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Practical Ophthalmology for “Equine Road Warriors”

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Take Home Message

Equine practitioners can develop solid expertise in field ophthalmology with practice and effort. Some problems will always have to be referred to specialists, but the average practitioner can examine, diagnose, and treat 85% of the eye problems that are seen in the field. This presentation provides many tips for success in diagnosing and treating ophthalmic problems of horses in the ambulatory setting.

Medications, Diagnostic Tools, and Supplies

Items to carry in the ambulatory vehicle for diagnosis and treatment of eye problems:

- Direct ophthalmoscope (www.welchallyn.com)
- Penlight, Finoff transilluminator (www.welchallyn.com) and/or Mini Mag Lite (K Mart)
- 14 D Magnifying lens (www.welchallyn.com)
- Digital Camera (4.0 megapixel camera or higher resolution, good autofocus system, large LED viewing screen advised)
- Fluorescein and Rose Bengal dye strips (carry in ophthalmoscope case)
- Schirmer tear test strips (carry in ophthalmoscope case)
- Tropicamide (Mydriacil)—topical agent to dilate pupils
- Proparicaine (topical anesthetic); Carbocaine (injectible local anesthetic)
- 30 ml bottles of 1 part Betadine to 50 parts Saline. Larger pour bottle of same.
- Sterile wooden handled Cotton Swabs bundled 6 swabs to a pack
- Sterile individual Dacron polyester swabs (Puritan Medical Products, 1-800-321-2313)
- Sterile 4 x 4 gauze, Non sterile 4 x 4 gauze, Sterile gloves, exam gloves
- Scalpel blades, packed in sterile sleeves (any size other than #22 as blunt end is used)
- 2 mm biopsy punches (for occasional “scooping” of foreign bodies)
- Slide boxes with 4 microscope slides to a box (for cytology specimens)
- Formalin in small jars (for preserving biopsy specimens)
- “Write on” Plastic bags—4x6” (to dispense meds and clarify tx schedules)
- Thioglycollate culture broth or agar plates, Porta-cult transport media
- Serum separator tubes (to prepare autologous serum)
• Fine suture material: 1-0 through at least 4-0, some use up to 6-0 PDS polygalactin or vicryl
• Sedatives (Xylazine, Butorphanol tartrate, Detomidine)
• Subpalpebral lavage systems (www.mila.com—the longer 60 inch “Florida” tubes are good for large patients; 36 inch tubes will suffice for smaller horses and foals)
• Adhesive tape (to make butterfly holding wings for lavage systems)
• 20 G catheters and IV Catheter caps (to use with SPL lavage system)
• Tongue Depressors (to use with SPL lavage systems)
• Braidette rubber bands (to braid mane for SPL systems)
• TB and 3 cc syringes as well as larger sizes
• Prescription Pad
• Halogen light on tripod or hook (Home Depot). Headlamp—Pella or other brand LCD with at least 4 diodes (buy at outdoor stores)

Medications readily available through veterinary distributors for ophthalmic problems
• Antibiotic Ointments: Triple Antibiotic, Chloramphenicol, Gentamycin-Most others need to be prescribed through pharmacies.
• Antibiotic solutions: Triple antibiotic, ciprofloxacin, moxifloxacin
• Corticosteroid Ointments: Triple antibiotic with 1% Hydrocortisone, Triple antibiotic with 0.1% Dexamethasone
• Corticosteroid solutions: Prednisolone acetate
• 1% Atropine ointment
• Injectable antibiotics to make fortified solutions for SPL or subconjunctival use: Cefazolin (1 gram vials of powder), Gentamycin (100mg/ml injectable), Amikacin (50 or 250 mg/ml injectable)
• Artificial Tears
• Timolol maleate (0.5% drops)
• NSAIDS: Injectable and oral flunixin meglumine and phenylbutazone
• Systemic corticosteroids: injectable and oral dexamethasone
• Fluconazole tablets (200mg)

Drugs that will take more effort to obtain
• Be ready to prescribe many drugs at local pharmacies such as Muro 128 solution or ointment (5% NaCl), CoSopt solution (Timolol maleate combined with Dorzolamide), Voltaren solution (0.1% diclofenac), Ocufen solution (flurbiprofen), Tobrex ointment (0.3% tobramycin), Vigamox (moxifloxacin), oxacillin, silver sulfadiazine crème and Ciloxan (ciprofloxacin ointment). Some practitioners use over the counter anti-fungal products in the eye such as Monistat (1-2% miconazole), or Gyno Lotrimin (1-2% clotrimazole) but caution is advised here.
• Other products must be ordered through compounding pharmacies in order to obtain the desired concentration or vehicle of a drug for ophthalmic use when it is not available commercially. Common items include: 2% cyclosporine solution or ointment (commercial product is 0.2% cyclosporine, but this is ineffective for most problems), 1% 5-fluorocytourasil (5 FU ophthalmic ointment), 1% miconazole solution, 1% itraconazole/30% DMSO ointment, oral itraconazole, sterile sesame oil (for mixing with...
cisplatin). **CAUTION:** Practitioners should be aware of the FDA guidelines on the use of compounded pharmaceuticals, and prescribe from reputable compounding pharmacies licensed in their state of practice.

- Some hard to find medications (Natamycin, Voriconazole, sequestersol EDTA prep) may be available through the pharmacy at the nearest veterinary school. Chemotherapeutic agents, antifungal products and other specialty items may be ordered from specialty human pharmaceutical distribution companies. A useful source is Florida Infusion/Nations Drugs ([www.floridainfusion.com](http://www.floridainfusion.com), 1-800-624-0152). Another useful source for veterinary distribution of human products is Amatheon, Inc. ([http://www.amatheon.com/](http://www.amatheon.com/))

### Examination and Diagnostic Tests in the Field

Ophthalmology texts listed at the end of this presentation provide comprehensive information on techniques of examination of the equine eye and various common diagnostic tests. Listed here are several tips that may help facilitate the examination and diagnostic process in the field.

- **Train owners to call for same day examination** on any lids that show severe swelling, and any eyes that show signs of pain (squinting, excessive tearing, lashes that point down, resentment for handling) or discoloration. **THEN COMMIT TO SEE THE HORSE ON THE SAME DAY!**
- **Owners calling about horses with painful eyes or eye trauma should be told to have a dark examination area available, and to have 4 bales of shavings or hay ready to use as head rest for standing surgery/diagnostics. A stool or other step stand may help if the horse is tall or the vet is short!**
- **Horses are often most relaxed if examined initially in stalls. Instruct the handler to stand on the side OPPOSITE to the side being examined. Always examine BOTH eyes fully even if there is an obvious problem in just one. Having the holder tilt the head one direction or another by applying pressure on the ear will help expose desired site of the globe.**
- **Chemical restraint** is often needed but can be short lived. **BE ORGANIZED with all supplies for diagnosis and treatment at hand before sedating—strive to work quickly! Butorphanol tartrate as a sedative can cause troublesome head tremors—Xylazine or Detomidine is generally more useful.**
- **Use a small syringe (1-3 ml) to draw up and administer topical drugs (anesthetics and mydriatics). Break off the needle and use the syringe as a small spray device to drip or spray the medication onto the globe.**
- **Oculomotor and sensory blocks** (auriculopalpebral and supraorbital nerve blocks) will facilitate examination of painful eyes and also aid photography of the lesions. These blocks are mandatory if the eye shows any sign of techtonic instability.
- **Carry Mydriacil (1% Tropicamide)** and use it as an examination aid. This medication will dilate the pupils in 15-20 minutes. A dose of 0.3 to 5 ml sprayed topically on to the surface of each cornea will produce good results. With a little planning, a screening examination can be performed on the undilated eyes then the mydriatic can be applied. Another horse can be examined while the dilation takes effect. The practitioner can then return to look at the dilated eyes of the patient. The view of the lens and intraocular
structures will be expanded, and many lesions will be easier to photograph, especially if they involve the lens. The short term dilation will wear off in a few hours.

- **ALWAYS judge pupil size and reactivity** on both eyes on every case. Pay attention to miosis! Pupil reactivity can help determine if the horse is visual, and reduced pupil size is often a tip off to subtle intraocular inflammation.

- Get in the habit of performing a **SYSTEMATIC** evaluation of all regions of the eye. Use penlight and direct ophthalmoscope and slit lamp if available. **EVEN IF PROBLEM IS OBVIOUS**, slow down and look at all regions: orbit, periorbit, lids, conjunctiva, tear film, cornea, anterior chamber, iris, lens, posterior segment, fundus and optic nerve. Assess cranial nerve function. Assess visual axis using dazzle, direct and consensual PLR, menace, and (when appropriate) blindfold obstacle maze navigation. Use dial settings to change lenses on the direct ophthalmoscope to focus on deeper layers of the globe. Use (or refer) for tonometry in suspected glaucoma cases.

- **Vascularization of the cornea** occurs in many disease processes. Superficial vessels are individual long branching vessels that lie within the epithelium or anterior stroma. Deeper, mid stromal vessels are multiple—they are short and straight and may form a brush border on the limbus. Very deep vessels that rest on the Descemet’s membrane interface are individual long branching vessels. Characterizing the depth and describing the extent of any vascularization that is present will help you understand the disease process at hand, and observing changes in vascularization over time may help decide if a problem is improving or worsening.

- Ambulatory vets work in all kinds of environments and **hygiene** is often suboptimal. Carry a pour bottle of 2% Betadine in the truck and use it to clean the periorbital region with gauze before doing any work on the globe surface. This dilution of Betadine is safe enough to use in the fornix and will not harm the globe or cornea. Wear exam gloves or sterile gloves when working on the globes to prevent transfer of pathogens from your hands to the patient.

- Corneal debridement is therapeutic, but should also be used to collect **diagnostic cytology samples** on 2-3 slides. The collection process is done using the base of a scalpel blade (non-sharp end) with the foil wrapper folded to create a handle. Slides should be carried in a slotted plastic box in the vehicle and stained with Gram stain and Diff Quik later at the office. No fixative is needed.

