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OPHTHALMIC LESIONS IN ANIMALS FROM A ZOOLOGIC COLLECTION

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Abstract: Ophthalmic lesions diagnosed in a zoological collection during a 9 year period are described. Thirty-six animals, including 24 birds, 10 mammals, 1 reptile and 1 fish had one or more ophthalmic lesion.

INTRODUCTION

Within the past 10-15 years an increasing amount of literature has accumulated concerning diseases and medical conditions of animals in zoologic collections. Scattered reports of miscellaneous ophthalmic conditions in zoo animals have been published,[2,5,7,9,11,16,18,20,23 25] as have surveys of ophthalmic lesions in primates.[21,22] Bellhorn[3] reviewed some of the ophthalmic problems of exotic species. This report describes the ophthalmic lesions diagnosed in either biopsy or necropsy material referred from one zoological collection over a period of 9 years.

MATERIALS AND METHODS

Material was submitted from necropsies or biopsies. Clinical observations of problems involving the eye or ocular adnexa were available for some of the cases. Eyes were fixed in either 10% neutral buffered formalin or Bouin's solution. After receipt in the laboratory they were washed in running tap water for 4 h, placed in 70% alcohol for 3 to 5 days, the culottes removed and the eye processed routinely for paraffin embedding. Routine sections were stained with hematoxylin and eosin (H&E) and special histochemical stains were used when indicated.

RESULTS

Thirty-six animals, including 24 birds, 10 mammals, 1 reptile and 1 fish, had one or more ophthalmic conditions diagnosed during the period from 1970 to 1978 (Table 1). Morphologic descriptions of some of the lesions will be given according to the general anatomic area of the eye involved.

Ocular adnexa, conjunctiva and cornea: There were three mammals, two with conjunctivitis and one with a nonspecific corneal degeneration, which consisted of variable erosion of epithelium involving one to several epithelial cells. Two mammals had conjunctivitis characterized by areas by epithelial necrosis, goblet cell hyperplasia and an accumulation of lymphocytes in the epithelium and subepithelial connective tissue.

Eleven birds had various lesions involving the superficial ocular tissues. A metastatic melanoma was found in a Southern Bahama pintail duck *(Anas bahamensis bahamensis).* Clinically, this bird had a large, proliferative, superficially necrotic lesion on the side of the face. Surgical excision was contemplated; however, the extensive involvement of the subcutaneous tissues and bony structures of the orbit and maxilla made complete removal impossible. At necropsy darkly pigmented

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TABLE 1. Ophthalmitic lesions seen in zoo cases — 1970-1978.

Animal	Diagnosis	Etiology
Rio Grande chicken *(Ortilas vitula)*	Panophthalmitis	Bacterial
African yellow-bill duck *(Anas undulata)*	Panophthalmitis	—
Wood thrush *(Hylocichla mustelina)*	Panophthalmitis	—
Philippine gallinule *(Porphyrio porphyrio porphyrio)*	Panophthalmitis	—
Eastern rosella *(Platycercus eximus eximus)*	Panophthalmitis	—
Rio Grande turkey *(Meleagris gallopavo)*	Conjunctivitis	Bacterial
Coscoroba swan *(Coscoroba coscoroba)*	Conjunctivitis	—
Coscoroba swan *(Coscoroba coscoroba)*	Conjunctivitis	Fungal
Magellan goose *(Chloephaga picta picta)*	Conjunctivitis	*Philophthalmus* sp.
Swan goose *(Anser cygnoides)*	Conjunctivitis	*Philophthalmus* sp.
Wood duck *(Aix sponsa)*	Conjunctivitis	*Philophthalmus* sp.
Herring gull *(Larus argentatus)*	Conjunctivitis	*Philophthalmus* sp.
Whistling swan *(Cygnus columbianus)*	Conjunctivitis	—
Herring gull *(Larus argentatus)*	Conjunctivitis	—
Duck (3) *(Anas* sp.)	Cataract	—
Rosy-billed pochard duck *(Netta peposceu)*	Cataract	—
Lesser Brazilian teal *(Amazonella brasiliensis)*	Cataract	—
Touraco *(Turacus corythaix)*	Cataract	—
Thicknee *(Burhimus bistriatus)*	Cataract	—
Boat-billed heron *(Cochlearis cochlearis)*	Cataract	—
Coscoroba swan *(Coscoroba coscoroba)*	Conjunctivitis and keratitis	—
Southern bahama pintail *(Anas bahamensis bahamensis)*	Melanoma, lacrimal gland	—
Chimpanzee *(Pan troglodytes)*	Cataract, retinal degeneration	—
Tapir *(Tapirus inducus)*	Cataract	—
Lesser panda *(Ailurus fulgens)*	Panophthalmitis	*Trypanosoma cruzi*
White-tailed gnu *(Connochaetes gnou)*	Panophthalmitis	—
Dama gazelle *(Gazella dama)*	Panophthalmitis	—
Blackbuck *(Antilope cervicapra)*	Panophthalmitis	—
Blackbuck *(Antilope cervicapra)*	Corneal degeneration	—
Grant's gazelle *(Gazella granti)*	Conjunctivitis	—
Nyala *(Traegelaphus angasi)*	Conjunctivitis	—
Goodfellow's tree kangaroo *(Dendrolagus goodfellowii)*	Retinal degeneration	—
Oscar fish *(Astronotus ocellatus)*	Microphthalmia	Congenital?
Gecko *(Gekko gecko)*	Retinal degeneration	—

