THE OPHTHALMIC EXAMINATION

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I. The Ophthalmic Work-up - Many busy practitioners forgo a complete history and rely only on the information volunteered by the owner. Similarly, the examination may be minimal or incomplete and initial therapy is empirically chosen and based on obvious signs such as redness or discharge that may or may not be the most important signs. Although this approach is successful in many patients with minor ocular disorders (which often improve on their own without treatment) it frequently results in a poor outcome in animals with more severe disease. It is important to remember that the eye is extremely intolerant of inflammation, that you often have only one chance to get things correct, and that empirical therapy without an accurate, specific diagnosis risks irreversible blindness.

A. Signalment - Begin here. This often markedly reduces the potential problem list.

1. **Species** - Although many diseases occur across species lines, some entities are more prevalent or unique to a particular species e.g., corneal sequestrum in cats.

2. **Breed** - Certain breeds are predisposed to certain diseases. Many texts offer comprehensive lists of ocular diseases by breeds. Very often this greatly limits the potential problem list or should alert the clinician to specifically rule in or rule out certain entities e.g., glaucoma in a Cocker Spaniel with a red eye. Also useful when counseling a client about which breed to select as a pet.

3. **Coat Color** - Important in color dilute animals eg., predisposition to ocular squamous cell carcinoma in lightly colored eyes. Also important as many genetic entities occur in albino or merled animals.

4. **Age** - Many entities, especially those of a genetic nature, occur at specific ages eg., PRA in mid-aged dogs. Also many diseases occur only in neonates or aged animals.

5. **Sex** - Less significant for ophthalmic disease. May consider pyometra in an intact female with uveitis. Males are also more prone to fight injuries.

B. History - See standardized history form. The importance of an accurate, thorough history cannot be overemphasized. In addition to a good ophthalmic history a general medical history is also essential as many systemic diseases have ocular manifestations.

C. Examination. Experienced clinicians will use the known breed and age predisposition to ocular disease to narrow the list of possible diagnoses even prior to examining the animal. Most ophthalmic diagnoses are at least initially anatomic (retinal detachment, corneal ulcer, etc) rather than etiologic (eg. systemic hypertension induced retinal detachment) and are based on direct inspection. I usually begin from the outside and work my way deeper into the eye and then consider what, if any, additional diagnostic tests are required. Be systematic and do not focus exclusively on the obvious.

1. **The setting** - A quiet, darkened room with a rheostat to control the lighting is best. For cattle/horses use a quiet, darkened stall or, if one is not available, cover the head of the examiner and animal with a blanket.

2. **Equipment** - Use a good source of focal illumination such as a Finoff transilluminator. Most penlights are not sufficiently bright or focused enough to permit examination through opaque media. Additionally you will need an ophthalmoscope and possibly several of the additional diagnostic items listed below.

3. **Restraint** - In general the less restraint the better. Often sedation or general anesthesia makes the exam more difficult in all but the most unruly animals because of elevation of the third eyelid, drug-induced miosis, or ventral rotation of the globe. An auriculopalpebral nerve block and sedation can facilitate examination of large animals by immobilizing the eyelids and getting the animal to lower its head to a comfortable working height.

4. **Preliminary Observations** - Begin with an unaided eye in a well lit environment and observe the animal moving around the stall/exam room. Observe visually guided behavior (you can set up an obstacle course for the animal to move around to assess vision), facial symmetry, the gross size and shape of the orbit/globe, the position of the eyelids and adnexal structures, and the presence of any ocular discharge or opacity. Avoid touching the head at this time as this induces blepharospasm in many animals and distorts the symmetry of the head.

5. **Close Inspection** - Now steady the animal's head. Repeat the above general exam. If orbital disease is present palpate the globe for retropulsion into the orbit, open the mouth to examine the pytergopalatine fossa caudal to the last molar and to check for pain on opening the mouth. Perform a preliminary neurophthalmic examination consisting of:

    1. **Menace response** - Assesses whether the animal has at least some vision. Check each eye separately by covering the fellow eye. Do not set up air currents that may induce blinking via touch receptors.

    2. **Cotton Ball test** - Visual animals usually follow a dropped cotton ball.

    3. **Blink reflex** - Touch the periocular area to induce a blink.

    4. **Corneal reflex** - touch the cornea with a wisp of cotton. This is usually done only if corneal anesthesia is suspected.

    5. **Doll's Eye Reflex** - Move the head side to side and up and down to assess the motility of the globe.