- **ALL PRACTITIONERS CAN READ OCULAR CYTOLOGY!!** The emphasis is simple: check to see if there is an inflammatory (neutrophilic) response surrounding the corneal cells that are removed, and if there are infectious elements like bacteria or fungal hyphae present. It is important to note if bacteria are intracellular or extracellular, and if they are cocci or rods. The presence of eosinophils is very abnormal and will dictate a different therapeutic course than a simple neutrophilic response. Occasionally foreign bodies will be appreciated (burdock bristles or other vegetative matter).

- **Culturing eye lesions** is not as simple as cytology, but can still be performed if the clinic laboratory technicians are experienced in culture techniques. One method for culturing corneal lesions **in the field** is to carry tubes of thioglycollate broth in the vehicle cooler. Culture samples (which are collected **BEFORE** cytology samples) are obtained with either a Dacron sterile swab or the base of a sterile scalpel blade (advise sterilization of foil wrapped blades in a sterile paper/cellophane sleeve so that the outer foil wrapper can be handled with sterile technique). Depending on the device used to obtain the sample,
the Dacron swab is then broken off into the broth tube or the whole scalpel blade is dropped into the broth, and the tube is recapped. The broth tube is placed in an incubator, then observed for turbidity. Turbid (positive) samples are analyzed for with gram stain for morphology and staining characteristics, then plated out on agar for antibiotic sensitivity.

- **Culture samples** that are collected **at the clinic** should be plated directly on blood agar media biplates. A good technique is to take the sample using the blunt end of a sterile scalpel blade, then embed the corneal cells and surface material in the media by making multiple small “c” shaped gouges in the agar in various sections of the plate. This may require using more than one sterile scalpel blade.

- **Sensitivity to antibiotics** can be measured by the **Kirby Bauer disc diffusion technique**. A wheel of discs should be created exclusively for eye cultures as some of the antibiotics that are used topically on eyes (e.g. ciprofloxacin, moxifloxacin) are different than the antibiotics used for other body systems frequently cultured (respiratory/uterus/wounds, etc)

- **Maze testing** is appropriate for horses with intraocular changes that may compromise vision. The author performs this test in a barn aisle. The aisle is cleared of any obstructions other than the maze obstacles and all stall doors are shut. A maze is created using upside down buckets or other objects that pose no hazard if the horse runs into them. A large towel is looped under the halter and used to cover first one eye and then the other. The horse is turned loose in the aisle and is coaxed to negotiate the maze by an assistant shaking a bucket with grain at the far side of the maze. All observers are instructed to keep their distance and avoid giving the horse navigational cues. Maze testing is often valuable in convincing an owner that a horse is blind when they are convinced that it can see out of the eye in question.

- **Buy at least one atlas or book on Equine Ophthalmology** (several are listed in the references). Studying many fundic photos will hone skills in deciding what is “normal” and what is ‘abnormal”. All practitioners should look at LOTS of “normal” eyes!!! At least 20% of all horses will have some finding of record.

- **Develop a recording system to write down observations.** START TAKING **DIGITAL PHOTOS OF EYES**. With a little practice and judicious cropping, it is easy to get great images using a camera with 4.0 megapixels or higher resolution. One or two select images should be archived in the horse’s medical record. Serial photographs at later intervals will help determine progress of chronic cases.

**Imaging in the Field**

Practitioners are well versed in imaging the musculoskeletal system with radiography, and using ultrasound to image the reproductive system, as well as the thorax, abdomen and soft tissue structures in the leg. While ultrasound and radiology are occasionally used to assess ocular problems, the premier field imaging technique for the eye is **digital photography**. The advent of high quality, inexpensive compact digital cameras has brought the capability of field imaging within the range of all practitioners.

Many practitioners try to image eyes and become frustrated because the images they get are blurry. This problem is often due to poor technique rather than a problem with the camera. The
biggest mistakes that are made are holding the camera too close to the eye, not engaging the autofocus system properly, and trying to use the digital zoom feature inappropriately.

Excellent images can be obtained very simply with a variety of cameras. The most important concept is an understanding of the autofocus system. If the camera is set on the PROGRAM (automatic) setting with the MACRO option (flower icon) selected, the autofocus will be optimized for taking pictures of objects that are 12-20 cm away from the lens. This autofocus system is engaged when the shutter button of the camera is pushed half way down. This action causes an infrared beam to be emitted from the camera. This beam bounces off of the object that is in the center of the camera viewfinder and is “read” by a computer inside the camera. The processor then adjusts the lenses and the light aperture for optimum imaging of the object in the center of the viewfinder. It signals the operator that it is focusing on the area of interest by projecting a bracketed outline on the viewfinder. If the camera shutter is depressed fully after the autofocus is engaged, and the distance from the camera lens to the eye has not changed at all, the image will be in sharp focus.

Experimentation with a given camera model will demonstrate the optimum focal distance for imaging the eye. The autofocus will NOT engage if the camera is held too close to the eye. The operator will know this because the bracket will not appear on the viewfinder. The author uses a camera that emits a soft audible chime when the autofocus is engaged, and finds that this feature expedites the imaging process (Kodak Easyshare Model Z712 IS).

Horses become restless if too much time is spent “setting up” an image, so the best practice is to take several images in rapid sequence, making sure the autofocus is operating for each one. The operator can then review the images on the viewfinder and decide if the quality is acceptable. A few of the images may be blurry because of operator or horse motion, and these may be deleted. If necessary, shots can be repeated, or slightly different angles can be taken to image the area of interest. Photographs will be of the highest quality if they are taken indoors in a dark area with a flash. The operator must be aware of background and foreground detail that may impair quality—the corneal surface is glossy and reflective and it will pick up windows or other reflections that are present behind the operator.

The digital zoom feature should NOT be used when the picture is taken. However, the digital zoom feature but it is very useful to use AFTER the image is obtained to demonstrate lesions to the owner. The clinician can use the camera “review” feature to scroll through the images on the LED screen on the back of the camera, selecting the best ones. Then the digital zoom and positional buttons can be used to center and enlarge the area of interest to fill up the LED screen. Owners can then look at the lesions in a magnified view. Showing the problem to the owner on the camera LED screen is a VERY important part of the treatment plan. It is hard for most owners to “see” lesions on the live horse, but it is easy for them to appreciate pathology on a camera screen. Treatment compliance and acceptance of the expense and effort involved in handling a tough problem will be enhanced by the stallside review of images.

Images obtained in the field should be downloaded to a viewing computer at the end of the day. The images will have superfluous detail of the animal’s head that will need to be cropped with editing software. This task is easily performed with a variety of software programs (Apple
iPhoto, Aperture, Microsoft Photo Editor, Adobe Photoshop). The detailed, magnified images can then be transferred to the medical record and/or emailed to the owner.

**Progressive photography** of lesions that are being treated or followed is important. Assessing progress (or worsening) of a lesion is difficult when the operator is relying on memory for judgment, but is straightforward when sequential images are compared side by side.

**Ultrasound** of the globe, orbit and periorbit can be performed with standard machines that ambulatory clinicians use for reproductive or musculoskeletal evaluation. Ultrasound is appropriate for cases where the clinician is trying to check for orbital fractures, assess tissue density in a swollen eyelid to check for abscesses, or assess globe size in cases of exophthalmos or suspected orbital tumors. It is also useful for inspecting the anatomy inside the globe to look for evidence of cataract, lens luxation, intraocular masses, or retinal detachment. The author favors the use of a 7.5 mHz curvilinear probe for most ocular imaging, but also uses a 5.0 mHz linear probe for assessment of tissue behind the globe. A transpalpebral approach is suitable for most ambulatory cases. The author always performs ocular ultrasound with the horse’s head supported by a bale table as this practice simplifies restraint. Images can be captured on a jump drive, printed out on a thermographic printer, or photographed directly from the machine screen.

Clinicians should be aware that many referral institutions have access to **high frequency ultrasound machines** that can obtain very high detail of ocular structures. Certain cases may benefit from referral for this procedure.

**Radiology** of the orbit or periorbit is indicated in a small number of cases. The most common indications are orbital trauma (to check for fractures or radiodense foreign bodies) and enlargement or deformity of the facial bones (to assess for evidence of neoplasia, sinus disease, dental abnormalities or osteomyelitis). Digital or computed radiology systems will provide images that are far superior to conventional films. Tips for field radiology include the use of a bale table for head support, and restraining the sedated horse with a home-made halter made of a guaze roll that will not show up on the imaging plate. It may be helpful to secure radiodense markers on the skin adjacent to the area of interest to aid in interpreting the images. Skin staples can be used as temporary markers, or small radiodense objects (like BB pellets) can be taped to the skin.

**Computerized Tomography** and **Magnetic Resonance Imaging** are advanced imaging modalities that may be available as referral options for selected cases. These imaging modalities are costly but they may provide the most comprehensive evaluation of challenging problems like orbital trauma, orbital tumors or sinus masses that threaten the eye.

**Tips on Field Therapeutics**

A detailed treatise on ocular therapeutics is beyond the scope of this presentation; the reader is directed to the texts listed in the reference section for discussion of current treatment options of various ocular problems. The following comments are tips that may help the clinician achieve excellent results when prescribing or performing common ocular therapies in field conditions.
• If **ophthalmic ointments** are prescribed, spend time with the owner demonstrating the best way to apply them. Helpful tips include pointing out the orbital rim and telling the owners that they can rest the finger that is holding the lid open against, or slightly underneath the rim dorsally. Having the owners touch the crease of the eyelid to lift it dorsally is another useful tip.

• An alternative method of applying ointments is to dispense a box of tuberculin syringes and instruct the handler to use a new tuberculin syringe for each treatment, “loading” the syringe with a small quantity of each prescribed medication (*personal communication, Dr. Claire Latimer*)

• Dispense **topical medications** in a 4” x 6” **“Write on bag”**. (Associated Bag Co. 1-800-926-6100, stock # 277-4-04W) Write out the treatment schedule for that medication for the next several days by making circles on the bag label next to days of the week. This simple step increases compliance and keeps the medication clean.

