How to Approach the Acutely Swollen Eye

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1. Introduction
One of the more common emergencies faced by the ambulatory practitioner is the acutely swollen eye. The differential list for this presentation is long, and the treatment strategies are varied. An accurate diagnosis is critical, given the serious nature of many of the differentials. This paper aims to break down the approach to the acutely swollen eye, paying particular attention to those cases whose diagnosis and treatment options are not straightforward.

The common differential diagnoses for the acutely swollen eye that the field practitioner may encounter include:

- **Orbit/periorbit**
  - Trauma, neoplasia, sinusitis, fracture, foreign body, abscess

- **Adnexae**
  - Blepharoedema, trauma, meibomianitis, lacrimal gland inflammation, foreign body, abscess, neoplasia, trichiasis

- **Cornea**
  - Ulcerative bacterial or fungal keratitis, corneal laceration, immune-mediated keratitis, foreign body, neoplasia, chemical irritation

- **Globe**
  - Recurrent uveitis, globe penetration, blunt trauma, glaucoma, neoplasia

- **Retrobulbar region**
  - Neoplasia, abscess, foreign body, hematoma

2. Materials and Methods
The ambulatory veterinarian must carry all the needed equipment to approach this type of emergency, including:

- Ophthalmic kit including ophthalmoscope, dye strips (fluorescein and/or Rose Bengal), and tetracaine or proparacaine solutions
- Sterile scalpel blades for corneal scraping/cytology
- Microscope slides with slotted transport box
- Formalin jars
- Sterile cotton-tipped swabs for corneal debridement
- Culturettes
- Mepivacaine or lidocaine for local nerve blocks
- Hemostats or forceps for grasping and manipulating the third eyelid
- Sedative such as xylazine, detomidine, or butorphanol
There are several ophthalmic skills that the practitioner must have mastered to examine and diagnose the spectrum of problems that may be encountered. Not all skills will be used in every exam, but the following must be part of each veterinarian's skill set.

3. **Periorbital Nerve Blocks**

Nerve blocks are often needed to facilitate examination of the eye. The materials needed include 25-gauge 5/8-inch needles, local anesthetic such as mepivacaine hydrochloride or lidocaine, and small-volume tuberculin or 3-cc syringes. Motor function of the eyelid is blocked by instilling 1 to 3 mL of local anesthetic over the palpebral branch of the auriculoopalpebral nerve. The palpebral branch courses over the dorsal zygomatic arch and can be located by palpating along the arch.

Sensory function of the eyelid is anesthetized by instilling 1 mL of local anesthetic into or over the supraorbital foramen to block the function of the frontal nerve. This foramen can be located by grasping the rim of the orbit with a thumb and forefinger at the medial-most aspect and sliding the fingers toward the lateral canthus, stopping when a widening of the bone is felt. The foramen is generally found under the forefinger at this location. Performing these blocks on the acute eye does not take much time and will greatly improve the quality of the examination. The blocks can last up to 90 minutes, so at the completion of the exam, the eye may be medicated with ointment to protect the cornea from drying.

4. **Topical Anesthesia of the Cornea**

Proparicaine or tetracaine drops are instilled into the eye to provide topical anesthesia for the cornea and to facilitate examination. An easy way of instilling liquid medications into the eye is to draw 0.5 to 1 mL of topical anesthetic into a small-gauge syringe and place the hub of a 25-gauge needle that has had the needle broken off onto the syringe. The syringe is then used to squirt medication at close range into the medical canthus. Care should be taken not to contact the cornea with the needle hub because the remaining “stub” of the needle is sharp.

5. **Stain Application on the Cornea**

Fluorescein stain is most commonly used to evaluate the cornea for abrasion or ulceration, including presence of a desmetocele. It is also used to evaluate nasolacrimal duct patency. Fluorescein is readily applied by inserting the stain strip into the medial canthus of a topically anesthetized eye. Another easy way to stain the cornea is to tear the tip of the dye strip from the strip and place it into a small syringe barrel. Sterile saline or tetracaine can then be added to the barrel to make a dye solution that can be squirted through the hub of a broken-off 25-gauge needle into the medial canthus. Rose Bengal dye is used after fluorescein to evaluate the quality of the precorneal tear film and to assess for superficial corneal epithelial pathology that may be fluorescein-negative, such as keratomycosis. Rose Bengal must be diluted as described above before application to prevent irritation.

