

A Summary: Wilderness Medical Society Practice Guidelines Treatment of Eye Injuries and Illnesses in the Wilderness

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Introduction

Eye problems in the wilderness represent a challenging group of complaints for several reasons: access to proper diagnostic tools and medications may be limited, most practitioners are not specially trained to evaluate ocular complaints, and many eye complaints can cause visual loss. In 2013, the Wilderness Medical Society published [practice guidelines for wilderness medicine practitioners for ocular complaints based on available and evidence-based information](#). This article is a summary of those guidelines.

Pre-trip Planning and Prevention

In general, examination and treatment of the eye requires specialized knowledge and equipment. Table (2) provides a list of equipment and medications that should be included in both a basic and an advanced eye kit. A basic kit is appropriate for short excursions, whereas the basic plus advanced could be used for prolonged expeditions, especially to remote locations. Given the potential difficulty in treating many of these complaints, prevention of eye illness and injuries is paramount. Many are a result of accident or trauma, and thus may not be preventable, yet adequate sun and protective eye wear, good hygiene, and proper hand washing can prevent a large number of these eye conditions.

Table 2. Basic and advanced equipment and medications

| <i>Basic equipment</i> | <i>Basic medications</i> |
|--|--|
| Light source: ideally would be penlight with blue filter, but bright headlamp is reasonable option | Artificial tears, individual bullet packs to avoid contamination |
| Fluorescein strips | Erythromycin ophthalmic 0.5% ointment |
| Cotton-tipped applicators | Proparacaine 0.5% drops |
| Paperclip for lid retraction | Oral pain medicine |
| <i>Advanced equipment</i> | <i>Advanced medications</i> |
| Metal eye shield: can be improvised from anything that will protect eye from further damage | Fluoroquinolone ophthalmic eye drop, such as moxifloxacin 0.5% |
| Magnifying glass | Prednisolone 1% drops |
| Fine forceps | Moxifloxacin 400 mg tablets |
| Small needle, such as 23G or tuberculin syringe | Prednisone 20 mg tablets |
| Direct ophthalmoscope | Atropine ophthalmic 1% ointment |
| Wire speculum for lid retraction | Pilocarpine 2% drops |
| | Diamox oral 250 mg tablets |
| | Topical NSAID, such as ketorolac, diclofenac, or bromfenac eye drops |

Equipment: 1C; medications: 1C.

NSAID, nonsteroidal antiinflammatory drug.

Eye Complaints

Eye complaints are frequently divided into traumatic versus atraumatic, the appearance of the eye (either red or white sclera), and by vision loss or lack thereof. Though there are numerous causes, any vision loss should be considered an emergency requiring emergency evacuation.

Exposure to high altitude (less than 18,000 feet elevation) may result in problems both for the previously healthy eye and for the patient with a history of ocular pathology. Because the cornea receives most of its oxygen from ambient air, the cornea becomes hypoxic at altitude and may not function normally. Those who have undergone radial keratotomy (RK) should use caution at high altitude, as they may experience significant vision changes. Patients with a history of laser-assisted stromal in-situ keratomileusis (LASIK) and photorefractive keratotomy (PRK) have not demonstrated significant vision change or danger at altitude.

Diving and the hyperbaric environment can also adversely affect the eye. The primary concerns include ensuring that patients have normal visual acuity while diving, and making sure that patients with a history of an intraocular gas bubble due to surgical procedure (usually for detached retina) do not dive. Diving can cause ocular and periocular barotrauma in normal eyes, the most common being “mask squeeze”, when the air inside the mask is exposed to high pressure during descent, drawing out the lids, skin and eyes. This force can cause significant injury, resulting in periorbital ecchymosis, edema, subconjunctival hemorrhage, and potentially hyphema. This can be prevented by frequently filling one’s mask with exhaled air from the nose to increase the volume of air in the mask, therefore equalizing the pressure.

The following table is a summary of other common ocular complaints, divided into appearance (white versus red eye) and cause (traumatic versus atraumatic).

Table: Most common eye complaints

| Diagnosis | Presentation | Cause | Treatment (non-wilderness) | Evacuation |
|----------------------------------|--|--|---|---|
| Central retinal artery occlusion | White eye, painless, vision loss | An ischemic stroke of the retina | Oxygen Hyperbaric O2 (External counterpulsation) (Pentoxifylline) | Emergent |
| Central retinal vein occlusion | White eye, painless, vision loss, Afferent pupillary defect* | Obstruction of venous outflow from the eye | Topical Steroid (surgical) | Emergent |
| Retinal detachment | White eye, painless, with floaters/flashes or curtain-like visual field defect | Detachment of retina from supporting structures | (Surgical) | Emergent |
| Preseptal cellulitis | White eye, painful, periorbital inflammation | Infection limited to superficial periorbital tissues | Systemic antibiotics -Amox/Clav - Fluoroquinolones | Non-emergent *If differentiated from |