• Study ophthalmic textbooks for **eyelid plastic surgery techniques**. Practice some procedures on cadavers to get a feel for tissue handling. Become comfortable using fine (4-0 or smaller) suture for ALL repairs. The author schedules suture removal of all skin sutures—whether resorbable or not-- at 8-12 days as the eyelid tissue retains some persistent inflammation if these sutures are left in.

• The use of a **fly mask** or modified **racing blinker hood** helps protect the periorbital region after surgery. Be sure that there is not a “greenhouse” effect from a closed blinker—perforate the plastic with 1 cm drill holes if needed.

• Decision making on handling **tumors in the periorbital region** is difficult as there are many options for treatment. If the tumor is large, close to the lid or approaching the globe, referral to a specialist is usually the best option. Recurrence or ineffective treatment may have a disastrous result.

• **Nictitans removal** (usually indicated for neoplasia of the third eyelid) is a simple surgical procedure that can be done at a clinic or in the field. This surgery should be performed with the horse restrained in stocks. Although it is most desirable to oversew the conjunctiva that is deep in the fornix to prevent fat prolapse, this is often not practical in the standing procedure. The author has had good results with simple amputation of the large pad of fat that is attached to the base of the nictitans.

• **Debridement of the cornea** should be performed in superficial ulcers and in deep ulcers that are tectonically stable. Debridement is usually a simple swabbing of the lesion with a series of dry sterile cotton swabs. Occasionally it involves removing some corneal stroma with a #15 or #63 blade. Experience will dictate the need for repeat debridements—generally intervals of three to seven days are advised. However, if the horse is becoming more painful or if the lesion is increasing in depth or intensity of opacity, the medical treatment plan should be revised. Any ulcer that is worsening in the face of medical therapy is a candidate for referral. If referral is declined, the horse should intensity/spectrum of home care should be revisited and increased.

• **Melting ulcers** are very serious problems that require intensive treatment and carry a guarded prognosis. Referral should always be offered. If referral is declined, the owner (and veterinarian) must commit to frequent topical therapy with substances that combat collagenolysis (autologous or homologous serum, dilute EDTA). **An SPL system is appropriate to assure medication delivery and simplify care.** Serum can be obtained by drawing 4 “red topped tubes” from a normal horse or from the...
patient. The tubes are allowed to sit for a minimum of one hour, then centrifuged to separate the cells from the serum. The serum is then drawn off into either tuberculin syringes or dropper bottles for administration. Acetylcysteine comes in an injection bottle with a concentration of 20%—this should be diluted with sterile water to a concentration of 5-10% as the stock 20% solution is irritating to the eye. An effective topical EDTA solution is made by filling a lavender top blood tube half way up with sterile water, then drawing the solution into tuberculin syringes.

- **Indolent ulcers** do occur in horses, particularly older individuals, but they are relatively RARE. This condition is helped by performing a grid keratotomy but the grid keratotomy procedure is CONTRAINDICATED in a corneal ulcer that is infected. A grid procedure should only be done on superficial, non healing lesions if (1) the horse has been treated with other methods (including cotton swab debridement) for at least two weeks, (2) the ulcer has stayed static and has NOT gotten worse, and (3) cytology has been performed and has shown NO infectious agents and NO inflammatory response. Disastrous consequences have followed inappropriate grid procedures, so if there is uncertainty about the infectious status of an ulcer, a grid keratotomy should NOT be performed.

- **Immune mediated keratopathies** are an emerging issue in equine ophthalmology. They are poorly understood, but the syndrome describes a set of conditions that present with variable opacity and vascularization of the cornea. Some cases have punctate epithelial defects that look like tiny pin firing marks on the cornea. Some cases have staghorn like, blotchy or circular opacities on the cornea that appear to move to different sites when relapses occur. Some have endothelial opacity. Most have vascularization that may shift in position as the condition changes. Some cases are painful, some are not. Recurrence is common. Research is ongoing. Many of these cases respond to topical or systemic steroids and/or topical 2% cyclosporine.

- **Eosinophilic keratitis** is a condition that is also thought to be immune mediated and is not well understood. It appears to have regional variations in presentation—cases seen in the Northeast frequently occur in the late summer in horses that are pastured. They may recur in subsequent years. Management is often helped by topical steroid application but therapeutic decision making can be challenging as these cases often present with extensive ulceration. Consultation with a specialist or referral is advised.

- **Subconjunctival injections** are easiest if the horse’s head is supported by a table made of bales, and the handler, who is standing on the contralateral side of the horse, uses the ear of the horse to tilt the top of the head away from the clinician, thereby exposing target sclera. The injection should be performed with a 25G needle, bevel up. The dose of injected medication should not exceed one ml. The goal is to inject the drug in the “sub Tenon’s layer”—the layer of tissue just superficial to the sclera. Warn the handlers and observers that there may be a little bleeding after the procedure. It is inconsequential but alarming to unprepared observers!

- **Application of topical anesthetic** via sterile cotton swab will facilitate subconjunctival injections and aid topical desensitization of the nictitans. The mucosa of the nictitans can also be injected with a small volume of local anesthetic administered through a 25 gauge needle for procedures like excision.

- **Uveitis** and **Glaucoma** are conditions that will likely require lifetime care and oversight. Acute bouts of uveitis generally require about one month of treatment with tapering doses
of topical steroids and mydriatics, and one to two weeks of systemic NSAIDs. Glaucoma may need to be treated long term. Initial medication should be three times a day but maintenance can be once or twice daily. Timolol maleate is inexpensive but other glaucoma drugs that drop intraocular pressure (IOP) are very costly and may be unaffordable. Management may require judicious use of topical steroids (with the attendant risks explained) and sometimes pulse use of systemic steroids.

- **Tips on enucleation:** Standing enucleations are frequently performed by the author for horses that are poor anesthetic risks (draft horses, very old horses, very tiny horses). Please refer to the accompanying notes on management of blindness in horses for surgical tips.

**Lavage catheters (SPL tubes)** are useful ways to deliver medication to the surface of the eye, especially in fractious horses. Mila International, Inc. ([www.milainternational.com](http://www.milainternational.com)) sells kits in two lengths (36” and 60”). The longer tubes are best for very large horses while the shorter ones are good for foals and small horses. Newer kits have a 12 G trochar swedged onto the silicone tubing. Preparation for tube placement should include braiding the mane of the horse into 5-10 braids that can be used as tubing guides. To facilitate insertion, the horse should be heavily sedated prior to insertion and the mandible should be mandible supported by a table made of bales. The steps for insertion are described:

1. Apply topical anesthetic to the globe with a syringe. Apply topical anesthetic to the fornix by holding a soaked swab to the target site to be punctured.
2. Perform auriculopalpebral and supraorbital blocks. Also block the skin over the target puncture site in the fornix, and the skin in the regions where the tape guides will be sewn.
3. Insert a gloved finger with the trochar laid along the finger length (but not beyond the tip) into the fornix. Cautiously advance the trochar to the target puncture site, taking care that it is as deep into the fornix cleft as possible. Push the trochar through the lid, then pull the tubing all the way through.
4. Take care that the footplate of the system is oriented so the oblique angle of the footplate is lined up with the angle of the fornix.

The tubing can be put in the fornix of the upper or lower lid depending on lesion location and clinician preference. The tubing must be secured to the face. This can be done by sewing adhesive tape “wings” onto the face just above the exit hole, then at one or two other intervals as needed to guide the tubing towards the poll. The green plastic U shaped guides are used by some clinicians to secure the tubing to the face, but this author prefers to use adhesive tape wings.

Then the tubing (with the trochar still attached) should be strung under the halter and woven through the mane braids. A secure pattern is to insert the trochar under the portion of the braid closest to the poll, bring it through the middle of the braid twist, then direct the tubing over the base of the braid closest to the withers, then proceed the weaving pattern (under, through, over the braid) down the neck until a braid close to the withers is reached. The trochar is then cut off and discarded and the tubing is ready to create the treatment port. The treatment port should be made by inserting a 20 gauge 1 inch catheter (included in the kit) into the tubing and then inserting by a standard catheter cap into the catheter. Tape the treatment port assembly to a half a
tongue depressor, and then tape this handy platform to the associated mane braid to make a handle to grasp to facilitate injection of medication. Sometimes it is advantageous to also sew the adhesive tape around the platform to both sides of the mane braid to prevent dislodgement.

Most specialists advise the injection of just one drug at a time through an SPL system. This is done using a tuberculin syringe and a 25 G needle, injecting 0.1 - 0.2 ml of drug at a time, and then slowly pushing the medication onto the globe with 1.0-1.5 ml of air. Subsequent medications are injected after a few minute waiting-period. Other clinicians “stack” multiple medications in the tubing without air interface, and treatment is accomplished by pushing a new set of drugs into the tubing, displacing a volume of drugs that was sitting in the tubing onto the globe. Some clinicians use infusion devices that pump a continuous cocktail of medication onto the globe at a fixed rate (Infu-disk, Mila International, www.milainternational.com). No research has substantiated the “cocktail” effect of drugs being mixed together and then applied to an infected cornea so no recommendation can be made about any treatment methods that involve mixing of drugs in a stacked or reservoir system, but some clinicians have found these methods practical and effective. The choice of solution application method should take into account the temperament of the horse, its reaction to the treatment process and the possibility of washout of medication if large volumes are pushed through in succession.

Horses that are being treated with SPLs may benefit from wearing hoods (Eyesaver, available from Jorgenson, Inc www.jorvet.com in left and right models of various sizes). The cups of the hoods can be perforated with a drill bit to optimize air circulation. The terry cloth “tear catchers” that line the hoods MUST be changed daily and may be supplemented by gauze pads to wick tears and debris. Some horses have developed serious periocular dermatitis when hood management has been lax. This author rarely uses hoods for management of SPL tubes, but often uses fly mask coverings over the systems.

