

## **Ocular Emergencies**

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From acute loss of vision to sudden pain, redness, and clouding of the eye, patients present to the emergency room for a variety of underlying causes. Uncovering the diagnosis can be difficult, but a thorough history coupled with basic ophthalmic tests and equipment can facilitate reaching an accurate conclusion. Obtaining a relevant ocular history uncovers how rapidly the clinical signs appeared, whether vision differs depending on lighting conditions, and whether an owner is currently administering any medications that might alter the diagnostic test results.

When possible, the exam should begin with eliciting a menace response, pupillary light reflexes (PLR), dazzle reflexes, and palpebral reflex followed by a Schirmer tear test, fluorescein stain and tonometry. Evaluation of the eye should include the lids, conjunctiva, cornea, anterior chamber and lens, using diffuse light or a slit lamp. In small animals, the fundic exam is preferably performed with an indirect light source and hand held lens. While the sudden red, cloudy, squinting eye could represent glaucoma, corneal ulcer, lens luxation or sudden keratoconjunctivitis sicca, performing the eye exam in a routine, systematic fashion will help reveal the underlying cause.

#### **GLAUCOMA**

Glaucoma describes an increase in intraocular pressure that leads to vision loss. The elevated pressure disturbs the axoplasmic flow in the optic nerve and damages the inner retinal layers (retinal ganglion cells and nerve fiber layers) as well as the outer retinal layers (outer nuclear layers and the rods and cones). This damage leads to loss of vision and pain with sustained high intraocular pressures. An elevated pressure is always the result of an obstruction in outflow (through the pupil or iridocorneal angle) and never an overproduction of aqueous in the ciliary body behind the iris.

#### **Acute or Chronic Glaucoma**

Acute glaucoma cases most commonly present as sudden episcleral injection and corneal edema with loss of vision. Accurate diagnosis depends on tonometry with pressure (taken on a relaxed patient) reading greater than 20mmHg in a dog and greater than 25mmHg in a cat. Other clinically relevant findings include a large difference in intraocular pressure between the two eyes, as well as concurrent findings of redness, clouding, blindness and pain.

Chronic glaucoma can be established within 48 hours of sustained, elevated pressures. It is typically characterized by the absence of vision and light reflexes and may present as a stretched, buphthalmic globe with Haab's stria (linear breaks in the corneal endothelium). In chronic glaucoma, the prognosis for vision is poor and comfort is the treatment goal. Medical management may be attempted, but salvage procedures such as enucleation, evisceration for prosthesis, or chemical cycloablation (i.e. gentamicin injection) can be recommended.

#### **Primary or Secondary Glaucoma**

Glaucoma can also be characterized as Primary or Secondary. Primary glaucoma describes an inherited narrowing or deformity in the iridocorneal drainage angle that obstructs the flow of aqueous humor from the eye. Familiarity with common breeds such as American cocker spaniel, Bassett Hound, Beagle,

Boston terrier, Siberian husky, Chow chow and Labrador retriever will aid with diagnostics. Further testing includes gonioscopy, which uses a special lens to examine the iridocorneal angle for narrowing (shortening of the pectinate ligament opening) or sheets of dysplastic tissues (goniodysgenesis /pectinate ligament dysplasia).

In secondary glaucoma, there is a physical obstruction to outflow such as hypopyon, hyphema or an anteriorly luxated lens. The intraocular pressure cannot decrease until the underlying cause is identified and treated.

Emergency treatment for glaucoma varies with whether a case would be classified as acute or chronic and whether the cause is primary or secondary. In acute glaucoma, aggressive treatment is initiated to attempt to lower the pressure and save vision if possible. If all chance of vision is gone in a chronic glaucoma patient, efforts are directed towards a goal of comfort. In certain glaucoma patients who are failing medical management but have potentially visual eyes may undergo laser therapy and valve placement (glaucoma shunt). These procedures are more likely to be considered in dogs who have already had one eye removed or who have one blind eye from primary glaucoma.

If the cause is primary glaucoma, the clinically unaffected eye is very likely to develop the disease within months. Referral to a veterinary ophthalmologist for gonioscopy to exam the drainage angle will aid with a prevention plan.

