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Disorders of the Third Eyelid in Birds: 17 Cases

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Abstract: The purpose of this retrospective study was to identify the types and causes of disorders that primarily or specifically afflict the membrana nictitans of birds. Seventeen wild, domestic, and pet exotic birds examined by the Ophthalmology Services at three institutional referral centers were identified with lesions of the third eyelid. Lesions were unilateral in 16 birds. Traumatic injury, with (three birds) and without (four birds) an associated foreign body, was the predominant cause of lesions. Neoplasia, presumed dystrophic mineralization, and inflammation with or without infection were equally represented (three birds each). One probable congenital malformation was identified. We conclude that although many specific and nonspecific external ocular disorders incidentally involve the membrana nictitans to a minor degree, clinically important primary disorders of the third eyelid seem distinctly uncommon in birds.

Key words: third eyelid, membrane nictitans, eye, avian, birds

Introduction

The membrana nictitans of birds is occasionally beset by disorders that affect its appearance, function, or both. These disorders may involve only the nictitans or may extend from or to adjacent tissues. Infectious diseases, traumatic injury, and, less commonly, neoplasia and degenerations are important causes of structural and functional abnormalities.

Documentation of these disorders has been infrequent and primarily limited to individual case reports and citations.¹⁻⁵ The purpose of the study reported here was to profile the types and causes of avian third eyelid disorders in a large case series of wild, domestic, and pet exotic birds. The 17 birds discussed represent a compilation of cases from the

Ophthalmology Services at three institutional referral centers.

Case Reports

Congenital disorders

Case 1: A 6-month-old red-vented cockatoo (*Cacatua haematouropygia*) was presented for a persistent corneal erosion of the left eye. The owners had noted blepharospasm, partial nictitans prolapse, and ocular discharge for 3 months. The right eye was normal. Palpebral response was normal and ocular discharge was absent bilaterally. The left nictitans appeared thickened; during spontaneous excursions and by forced duction under topical anesthesia it could cover only approximately two-thirds of the cornea (Fig. 1). A ventrotemporal epithelial erosion was present that corresponded to the area not covered by the nictitans. On forceps manipulation of the nictitans its motility appeared restricted by attachment to the upper eyelid. Clinical assessment was congenital or acquired symblepharon between third and upper eyelids with secondary lagophthalmos and exposure keratitis. Permanent partial lateral

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canthorrhaphy was performed, after which the erosion healed.

Traumatic disorders

Case 2: A 10-year-old male domestic goose (*Anser anser*) was presented with a 1-week history of ocular discharge from the left eye. Ocular examination showed mucopurulent discharge, mild upper and lower blepharidema, edema and hyperemia of the nictitans, and a 1-mm-diameter neovascularized central corneal ulcer involving half of the stromal thickness (Fig. 2). A foreign body was visible on the medial palpebral surface of the third eyelid. Culture of the conjunctival sac yielded *Streptococcus* sp. The foreign body was removed under topical anesthesia and identified as a foxtail seed. All ocular signs resolved following 3 weeks of topical treatment with chloramphenicol ointment.

Case 3: An adult screech owl (*Otus asio*) was presented after being hit by a car and treated by a local rehabilitator. The right eye was normal. Palpebral response was absent from the left eye and the nictitans showed no spontaneous excursions, although it could be easily protracted manually with forceps after topical anesthesia. Pyramidalis muscle injury and cranial nerve six dysfunction were considered possible explanations. Periocular sensation was demonstrable. Extensive exposure keratitis with corneal erosion and scarring secondary to presumed facial nerve paralysis and third eyelid dysfunction prevented intraocular examination (Fig. 3). Transaural enucleation was performed and the bird was placed permanently with a rehabilitator.

Case 4: An adult great horned owl (*Bubo virginianus*) was presented for treatment of porcupine quill injuries of the head. Numerous quills were removed from the oral mucous membranes. A single quill was identified and extracted from the base of the right nictitating membrane (Fig. 4). Focal healed corneal scars and a focal cataract were evident, possibly associated with perforation by a quill.

Case 5: A black-bellied whistling-duck (*Dendrocygna autumnalis*) was presented for evaluation of unilateral periocular hemorrhage of presumed traumatic origin. A large subconjunctival hematoma involved the nictitans and dorsal conjunctiva. The third eyelid's motility was greatly reduced and it was partially prolapsed, at least in part because of increased girth from the hematoma (Fig. 5). The globe was normal. Following several days of treatment with topical antibiotic-corticosteroid ointment the hemorrhage resolved and the function and appearance of the membrana nictitans returned to normal.