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| | | | | orbital cellulitis |
| Orbital cellulitis | White eye, painful, proptosis*, pain with EOM*, +/- visual disturbance | Infection of soft tissues of the bony orbit/ surrounding the eye | Systemic antibiotics -Amox/Clav - Fluoroquinolones | Emergent |
| Acute angle closure glaucoma | Red eye, painful, blurry vision, nonreactive pupil, taut globe | Blockage of aqueous outflow resulting in increased IOP* | Topical beta blockers Steroids Pilocarpine Oral acetazolamide (surgical) | Emergent |
| Iritis | Red eye, painful, blurred vision, photophobia, consensual photophobia* | Inflammation of iris (non-traumatic) | Topical or systemic steroids Mydriatic* drops Topical NSAIDs | Emergent |
| Herpes Keratitis | Red eye, painful, dendrites* seen on fluorescein stain, history of prior | Ocular herpes infection/ reactivation | Oral or topical antivirals | Non-emergent |
| Conjunctivitis | Red eye, painful, involves palpebral conjunctiva*, very common | Allergic, viral, or bacterial inflammation of conjunctiva | Topical or systemic antibiotics Hand washing | Non-emergent |
| Retinal hemorrhages | White eye, no pain, more severe if visual disturbance | Bleeding resulting from physiologic changes at altitude | Descent if visual changes | Descent if visual changes |
| Periocular trauma | Traumatic, i.e.: eyelid laceration, complex = full thickness, involving the lid margins or medial/lateral canthi* | Trauma to periorbital structures/ eyelid | Wound care Antibiotic ointment Eye Shield | Emergent if complex |
| Orbital fractures | Traumatic, painful, can have entrapment* of ocular muscles | Trauma to the eye causing fracture to orbital bones | No nose blowing Decongestant spray Systemic steroids (Surgical) | Emergent if visual derangements |
| Retro-orbital hemorrhage | Trauma, painful, elevated IOP, vision loss, afferent pupillary defect. | Bleeding behind the eye that can cause a compressive optic neuropathy | Lateral cantholysis* (Surgical) | Emergent |
| Globe Rupture | Traumatic, painful, "soft" eye, deformed globe, irregular-shaped pupil | Rupture of the structure of the eye, at risk for infection; endophthalmitis | Shielding Systemic antibiotics Steroids (Surgical) | Emergent |
| HypHEMA | Traumatic, painful, blood seen in the | Collection of blood in anterior chamber; | Activity Restriction -Walking only | Emergent |

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| | anterior chamber | between iris and cornea, can lead to increased IOP | Steroids or Cycloplegics* Acetazolamide Shielding Avoid NSAIDs Antiemetics | |
| Corneal Abrasion | Traumatic, red eye, painful, seen on fluorescein staining | Abrasion to the cornea | Topical antibiotics Cycloplegics NSAIDs Artificial tears Sunglasses Avoid patching | Emergent for deep defect or concern for globe rupture |
| Corneal ulcers | Red eye, Painful, white or gray infiltrate on cornea, defect on fluorescein staining | Usually infectious damage to cornea. Can be due to contact lens wear or from a corneal abrasion | Topical antibiotics Systemic antibiotics Cycloplegics | Emergent |
| Chemical eye injuries | Chemosis*, blepharitis*, corneal irritation | Multiple causes including snake venom, jellyfish stings, skunk musking, or cooking gases | Large volume irrigation Topical antibiotics | Emergent |
| UV Keratitis | Red eye, pain, burning, tearing after UV ray exposure | Self-limited inflammation of cornea caused by UV rays | Sunglasses Topical antibiotics Cycloplegics NSAIDs Artificial tears | Non-emergent |
| Sub-conjunctival hemorrhage | Bright red spot/s on sclera | Bleeding between the conjunctiva and sclera | None | Not necessary |

Conclusions

Wilderness eye injuries encompass a diverse group of illnesses that often require specialized equipment, medications, and expertise. This review provides an evidence-based overview of the most commonly encountered eye injuries; however, evidence regarding wilderness treatment is limited to case reports and extrapolation of clinical and hospital care, and is often based on available supplies and treatments rather than on the most evidence-based interventions. However, with the proper tools and physical examination skills, most providers can determine the need for further intervention or evacuation in cases of ocular pathology in the wilderness.

*Definitions:

Afferent pupillary defect: when a light is shone in the normal eye, both pupils will constrict, but when the light is then quickly shone in the abnormal eye, both pupils will dilate.

Proptosis: protrusion of the eyeball.

EOM: extraocular movements, controlled by various muscles connected to the eye.

IOP: Intraocular pressure; the fluid pressure within the eye.

Consensual photophobia: sensitivity and pain in the affected eye when light is shone into the healthy eye.

Mydriatic: agent that dilates the pupil.

Dendrites: a branching figure, resembling a shrub or tree.

Palpebral conjunctiva: the part of the conjunctiva that coats the inside of the eyelid.

Canthi: the corners of the eye.

Entrapment: when intraorbital contents, such as muscle or soft tissue, are entrapped by bone fragments.

Lateral cantholysis: surgical incision of the lateral canthus for emergent orbital decompression due to retro-orbital hemorrhage.

Cycloplegics: cause paralysis of the ciliary muscle of the eye, resulting in the loss of accommodation.

Chemosis: swelling of the conjunctiva.

Blepharitis: inflammation of the eyelid.