6. **Examination with bright focal lights**

    a. Begin with a Finoff transilluminator (or a direct ophthalmoscope set at 0 diopters) at arm's distance and establish both tapetal reflexes. This allows you to detect unequally sized pupils

(anisocoria) and whether any opacities are present in the ocular media between you and the tapetal reflection.

b. Move the light source close to the eyes and check for a direct and consensual pupillary light reflex. Also use the light to directly and obliquely illuminate the eye. Retroillumination, in which a more anterior lesion is back-lit by bouncing light off the tapetum or iris, also can be helpful. Magnification with an Opti-VISOR or loupes can also be very useful. Be sure to inspect the eyelids, eyelid margin, the anterior surface of the third eye, the conjunctiva, the pre-corneal tear film (seen as a bright reflection from the ocular surface), the cornea, depth and clarity of the anterior chamber, the color size and shape of the iris/pupil, and the lens. The animal naturally wants to keep its eye on a horizontal plane; therefore, lesions involving the inferior cornea can be seen by pointing the animal's nose to the ground. Lesions can be localized within the eye by one of 4 main techniques.

   1) **Object overlay** - Anterior structures cover those located more posteriorly. For example, an opacity can be localized to the lens and not the cornea if the lesion disappears when the pupil gets smaller.

   2) **Purkinje images** - Extremely useful in localizing lesions in the anterior segment of the eye because they create optical cross sections of the eye. If a slit-beam of focused light (the slit or small circle option on the direct ophthalmoscope) is held obliquely to the eye, the various layers of the eye become visible. The first reflection closest to the light source is from the tearfilm/cornea. Then a black space representing the anterior chamber can be seen. Another (the second) reflection can be seen from the anterior lens capsule. The lens itself follows and appears "smoky". Finally, the reflection (which is not as bright) from the posterior lens capsule becomes visible. Excessive amounts of protein in the anterior chamber produce aqueous flare, which looks like a beam of light from a lighthouse in the fog. Aqueous flare is a hallmark of anterior uveitis.

   3) **Axis of rotation** - This is another way of localizing lesions within the eye. When the animal shifts its gaze from side to side the eye as a whole rotates around the center of the lens. Lesions that are anterior to the center of the lens (e.g. cornea, anterior lens capsule) move in the same direction as the eye. Lesions that are posterior to the center of the lens, however, move in the opposite direction.

   4) **Dioptric setting of the direct ophthalmoscope** - The setting required to clearly view a lesion with the direct ophthalmoscope gives a clue as to its location within the eye. See below for a more complete description.

c. **Ophthalmoscopy** - Used to examine the vitreous and retina/choroid (fundus). In general indirect ophthalmoscopy is preferable to direct ophthalmoscopy. If pupillary dilation is required to adequately see the fundus, it may be preferable to perform certain special diagnostic tests (bacterial culture and Schirmer tear test) prior to the instillation of the dilating agent. The fundic examination can be done in the following 3 ways.

1). **Direct Ophthalmoscopy** - The exam is begun by setting the instrument to 0 diopters, holding it your brow, and viewing the tapetal reflection from a distance of about 18-24 inches from the animal's eye. The examiner then continues to view the tapetal reflection and moves to within 1-2 inches of the cornea of one of the animal's eyes and adjusts the dioptric settings until the fundus comes into clear focus. In some cases more positive dioptric settings may then be "dialed-in" so that opacities in more anterior structures become visible. In general, the posterior lens is in focus at +8D, the anterior lens at +12D, and the cornea at +20D. If no opacities are present in these anterior structures, all that is seen is a blurred image of the fundus because the lens and cornea normally reflect very little light. Only when an opacity is present is sufficient light reflected to permit the lens or cornea to be seen. Because of the long nose of many dogs it may be necessary to view the animal's left eye with your left eye and the animal's right eye with your right eye. The image is more magnified than with indirect ophthalmoscopy. It is right side up, and the right is on the right side and left is on the left side. The field of view is much smaller than that with the indirect ophthalmoscope. The ophthalmoscope can be adjusted in several ways.

   a). Lighting intensity – Usually is done by turning a knurled knob.

   b) Viewing Apertures - In general the large circular aperture is used when the pupil is large and the small circular aperture is used when the pupil is small. The slit aperture is useful for eliciting the Purkinje images or determining whether the optic nerve head is raised or depressed. The grid aperture can be used to directly measure the size of lesions or to relate the size of a lesion to that of the optic nerve. The green light is red-free and permits the differentiation of black melanin pigment from blood. With red-free light blood looks black and pigment still looks brown. The blue light filter excites fluorescein dye.

   c). Dioptric power - The black (or green in some models) numbers represent the power of converging lenses and are used to bring nearer objects in focus. For example, the retina is usually in focus at 0 diopters, the posterior lens capsule at +8 diopters, the anterior lens capsule at +12 diopters and the cornea at +20 diopters. The red or negative (diverging) lenses are used to correct for near-sightedness on the part of the observer (so he or she does not need to use their glasses) or when the eye is abnormally long, as in an animal with coloboma of the optic nerve head.