#### **GLAUCOMA MEDICATIONS**

**Latanoprost 0.005%**(especially for primary glaucoma) – ‘BIG GUN’! Now generic

- prostaglandin analog, increase aqueous humor outflow via uveoscleral pathway
- can reduce IOP by up to 50% in 1-2 hours
- causes miosis – use with caution in the presence of lens luxation or uveitis

**Dorzolamide 2% (also available in combination with timolol)** Now generic

- topical carbonic anhydrase inhibitor in combination with beta blocker, acts by reducing aqueous humor production.
- use in combination with Latanoprost especially with IOP >40mmHg.
- can reduce IOP by 30% in some dogs
- avoid timolol in patients with cardiac disease

**Timolol or Levobunolol**

- Beta blocker (non cardio-selective); decreases aqueous production.

**Mannitol**

- IV, 1 gram/kg, given slowly over 30 minutes
- use with caution in patients with heart disease, kidney disease or patients that are dehydrated or hypovolemic
- withhold water for at least 4 hours.

**Tramadol** as necessary for pain

**Topical corticosteroid** 2-3 times daily to decrease the intraocular inflammation if glaucoma is secondary

When an emergency patient presents with profound corneal edema (from the stretched corneal endothelium allowing aqueous into the corneal stroma), it can be difficult to see the internal structures of the eye to rule out an anterior lens luxation. An IOP greater than 40mmHg often requires latanoprost for any significant improvement. However, latanoprost would be contraindicated in the event of an anterior lens luxation as severe miosis around the lens would lead to further increase in the pressure. If it is not possible to see the position of the lens, familiarity with breeds who commonly get inherited, primary glaucoma will aid treatment decisions.

#### **Treatment if IOP greater than 40mmHg (and suspect primary)**

1. Latanoprost 0.005%: Administer one drop
2. Carbonic anhydrase inhibitor/beta-blocker e.g. dorzolamide/timolol: Administer one drop
3. Measure IOP every 30 mins. Miotic pupil generally indicates that Latanoprost is having a positive effect.
4. If IOP still >40mmHg in one hour, re-dose all three meds and recheck in 1 hour.

If Latanoprost is contraindicated or IOP does not begin to decrease after 60-90 minutes, consider:

1. Administering Mannitol: IV once 1 gram/kg IV given slowly over 30 minutes
2. Performing an aqueous paracentesis to reduce IOP.

#### **CORNEAL ULCERATION**

Corneal ulcers can vary from a superficial break in the corneal epithelium to a deep, infected divot in the corneal stroma. Fluorescein stain uptake in the corneal stroma confirms a defect in the epithelium that is allowing the stain to penetrate. When a divot is present and there is no stromal staining, concern should rise for a descemetocele in which only Descemet's membrane remains.

##### **Superficial ulceration**

A simple, superficial ulcer should heal within 3-5 days. Treatment would include broad spectrum, topical antibiotics and lubrication drops two to three times daily in addition to an E-collar to avoid self-trauma.

##### **Indolent, Non-healing ulcer**

An indolent, non-healing ulcer fails to heal within a week as there is an attachment defect between the migrating epithelial tissues and the cornea stroma below. As this is a mechanical defect, it is often necessary to intervene with a procedure to stimulate healing. A corneal debridement with dry, sterile cotton tipped applicators typically results in a 50% healing rate whereas advancing to a grid, punctate, or diamond burr keratotomy increases the success rate to 80%. A superficial keratectomy, in which the superficial layer of stroma is removed with microsurgical instruments, is 100% effective but requires general anesthesia and increased costs.

### **Deep Complicated Corneal Ulceration**

A deep corneal ulcer involves stromal loss which is often visible as a 'divot' in the cornea. If there is visible cellular corneal stromal infiltrate (white or yellow ring), bacterial infection is likely. Infected corneal ulcers can progress quickly and are often deep on initial presentation.

Typically, a deep cornea ulcer results when opportunistic bacteria invade an open break in the corneal epithelium and begin to digest the corneal stroma with collagenases and proteases. The most common culprits are *Staph ssp*, *Strep ssp* and *Pseudomonas spp*. In addition, the body's own white blood cells are capable of digesting corneal tissues, so owners should be encouraged to gently rinse discharge from affected eyes with wet cotton balls. While it is important to choose antibiotics appropriately, it is also valuable to use lubricants to protect the cornea and flush debris.

### **MEDICATIONS FOR COMPLICATED CORNEAL ULCERS**

**Ofloxacin antibiotic ophthalmic solution. Moxifloxacin is now generic but should be used sparingly.**

- one drop every 2 hours for 24 hours, then q 4-6 hours.