Occasionally an SPL system may develop a hole in the tubing. Repair can be done by cutting the tubing and “splinting” the severed ends with a 20 G catheter. One end of the tubing can be slid around the catheter end, then the hub of the catheter can be cut off and the other end of the tubing coaxed to slide around the other end of the catheter. SPL systems have been left in place for over a month. The tubing near the footplate in the lid should be checked daily to assure that the label that reads “Mila” is located about 2 cm away from the skin puncture. This will assure that the footplate is seated securely in the tarsal conjunctiva and is not migrating towards the cornea.

Prognosis of Ophthalmic Issues

- Prognosis of orbital and periorbital disease varies with the etiology, but prompt assessment, vigorous therapy and judicious referral will optimize outcome. Client seminars or handouts discussing eye problems should stress that lumps, cuts and asymmetry of the region around the eye can be very serious, and they should schedule examination of these conditions without delay. All horses who exhibit epistaxis after skull trauma should be carefully evaluated and treated as this sign can accompany sinus fractures which can lead to orbital complications.
• **Prognosis of eyelid lacerations** or **reconstruction of acquired scars** is dependent on meticulous technique. Immediate repair of lacerations is desirable, but if the clinician is presented with an “old” injury, there may be plastic surgery strategies that will effectively reconstruct the eyelid. Prognosis of the repair is optimized if the clinician uses careful placement of small gauge sutures, and takes care in reconstructing the tarsal plate. Some severe lacerations may be stabilized by temporary tarsorrhaphy. Placement of the head of the horse on a “table” made of bales will facilitate standing surgery.

• **Prognosis of eyelid neoplasia** should always be guarded. Owners should be urged to report any odd looking growths promptly. Adnexal neoplasia cases often benefit from referral to specialists who can offer the most advanced adjunctive therapies in addition to meticulous excision.

• **Corneal ulcers** can be simple traumas that resolve uneventfully or complex problems that are among the most complicated and expensive that horses experience. Often, prompt assessment and aggressive therapy wards off disaster. Many drugs are used to treat corneal problems. Familiarity with the available medications will optimize success of treating the equine cornea. Many of these medications are human products that must be prescribed through pharmacies, compounded, or obtained at universities. The table below summarizes many of these products.

• **Immune mediated keratopathies** are some of the most challenging cases to manage. Treatment decisions may be tempered by co-existent problems like corneal ulcers or laminitis which may limit aggressive anti-inflammatory therapy. Scientific understanding of these conditions is limited and owners will be frustrated that their questions on etiology and therapeutic rationales can not be answered. Veterinarians should prepare owners of horses with immune mediated keratopathies or eosinophilic keratitis for possible recurrence and uncertain response to therapy.

• **Cataracts** are rarely operated unless congenital and complete. Lens luxation and cataract are frequent complications of uveitis. Any horse that suffers significant blunt globe trauma is at risk for later development of a cataract in that eye.

• **Uveitis** should always carry a guarded visual prognosis. An important part of management of uveitis cases is a candid discussion with the owner. The dedication necessary to treat acute episodes is significant. Expenses can mount up and the outcome can be poor even with the best management. Owners should be warned that over 50% of eyes with significant uveitis eventually lose vision (author’s data). Referring the horse to a specialist for surgical implantation of a suprachoroidal cyclosporine implant may improve visual prognosis and case management.

**Common Conditions Seen in the Field**

This section lists the most common conditions seen in anatomic order. It includes some practice tips on handling the conditions in the field. The comments are not exhaustive; they are framed to provide a perspective on the most common challenges the equine practitioner faces. More specific information can be found in the texts listed in the references.

*Orbit and Periorbit*

The most common problems seen in the periorbital region involve trauma.
Chronic **facial deformity** reflecting past trauma is often encountered in mature horses in the form of dents or abnormal contour of the facial bones, especially in the sinus region. Practitioners must be alert to any acute facial deformity that could indicate recent fractures of the frontal, temporal or zygomatic bones, sequestra formation or local abscessation in the soft tissue. Foreign body, abscess or fracture detection may require imaging with ultrasound or radiology.

Horses with acute **sinus fractures** or **sinus infections** are at risk for **orbital cellulitis** and require aggressive antibiotic therapy and/or sinus trephination and lavage. Horses with impaired eyelid function secondary to periorbital **oculomotor (CN VII) nerve trauma** will require frequent applications of topical lubricants and may require a temporary tarsorrhaphy to protect the globe. Horses that have sustained head trauma with **hyphema** where more than half of the anterior chamber is filled with blood have a guarded prognosis. If bleeding recurs the eye has a poor prognosis and may become phthisical. Horses that show any restriction or deviation in eye position or movement following blunt trauma are candidates for referral. Horses that have sustained enough trauma to the head to cause optic neuropathy may lose vision in the affected eye.

Horses may occasionally present with exophthalmos caused by **orbital tumors** or masses. Exophthalmos can be differentiated from buphthalmos by measuring globe diameter with ultrasound. Ultrasound of the orbit can give an indication of the consistency and dimensions of any abnormal tissue behind the globe. Practitioners who attempt enucleation of horses with presumptive orbital tumors should realize that hemorrhage during removal of orbital neoplasia may be excessive.

**Eyelids and Adnexa**

The most common problems seen in the eyelid region involve trauma, allergy and neoplasia.

**Eyelid lacerations** commonly occur when stabled horses rub their heads on prong like objects and avulse the eyelid margin. The incidence of eyelid trauma can be reduced if owners tape up the J shaped bases of the handles of stall buckets. Repair of eyelid lacerations in the field will be facilitated if a “surgery table” is constructed for head support using stacked bales of hay or shavings. A bright LED headlight or tripod halogen light positioned near the patient will aid visualization. Practice tips for effective closure include cleansing the wound with liberal application of 2% Betadine solution, minimal sharp debridement with a small pair of Metzenbaum scissors, and closure of the subcutaneous tissues with knots that are buried and placed sparingly. Precise apposition of the torn tarsal margin is critical and should be achieved with careful placement of a figure of eight suture that does not penetrate the conjunctiva or have tags that rub on the cornea. The author obtains excellent cosmetic results with the use of 4-0 absorbable suture for all layers, placed using a 5½ inch Olsen Hegar needle holder and a small pair of forceps. Repair of chronic lacerations that are several days old is often successful if done with great care for the preservation of anatomy.

Owners often call for emergency examinations of horses with very **swollen eyelids**. Many of these horses are suffering dramatic acute eyelid edema related to insect allergy or other seasonal irritant. If edema is the only problem, the pupil of the affected eye will be midrange and
reactive, and the surface of the cornea will be transparent and show no fluorescein dye uptake. This problem responds quickly to topical corticosteroid application, but must be differentiated from chemosis accompanying a corneal ulcer or a deeper problem in the globe.

Neoplasia of the eyelid or periorcular region is a difficult challenge for the practitioner. The most common tumors are squamous cell carcinomas and sarcoids, though melanoma, lymphoma, fibroma, mast cell tumors and other neoplasias may occur. Patients at risk for squamous cell carcinoma include draft horses and color dilute breeds that lack pigmentation in the lid region. A high level of solar radiation is also a risk factor. Field therapy for eyelid tumors may include excision and local immunotherapy, cryotherapy or infiltration of the region with chemotherapeutic agents (cisplatin or 5-fluorourasil). However, many of these patients are best served by prompt referral to a veterinary specialist who can perform excision with reconstruction and administer adjunctive therapies. Current adjunctive therapies include cryotherapy, hyperthermia, photodynamic therapy, brachytherapy and intralesional chemotherapy. Early referral gives the best chance of good long term results.

Nictitans

The most common problems seen in the nictitans are trauma, neoplasia and burdock pappus bristle keratopathy.

Minor tears of the nictitans may not cause a clinical problem. Lacerations that cause the nictitans to evert intermittently outside the eyelid margin may require excision or surgical revision of the leading edge of the nictitans.

The most common neoplasia affecting the nictitans is squamous cell carcinoma. This tumor presents as a raised or ulcerated irregular reddened region of abnormal mucosa. Occasionally it may present bilaterally. The extent of the tumor may not be appreciated until the nictitans is everted with forceps for examination. Affected horses may show profuse mucopurulent discharge. Treatment is either local excision (small masses near the leading edge) or complete excision of the nictitans (larger masses). Surgery may be performed as a standing procedure in the sedated horse. Practice tips for successful removal include supporting the horse’s head on a table made of stacked bales, heavy sedation, doing the surgery within stocks, and judicious infiltration of the mucosa of the nictitans with local anesthetic, using a tuberculin syringe attached to a 25 G needle. The base of the nictitans is attached to a large pad of orbital fat which will be pulled out of the fornix during the surgery. Complications from orbital fat prolapse are rare if the fat pad that is attached to the gland is amputated along with the nictitans.

Burdock pappus bristle keratopathy is often seen in the fall in horses that live in temperate climates like the Northeast where burdocks are a common pasture weed. The tiny bristles of the mature plant can become embedded in the mucosa of the nictitans that apposes the cornea or in the cornea itself. A hallmark of this condition is a cobblestone appearance of the inner mucosa of the nictitans, and adjacent scarring and ulceration of the apposing nasoventral corneal epithelium. Treatment involves topical anesthesia of all affected surfaces, eversion of the nictitans and debridement of both the nictitans mucosa and the affected cornea. Cytology samples should be taken to check for associated infection. Practice tips for successful resolution.
include using the open jaw of a small hemostat as a scraping instrument for the mucosa, and following hemostat debridement with judicious rubbing of the mucosa with a bit of gauze stretched over a gloved finger.

**Nasolacrimal System and Conjunctiva**

**Dacryocystitis** is a common problem in the field. Retrograde flushing of the system can be performed using a variety of thin tubes that attach to a syringe containing wash fluid including plastic teat cannulas, IV catheters, tomcat catheters and intranasal vaccine applicators. Stubborn blockages can benefit from passing a small 5 Fr nasogastric feeding tube (Mila International, NG522S, 5Fr x 55 cm) as far up the duct as it will pass. Practice tips for smooth flushing include the use of an LED headband light for illumination of the nasal puncta, application of a small dab of local anesthetic gel onto the nasal mucosa around the puncta and inclusion of a small amount of local anesthetic in the first volume of sterile wash that is flushed into the duct. Cases that present seasonally with a lot of mucopurulent discharge may benefit from the topical application of an ocular preparation containing 1% hydrocortisone or 1% dexamethasone that will medicate the system as tears drain down the duct.

