How to differentiate and treat common eye conditions of the horse

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How to perform an equine ophthalmic examination

For the conditions discussed in these proceedings, the most common reason for their presentation is a painful eye. Collecting the signalment and history is important as these can influence your initial differentials list, particularly important history is duration and if there's been prior episodes. For a painful eye, owners will likely notice squinting or a closed eye, and tearing, on an ophthalmic exam this translates to reduced eyelash angle (stand in front of the horses and assess symmetry), blepharospasm and identified during the general physical examination. As some ophthalmic conditions can be a manifestation of a systemic disease process it is important to complete a physical exam before proceeding with an ophthalmic exam. To facilitate a thorough ophthalmic exam and to minimise patient stress, the horse should be sedated (e.g. alpha-2 agonist IV). However, assessing the neuro-ophthalmic component of the ophthalmic exam must be performed prior to sedation and nerve blocks.

For a comprehensive equine ophthalmic exam in the field, perform the following in order (Dwyer and de Linde Henriksen 2022):

- Signalment, history, distance exam and physical exam
- Neuro-ophthalmic exam bilaterally:
  - Menace (II – occipital cortex – cerebellum - VII) – assesses vision.
  - Dazzle (II – brainstem - VII) – important to check for a dazzle if menace negative.
  - PLR (II – brainstem - III) – both direct and indirect should be performed.
  - Palpebral reflex (V – VII) – loss of motor innervation can lead to corneal ulcers.
- Sedate intravenously and perform auricular palpebral block to facilitate a thorough exam.
  - The auricular palpebral nerve can be palpated where it lies over the zygomatic arch caudal to the frontal bone's bony process. Overlying this landmark, administer 1-2ml of anaesthetic agent via a 25-guage needle subcutaneously. This reduces the strength of eyelid closure.
- Collect samples for culture if indicated prior to applying topical agents (e.g. complicated corneal ulcer).
  - Using a sterile cotton-tip applicator, cytobrush or back of a sterile scalpel blade.
  - Bacterial and/or fungal culture can be submitted to a commercial laboratory.
- Apply topical mydriatic (e.g. tropicamide) to dilate the pupil, facilitating the fundic exam.
- Direct illumination bilaterally of adnexa and anterior structures using Finnoff transilluminator light source, and if available a direct ophthalmoscope.
  - Best performed in a dark environment, bilaterally.
  - External: Eyelids, third-eyelid, bulbar and palpebral conjunctiva, sclera, and cornea.
  - Internal: anterior chamber using the 'slit' beam on the direct ophthalmoscope, and iris.
- Apply topical anaesthesia (e.g. tetracaine or proparacaine).
  - Facilitates: collecting cytology samples of a corneal ulcer, assess behind the third-eyelid, and tonometry (if available), collect culture samples if not tolerated without anaesthesia.
  - Use a sterile cotton-tip applicator, cytobrush or back of a sterile scalpel blade and roll the sample gently onto slides – perform cytology in-house or send to a commercial laboratory.
- Sodium fluorescein staining to detect corneal ulceration, ideally using a cobalt blue light.

- Fundic exam and lens assessment using a direct ophthalmoscope, ideally in a dark environment.
  - Perform bilaterally at the end to allow for pupil dilation from mydriatic application.
  - Fundus: assess tapetum, non-tapetum, optic disk, retinal vasculature.
  - Lens: assess for cataracts, subluxation and luxation.
- +/- Ocular ultrasound
  - Useful to assess internal structures (vitreous, lens, retina and comparison of ocular size to the contralateral eye) when there's severe corneal/anterior disease prohibiting the fundic exam.
- Record findings and take photographs for monitoring purposes.

Ulcerative keratitis (corneal ulcer) in horses

Cases of equine ulcerative keratitis typically present with blepharospasm, epiphora, reduced eyelash angle and conjunctival hyperaemia. There are different types and aetiologies for corneal ulcers: simple non-infectious, those complicated by infectious agents (bacterial and/or fungal), indolent and immune-mediated. Ophthalmic exam will reveal an abnormal appearance to the cornea in cases of complicated/severe/deep corneal ulcers, whereas simple/superficial corneal ulcers (usually traumatic in origin) often can only be identified through positive results with fluorescein staining. Corneal abnormalities that can occur with complicated corneal ulcers include corneal oedema adjacent to the lesion, keratomalacia ('melting ulcer') and corneal neovascularisation (red) from the limbus that develop towards the lesion in horses with a subacute-chronic history (it takes several days for corneal neovascularisation to develop, the vessels will then grow towards a lesion approximately 1mm per day). Collecting corneal samples for cytology and bacterial/fungal culture is indicated for complicated corneal ulcers to facilitate an aetiological diagnosis, but is not essential for first-opinion, simple corneal ulcers. Additionally, some cases of corneal disease will present with secondary anterior uveitis (see below).