2). **Monocular Indirect Ophthalmoscopy** - The exam is begun by holding a bright focal light source (usually with the right hand) against your lateral canthus/cheek until the tapetal reflection is observed. A 20- or 28-diopter condensing lens is held in the left hand between the thumb and index finger, and the left ring finger and pinky are used to hold the upper lid up. Initially the lens is held to one side of the eye until the tapetal reflection is established, and then it is rotated such that the eye can be observed through it. Usually the lens is first held about 1/2 inch from the eye and then slowly pulled towards you until the image of the fundus fills the lens (usually about 1 inch away from the animal's eye). When the image is lost (usually because you or the animal moved), the lens is rotated away from the eye (the left ring finger and pinky continue to hold up

the upper lid), the tapetal reflex is re-established and the lens rotated into place again so the fundus comes into view. The image is less magnified than that of a direct ophthalmoscope, upside down and backwards. The field of view is much larger than that with a direct ophthalmoscope, which makes it much easier to get a view of the fundus when there is less than perfect anterior segment media (such as in animals with mild cataracts or corneal disease). This technique is about as difficult as direct ophthalmoscopy to learn, but it is a much superior method for the general practitioner to use to examine the eye.

3). **Binocular Indirect Ophthalmoscopy** - Very similar to monocular indirect ophthalmoscopy except that a special headset with attached light source is used to split the image so that it may be viewed with both eyes (hence better depth perception) and both hands are freed up to manipulate the animal and the lens. The headsets are moderately expensive however.

B. Additional Diagnostics - After performing the above examination one or more specialized diagnostic tests may be selected. It is uncommon for all of the following tests to be performed in the same animal. Therefore, the tests should be viewed as your armamentarium rather than as something to be done in every patient. If more than one of these tests are indicated it may be necessary in some cases to perform them in a specific order to avoid the preceding tests from adversely affecting the results of subsequent test(s). For example, a culture should be obtained prior to instilling topical anesthesia as the topical anesthetics contain bacteriostatic preservatives. If topical anesthesia is required 0.5% proparacaine is preferred. Pupil dilation, if necessary, should be accomplished with 0.5-1.0% tropicamide as this mydriatic lasts only a few hours versus up to several days for atropine.

1. **Bacterial culture and sensitivity** - Do early in the exam before anything is placed in the eye. Indicated if there is a corneal infiltrate in the area of a corneal ulcer or a purulent component to the ocular discharge. Wipe out any excess debris prior to collecting the sample. Culture the conjunctiva in cases of conjunctivitis and the cornea when there is a corneal defect. It is suboptimal to culture the conjunctiva when the problem is with the cornea. Usually aerobic cultures are performed although anaerobic corneal infections have been reported. Best results are obtained by using of a mini-tip calcium alginate swab that is moistened with transport medium prior to collection of the sample. The volume of the sample is small so it is best to plate out the swab as quickly as possible.

2. **Schirmer Tear Test** - Measures the aqueous component of the tear film. A standardized strip of filter paper is bent at the notch and the short end of the strip is hooked over the lower lateral canthal eyelid margin and placed in conjunctival cul-de-sac. The mm of wetting which occurs over 60 seconds is then measured using the scale provided with the strips. This test needs to precede fluorescein staining or application of topical anesthesia. The latter blocks the reflex tearing elicited by the mild irritation by the strips and greatly affects results. For dogs, values > 15 mm/min are normal, 10-15 mm/min are questionable, less than 10 mm/min are abnormally low and suggest KCS. Normal for horses and cattle is often >15-20 mm in 30 seconds.

3. **Conjunctival/Corneal cytology** - Indicated if there is corneal infiltrate or a purulent component to the discharge. After the application of topical anesthesia scrapings may be obtained with the butt-end of a sterile scalpel blade, a sterilized chemistry spatula or a malleable Kimura platinum spatula (the latter works very well but expensive). Often 3 slides are collected. One is stained with a Wright-type stain (Diff-Quik), another with a gram-stain, and the third is saved for special stains or to examine if the first two slides were non-diagnostic. Cytology is very useful in directing initial antibacterial therapy until culture results become available and in making the diagnosis of certain conditions such as eosinophilic conjunctivitis of cats. Additionally immunofluorescent antibody tests for feline herpesvirus or chlamydia may be performed by commercial laboratories on corneal or conjunctival scrapings. Hence, collect cytology specimens for this test prior to the application of fluorescein that may confuse the results of the IFA. Scrapings also may be smeared onto a sterile culture swab and submitted for bacterial cultures, or sent to an outside laboratory for PCR testing for feline herpesvirus and other infectious agents.