**Conjunctivitis** is also a common field problem. Practitioners must understand that *conjunctivitis is rarely a primary diagnosis*—it is usually a secondary symptom of more widespread ocular inflammation. Practitioners should look for allergic, infectious, immune mediated, neoplastic or parasitic disease elsewhere in the eye as the inciting cause.

**Cornea**

**Corneal trauma** is the most common equine ophthalmic emergency. Serious sequellae including bacterial and/or fungal infection, keratomalacia, techtonic instability and uveitis can result and all these problems are complicated therapeutic and management challenges. Horses that present with signs of ocular pain, blepharospasm, epiphora and/or surface discoloration must be treated as same day emergencies and should undergo meticulous screening for **abrasions** and **ulcers**. Intense management with topical broad spectrum anti-infective agents and mydriatics, as well as systemic non-steroidal medication must be initiated immediately. Choice of therapeutic agents will always depend on diagnostic aids like cytology and culture, but various geographic regions may experience variations in colonization patterns that influence the choice of efficacious therapies.

Corneal transparency changes are also commonly seen in equine practice. The most serious of these are **stromal abscesses** which present as painful non-staining focal yellow to white densities which reflect microabscesses located within the corneal stroma. While some stromal abscesses respond to intense and prolonged medical therapy, others require resection and corneal transplantation for successful resolution. Practitioners must discern these lesions from corneal scars, and initiate comprehensive therapy immediately. **Referral should be offered when available.**
Less serious but still problematic transparency changes are seen in the group of conditions known as the **immune mediated keratopathies**. This group of diseases is poorly understood. Some variants have focal or diffuse regions of opacity limited to the stroma or endothelium and retain an intact epithelium and thus do not take up ophthalmic stains. Other variants, such as **eosinophilic keratitis** and **superficial punctate keratitis**, may involve the epithelium of the cornea and be associated with focal ulceration. Many of these conditions are recurrent. Management can be challenging but often depends on anti-inflammatory therapy (topical prednisolone acetate or dexamethasone) combined with a topical immodulating agent (compounded 2% cyclosporine).

Practitioners must be able to diagnose and treat a variety of other corneal conditions in the field including **corneal foreign bodies**, **recurrent (indolent) corneal erosions**, **corneal mineralization** and **corneal neoplasia**.

**Corneal disease is similar to podiatry in terms of the frequency of serious, career affecting problems that occur.** All equine practitioners should devote time and effort to mastering skills of recognizing, diagnosing and treating corneal disease. Failure to aggressively manage corneal problems, particularly infections and traumas can quickly lead to a chronically painful eye, loss of vision or even loss of the globe. Study of current information on corneal disease, as reported in the texts listed at the end of these notes, is a critical part of the continuing education of every ambulatory practitioner.

**Uvea**

The most common problem seen in the uvea (the iris, ciliary body and choroids) in the field is **uveitis**. Uveitis can present as **recurrent episodes (ERU)** or as persistent **insidious disease**. The pathogenesis of the syndrome is complex, involving genetic susceptibility in some cases, and exposure to infectious agents, particularly leptospirosis, in others. Recent research has demonstrated that the disease complex is immune mediated.

Intraocular inflammation in the uveal tissues is quickly followed by inflammation in other ocular structures manifesting variably as corneal edema, corneal vascularization aqueous flare, vitritis, optic neuritis and retinitis. Previous bouts of inflammation may have damaged both uveal and non uveal tissue, leaving chronic signs of damage in the form of corneal scars, synechiae, iris atrophy, cataracts and fundic scarring. The pain of acute uveitis can be severe enough to cause the horse to incur secondary trauma (ulcers, eyelid trauma, etc) from self mutilation. Thus the diagnosis of uveitis can be challenging.

Practitioners must remember that **miosis** is a **hallmark of acute uveitis**. A thorough examination is needed to sort out signs of acute inflammation from signs of secondary trauma or chronic scarring. Appropriate therapeutic intervention relies on the administration of topical mydriatics and corticosteroids, coupled with intense administration of systemic non-steroidal anti-inflammatory medication. Therapeutic decisions may, however, be tempered by the co-existence of other ocular disease such as corneal ulcers, or systemic disease concerns like gastric ulcers or laminitis.
Glaucoma is a very troublesome problem in horses and most cases are secondary to uveitis. Classic cases present as globes that are “big and blue” from corneal edema and elevated intraocular pressure. Signs of glaucoma can include focal or diffuse corneal edema, deep non-refractile linear corneal striae, superficial corneal vascularization and/or epithelial bullae and optic nerve atrophy or “cupping”. Appaloosas with insidious uveitis are at particular risk for glaucoma.

Uveitis is the leading cause of blindness in horses. Practitioners must be able to recognize the disease complex in its many presentations. Candid owner counseling with discussion of visual prognosis and explanation of the time and expense involved in managing acute relapses is critical. Practitioners should know how to prescribe aggressive therapy for acute cases and how to manage complications of chronic cases. They should also be aware of referral options, such as suprachoroidal cyclosporine implants, that may control recurrences and preserve vision.

Variations in the normal observed anatomy of the anterior uvea are frequently observed in practice, and include uveal cysts, iris hypoplasia, heterochromic irises, persistent papillary membranes, iris colobomas and hyperplastic granula iridica. Neoplasia is rare but cases of melanoma, medulloepithelioma and lymphoma have been reported in the iris and other uveal tissues.

Lens

Lens abnormalities commonly encountered in the field include cataracts and lens luxations. Both these conditions are common complications of uveitis but may also occur for other reasons.

Cataract evaluation is aided by short term mydriasis. Dilation is induced 15 – 20 minutes after 0.3 to 0.5 ml of tropicamide (Mydriacil) is applied to the corneal surface. Digital photography of cataracts is advised to document the extent of opacity, provide a baseline image for assessing progression and demonstrate the lesion to the owner. Lens opacities should be described using the classification system proposed by Matthews (see references below) which specifies the anatomic location (capsulolenticular, lenticular; zonal, anterior capsule, axial, sutural, perinuclear, equatorial, and complete), physical appearance (diffuse, crystalline, vacuolated, floriform, elliptic) and etiology (acquired or developmental) of the lesion.

Extracapsular phacoemulsification discussion and aspiration surgery is advisable for foals under 6 months of age that present with congenital cataracts. Phacoemulsification surgery may also be appropriate for a some affected adult horses but case selection is important as post operative complications for of adult horses undergoing cataract surgery are common. Owners of horses that suffer severe blunt trauma should be cautioned that cataract formation often occurs several months after the trauma due to autoimmune reaction to lens proteins normally sequestered from the immune system. Lens luxation is common in Appaloosa horses that suffer insidious uveitis and may be seen in other horses with uveitis or in horses that sustain blunt trauma. Most posterior luxations are asymptomatic, but anterior luxations may cause pain. Intracapsular cataract surgery for removal of a luxated lens is associated with poor results in the horse.
**Vitreous**

The vitreous is a clear, gel-like substance that fills the posterior segment. The most common abnormal field findings include the presence of optically refractile elements within the vitreous, liquefaction of the gel and inflammatory changes (vitritis).

**Optically refractile elements in the vitreous** are best appreciated by retroillumination against the tapetal reflection. They can appear as small dust-like opacities, as thread-like filaments, as focal highly refractile crystals or as tangled clumps of material. Larger densities may or may not be attached to the posterior lens capsule. Small focal densities are common and usually of no clinical significance.

**Liquifaction of the vitreous** is most commonly observed as a function of aging but may also accompany uveitis. Liquified vitreous is best appreciated when the horse’s head is moved enough to cause ocular saccades (globe movements). Small densities present within a liquefied vitreous can be seen to swirl within the globe as if they are suspended in oil.

The most common causes of **vitritis** are posterior uveitis and ocular trauma. Following the influx of inflammatory proteins and blood cells into the posterior segment, the normally transparent vitreous assumes a yellow to orange hue and appears cloudy. The observable fundic image then appears hazy and the optic disc appears orange tinted when seen through the filter of the inflamed vitreous. In sequential examinations, resumption of a sharp fundic image of normal color is a sign that vitritis has subsided, while persistence of a hazy orange tinged disc image and blurred fundic detail indicates continued inflammation.

**Fundus**

Most equine practitioners use direct ophthalmoscopy to perform fundic examinations in the field. Assessment will be most complete if the examination is done in the dark and the pupils are dilated with tropicamide (Mydriacil). Induction of dilation takes 15-20 minutes so the timing of the examination must be planned accordingly.

Identification of the major structures that can be seen on fundic examination (tapetal and non-tapetal portions of the fundus, optic nerve head, retinal vasculature and choroidal vasculature) is relatively easy as these structures can be seen just ventral to the axis, and each is distinct in shape, color and position. The major challenge that practitioners face is recognizing the wide variation in “normal” clinical findings that occur, and discriminating these from true pathology. Most aberrations and common pathologic changes are visible within one to two disc diameters of the optic disc border and thus are readily observable.

Skills in fundic examination will be enhanced by studying photographs of normal and abnormal fundic images in textbooks (See references at the end of proceedings: Barnett, Gilger, Brooks, Gelatt) and by performing a large number of fundic exams on horses of various ages, colors, breeds and sizes. Observable **pigment patterns** of the tapetal fundus and non tapetal fundus are highly variable and often correlated with coat color. The degree to which the **choroidal vasculature** can be seen is dependent on the intensity of the pigment expressed. Slight
variations in the observable shape of the optic disc, the contour of its border, and the pattern of vessels that cross the disc surface are common. Practitioners must be able to recognize these normal papillary variants and also identify findings such as circumpapillary pigment variants, ectopic myelination of ganglion cell axons, persistant hyaloid artery remnants, tapetal pigment variations, partial albinism, tapetal naevi and certain small colobomas of the fundus as variants of the peripapillary region.

