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Ophthalmological disorders of backyard poultry

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Very few diseases in poultry solely affect the eye, whereas many systemic diseases have ocular manifestations. Due to this, few ophthalmological studies have been conducted in poultry and as such – extrapolation from what is known about mammalian eyes may not be appropriate considering the differences in anatomy and pathological responses to disease. The small size of the eye of backyard poultry also complicates efforts to deal with ocular disease in these species.

NORMAL ANATOMY

The avian eye (Figure 1) has several differences compared to the mammalian eye, several of which have considerable consequences with regard to the diagnosis and treatment of ocular conditions in backyard poultry. Perhaps the most important difference is not the globe itself but in the surrounding structures.

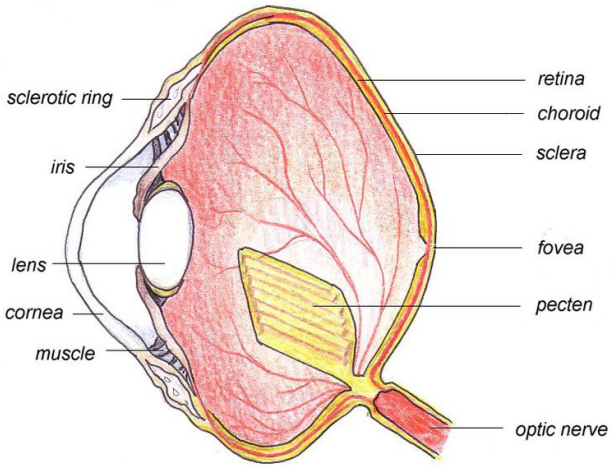


Figure 1: Cross-section of the avian eye (Wikipedia)

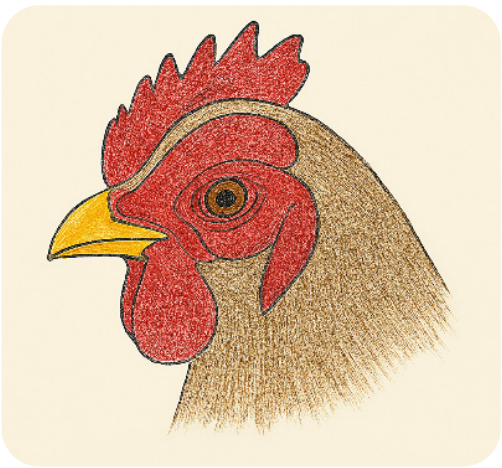


Figure 2: AI-generated image showing the location of the sinuses of a chicken

The sinuses around the eye (Figure 2), particularly the infraorbital sinuses, impinge on the globe and pathology in these structures may have significant impact on the eye.

The lacrimal and Harderian glands are important not only for the production of ocular surface secretion, but also in immunological activity at the ocular surface. In the eye itself, a ring of bony plates (ossicles) supports the eye. These ossicles and the role of the globe in maintaining the shape of the skull are important when considering enucleation.

The conjunctiva has a similar appearance to that of mammals, but its population of immune cells play an important role in systemic immunity. Their presence allows successful vaccination using eye drop formulations (e.g., Newcastle disease). The cornea of chickens is remarkably thin at 0.25mm (compared to 0.55mm in the dog). This may explain why backyard poultry appear susceptible to penetrating injuries or foreign bodies.The avian iris is usually brightly coloured and comprises striated rather than smooth muscle so is under conscious rather than autonomic nervous control.

VISION

Birds see in three primary colours, with ultraviolet cones in addition to the trichromatic photoreceptors. Being diurnal, chickens have a high rod : cone ratio. Unlike many other bird species, chickens do not appear to have an obvious macula for high visual resolution. In backyard poultry where pecking for food close-up requires short-sighted vision but being aware of potential predators requires long-distance vision, the eye is adapted to allow down gaze myopia but up gaze emmetropia. The refractive state of the eye is varied to match the viewing distances of different areas of the visual field. Estimates of visual acuity vary, but are comparable to around a quarter of the acuity of adult humans.

OPHTHALMOLOGICAL EXAMINATION

Direct ophthalmoscopy is easily achieved in the consulting room or off-site.

1. Performing distant direct ophthalmoscopy with the ophthalmoscope held 20cm away from the bird's head and with the setting at 0 dioptres will reveal whether corneal or lens opacity is present.
2. Keeping the setting at 0 dioptres, closer assessment of the eye (approximately 5cm from the head) will show the retina with a pink/orange reflex associated with the choroidal blood vessels, and the black or brown pleated pecten protruding from the posterior pole of the eye.