nodules of varying diameters were seen in the liver, adrenal, brain, heart, lung, kidney and adnexal structures of the eye. The lesion on the face was very extensive and appeared to extend through the subcutis and underlying skeletal muscle into bone. Histologically, the nodules in the organs mentioned above were composed of malignant melanocytes which had replaced the existing parenchymal cells. Neoplastic melanocytes had also infiltrated lacrimal gland tissue (Fig. 1). The tumor appeared to originte in the skin of the face, spread into the subcutis and skeletal muscle of this area, and then into the maxilla. Neoplastic cells were found in the marrow cavity of the bone forming the nasal passages.

Necrotic conjunctivitis with heterophil and macrophage accumulations was noted in one other bird. Palpebral and bulbar conjunctivae were affected. Streptococci and a *Pseudomonas* sp. were isolated from the affected eye. Another severe conjunctivitis characterized by necrosis, hemorrhage, and pleocellular exudate was due to a fungus morphologically compatible with *Mucor* sp.

Six severe cases of proliferative conjunctivitis with similar histologic changes were seen in birds. In four cases the nictitating membranes were swollen and protruded (Fig. 2). Numerous adult trematodes of the genus *Philophthalmus* were attached to the conjunctival mucosa covering the outside of the nictitating membrane in the lower portion of the eye (Fig. 3). Histologically, attachment of these trematodes to the conjunctival mucosa resulted in inflammation characterized by an influx of eosinophils,

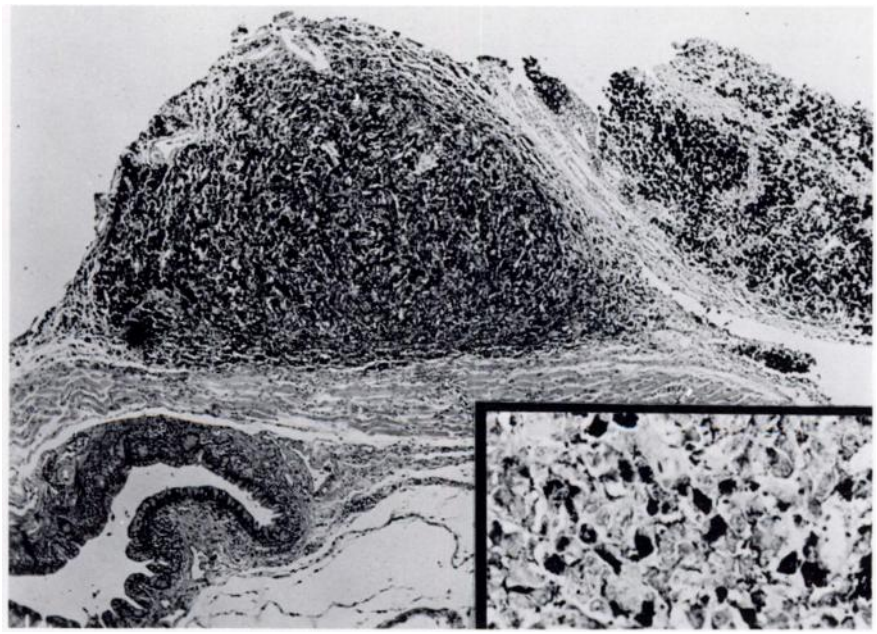

FIGURE 1. Photomicrograph of lacrimal gland tissue adjacent to the eye of a southern Bahama pintail duck. Normal architecture and parenchyma has been replaced by neoplastic melanocytes. Inset, higher magnification of portion of tumor. H&E × 60. Inset × 150.

heterophils, macrophages, and lymphocytes into the affected mucous membrane, and hyperplasia of the mucosa adjacent to the point of attachment of the trematodes (Fig. 4).