Case 6: An adult Canada goose (*Branta cana-*

densis) was presented for treatment of gunshot wounds. In addition to body wounds, a draining tract was associated with a swollen, tonically prolapsed right third eyelid (Fig. 6). A small twig was embedded in the medial orbit, penetrating the nictitans. The globe was normal. Injury of the third eyelid was presumably incurred during the fall from flight resulting from the gunshot wounds. The twig was removed. Antibiotic-corticosteroid topical ointment and systemic broad-spectrum antibiotics were administered. The draining tract resolved and the appearance and function of the third eyelid returned to normal over a 6-week period.

Case 7: An emu chick (*Dromiceius novaehollandiae*) was presented for evaluation of a unilateral ocular injury resulting from being pecked by a clutchmate. Hyphema and subconjunctival hemorrhage involving the third eyelid were evident (Fig. 7). The nictitans was partially prolapsed but its motility was relatively normal. The bird was separated from its clutchmates. The hemorrhages resolved without treatment or complication.

Case 8: An adult gray-cheeked parakeet (*Brotogetis pyrrhopterus*) was presented for evaluation of chronic unilateral conjunctivitis. Conjunctival cultures were negative for aerobic and anaerobic bacteria, chlamydia, and viruses. Persistent self-trauma inflicted on the affected eye resulted in a linear laceration of the nictitans parallel to its leading edge, resulting in an oval window defect in the membrane (Fig. 8). The conjunctivitis resolved following a 32-day course of tetracycline administered orally for possible occult chlamydiosis. The defect in the nictitans persisted but without sequelae.

Inflammatory disorders

Case 9: An adult Swainson's hawk (*Buteo swainsoni*) was presented for evaluation of bilateral smooth pink nodules of the palpebral surface of the third eyelids (Figs. 9, 10). Both nodules were completely surgically excised. Histologic diagnosis was nongranulomatous conjunctivitis from unknown causes. The bird was released and lost to follow-up.

Case 10: A cormorant (*Phalacrocorax* sp) was presented for evaluation of unilateral ocular and periocular swelling and discharge. A smooth white swelling involved the third eyelid (Fig. 11). Conjunctival culture yielded several species of gram-negative bacteria. Sinusitis caused by *Candida* sp was diagnosed by cytologic examination of aspirated material. The sinusitis and membrana nictitans swelling resolved following several weeks of therapy with ketoconazole administered orally.

Case 11: An adult ring-billed gull (*Larus dela-*



Figure 1. A red-vented cockatoo with dorsotemporal symblepharon, tonically prolapsed and immobile third eyelid, and inferior corneal erosion.

Figure 2. A domestic goose with a hyperemic, edematous, prolapsed third eyelid. Plant foreign body near the medial canthus is obscured by the eyelids.

Figure 3. A screech owl with extensive exposure keratitis associated with presumptive facial paralysis and immobility of the third eyelid.

Figure 4. A great horned owl with a focal cataract and a hyperemic nodule on the third eyelid, which contained a porcupine quill.

Figure 5. A black-bellied whistling-duck with a hematoma of the third eyelid and superior palpebral conjunctiva.

Figure 6. A Canada goose with a swollen, prolapsed third eyelid and a draining tract at the medial canthus containing a twig (not visible).

Figure 7. An emu chick with hemorrhagic swelling of the third eyelid and hyphema secondary to trauma.

Figure 8. A gray-cheeked parakeet with acquired central window defect of the third eyelid secondary to self-trauma.

Figure 9. The left eye of a Swainson's hawk with a conjunctival nodule arising from the palpebral surface of the third eyelid.

warensis) was presented for treatment of a fractured humerus. On physical examination, three oval white nodules were noted on the palpebral surface of the right third eyelid (Fig. 12). The membrana nictitans was partially prolapsed, covering approximately one-fourth of the eye. The globe, eyelids, and remainder of the physical examination were normal. Two of the nodules were excised under topical anesthesia. The tissue was fixed in 10% formalin, processed for histopathologic examination, and stained

with hematoxylin and eosin. Foci of granulomatous inflammation surrounded niduses of yeasts, which were periodic acid-Schiff- and Gomori's methenamine silver-positive (Figs. 13 and 14). A follow-up biopsy specimen was obtained for fungal culture by complete excision of the remaining nodule. *Candida albicans* was cultured, which was sensitive to natamycin, 5-fluorocytosine, and nystatin and resistant to ketoconazole, miconazole, amphotericin B, and clotrimazole. The bird received topical micon-



Figure 10. The right eye of a Swainson's hawk with conjunctival nodule arising from the palpebral surface of the third eyelid.

Figure 11. A cormorant with a large fungal granuloma of the third eyelid caused by *Candida* sp.

Figure 12. Multifocal nodular candidiasis affecting the right third eyelid of a ring-billed gull.

Figure 13. Photomicrograph of a conjunctival granuloma excised from the right third eyelid of a ring-billed gull. Black foci represent yeast organisms proven by culture to be *Candida albicans*. Gomori's methenamine silver stain. Original magnification $\times 40$.

