[38] and are reported to be common in cockatoos.[5] A single dose of topical ivermectin (dose range 0.005—0.05 mg) was effective in

eliminating *Oxyspirura* nematodes from the conjunctival sac of experimentally infected chickens, although ivermectin was not effective when administered orally or intramuscularly.[38]

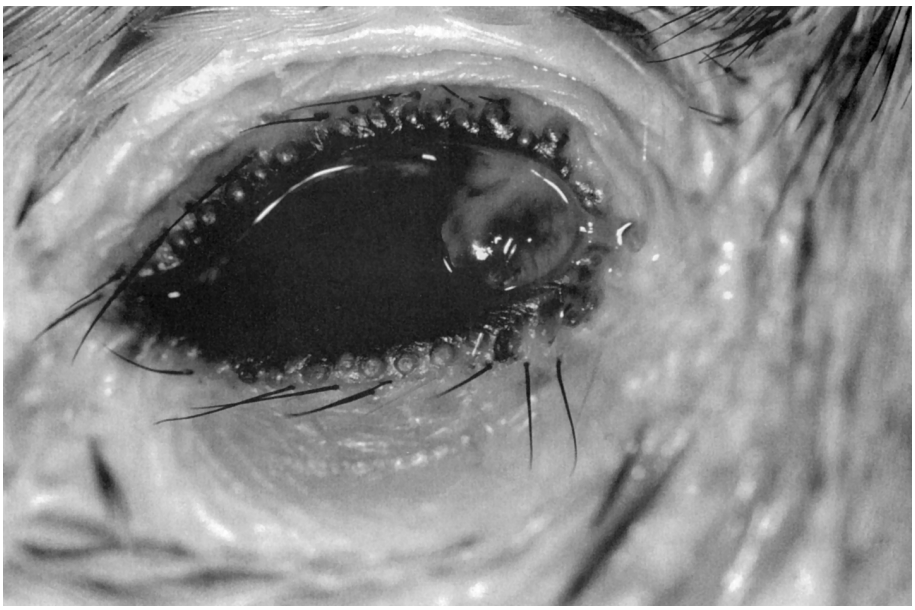

**Figure 3.** An Amazon parrot with a verrucous mass extending from the leading edge of the nictitating membrane. Excisional biopsy, while preserving the leading edge of the nictitans, yielded a histologic diagnosis of a xanthoma.

**Nutritional Deficiencies**

Hypovitaminosis A is common in birds habitually fed all-seed diets. The conjunctiva and respiratory tract, as well as many other body systems, can be affected.[39] Swollen eyelids may be caused by hy-perkeratosis of the conjunctiva, and epiphora may result from occluded nasolacrimal ducts that have undergone epithelial thickening. These mucosal surfaces may be more susceptible to secondary bacterial, viral, or fungal infections because of diminished secretory antibody (immunoglobulin A). Other than dietary deficiency of vitamin A or its precursors, hypovitaminosis may be associated with liver or pancreatic disease. Poor absorption of adequate dietary levels of vitamin A could be secondary to intestinal disease. Vitamin A supplements, either oral or parenteral, may be included in the management of conjunctivitis, nasolacrimal obstruction, or sinusitis if the dietary history is suspect or if other clinical signs of deficiency exist.

**Neoplasia**

Neoplasms involve a variety of ocular and ad-nexal structures and may be primary or metastatic from distant organs. The eyelids and the nictitating membrane have been involved in neoplastic processes, including a benign basaloid cell tumor[40] and lipogranuloma[41] in the eyelid of budgerigars. A basal cell carcinoma was removed from the leading margin of the nictitans of a conure.[8] A mass recurred at the same eyelid margin 9 months later, and excisional biopsy revealed a diagnosis of squamous cell carcinoma. A xanthoma of the third eyelid has been reported in a budgerigar,[8] and a xanthoma of the third eyelid of an Amazon parrot with no other clinical signs has also been observed (Fig. 3). However, results of preoperative blood tests revealed slightly high concentrations of liver enzymes (A.M.W., unpublished data, 1999). A cystadenoma was resected

from the medial periorbital region of the left eye of an African grey parrot; it was speculated to have been associated with the lacrimal gland.[42] A malignant intraocular medulloepithelioma has been described in two cockatiels.[43]