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3. Move the setting to 10 dioptres and hold it 10cm away from the head. This will provide a magnified view of the lens and iris and show any cataracts in more detail.
4. Move the setting to 20 dioptres and hold it at 5cm. This will provide a magnified view of the cornea and adnexa.

Ancillary tests in the examination of the eye should include measurement of tear production (Schirmer tear test) and of intraocular pressure (IOP) by tonometry. The average IOP of backyard chickens is 11.4 mmHg whilst the average result of the Schirmer tear test is 10.7 mm/min. Younger birds have higher IOP.

CLINICAL SIGNS OF DISEASE

Adnexal disease

Most ocular diseases in backyard flocks involve the adnexal structures, from conjunctivitis to sinusitis, and recognizing the subtle signs of early disease in these periocular tissues can be very important for ensuring that the condition does not progress to the point where it becomes a significant health and welfare problem.
Sinusitis is commonly seen in respiratory disease and has a profound influence on the eye. Mild upper respiratory disease causes slight periorbital swelling. With increasing severity, the inflammatory exudate closes the narrow entrance to the sinus, and the inflammatory deposit becomes a caseous mass which requires surgical resection rather than simple lancing/draining.

A substantial number of different infectious organisms can lead to sinusitis. The use of broad-spectrum antibiotics can be useful in the early stages of the disease. Once a caseous mass has formed in the sinus, drug penetration can be very poor, and successful treatment is difficult or impossible.

The infraorbital sinus can become so enlarged that its upward swelling closes the eyelids and renders the animal blind if bilateral (which it often is). Affected animals need to be fed and watered by hand.

Congenital abnormalities

Congenital abnormalities which might lead to death in the wild or euthanasia in a commercial setting, such as microphthalmos, anophthalmos and cataracts may be tolerable in the context of pet poultry. Affected birds need to be hand reared and careful consideration needs to be given to the welfare needs of the individual, in particular the freedom to fulfil its natural behaviour.

Corneal ulceration

Erosion of the corneal epithelium or deeper involvement of the stroma can occur after external trauma or as a result of abrasion from swollen eyelids (Figure 3). In most cases profuse lacrimation is seen, which could be considered to be exactly what the ocular surface needs to maintain lubrication, as well as immunological support, given that immunoglobulin A is produced by lymphocytes in the Harderian gland.

Topical antibiotics in a tear replacement base are ideal in these situations.



Figure 3: Corneal ulceration in a chicken following surface abrasion (courtesy of BSAVA library)

In most cases, if perforation does occur, the fibrinoid aqueous resulting from such trauma rapidly plugs the defect. In more severe cases, the iris can protrude through the perforation. In such cases, ocular evisceration (rather than enucleation) may be needed. The problem with enucleation is that the globe occupies such a large proportion of the cranial volume, removing one eye results in such a large dead space and a potentially unbalanced bird.

Uveitis

Many, if not all, cases of corneal ulceration have a degree of uveitis, but intraocular inflammation can also occur when systemic bacterial infection leads to septicaemia. Pupil constriction and purulent material in the anterior chamber (hypopyon) are characteristic signs of severe uveitis.

Earlier signs of uveitis include reddening of the iris as a result of neovascularisation. Irritation associated with more severe inflammation can result in the eyelids being closed and it can be difficult to differentiate this condition from severe conjunctivitis.

CAUSES OF DISEASE

Infectious disease

Infectious agents are a common cause of ocular disease in both commercial and backyard flocks. Mycoplasma and other bacterial species are most commonly implicated, but there are also several important viral agents that should be considered. The following infectious agents affect the eyes of backyard poultry and have been discussed in previous articles.

Viral infections:

- Fowlpox
- Marek's disease
- Avian encephalomyelitis
- Avian influenza
- Newcastle disease
- Infectious laryngotracheitis
- Infectious bronchitis

Since avian viruses tend to be highly contagious and both ND and AI are controlled diseases, determination of the causative agent responsible for the lacrimation, conjunctivitis and blepharitis is important.

Bacterial infections:

Bacterial infections of the periocular region and sinuses are far more prevalent than viral diseases. Details of the systemic pathology and diagnosis of these conditions have been discussed in a previous article. Many bacterial agents can cause conjunctivitis.