4. **Fluorescein staining** - Fluorescein is a water-soluble dye that is impregnated in a paper strip. The strip is moistened with a few drops of sterile eyewash or saline and applied to the ocular surface. Fluorescein is used in several ways.

    a. **For corneal/conjunctival epithelial defects** - Intact corneal/conjunctival epithelium is hydrophobic and does not retain fluorescein dye. If the epithelium is missing, however, the hydrophilic stroma retains fluorescein dye thereby highlighting the ulcer/erosion. Retained dye cannot be readily rinsed from the eye.

    b. **Jones test** - If the nose is held down fluorescein may pass through the puncta and nasolacrimal duct and become apparent at the nares. This may take several minutes and does not occur in every patient. A positive test means the nasolacrimal system is patent. A negative test can occur for several reasons and lack of patency is usually confirmed by a nasolacrimal flush.

    c. **Tear Film Break-up Time** - Provides a rough assessment of tear quality. A few drops of dye are applied to the ocular surface (do not rinse them out as you would to check for an ulcer) and the eyelids are closed (to distribute the dye) and then opened. The observer determines the length of time it takes for the homogeneous pool of green fluorescein over the corneal surface (which is mixed with, and highlights, the aqueous component of the tear film) to break up into separate pools (much like water beads up on a freshly waxed surface). Normally this requires about 5-10 seconds, but if the mucin layer of the tear film (which binds the aqueous layer of the tears to the normally hydrophobic surface epithelium) is abnormal, the tears break-up almost instantly.

    d. **Seidel test** - Tests for leaking corneal wounds such as may occur after a corneal laceration or intraocular surgery. A dry fluorescein strip is used to "paint" over the surface of the defect. The dye mixes with the very small volume of tears in the region and usually appears as an intense orange (again do not rinse out the dye prior to the conclusion of the test). If the wound is leaking aqueous, however, the larger volume of aqueous mixes with the dye resulting in a green "trickle" or "fountain" from the wound.

6. **Nasolacrimal flush** - Requires topical anesthesia. For dogs, cats, and cattle the superior puncta is cannulated with the flexible portion of a 22-24 gauge IV catheter attached to a 3-5 ml syringe filled with sterile saline. As saline is infused it should become visible at the inferior puncta. The inferior puncta is then occluded by digital pressure through the skin in the medial canthus and continued flushing results in saline exiting the nares. In some cases fluid may exit the distal meatus of the nasolacrimal duct and flow posteriorly in the nasal cavity resulting in a soft cough as saline flows into the pharynx. For horses a 5-8 french infant feeding tube or red-rubber catheter or sometimes a 3.5 french Tom cat catheter is passed through the nasolacrimal duct's nasal meatus and the system is flushed in a retrograde fashion.

7. **Eversion of the eyelids/nictitans**. Necessary for a thorough foreign body search. To check the conjunctival cul-de-sac or the palpebral conjunctival surface of the eyelids a fine, curved mosquito hemostat or a Jameson muscle hook can be used to gently retract the lids away from the globe. A 1X2 Addson Brown forceps can be used to grasp the anterior conjunctival surface of the nictitans and pull it away from the globe. I have found it works best to grasp the conjunctiva of the nictitans about 2-3 mm away from the margin (avoid grabbing the cartilage as this may permanently distort the lid's contour) and to pull the lid up towards the superior-lateral fornix. Once the nictitans almost completely covers the globe it can be pulled away from the globe and breaking the suction between it and the tear film. In some cases then a hemostat or muscle hook may be necessary to visualize the conjunctival cul-de-sac between the nictitans and the globe but this is essential to do to rule out a foreign body.

8. **Tonometry** - Schiotz indentation tonometry or applanation tonometry with a Tono-Pen is essential in every patient with a red eye or vision loss that cannot be readily explained by something other than glaucoma. Should be done prior to pupil dilation.

9. **Gonioscopy** - Specialized lenses are used to examine the drainage angle.

10. **Pupil dilation** – 0.5 to 1% tropicamide. Allows a better exam of the lens/fundus.

11. **Ocular Ultrasound** - A 10 MHz probe is very useful in examining the posterior segment for abnormalities (e.g., retinal detachments, tumors etc.) when opacities in the anterior segment media prevent direct visualization of the fundus.

12. **Electroretinography** - Investigates retinal function (photoreceptors etc.) up to, but not including the retinal ganglion cells.