FIGURE 2. Swollen and protruding nictitating membrane is seen in a swan goose infected with *Philophthalmus gralli*. The white area at the center of the cornea is a photographic artifact.

FIGURE 3. Exposed outer surface of nictitating membrane from swan goose shown in Fig. 2. Arrows point to adult *P. gralli* attached to conjunctival mucosa.

Lens: A clinically blind malayan tapir *(Tapirus indicus)* had bilateral opacity of the lenses. Histologically there were subcapsular degenerative changes including fiber breakdown and cystoid spaces filled with eosinophilic debris. These changes were present anteriorly and posteriorly, with the most severe changes being posterior. Nine birds had cataracts diagnosed either clinically and/or histologically. Although the lesions varied in severity there was usually involvement of secondary lens fibers at the equator and anterior pole of the lenses. Subcapsular and cortical changes included fiber disorganization, cystoid spaces and the accumulations of homogeneous eosinophilic material.

Retina: A Goodfellow's tree kangaroo *(Dendrolagus goodfellowii)* and a Gecko *(Gekko gecko)* had lesions involving the retina only. In the tree kangaroo the lesion was bilateral and there was an area of degeneration involving the central retina. A total loss of retinal layers external to the inner nuclear layer was the prominent feature (Fig. 5). There was disorganization of the inner nuclear layer with some loss of nuclei. The Gecko had a lesion in the right eye. There was a loss of photoreceptor inner and outer segments, disorganization of nuclear layers, and the accumulation of debris and pigment-laden macrophages in a focal area of retina (Fig. 6).

Involvement of more than one segment: Five mammals had multiple ocular lesions. A chimpanzee *(Pan troglodytes)* had a unilateral lens opacity. In addition to the cataractous lens there was diffuse retinal degeneration, possibly secondary to detachment. Panophthalmitis was seen in a blackbuck *(Antilope cervicapra)*, a dama gazelle *(Gazella dama)*, and a white-tailed gnu *(Connochaetes gnu)*. In each case there was neutrophilic infiltration of the cornea, anterior chamber, iris, and ciliary

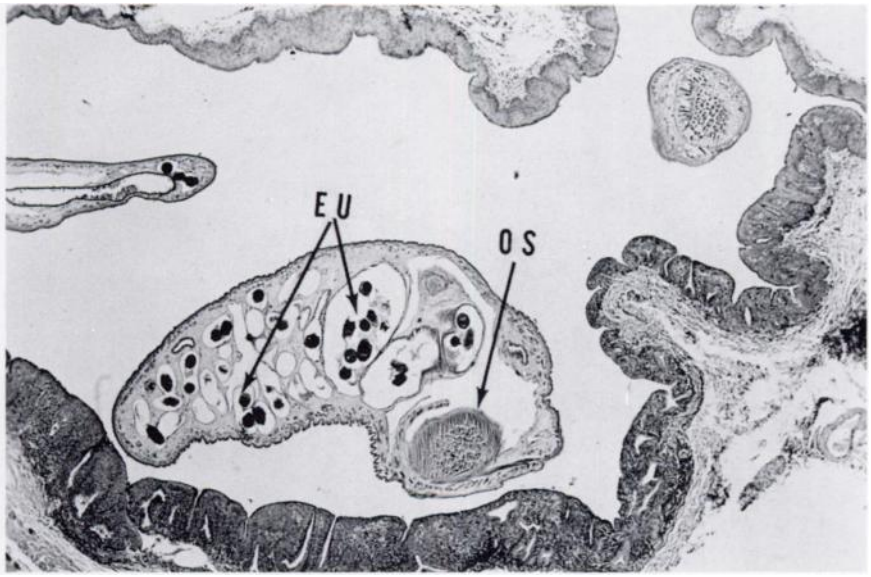

FIGURE 4. Photomicrograph of conjunctival membrane from an infected Magellan goose with an adult *P. gralli* adjacent to hyperplastic, inflamed the mucosa. EU, eggs in uterus, OS, oval sucker. H&E × 40.