Some of the causative agents:

- *Mycoplasma* spp.
- *Salmonella*
- *Pasteurella multocida* (fowl cholera)
- *Staphylococcus* spp.
- *Avibacterium paragallinarum*
- *Chlamidophila psittaci*
- *E. coli*

Fungal infections caused by *Aspergillus* spp. can also cause ocular symptoms. Avian ringworm can also affect the periocular skin, resulting in an appearance of 'fine flour sprinkled around the eye'

Parasitic diseases:

Toxoplasmosis results in a watery ocular discharge with swollen conjunctiva as well as optic neuritis and blindness. Cryptosporidiosis and some helminths of the order Oxyspirura can cause ocular signs ranging from a mild conjunctivitis to profuse lacrimation and loss of condition.

Cataracts

Lens opacities can arise due to trauma or infectious agents such as AE, Marek's, ND and *E. coli*. Cataracts may also occur due to nutritional deficiencies or have a hereditary basis, but most are likely to be age related.

Trauma

Injury from pecking or due to flock mates' spurs is relatively commonly seen in backyard poultry, especially with higher stocking densities. Such injuries can result in corneal ulceration, opacity or even penetration.

Ankyloblepharon (where eyelids fuse, yielding a small palpebral aperture) can occur after lid injury. Treatment is difficult as any surgical intervention tends to exacerbate the centripetal growth of the conjunctiva, further fusing together over the ocular surface.

Neoplasia

Neoplastic transformation is possible in any of the tissues in or around the avian globe, but is rare.

Ammonia toxicity

More commonly seen in intensive production systems but can be seen in backyard poultry if poultry housing is not cleaned. Ammonia causes ocular irritation at concentrations >15 ppm. Symptoms include photophobia, lacrimation and conjunctival hyperaemia. Birds generally sit with their eyes closed, and lid swelling and oedema may be noted. Remedying the environmental problem is essential on a flock basis, but for individual birds, lavage of the corneal surface and periorbital region reduces the irritation immediately.

OCULAR SURGERY

The avian eye takes up a considerable proportion of the cranial volume and is important in maintaining the structural integrity of the skull. This together with the presence of scleral ossicles, which complicate the removal of the entire eye, renders evisceration a preferable option. The cornea is opened, and a central disc of corneal tissue is removed. The intraocular contents are removed with a curette and a pad of haemostatic felt is used to fill the globe.

The lid margins are excised, and the eyelids closed over the open face of the globe shell. This retains the volume component of the eye whilst alleviating the prolonged pain associated with uveitis or ocular surface disease. It should be noted that this procedure is not appropriate where there is intraocular infection or neoplasia.

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MULTIPLE-CHOICE QUESTIONS

QUESTION 1

Comparing the avian and mammalian eyes, what is the most important difference between the two?

a. The size of the globe
b. Corneal thickness
c. The surrounding sinuses
d. Scleral ossicles
e. None of the above

QUESTION 2

Which structures are most significant for eye drop vaccinations?

a. Lacrimal glands
b. Bony ossicles
c. Zonule fibres
d. Globe size
e. Conjunctival lymphoid tissue

QUESTION 3

Which of the following is true regarding the vision of chickens?

a. Chickens only see the three primary colours
b. Chickens have a high rod : cone ratio
c. Chickens have a macula for high visual resolution
d. Chickens are short-sighted
e. Chickens are far-sighted

QUESTION 4

What is the corneal thickness in chickens?

a. 0.55mm
b. 0.2mm
c. 0.35mm
d. 0.25mm
e. 0.75mm

QUESTION 5

What is the visual acuity of chickens when compared to humans?

a. 33%
b. 66%
c. 75%
d. 25%
e. 50%

QUESTION 6

What is the average IOP of backyard chickens?

a. 11.4 mmHg
b. 10.4mmHg
c. 4mmHg
d. 40mmHg
e. 14mmHg

QUESTION 7

What is the average result of the Schirmer tear test?

a. 1.7 mm/min
b. 17 mm/min
c. 10.7 mm/min
d. 11.7 mm/min
e. 11.4 mm/min

QUESTION 8

Which of the following structures is most important for the immunological function in the eye?

a. Lacrimal ducts
b. Harderian gland
c. Scleral ossicles
d. Ciliary body
e. Pecten

QUESTION 9

Which of the following concentrations of ammonia would cause ocular irritation?

a. 1 ppm
b. 5 ppm
c. 12 ppm
d. 17 ppm
e. 10 ppm

QUESTION 10

Which structure in the avian eye renders enucleation difficult?

a. Scleral ossicles
b. Lens
c. Pecten
d. Zonule fibres
e. Iris

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