6. **Obtaining Samples for Culture and Cytology**

A culture swab can be rolled over the edges of a corneal ulcer to obtain a sample for culture and sensitivity. Cytology samples can be obtained by scraping the margins of a corneal ulcer with the back (nonsharp) edge of a sterile scalpel blade. The sample is then smeared on several glass slides and air-dried. When dry, the slides are stained with Diff Quik and Gram stain for microscopic examination at the practice laboratory or reference laboratory.

7. **Diagnostic Approach to the Swollen Eye**

**History**

A stepwise approach to the acutely swollen eye seen as an emergency starts with a proper patient history. Signalment may give clues to potential age- or breed-related conditions. The onset and progression of swelling, bilateral or unilateral nature, additional clinical signs noted by the owner in this horse or others in the barn, and any history of previous ocular disease can help to direct the differential list. An important last question is to find out if the horse has received any previous treatment or is on any current medication because this can affect the clinical presentation and complicate diagnosis. Important to note is the inherent difference that can exist in the meaning of the word “acute.” Veterinarians have a definition of “acute” that implies a very recent onset, in which an owner may present a horse with an eye that has been diseased for some time or an eye that has been waxing and waning and is now in an “acute” symptomatic phase.

**Assessment and Examination**

While obtaining the history, the practitioner should observe the mentation and overall comfort of the horse. The horse should be evaluated for evidence of external trauma including wounds, asymmetry of the skull or facial structures that may suggest frac-
ture, or other areas of swelling. A full exam of the eye should be accompanied by imaging to assess the skull and/or if the horse presents with evidence of trauma, fracture, bullet wound, sinusitis or neoplasia.

An assessment of cranial nerve function should follow, paying particular attention to the menace response (which demonstrate intact function of cranial nerve [CN] II and CN VII), pupillary light reflex (which demonstrates intact function of CN II and CN III), and palpebral reflex (which demonstrates intact function of CN V and CN VII). Cranial nerve tests address issues of vision and eyelid function. Absence of the palpebral reflex and the ability to blink, such as with a facial nerve paralysis, leaves the corneal surface vulnerable and likely to develop ulcerative keratitis. If visual compromise is suggested by a decreased or absent menace and/or pupillary light reflex, diseases of the optic nerve and/or retina move to the top of the differential list, and the patient must be examined for other clinical neurologic signs. If other neurologic signs are observed, a systemic neurologic workup is indicated, paying particular attention to diseases known to affect vision. If severe visual deficit is recognized, ultrasound can be performed and provides valuable information about retinal health.

Evaluation of the eyelids should note their position and movement and the orientation of the cilia along the tarsal margin. Wounds may be accompanied by underlying corneal injury or conditions that could favor development of an abscess. In the case of grossly swollen eyelids with no accompanying globe abnormalities, blepharoedema may be primary and should be evaluated as such. A substantial portion of cases presented in the field may be the result of a simple inflammatory process as can occur with irritation from flies, allergies, contact irritant, or an insect bite. These horses present with hyperemic conjunctiva, varying degrees of thick, creamy discharge, and no corneal or other ocular abnormalities. Conjunctivitis is common and is often severe. These patients are frequently itchy but may occasionally be painful. The conjunctiva can be scraped for cytologic diagnosis or even biopsied in the field to confirm, but this is rarely necessary. Ultrasound of the eyelids can rule out abscessation, dacyroadenitis, or underlying fractures in trauma cases.

A practitioner may encounter cases in which blepharoedema is so severe that the lids simply cannot be opened enough to facilitate thorough exam of the underlying eye, even with appropriate blocks. Ultrasound imaging of the eye will be useful in these cases. If no severe pathology is identified needing immediate attention, the eyelid swelling can be treated overnight with systemic nonsteroidal anti-inflammatory drug (NSAID) therapy. The horse can then be rechecked the following day, and the exam can be continued.