Practitioners must also learn to recognize the footprints of disease in the fundus. The most common lesions observed are pigmentary retinopathies. The most common of these are focal chorioretinitis (also termed “bullet hole lesions”), peripapillary chorioretinitis (sometimes called “butterfly lesions”) and senile retinopathy. While lesions of focal or peripapillary chorioretinitis are probably acquired presumably from previous inflammation or blunt trauma, the determination of their clinical significance in an individual horse can be difficult. These lesions can be problematic in the prepurchase examination. Senile retinopathy is a common bilateral finding in horses over the age of fifteen.

Other fundic pathology may be observed, and the practitioner should study texts to interpret the significance of observed lesions. Focal proliferative optic neuropathy is not uncommon in older horses and must be distinguished from optic neuritis, neoplasia or traumatic neuropathy. Practitioners must also be able to discern signs of retinitis, retinal or optic nerve atrophy and retinal detachment.

Ophthalmic Issues at Various Life Stages in Horses

Practitioners should study atlases to assure that they can recognize the listed condition and should be alert to detecting the following conditions as they examine horses through the stages of their lives.

Neonatal-congenital at birth
- Microphthalmos
- Lacrimal puncta agenesis or duct atresia
- Strabismus
- Dermoids
- Aniridia
- PPMs (persistant papillary membranes)
- Anterior segment dysgenesis (may not be noticed till maturity)
- Congenital cataracts
- Coloboma
- Persistant hyaloid artery
- Congenital glaucoma or retinal detachment (rare)

Neonatal-acquired in first days or through birth process
- Entropion (be vigilant for this in sick foals)
- Subconjunctival hemorrhage
- Retinal hemorrhage
- Uveitis secondary to septicemia
• Jaundice secondary to neonatal isoerythrolysis (scleral icterus)
• Various manifestations of HIE (hypoxic ischemic encephalopathy)
• Ulcers: Uncomplicated, melting, infected, or persistent erosions
• Secondary manifestations of adenovirus, botulism

**Pediatric**
• Blunt head trauma—concussive during pasture roughhousing or training accidents—can cause acute blindness
• Blunt globe trauma—as above
• Sharp facial or lid trauma
• Uveitis secondary to R. Equi or strangles
• Corneal ulcers
• Vitiligo

**Mature Horses**
• Trauma: blunt and sharp
• Corneal ulcers
• Uveitis
• Squamous cell carcinoma
• Sarcoid

**Geriatric Horses**
• Sinus disease with ocular manifestations
• Periocular neoplasia
• Indolent ulcers
• Cataract
• Glaucoma
• Insidious uveitis
• Vitreal syneresis
• Asteroid hyalosis/Synchesis scintillans
• Senile retinopathy
• Proliferative optic neuropathy

**The Ophthalmic Portion of the Prepurchase Examination**

Practitioners frequently perform prepurchase examinations for buyers. These examinations are intended to discover and disclose medical information pertinent to the intended use of the horse. These examinations do not “pass” or “fail” horses, but all findings should be summarized in a report that the buyer can use to make the decision on whether or not to buy the horse. Buyers expect the examining veterinarian to render an opinion on the significance of any abnormal findings.

An ophthalmic examination is a critical part of the prepurchase examination. The examination is a thorough inspection of the skull, adnexae and globes. It is commonly performed using a bright light (ideally a Finoff transilluminator, but a good penlight is acceptable) and a direct
ophthalmoscope. The horse should be assessed in both bright light and in a very dark area. The report should record any lesions or variants that are detected. It is advisable to write the report in such a way that each anatomic region of both eyes is assessed individually (Skull, globe, adnexae, cornea, anterior chamber, iris, lens, vitreous, fundus).

Many practitioners examine the globes in both an undilated and a dilated state during the examination. This practice (which involves the application of about 0.5ml of tropicamide solution to the surface of each globe about 20 minutes prior to the dilated examination) is recommended as it allows a comprehensive evaluation of each lens, a wider view of the fundus, and it checks for the presence of synechia. However, the dilation process is not a universal one as some sellers may not allow dilation and some practitioners do not carry tropicamide. The prepurchase report should state whether the examination included pupil dilation or not. Some practitioners may also include tonometry as part of their prepurchase examinations.

Problems arise in prepurchase examinations when findings are missed because of an incomplete examination or inexperience on the part of the examiner. It is also problematic when a clinically insignificant variant is interpreted as a major lesion, or a major lesion is interpreted as a normal variant. Practitioners preparing prepurchase reports will be aided by consulting, and in some instances citing, information from current ophthalmic reference texts and atlases listed in the references below (Gilger, Barnett, Brooks, Gelatt). The following tables give some guidelines as to findings that are very significant, findings of uncertain significance and findings that are likely normal variants. Practitioners are well advised to study the atlases and texts cited to be sure they can recognize the various conditions listed.

**Prepurchase Examination Findings That Are Very Significant**

**GLOBE:** Exophthalmos, microophthalmos, enophthalmos or buphthalmos, pronounced or unilateral strabismus, elevated IOP, phthisis bulbi  
**ADNEXAE:** Sarcoids or other adnexal tumors, dysplasia of eyelid tissue or conjunctiva, ectropion or entropion, lid motility disorder, trichiasis, chalazion  
**CORNEA:** Large corneal axial scars, multiple punctate corneal opacities, mineralized corneal deposits, corneal edema, multiple corneal stria, corneal vascularization,  
**ANTERIOR CHAMBER:** Flare, hyphema or hypopyon  
**IRIS:** Miosis, impaired pupillary light reflex(es), eccentric pupil shape, synechia  
**LENS:** Mature cataracts, extensive cortical cataracts, lens luxation or subluxation  
**VITREOUS:** Vitritis, multiple opacities in the vitreous  
**FUNDUS/RETINA:** Extensive peripapillary chorioretinitis with vessel attenuation, retinal detachment, optic nerve atrophy, optic neuritis

**Prepurchase Findings That Are Uncertain in Terms of Prognostic Significance**

**GLOBE:** Slight strabismus  
**ADNEXAE:** Signs of past sinus trauma-dents or raised areas, eyelid coloring that lacks pigment, solar blepharitis  
**CORNEA:** Small focal corneal scars, single corneal stria, pigment deposit on the cornea with no other ocular abnormalities, lipid deposits in the cornea.
ANTERIOR CHAMBER: Corneal curvature may be increased in some miniature horses and Rocky Mountain Horses, or horses with silver dapple color
IRIS: Large iridal cysts, iridal hypoplasia, large granula iridica cysts
LENS: Pigment deposit on the lens with no other ocular abnormalities, small focal cataracts
VITREOUS: Vitreal syneresis, vitreal membranes
FUNDUS/RETINA: Focal chorioretinopathy without other ophthalmic abnormalities, diffuse (butterfly wing) peripapillary chorioretinitis without other ophthalmic abnormalities, proliferative optic neuropathy, senile retinopathy

Prepurchase Findings That May be Variants or Minor Blemishes

GLOBE: Variations in pigment on the sclera
ADNEXAE: Small healed traumatic notches in the tarsal margin or nictitans
CORNEA: Small scar not on visual axis with firm history of diagnosis, treatment and resolution
IRIS: PPMs that bridge iris stroma, small iris colobomas or naevi, heterochromia iridis, small granula iridica cysts
LENS: Small vacuolations in the lens, Mittendorf’s dot, faint retrolenticular fibroplasias, prominent suture lines in the lens
VITREOUS: Small focal inclusions in the vitreous, persistent hyaloid vasculature
FUNDUS/RETINA: Variations in color of the tapetum, partial albinism, circumpapillary marginal pigment proliferation, a few scattered chorioretinal scars, ectopic myelination of the disc, small fundic pigment colobomas

Most practitioners opt to err on the side of caution when preparing their report of ophthalmic findings. When equivocal lesions are discovered, it is advisable to give buyers the option of obtaining a second opinion from a board certified veterinary ophthalmologist who may be able to provide additional prognostic expertise or advanced testing. Even if the buyer declines this option, the report should document that referral was offered and discussed.

Drugs, Dosages, and Indications

Listed below are tables that detail the major drugs used to treat periocular disease, corneal disease, and uveitis, glaucoma and immune mediated keratitis.