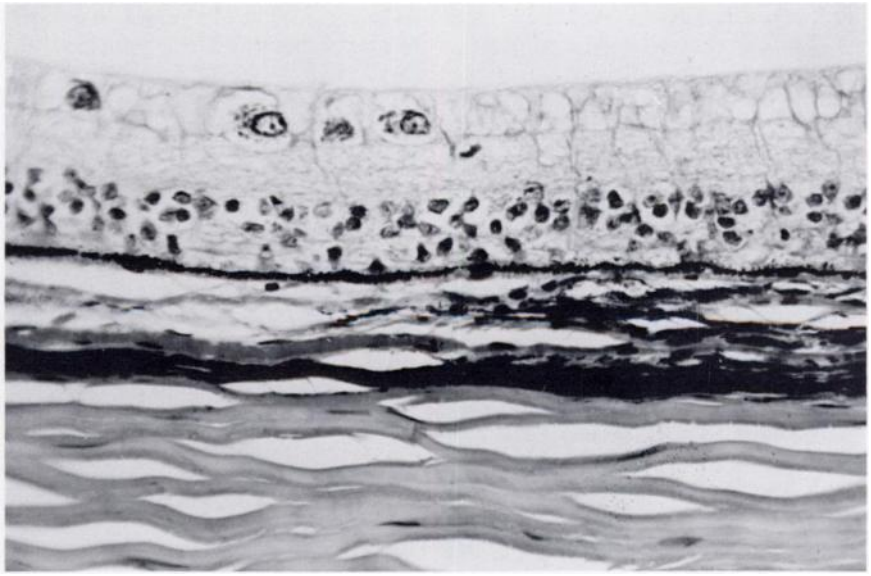

FIGURE 5. Outer layer degeneration in the retina of a tree kangaroo. Loss of and disorganization of nuclei in the inner nuclear layer are also present. H&E × 340.

FIGURE 6. Retina of a Gecko. Note transition from relatively normal retina to area of photoreceptor necrosis and accumulation of pigment-containing macrophages. H&E × 170.

body. Fibrin and a few macrophages were present in the anterior chmber. In the gnu there was also lens degeneration and retinal folding and detachment.

A lesser panda *(Ailurus fulgens)* that died as a result of a mixed infection with Tyzzer's disease and Chaga's disease had bilateral panophthalmitis. There was keratitis, iridocyclitis, and chronic retinitis and retinal detachment. Organisms morphologically compatible with leismanial forms of *Trypanosoma cruzi* were present in macrophages (Fig. 7).

The five birds in the series had purulent panophthalmitis. In two of the birds there was phthisis bulbi. *Streptococci* and a *Corynebacterium* sp. were cultured from the affected eye of one bird.

An Oscar fish was presented with unilateral microphthalmia. The lens was approximtely half the size of that in the contralateral eye and appeared immature with an indistinct capsule, thickened epithelium, and large cortical fibers (Fig. 8).

DISCUSSION

The increasing emphasis on proper management and medical care of exotic animals in zoos and other types of collections necessitates determining the type and prevalence of abnormal conditions for proper prevention and/or treatment. Although ophthalmic conditions, especially those of the posterior chamber, often have not been sought systematically, the recent literature includes more