Figure 14. Photomicrograph of *Candida albicans* contained in the conjunctival granulomas of the ring-billed gull described in Fig. 13. Gomori's methenamine silver stain. Original magnification $\times 100$.

Figure 15. Hard white calcareous plaque involving the central portion of the right third eyelid of an adult male kestrel.

Figure 16. Epidermoid carcinoma involving the leading edge of the left third eyelid of a red-tailed hawk.

Figure 17. Xanthoma of the third eyelid of a budgerigar.

Figure 18. Squamous cell carcinoma of the right third eyelid of a conure.

azole ointment once daily for 7 days, before results of the antifungal drug sensitivity test were available. The gull was released to the wild and lost to follow-up.

Dystrophic disorders

Cases 12, 13, and 14: Three adult kestrels (*Falco sparverius*), two males and one female, were pre-

sented separately over a period of several years for examination and treatment of injuries. Incidental findings on physical examination of all three birds were small hard dense white plaques within the membrana nictitans (the right in the male and one female, the left in the second female), which was otherwise normal in function and appearance (Fig. 15). A conjunctival scraping specimen obtained

from one of the females and examined microscopically under polarized light gave the appearance of mineralization. Treatment of the lesions was not recommended. The birds were released and lost to follow-up.

Neoplasia

Case 15: An adult red-tailed hawk (*Buteo jamaicensis*) was presented for a fractured humerus. On physical examination a 0.75-cm-diameter red oval mass was noted attached to the central portion of the leading edge of the left membrana nictitans (Fig. 16). Motility of the third eyelid was not affected but the mass was visible in the dorsomedial quadrant of the palpebral fissure when the nictitans was fully retracted. The remainder of the ocular and physical examinations were unremarkable. Following immobilization with ketamine and diazepam, the mass and associated leading edge of the nictitans were sharply excised; the margin of the third eyelid was not surgically reconstructed. The tissue was processed for histopathologic examination after fixation in 10% formalin and sections were stained with hematoxylin and eosin. Histopathologic diagnosis was epidermoid carcinoma. No recurrence was noted during a month of observation before release of the bird to a rehabilitator.

Case 16: A 2½-year-old budgerigar (*Melopsittacus undulatus*) was evaluated for a 1 × 2-mm yellow-orange oval mass present for 2 months on the nasal margin of the left membrana nictitans (Fig. 17). The mass had recurred following previous excision by the referring veterinarian. After induction of general anesthesia with halothane, the mass was removed by focal full-thickness wedge resection. The wound was not sutured. Recovery was uneventful. Histopathologic diagnosis was xanthoma. Fifteen months later the bird was found dead. Post-mortem findings included chronic active hepatitis with marked cirrhosis, coronary atherosclerosis, agonal aspiration pneumonia, and muscle atrophy of the left leg of unknown cause. Relationship of these findings to the nictitans mass was not apparent.

Case 17: An adult conure (*Aratinga* sp) was presented for evaluation and treatment of a 2-mm red friable mass on the palpebral surface near the leading margin of the membrana nictitans of the right eye (Fig. 18). Intended complete excisional biopsy yielded the histopathologic diagnosis of basal cell carcinoma. A mass recurred at margin of the third eyelid 9 months later. Excisional biopsy yielded the histopathologic diagnosis of squamous cell carcinoma. The bird was lost to further follow-up.

Discussion

The normal avian membrana nictitans is comprised of epithelium, connective and vascular tissues, and muscle. When retracted it lies medial or superomedial to the globe. Protraction of the third eyelid is accomplished by contraction of the striated pyramidalis muscle, which attaches to the nasal edge of the nictitans. The temporal edge of the nictitans is tightly adherent to the associated conjunctiva and underlying sclera. The quadratus muscle forms a sleeve dorsal to the optic nerve through which the tendon of the pyramidalis muscle passes, allowing a pulley action of the quadratus muscle to amplify or modify action of the pyramidalis. The pyramidalis tendon passes first dorsally, then temporally, then ventrally around the optic nerve, then anteriorly and nasally to insert on the nictitans. Innervation of both muscles by the sixth cranial nerve is widely cited although one study alleges sole innervation is by the oculomotor nerve.⁶⁻⁹ The leading edge is pigmented and forms a marginal plait (plica marginalis), which has the dual action of sweeping tears ahead during protraction and drawing the tear film back across the cornea during retraction. This apparently facilitates presentation of tears to the puncta and resurfacing of the cornea and conjunctiva by tears. Specialized "featherlike" epithelia, which assist in sweeping debris from the corneal surface, line the bulbar surface near the leading edge in some species.¹⁰