Position and size of the globe are also evaluated. If the globe’s integrity has not been severely compromised or lost, it should be gently assessed for ease of retropulsion. An exophthalmus with limited retropulsion suggests specific conditions occupying the retrobulbar space. Limited retropulsion should be evaluated by ultrasonic and radiographic imaging to assess for retrobulbar abscess/hematoma, neoplasia of the eye, or sinus disease. If the globe has ruptured, this is generally obvious by collapse of the globe or evidence of a corneal laceration or perforation that may or may not be sealed with iris or hemorrhage. In some cases, referral to an ophthalmologist can result in the eye being saved, though it is generally not possible to retain vision. Most often these eyes are enucleated. If referral is not an option, vision has been lost, or prognosis for regaining health of the eye is poor, consider a standing enucleation, which can be readily performed with proper anesthetic blocks and sedation. Phthisis bulbi, or shrinking of the eye, suggests a chronic disease process and blindness. The pain and swelling may be an acute exacerbation of a chronic disease or an ongoing condition that has only now become severe enough for the owner to recognize, and this will affect your communication and treatment choices.

Ophthalmic Exam

An ophthalmic exam with the direct ophthalmoscope should include a careful assessment of all structures, including a fundic exam. Due to swelling and/or discomfort, access to the globe may be limited unless sedation and nerve blocks are performed as described above. Typically, the first structure to be examined is the cornea, noting any lesions/opacities, edema, neovascularization, pigmentation, or foreign body. The anterior chamber should be evaluated for aqueous flare, hypopyon, hyphaema, or fibrin clots, which support a diagnosis of uveitis and are often seen with trauma as well as systemic disease such as sepsis. The size of the pupil should be noted. A miotic pupil is consistent with intraocular inflammation, whereas a midrange pupil that is the same size as the opposite globe suggests an extraocular source of swelling. The color of the iris can give clues, as changes in color can be present with chronic uveitis. Anterior or posterior synechia (adhesions of the iris to the cornea or lens) are indicators of chronic inflammation. Tropicamide may be used to dilate the pupil to allow for a full lens and fundic exam.

The above observations are typically made before the cornea is stained. Staining is important even if the practitioner has identified another clinical condition that could explain the presentation, since ulcerative keratitis is a common secondary event and medication with a steroid is contraindicated in the presence of any corneal loss of integrity. In the case of the stain-positive eye, the pattern and intensity of the stain uptake will guide the diagnostics. Obtaining swabs and corneal scrapings for culture and cytology is indicated when ulcerative keratitis is

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diagnosed but may have unacceptable risk in cases with deep ulcers presenting with desmetocoeles.

A stain-negative corneal lesion must be evaluated for surface character. Irregular surface characteristics have a long differential list that includes corneal neoplasia, oncocerchiasis, habronemiasis, eosinophilic keratitis, or corneal foreign body. The practitioner can perform cytology on some of these lesions by scraping with a scalpel blade. Some proliferative lesions can be biopsied in the field, but shallow lesions of the cornea are generally not amenable to field biopsy. A smooth surface with underlying opacity could indicate a stromal abscess of bacterial or fungal origin. Evaluation of the pupil will be an indicator of the degree of ocular inflammation. Stain-negative eyes with abnormalities of the anterior segment consistent with uveitis should be treated with well-established anti-inflammatory therapy and systemic testing where indicated. Chronic changes associated with equine recurrent uveitis (ERU) will warrant discussion of long-term management; many of these cases progress to vision loss.

Foreign bodies are occasionally recognized and can be superficial or deeply embedded. Sharp or blunt corneal trauma can be recognized with edema, stain uptake, or visible partial or full-thickness corneal lacerations or avulsions.

Examination of the cornea under the third eyelid is facilitated by application of topical anesthetic and manipulation with a hemostat or forceps. The nictitans should be lifted to expose the underlying cornea for examination, to check for stain uptake, opacities, or masses in this location. Both the inner and outer mucosal surfaces of the nictitans can then be fully examined for abnormalities.

A digital exam of the fornices may conclude the complete ocular evaluation. An exam glove is worn and sterile triple-antibiotic ophthalmic ointment is used to thoroughly lubricate the index finger. The index finger is then used to gently probe the fornices, including beneath the third eyelid. This exam can be critical to rule out the presence of a foreign body but is contraindicated in cases with instability of the globe.