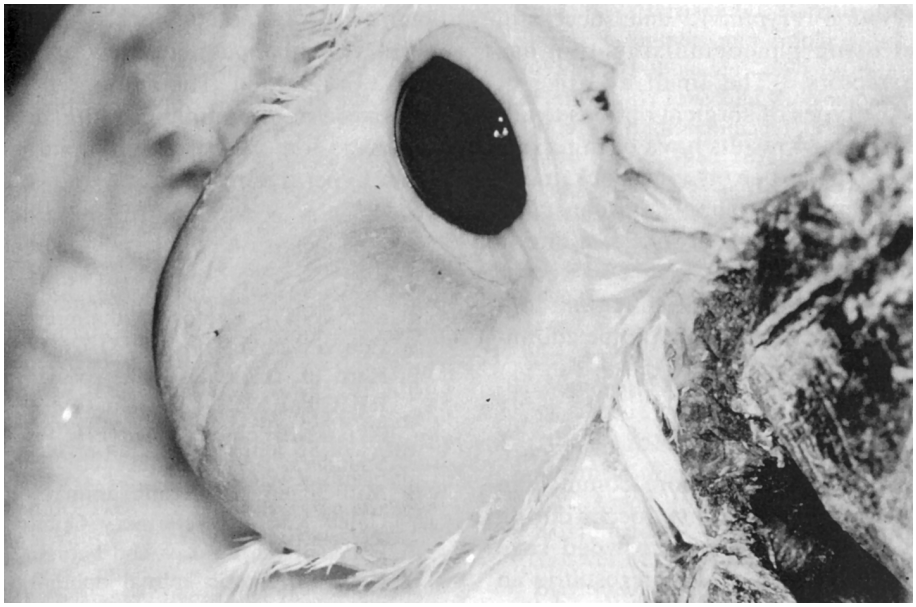

**Figure 4.** A cystic mass lesion ventral to the globe of a cockatoo. A bite wound, presumably inflicted by a cagemate, was identified in this region shortly before the periorbital mass lesion developed. An epithelial-lined cyst was identified after surgical excision. (Photo courtesy of Jean Stiles.)

Pituitary adenomas have been described in a 4-year-old cockatiel with apparent blindness and dilated pupils,[44] in an 11-year-old Amazon parrot with associated exophthalmos, comeal ulceration, and blindness,[45] and in 9 of 50 budgerigars with unilateral or bilateral exophthalmia.[46] Exophthalmos with exposure keratitis was also a prominent clinical feature of a periorbital lymphoreticular neoplasm in an African grey parrot[47] and an orbital lymphosarcoma in an Indian peafowl *(Pavo cristatus)*.[16]

**Miscellaneous Disorders Corneal degeneration**

Crystalline corneal degeneration was found in 8.7% of birds (including Amazon parrots, budgerigars, cockatiels, parakeets, and finches) that were necropsied at a quarantine station.[18] The cause of the degenerative lesions in this group of birds was not determined; however, this lesion has been reported as a sequelae to ocular inflammation.[13]

**Cataracts**

Cataracts are found in birds associated with skeletal malformations, genetic disorders, nutritional deficiencies, infection, trauma, senescence, toxic effects, and other ocular disease such as uveitis and retinal degeneration.[2] Senile onset cataracts may be the most common type observed in aged birds.[48] However, this must be differentiated from lenticular nuclear sclerosis that accompanies normal aging of the lens and is not associated with significant changes in vision. Hereditary cataracts have been reported in Yorkshire canaries.[49] In these birds, pedigree analysis suggested

inheritance is associated with a fully penetrant recessive allele at an autosomal locus. An attempt at microsurgical extracapsular extraction of the lens was considered unsuccessful because of secondary uveitis and the small size of the canary eye. Hypermature cataracts, in addition to retinal degeneration, were described in a crested mynah *(Acidotheres cristatellus)*.[50] Both anterior and posterior luxation of cataractous lenses have been observed in an aged cockatoo, presumed to be secondary to inflammatory zonulysis (A.M.W. and D.A.W., unpublished data, 1999). Extracapsular cataract extraction was successfully performed in an Andean condor, (Vultur gryphus)[51] and successful cataract removal using phacoemulsification has been reported in raptors.[52] The small eye size ot some birds limits the types of surgical options available, although satisfactory results have been reported in a cockatiel, Amazon parrots, and cockatoos.[2] A veterinary ophthalmologist should be consulted for therapeutic options and to determine if a bird is a candidate for surgery. Cataracts may be a source of immune-mediated intraocular inflammation; topical anti-inflammatory medication should be administered in such cases.

**Trauma**

Ocular and adnexal trauma is more common in birds housed with cagemates and may occur during reproductive activities or in an overcrowded cage environment. Trauma to the eyelids can result in an eyelid cicatrix and secondary chronic corneal irritation. The nictitating membrane serves an important mechanical function in spreading the tear film; if lacerated, the nictitans should be sutured. Either eyelid can be repaired promptly by using a 7-0 to 9-0 absorbable suture at a depth of approximately .75 thickness (to avoid the suture rubbing on the corneal surface). Blunt or sharp trauma can produce a myriad of ophthalmic lesions, including uveitis, hyphema, corneal perforation, iris prolapse, lens capsule rupture, retinal detachment, and damage to the scleral ossicles. A periocular cyst was identified inferior to the globe of a white cockatoo with a history of recent facial trauma associated with a bite wound (J. Stiles, oral communication, 1999; Fig. 4). The cyst was lined with a secretory epithelium, and it did not recur after surgical resection. Foreign bodies, such as a seed trapped beneath the nictitating membrane, can irritate the surface and induce trauma to the cornea and conjunctiva.

**Glaucoma**

References to primary glaucoma in companion avian species are conspicuously lacking in the literature, although the disease has been described in poultry[6] and raptorial species.' An apparent primary glaucoma has been observed in a canary.[5] Glaucoma may develop as a sequelae to lens luxation or secondary to chronic inflammation, with posterior or peripheral anterior synechiae and preiridal fibro-vascular membrane formation.

**Retinal degeneration**

Bilateral retinal degeneration was confirmed histologically in a 3-year-old parakeet with visual impairment.[53] Cataracts were suspected clinically, but results of histopathologic examination of the lens was not reported. The authors did not speculate on the cause of the retinal degeneration. Foci of retinal degeneration were identified in a crested mynah with hypermature cataracts.[50]

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