**Neo-Poly-Gram drops:(dogs only) or Cefazolin Ophthalmic (50 mg/ml fortified solution)**

- one drop every 2 hours for 24 hours and then q 4-6 hours

**Atropine 1% solution:**

- one drop 1-2 times daily (or to effect = pupil dilated)

**Lubrication drop with hyaluronate**

- one drop q 4-6 hours

**Serum:** particularly useful if cornea is determined to be melting

- one drop q 2-4 hours

**Systemic NSAID and Systemic analgesia:** e.g. Tramadol

**Systemic antibiotic:** Consider doxycycline if there is collagenase/melting since doxycycline has anti-proteinase properties and gets into the tear film when given systemically. Choose other antibiotics systemically depending on your clinical judgment.

Never use topical anesthetic drops therapeutically: Proparacaine is toxic to the cornea if used repeatedly.

### **Surgical Decision for Complicated Corneal ulcers**

Ulcers with greater than 50% stromal loss that worsen in the face of aggressive medical management may require surgery to prevent rupture and loss of the eye, especially if there is no evidence of new blood vessels growing into the cornea to aid with healing. In cases of descemetocoeles, the danger of rupture is imminent.

The most common surgical options include conjunctival graft, corneal-conjunctival transposition and corneal graft with fresh or frozen cornea or synthetic materials if a rupture has occurred. Typically, total healing time following surgery is 4-6 weeks. The first post-operative week represents the highest risk of complications including persistent leaking of aqueous or suture dehiscence.

## **SUDDEN BLINDNESS**

When a patient presents with sudden blindness, the most important question to answer is whether the loss of vision originates in the eye or the central nervous system. Typically, a dog without vision will have a negative menace response, will fail to navigate through a maze test, and if small enough to be held in the clinician's arms, will fail to place a foot on the surface when approaching the exam table. Once the absence of vision is established, a thorough ophthalmic exam will rule out structural abnormalities that would explain loss of vision such as rapid onset diabetic or juvenile cataracts or retinal detachment. A common cause of sudden blindness is bilateral retinal detachment most commonly seen in an older cat with renal disease.

Without an obvious cause for the vision loss, the presence or absence of pupillary light reflexes (PLR) and dazzle reflex become the next most important tests. If an absent menace response is coupled with absent PLR and dazzle reflexes, the source of blindness is typically within the eye (i.e. retina or optic nerve) as no visual stimuli is transmitted back to the brain. Sudden Acquired Retinal Degeneration Syndrome (SARDS) provides an example for this scenario. With SARDS, the retina appears normal on fundic exam so in most scenarios, an electroretinogram (ERG) can be performed to demonstrate decrease or absent retinal function to confirm the suspicion of retinal disease. The ERG can be performed awake on most patients and helps rule out central nervous system disease without general anesthesia for MRI and CSF tap.

## **PROPTOSIS**

Typically caused by trauma, the globe is forced out of the orbit. The eyelids subsequently trap the globe from behind, and the periorbital tissues swell profoundly preventing the globe from returning to a normal position. Proptosis differs from exophthalmos which describes an anteriorly protruding eye, generally caused by a space occupying mass behind the globe.

Only 20-30% of eyes that suffer proptosis will retain vision. Globe replacement is recommended in most cases even if vision is unlikely. However, enucleation may be warranted due to poor prognosis if there is blood inside the eye, an obvious rupture of the globe, rupture of more than three extraocular muscles, or the patient is a dolicocephalic dog or a cat.

If the patient is otherwise stable, lubricate and replace the globe immediately under anesthesia. The goal is to pull the lids over the globe and to temporarily suture the lids together using horizontal mattress sutures with stents for 14 days. Leaving the medial 0.5-1 cm of the palpebral fissure open will facilitate topical medication delivery. Medications should include topical antibiotics and atropine as well as oral antibiotics, anti-inflammatories and pain medications.

Most dogs are able to maintain a comfortable eye following replacement of the globe. In many dogs, a medial, ventral strabismus will be seen following avulsion of the medial rectus muscle. The globe deviation may resolve in 3-6 months. In addition to loss of vision, complications following proptosis include infection, glaucoma, corneal ulceration and long-term keratoconjunctivitis sicca (KCS/Dry Eye) caused by damage to nerve and blood supply. Enucleation may also become necessary later if the eye remains painful.