### Drugs, Dosages, and Indications for Treatment of Periocular Disease

<table>
<thead>
<tr>
<th>Key Drug</th>
<th>Drug Class</th>
<th>Dose Range</th>
<th>Frequency</th>
<th>Route</th>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisplatin*</td>
<td>Chemotherapy</td>
<td>inject at 1 mg per cm³, tumors up to 20 cm³</td>
<td>3 or more sessions at 2 week intervals</td>
<td>Intrallesional*</td>
<td>Certain neoplasias, esp. squamous cell carcinoma. Can inject on same day as excisional surgery.</td>
</tr>
<tr>
<td>1mg/ml; Can order in 50 or 250 ml bottles from Florida Infusion, mix with small volume of sterile sesame Oil to emulsify</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-FU* (Efudix 5% cream)</td>
<td>Chemotherapy</td>
<td>Cover the lesion with cream</td>
<td>Q 12 - 24 h for 7 days</td>
<td>Topical*</td>
<td>Certain neoplasias Sarcoids</td>
</tr>
<tr>
<td>5-Fluorouracil</td>
<td>Chemotherapy</td>
<td>Inject 1 ml</td>
<td>4 or more</td>
<td>Intrallesional</td>
<td>Sarcoid, certain</td>
</tr>
<tr>
<td>Drug/Method</td>
<td>Description</td>
<td>Dosage/Intervals</td>
<td>Notes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-Fluorouracil (1%)-injectable</td>
<td>Chemotherapy Topical, after treatment of ocular masses</td>
<td>Apply 1/4&quot; strip TID per cm³ of mass</td>
<td>Clinician preference—minimum one month? Topical, in conjunctival sac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-Fluorouracil (1%)-compounded ophthalmic ointment</td>
<td></td>
<td>sessions at 2 week intervals</td>
<td>Topical, in conjunctival sac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X terra</td>
<td>Immunotherapy</td>
<td>Cover lesion with paste 1/8-1/4&quot; thick Daily for 4-6 days. May repeat if no response</td>
<td>Topical paste Sarcoïd, possibly other neoplasias CAUTION ADVISED IF LESION IS CLOSE TO GLOBE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCG</td>
<td>Immunotherapy</td>
<td>Inject 1 ml/cm³ of mass Repeat q 2-4 wks for up to 6 txmts</td>
<td>Intralesional Sarcoïd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple Antibiotic with 1% Hydrocortisone ointment or drops</td>
<td>Corticosteroid with antibiotic 1/4 inch strip ointment</td>
<td>Q 6 - 24 h Topical **</td>
<td>Chemosis, Allergic or Solar blepharitis, Dacryocystitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NOTE: Does not penetrate the cornea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple Antibiotic with 0.1%*dex-amethasone ointment or drops</td>
<td>More potent corticosteroid with antibiotic 1/4 inch strip ointment</td>
<td>Q 6 - 24 h Topical **</td>
<td>Chemosis, Allergic or Solar blepharitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple Antibiotic ointment</td>
<td>Antibiotic 1/4 inch strip of ointment</td>
<td>Q 6 - 24 h Topical</td>
<td>Antibiotic for lid repair followup, minor purulent dacryocystitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimmune Cyclosporine A 0.2%</td>
<td>Immune modulator</td>
<td>1/4 inch strip of ointment</td>
<td>Solar Blepharitis, not effective on corneal disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procaine Penicillen G (PPG) 300,000iu/ml</td>
<td>Antibiotic</td>
<td>15,000-44,000 mg/kg Q 12 h Intramuscular ONLY</td>
<td>Orbital infection/trauma in combo with Gentamycin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gentamycin Sulfate 100mg/ml</td>
<td>Antibiotic</td>
<td>6.6 mg/kg Q 24 h Intramuscular, intravenous</td>
<td>Orbital trauma/infection—use in combo with PPG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceftiofur sodium (Naxcel), 4 gms per 80 ml bottle, 50 mg/ml</td>
<td>Antibiotic</td>
<td>2.2 mg/kg Q 24 hr Intramuscular,</td>
<td>Alternative broad spec antibiotic for orbital infection or severe trauma, $$$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trimethoprim Sulfadiazine, Double strength (960mg)</td>
<td>Antibiotic</td>
<td>20-30 mg/kg Q 12 h Oral</td>
<td>Antibiotic for lid laceration or corneal infection</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: The use of Trimethoprim Sulfadiazine is restricted to veterinary use and should be prescribed under veterinary supervision.*
* Not available through veterinary distributors, must write prescription to fill at human pharmacy.

** hard to find at all, generally must be compounded

*** available over the counter at human pharmacies.

**** may only be available at referral institutes

### Drugs, Dosages, and Indications for Treatment of Corneal Problems

<table>
<thead>
<tr>
<th>Key Drug</th>
<th>Drug Class</th>
<th>Dose Range</th>
<th>Frequency</th>
<th>Route</th>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atropine HCL</td>
<td>Mydriatic</td>
<td>1/4 inch strip or 0.1 ml (drops)</td>
<td>Q 6-12 h</td>
<td>Topical SPL</td>
<td>Dilate miotic pupil, Control pain of ciliary spasm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reduce freq, once dilated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple Antibiotic</td>
<td>Antibiotic</td>
<td>1/4 inch strip</td>
<td>Q 6-2 h</td>
<td>Topical</td>
<td>Ulcers, minor</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>Antibiotic</td>
<td>1/4 inch strip</td>
<td>Q 2-8 h</td>
<td>Topical</td>
<td>Ulcers, gram positive and gram negative</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>Antibiotic</td>
<td>1/4 inch strip or 0.1-0.2 ml (fortified is 33 mg/ml)</td>
<td>Q 2-8 h</td>
<td>Subconj inj</td>
<td>Ulcers, gram negative</td>
</tr>
<tr>
<td>Amikacin</td>
<td>Antibiotic</td>
<td>0.2 ml of 10-15 mg/ml</td>
<td>Q 2-8 h</td>
<td>Topical SPL</td>
<td>Ulcers sensitive to drug, esp. gram negative</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25 mg</td>
<td>Can repeat</td>
<td>Subconj. Inj</td>
<td></td>
</tr>
<tr>
<td>Tobramycin</td>
<td>Antibiotic</td>
<td>1/4 inch strip or 0.1-0.2 ml of 15 mg/ml 20-40 mg</td>
<td>Q 2-8 h</td>
<td>Topical SPL</td>
<td>Ulcers, gram positive and gram negative</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Can repeat</td>
<td>Subconj. Inj</td>
<td></td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>Antibiotic</td>
<td>1/4 inch strip or 0.1 –0.2ml solution</td>
<td>Q 2-8 h</td>
<td>Topical SPL</td>
<td>Ulcers, gram positive and gram negative</td>
</tr>
<tr>
<td><em>Moxifloxacin</em></td>
<td>Antibiotic</td>
<td>0.1 ml solution</td>
<td>Q 2-8 hr</td>
<td>SPL</td>
<td>Very broad spectrum, little resistance, $$$</td>
</tr>
<tr>
<td>Oxacillen</td>
<td>Antibiotic</td>
<td>0.1 ml of human drops</td>
<td>Q 2-8 h</td>
<td>Topical SPL</td>
<td>Ulcers, sensitive to drug</td>
</tr>
<tr>
<td>Cefazolin</td>
<td>Antibiotic</td>
<td>0.1-0.2 ml</td>
<td>Q 2-8 h</td>
<td>Topical SPL</td>
<td>Ulcers, gram positive</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Subconj inj</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Can repeat</td>
<td></td>
</tr>
<tr>
<td>2% povidone</td>
<td>Anti-infective</td>
<td>0.1 –0.2ml</td>
<td>Q 6 h</td>
<td>Topical</td>
<td>Suspected fungal ulcers</td>
</tr>
<tr>
<td>Drug</td>
<td>Type</td>
<td>Dose/Route</td>
<td>Frequency</td>
<td>Application Area</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------------</td>
<td>-----------------------------</td>
<td>-------------------------</td>
<td>-----------</td>
<td>-----------------------------------</td>
<td></td>
</tr>
<tr>
<td>Iodine mix at 1 part betadine/50 pts saline</td>
<td>Anti-infective burn cream</td>
<td>1/4 inch strip cream</td>
<td>Q12 h</td>
<td>Topical</td>
<td></td>
</tr>
<tr>
<td>Silver sulfadiazine</td>
<td>Anti-fungal</td>
<td>1/4 inch strip ointment</td>
<td>Q 6 h</td>
<td>Fungal ulcers</td>
<td></td>
</tr>
<tr>
<td>**1% Itraconazole/30%DMSO in petroleum</td>
<td>Anti-fungal</td>
<td>1/4 inch strip ointment</td>
<td>Q 6 h</td>
<td>Fungal ulcers</td>
<td></td>
</tr>
<tr>
<td>****Natamycin (Natacyn, Alcon Laboratories) dilute from vials, expect a cake frosting like residue</td>
<td>Anti fungal</td>
<td>0.1%. 0.1-0.2ml</td>
<td>Q 6 h</td>
<td>Fungal ulcers</td>
<td></td>
</tr>
<tr>
<td>****Voriconazole</td>
<td>Anti fungal</td>
<td>1/4 inch strip Cream</td>
<td>Q 4-6 h</td>
<td>Fungal ulcers</td>
<td></td>
</tr>
<tr>
<td>Clotrimazole</td>
<td>Anti yeast</td>
<td>1/4 inch strip cream</td>
<td>Q 6 h</td>
<td>Fungal ulcers, available though AMATHEON, $$</td>
<td></td>
</tr>
<tr>
<td>**Itraconazole</td>
<td>Antifungal</td>
<td>3 mg/kg</td>
<td>Q 12 h</td>
<td>Fungal ulcers (Compounded in Ky)</td>
<td></td>
</tr>
<tr>
<td>Fluconazole</td>
<td>Antifungal</td>
<td>Load ONCE with 14 mg/kg, then 5 mg/kg maintenance</td>
<td>Q 24 hr</td>
<td>Fungal ulcers (Compounded in Ky)</td>
<td></td>
</tr>
<tr>
<td>Clotrimazole</td>
<td>Anti yeast</td>
<td>1/4 inch strip cream</td>
<td>Q 6 h</td>
<td>Ulcers with yeast infx.: Off label</td>
<td></td>
</tr>
<tr>
<td>***Muro 128 (hypertonic saline)</td>
<td>Osmotic agent</td>
<td>1/4 inch strip ointment</td>
<td>Q 8-12 h</td>
<td>Clear corneal edema</td>
<td></td>
</tr>
<tr>
<td>*Flubiprofen (Ocufen)</td>
<td>NSAID</td>
<td>0.1 ml</td>
<td>Q 6-12 h</td>
<td>Keratitis, idiopathic</td>
<td></td>
</tr>
<tr>
<td>*Diclofenac (Voltaren)</td>
<td>NSAID</td>
<td>0.1 ml.</td>
<td>Q 6-12 h</td>
<td>Keratitis, painful keratopathy. $$ but often very effective</td>
<td></td>
</tr>
<tr>
<td>Adequan (dilute with art. Tears)</td>
<td>Topical anti-inflammatory</td>
<td>Mix to 50 mg/ml</td>
<td>Q 6-12 h</td>
<td>Keratitis Non-healing ulcers</td>
<td></td>
</tr>
<tr>
<td>Serum, autologous or homologous</td>
<td>MMP inhibitor Serine protease inhibitor</td>
<td>Undiluted, 0.1-0.2 ml per treatment (replace stock every 5-7 days)</td>
<td>Q 1-6 h</td>
<td>Melting ulcer Prevent collagenolysis Non-healing ulcer</td>
<td></td>
</tr>
<tr>
<td>Doxycycline 500 mg tablets</td>
<td>MMP inhibitor Antibiotic</td>
<td>5-10 mg/kg</td>
<td>Q 12 h</td>
<td>Melting corneal ulcer; lower dose is anti-inflammatory</td>
<td></td>
</tr>
<tr>
<td>Disodium</td>
<td>MMP inhibitor</td>
<td>0.17% to 1.0%</td>
<td>Q 1-6 h</td>
<td>Melting ulcer</td>
<td></td>
</tr>
</tbody>
</table>