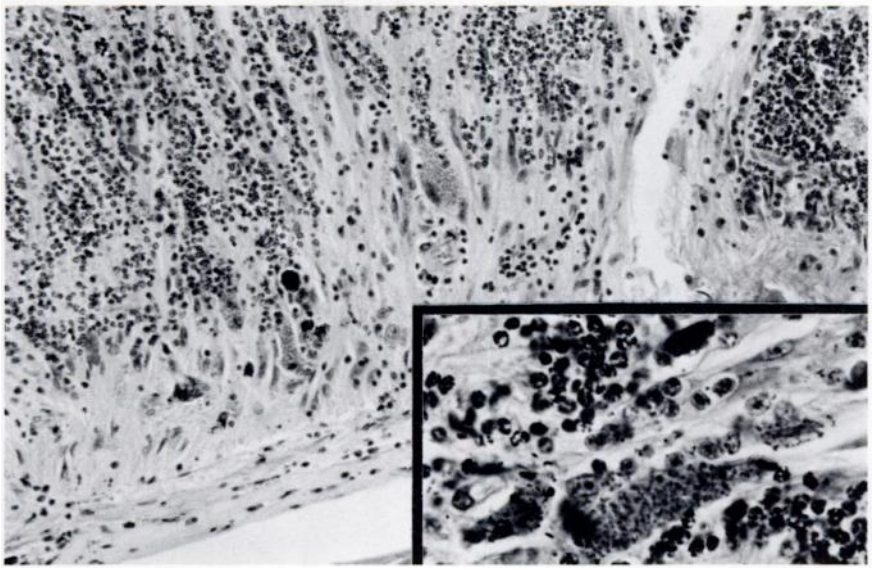

FIGURE 7. Retinal remnant from a lesser panda. Normal layered architecture is gone. Remaining photoreceptor nuclei are interspersed with connective tissue (glial) proliferation and macrophages containing organisms (inset) morphologically compatible with *T. cruzi*. H&E × 160, inset × 370.

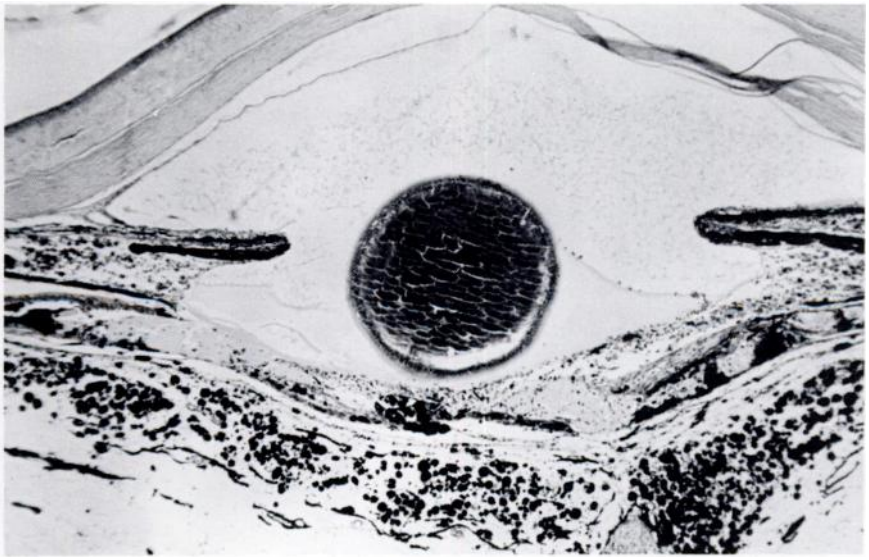

FIGURE 8. Eye from Oscar fish. The lens is small and has prominent epithelium around its entire circumference. Very little recognizable retina is seen. H&E × 55.

references to diagnosis and treatment of ocular disease in zoo animals.

Although many of the conditions seen in our survey were sporadic and their etiology obscure, several represent potentially widespread problems, especially in birds. The possibility that vitamin A deficiency may exist in many birds must not be overlooked, as such deficiency can produce keratinization, reduced ocular secretions, and a predisposition to keratoconjunctivitis.[7]

Philophthalmus sp. infection can also become widespread and enzootic in a zoo collection. Trematodes in the Family Philophthalmidae are medium-sized digenetic trematodes that commonly parasitize the conjunctival mucosa of avian species. *Philophthalmus gralli*, the oriental eye fluke, is typical of this family.[10] This parasite has been reported in natural infections in a number of avian species.[4,6,12,17] A related species has been reported in birds from Oregon, and a marine species has been found in several species of birds in Florida.[13,19] The morphologic features of the trematodes affecting these birds, and the specific anatomical location within the host were consistent with those reported in the literature for *P. gralli*.[10,17] The life cycle of these trematodes is indirect and requires a snail as the intermediate host.[1] Both *P. gralli* and the snail intermediate hosts *Tarebia granifera* and *Melanoides tuberculata* are exotic species that were accidently introduced into this country from Asia.[14,15] It is assumed that the eye fluke entered the United States with infected species of Oriental fowl that were acquired by a zoo.[17] There also have been infrequent reports of this infection in man;[12,19] therefore, this parasite has potential public health significance. These factors emphasize the importance of a thorough physical examination and strict quarantine of all exotic species brought into this country.

Although admittedly incomplete due to the failure to examine all eyes from animals dying during the survey period, our study indicates that a number of interesting and potentially hazardous conditions can affect the eyes of zoo animals. If information on the prevalence and type of ophthalmic lesions in a zoologic collection is desired, thorough necropsies, including examination of eyes, are necessary.

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