The functions of the membrana nictitans in birds include protection of the globe as well as assistance with distribution and removal of the precorneal tear film. Because the upper eyelid is relatively less mobile than the lower eyelid and nictitans, the third eyelid performs a critical role in coverage of the cornea during blinking. The membrana nictitans sweeps across the cornea immediately before lid closure when a palpebral reflex is stimulated. Translucent to transparent in some species and opaque in others, the nictitans may protect the cornea in flight or underwater. A postulated role of the nictitans in alteration of the refractive state in diving birds has been discredited.¹¹ Movements of the third eyelid seem not to affect vision.^{12,13} The Harderian gland of birds, unlike the superficial gland of the third eyelid of dogs and cats, is not enveloped by the membrana nictitans. Rather, the avian gland lies medial and posterior to the globe, between the dorsal and ventral oblique muscles and the ventral and medial recti. Its duct(s) open below the nictitans.

Avian species differ in degree of marginal pigmentation, relative translucency, and direction of movement of the third eyelid. In raptors the direc-

tion of nictitans excursion is dorsomedial to ventrolateral; in psittacines and others it may appear more medial to lateral. The anatomy of the avian orbit and its contents has been described elsewhere.¹⁴

In this series of cases, traumatic injury, both with (three birds) and without (four birds) an associated foreign body, was the predominant cause of third eyelid abnormalities. Not unexpectedly, the nictitans injuries were not the only ocular lesions in any of the traumatized birds. Supportive and topical broad-spectrum antibiotic therapy and foreign body removal, where necessary, were associated with resolution of lesions in six birds; enucleation was required for one bird. Focal to multifocal inflammation, neoplasia, and presumed dystrophic mineralization were equally represented in the series (three birds each). Although not definitive of the lesion's origin, the perinatal occurrence of the symblepharon involving the third eyelid of the young cockatoo suggests the possibility of congenital malformation, or, alternatively, a neonatal injury or infection. Lesions were unilateral in 16 of the birds.

Conjunctival candidiasis was the cause of nodular conjunctivitis of the nictitans in two of the three birds with that diagnosis. Ocular candidiasis has been reported in a mixed flock of ornamental ducks in England, in which affected individuals had a spectrum of lesions including both nodular and diffuse conjunctivitis, keratitis, and endophthalmitis.⁵ The birds in that report were variably treated with topical and subconjunctival amphotericin B or oral 5-fluorocytosine. In our series two birds had nodular fungal conjunctivitis involving the third eyelid. Oral administration of ketoconazole was associated with resolution of lesions in the cormorant (case 10). The lesions were completely removed during excisional biopsies in the gull (case 11); unfortunately, the *Candida* sp isolate proved by sensitivity testing to be resistant to the topical miconazole that was administered for 1 week before the bird's release. The cause of the nongranulomatous nodular conjunctivitis in the Swainson's hawk (case 9) was not determined. *Mycobacterium tuberculosis* was reported to have been the cause of nodular growths of the membrana nictitans in an Amazon parrot.¹ Diffuse conjunctivitis has been associated with presence of trematodes and nematodes in the conjunctival sac and, especially, under the third eyelid; parasites were not identified in any of the birds in this series.

The nature and potential causes of the focal apparent mineralization of the third eyelid in the three kestrels are unresolved. Possible causes include trauma, dystrophic calcification associated with a systemic metabolic abnormality, and dietary, genetic, and other unspecified factors. The lesions caused

no apparent discomfort or dysfunction and were not treated.

Ocular neoplasia has been reported relatively infrequently in birds. Solitary neoplasia of the third eyelid seems distinctly rare; a chondrosarcoma of the nictitans, possibly arising from the pyramidalis tendon, was noted in a wild great white heron (*Ardea herodias occidentalis*).⁴ A myoid cystoma in an eagle and multifocal ocular involvement including the third eyelid in Marek's disease in chickens were reported by Dukes and Pettit.³ Orbital malignant lymphoma with associated third eyelid involvement was noted in a domestic pigeon (*Columba livia*).² A subconjunctival hibernoma reported in a goose surrounded the tendon of the pyramidalis muscle en route to its insertion on the membrana nictitans.¹⁵ Two of the three neoplasms in our series were epithelial in origin. Possible causes include chronic exposure to ultraviolet radiation, chronic trauma, and other factors. Cutaneous and subcutaneous xanthomatosis without third eyelid involvement has been reported in both budgerigars and chickens.^{16,17} Associated systemic disorders or causes of the xanthoma in the budgerigar were not discovered.

In the collective experience of the ophthalmologists and institutions that contributed to this retrospective study, disorders that primarily or exclusively afflict the third eyelid are distinctly uncommon in wild, domestic, and exotic pet birds. That impression notwithstanding, inflammatory and infectious disorders of the ocular surface in birds probably commonly also involve the third eyelid, albeit unrecognized or minor in extent.

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