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| **EDTA**  
(can be made by adding 1 to 5 ml water to EDTA blood tube) | Chelating agent (Ca and Zn) | solution: 0.1-0.2ml ointment: 1/4 inch strip | Concentrated form is applied to eye via a soaked swab | Held against mineral deposit until it loosens | Topical on swabs | Topical chelation of calcific keratopathy |
|---|---|---|---|---|---|---|
| **N-acetyl-Cysteine**  
Dilute the 20% solution to 5-10% with water | MMP inhibitor Chelating agent (Ca and Zn) | 5-10% sol’n 0.1-0.2ml | Q 1-6 h | Topical | Melting ulcer—prevent collagenolysis |
| ****Ilomastat**  
(Galardin) | Mmp inhibitor Chelating agent 9Ca and Zn | 0.1% 0.1-0.2ml | Q 1-6 h | Topical | Melting ulcer—prevent collagenolysis |
| **Tetanus antitoxin** | Immune globulin reduces collagenolysis | 1 ml | Single injection | Subconjunctival injection | Melting ulcer |
| ****Tissue Plasminogen Activator (TPA)** | Fibrin dissolution | 50 to 150 micrograms (kept frozen at referral ctrs) | Single intracameral injection | Inject in anterior chamber under gen. Anesthesia | Extensive fibrin in Anterior chamber. Referral procedure, contraindicated if hemorrhage is present. |
| *Idoxuridine**  
(Stoxil, Herplex Liquifilm) | Antiviral | 1/4” strip or 0.1 –0.2ml | Q 4-6 h | Topical | Punctate keratitis Some superficial keratitis |
| Cromolyn sodium 1%  
(Crolom) | Mast cell stabilizer | 0.1 ml | Q 6-12 h | Topical drop | Eosinophilic keratoconjunctivitis |
| **Phenylbutazone** | Anti-inflammatory | 2.2-4.4 mg/kg | Q 12-24 h | Oral | Various inflammatory conditions,pain control |
| **Flunixin meglumine** | Anti-inflammatory | 0.25 – 0.5 mg/kg | Q 12-24 h | Oral, intravenous | Various inflammatory conditions,pain control |
| **Dexamethasone** | Anti-inflammatory | ¼ inch strip or 0.2 ml | Q 6-24 h | Topical | Various inflammatory conditions where the corneal epithelium is intact. |
| **Triamcinolone**  
(Vetalog, 6mg/ml)) | Anti-inflammatory | 1-6 mg | Single injection | Subconjunctival injection | Selected ocular inflammations with intact corneas (do NOT use Depo-medrol) |
| SPL lavage system kits  
Mila International  
859-371-1722 | Treatment device | 60” length for large horses; 36” for small horses and foals; cut to fit | Treatment can be given as often as needed | Topical treatment device | Deep ulcer therapy Topical therapy for fractious horses |
* Not available through veterinary distributors, but available by prescription through human pharmacies.
** hard to find at all, generally must be compounded
*** available OTC at human pharmacies.
**** may only be available at referral institutes or specialized distributors.

## Drugs, Dosages, and Indications for Treatment of Uveitis, Glaucoma, and Some Cases of Immune Mediated Keratitis

<table>
<thead>
<tr>
<th>Key Drug</th>
<th>Drug Class</th>
<th>Dose Range</th>
<th>Frequency</th>
<th>Route</th>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atropine HCL 1%</td>
<td>Mydriatic</td>
<td>1/4 inch strip or drops, 0.1 ml</td>
<td>Q 6-48 h</td>
<td>Topical</td>
<td>Dilate pupil and decrease pain from ciliary spasm</td>
</tr>
<tr>
<td>Phenylephrine 10% (phenoptic, neo-synephrine)</td>
<td>Mydriatic</td>
<td>Drops</td>
<td>Q 6-8 h</td>
<td>Topical</td>
<td>Can be epitheliotoxic-use only if atropine fails to dilate pupil.</td>
</tr>
<tr>
<td>Prednisolone acetate 1%</td>
<td>Corticosteroid</td>
<td>Drops, 0.1 ml</td>
<td>Q 1-6 h</td>
<td>Topical</td>
<td>Anti-inflammatory, good penetration</td>
</tr>
<tr>
<td>Dexamethasone HCL 0.5%-1%</td>
<td>Corticosteroid</td>
<td>Drops or ointment</td>
<td>Q 4-6 h</td>
<td>Topical</td>
<td>Anti-inflammatory, good penetration</td>
</tr>
<tr>
<td>Flurbiprofen 0.03% (*Ocufen)</td>
<td>Topical NSAID</td>
<td>Drops, 0.1 ml</td>
<td>Q 1-6 h</td>
<td>Topical</td>
<td>Non steroidal anti-inflammatory</td>
</tr>
<tr>
<td>Diclofenac 0.1% (*Voltaren)</td>
<td>Topical NSAID</td>
<td>Drops, 0.1 ml</td>
<td>Q 6-12 h</td>
<td>Topical</td>
<td>Non-steroidal anti-inflammatory. $$ but potent</td>
</tr>
<tr>
<td>Cyclosporine A 2% **Best to order this compounded; commercial prep 0.2% is not effective on corneas</td>
<td>Immuno-suppressant (Poor ocular penetration)</td>
<td>Ointment 1/4 inch strip</td>
<td>Q 6-12 h</td>
<td>Topical</td>
<td>Suppresses inflammation, can be used on ulcerated eye, may help insidious cases with solar blepharitis, KCS, NKU</td>
</tr>
<tr>
<td>Timolol maleate 0.5% (Timoptic)</td>
<td>Beta blocker to decrease aqueous</td>
<td>Drops or gel</td>
<td>Q 12 h</td>
<td>Topical</td>
<td>Glaucoma secondary to uveitis</td>
</tr>
<tr>
<td>Dorzolamide 2% (*Trusopt)</td>
<td>Carbonic anhydrase inhibitor to decrease aqueous</td>
<td>Drops, 0.1 ml</td>
<td>Q 12 h</td>
<td>Topical</td>
<td>Glaucoma secondary to uveitis</td>
</tr>
<tr>
<td>Timolol/Dorzolamide (*Cosopt)</td>
<td>Combo drug for glaucoma</td>
<td>Drops, 0.1 ml</td>
<td>Q 12 h</td>
<td>Topical</td>
<td>Glaucoma unresponsive to either drug alone. $$</td>
</tr>
<tr>
<td>Flunixin</td>
<td>NSAID</td>
<td>0.25 – 0.5 mg/kg</td>
<td>Q 12 h for 5 days, then as PO, IV, IM</td>
<td>Uveitis, pain, swelling</td>
<td></td>
</tr>
<tr>
<td>Drug</td>
<td>Class</td>
<td>Dosage</td>
<td>Administration</td>
<td>Frequency</td>
<td>Indications</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
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<td>-------------</td>
</tr>
<tr>
<td>Meglumine</td>
<td>Needed</td>
<td>Q 12-24 h</td>
<td>PO or IV</td>
<td>Uveitis, pain, swelling</td>
<td></td>
</tr>
<tr>
<td>Phenylbutazone</td>
<td>NSAID</td>
<td>2.2-4.4 mg/kg</td>
<td>Q 12 - 24 hr</td>
<td>PO or IV</td>
<td>Uveitis, pain, swelling</td>
</tr>
<tr>
<td>Dexamethasone</td>
<td>Corticosteroid</td>
<td>.01-.1 mg/kg</td>
<td>Q 12-24 h loading</td>
<td>PO or IM</td>
<td>Uveitis—be cautious of laminitis risk and taper dose once loaded</td>
</tr>
<tr>
<td>Triamcinolone (Vetalog)</td>
<td>Corticosteroid</td>
<td>2-6 mg</td>
<td>1x, can repeat in 7-21 days</td>
<td>Subconj. Inj.</td>
<td>Uveitis</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>Antibiotic</td>
<td>10 mg/kg</td>
<td>Q 12 h for 4 weeks</td>
<td>PO</td>
<td>Anti-leptospiral infection therapy; intraocular penetration uncertain</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>Antibiotic</td>
<td>4mg injection; must dilute</td>
<td>Once SPECIALIST ONLY</td>
<td>Intravitreal injection under general anesthesia</td>
<td>May decrease signs in leptospiral associated cases, but there are safety concerns.</td>
</tr>
<tr>
<td>Cyclosporine A</td>
<td>Immune suppression in the posterior segment</td>
<td>Implant yields slow release of drug</td>
<td>Surgical implant under sclera</td>
<td>Many ACVO diplomats have access to the implants through Dr. Gilger (NC STATE)</td>
<td>Uveitis, best patients are those with EARLY, uncomplicated disease that is quiescent at surgery time. Improves visual prognosis. Requires general anesthesia usually.</td>
</tr>
<tr>
<td>Tacrolimus, sirolimus, rapamycin</td>
<td>Immune suppression</td>
<td>Research drugs under development</td>
<td>Awaiting results of clinical trials</td>
<td>Under investigation</td>
<td>Topical/intraocular</td>
</tr>
</tbody>
</table>

**References and Suggested Reading**

*Field Equine Ophthalmology*


*Texts and General References on Equine Ophthalmology*


**Recent Monographs and Updates**


**Ocular Digital Photography of Horses**


**Internet Resource for Owners of Blind Horses and Horses with Uveitis**

[www.blindhorses.org](http://www.blindhorses.org)
Great outline format with lots of anatomic detail, extensive references, links to lecture outline by Dr. Dennis Brooks on equine eye problems