8. Imaging

Ultrasoundography

Technique for ocular ultrasound has been outlined and may be very useful in cases in which severe blepharoedema or corneal opacification obstructs visualization of the inside of the globe or full assessment of the orbital region. The practitioner may be able to identify underlying pathology of the anterior chamber or posterior segment and orbital/periorbital pathology such as lacrimal gland inflammation, orbital rim fractures, periorbital hematoma, or abscess. Penetrating injuries are suggested by a decrease in axial length of the globe, presence of intraocular echogenic structures, or iris abnormalities.

Radiology

Radiographic imaging of the skull is indicated to evaluate for fractures, neoplasia, sinusitis, and some foreign bodies. Several texts provide outlines of radiographic technique of the skull.

Digital Photography

Technique for acquiring digital photos of the globe was presented previously. Quality digital photographs enhance the medical record, allow chronologic tracking of lesions, and provide the ability for conference with colleagues.

9. Treatment

Treatment options for diseases of the cornea, globe, and adnexae diagnosed on examination of the acutely swollen eye are well outlined in many reference texts. The medications most commonly used that must be carried by the field practitioner include the following:

- Antibiotic ophthalmic ointments and/or solutions
- Antifungal ophthalmic ointments and/or solutions
- Systemic NSAIDs
- Atropine ophthalmic ointment
- Hydrocortisone or dexamethasone ophthalmic ointment
- Hypertonic saline ophthalmic ointment

Additional treatment techniques and materials used by the practitioner when dictated by the diagnosis and management situation include the following.

10. Tarsorrhaphy

Tarsorrhaphy can be readily performed with fine (4–0 to 2–0) nonabsorbable sutures in a horizontal mattress pattern. If desired, the technique can be performed with the use of stents, such as cut pieces of an extension set or short rubber band segments, to protect the skin. Many practitioners leave the medial canthus open to medicate the eye.

11. Lavage Catheters

Subpalpebral lavage (SPL) catheters have been in use for many years, simplifying the treatment of one of the most common causes of swollen eyes: corneal ulcers. SPL catheter kits permit safe, simple administration of multiple medications into the tear film several times a day. Installation and use of SPLs have recently been reviewed. Most SPL catheters are placed in the dorsotemporal fornix, but they may also be placed in the lower lid if the upper lid is inaccessible or damaged.

When an SPL cannot be placed for structural, financial, or other reasons, a nasolacrimal duct catheter can be placed as an alternative. This can be a good choice for a fractious patient or one with severe blepharoedema. There are commercially available...
kits that are positioned to sit at the punctum and thus deliver all the medication pushed directly to the eye. A secondary nasolacrimal option in the absence of a kit is to thread a small-bore (5F to 8F) feeding or urinary tube into the nasal punctum up the nasolacrimal duct toward the globe. The 5F catheter can often be inserted far up the duct, close to the ocular punctum. Alternatively, a larger tube can be inserted 15 mm up the duct, taking note that larger volumes of solution will be needed to medicate the eye, given the backflow that will occur. Several ophthalmic texts discuss the selection of medication for lavage catheters and the specifics of dosing and frequency.

12. Infusion Disk Antibiotic Delivery Systems

Owner compliance can be very challenging with ophthalmic disease, especially in a backyard situation. Without the benefit of a boarding situation or owners who work from home, it can be difficult to get medication into the eye as often as needed. Referral to a hospital or layup facility is often the best choice for care, but this may prove too costly for many owners. A field treatment solution that the practitioner can use is an infusion disk. Disks can be filled with medication of choice and fitted with adapters to allow more than one disk to be used at once in conjunction with an SPL or nasolacrimal catheter. Medication is continuously infused into the tubing of the catheter as a small battery that is part of the disk operates, slowly collapsing the disk bladder bag that contains the medication reservoir. Note that ambient temperature can be a concern for medications that must be refrigerated or in climates that are experiencing freezing temperatures.

13. Conclusion

The acutely swollen eye can present many diagnostic challenges to the field practitioner, but by following a stepwise approach to evaluation and using additional diagnostics, the practitioner can arrive at a diagnosis on the farm in the majority of cases. Additionally, most of the conditions diagnosed can be effectively treated either medically or surgically by the field practitioner despite common limitations faced. Field veterinarians often find themselves with a need to improvise not only with diagnostic strategies but also treatment therapies. Many outside factors can prevent the use of the traditional or the gold standard. A variety of techniques and alterations may be helpful to the field practitioner for managing the conditions discussed.

References and Footnotes


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