The therapeutic principles for treating a corneal ulcer include: analgesia (systemic NSAID e.g. flunixin or phenylbutazone), topical antimicrobials as either prophylaxis (simple corneal ulcers) or treatment (complicated corneal ulcers), and topical atropine. For first-opinion cases, starting with ophthalmic ointment is most practical – either neomycin-polymixin B-bacitracin ('triple') or chloramphenicol, applied topically to the affected eye q6h (4x daily). For fungal prophylaxis, silver sulfadiazine (SSD) cream or miconazole cream can be used topically off-label as well. For infectious corneal ulcers, a subpalpebral lavage (SPL) line can be placed to facilitate the administration of ophthalmic solutions (voriconazole for fungal aetiology, ciprofloxacin or gentamicin for gram negative bacteria, +/- cefazolin for gram positive bacteria), antimicrobial solutions need to be administered at least q4h to maintain therapeutic concentrations. Additional treatments considered for keratomalacia are proteinase-inhibitors, e.g. topical 0.2% EDTA (prepared by adding sterile water to a commercial blood tube) +/- serum. Deep ulcers and melting ulcers are at higher risk of perforation whereby surgical treatment at a referral hospital might be indicated. A recheck appointment within 3-7 days should be scheduled to revise the medical plan (depending on severity of the ulcer) and medications should be continued until the recheck date. Lastly, topical corticosteroids are contraindicated in cases of ulcerative keratitis.

Corneal stromal abscess in horses

Cases of a corneal stromal abscess, like corneal ulcers, typically present with blepharospasm, epiphora, reduced eyelash angle and conjunctival hyperaemia. However, stromal abscesses are less common than corneal ulcers in first-opinion equine practice. The most common aetiology is micropuncture/inoculation and entrapment of infectious agents (bacteria and/or fungus) in the corneal stroma while the overlying corneal epithelium and endothelium remain intact (Brooks

2004, Henriksen *et al.* 2013). These infectious agents cause a focal inflammatory response leading to stromal abscess formation – this appear as a focal, white-yellow corneal opacity on ophthalmic exam. Depending on chronicity, corneal abscesses will be associated with adjacent corneal oedema (blue) and marked corneal neovascularisation (red). Similar to complicated corneal ulcers, corneal stromal abscesses also develop a secondary anterior uveitis. Unlike corneal ulcers, stromal abscess cases will be fluorescein negative – diagnostically, this is the main differentiating feature. As the epithelium typically remains intact, obtaining a sample for cytology and culture is not possible; this can only be done safely in severe cases where surgery is indicated (McMullen Jr *et al.* 2015).

A common medical error is commencing topical corticosteroids on a corneal stromal abscess because of the fluorescein negative finding. To avoid this, a safe rule of thumb to follow in these instances is if there is a focal, non-staining corneal opacity/lesion – a corneal stromal abscess must be considered a differential, therefore, commence antimicrobial agents (not corticosteroids) and take photos to discuss the case with colleagues. Most corneal stromal abscesses can be treated medically depending on the severity, and the duration of therapy is typically at least 2-4 weeks. Similar to corneal ulcer treatment, the therapeutic principles for treating a corneal stromal abscess include: analgesia (systemic NSAID, e.g. flunixin or phenylbutazone), topical antimicrobials (both antibacterial and antifungal) and topical atropine (de Linde Henriksen *et al.* 2014). Unlike treatment for corneal ulcers, the pharmacological properties of the antimicrobial agents selected is extremely important: lipid-soluble drugs are essential to penetrate the intact epithelium to achieve drug concentrations in the corneal stroma. Lipid-soluble antimicrobials include chloramphenicol, fluoroquinolones (ciprofloxacin or ofloxacin) and voriconazole for fungal treatment. Although it is possible to compound antifungal voriconazole ointment, most cases require SPL placement to facilitate more convenient/compliant medication of the affected eye, especially since these require many weeks of treatment. Once again, solutions administered via an SPL should be administered at least q4h to maintain therapeutic concentrations (Clode *et al.* 2006, Hendrix *et al.* 2007). Hospital referral is often pursued as these cases initially can be difficult to manage in ambulatory practice. Improvement in corneal appearance and increasing ocular comfort are indicative of response to treatment. Additionally, once the corneal abscess has become vascularised from neovascularisation ingrowth, on-going healing is usually guaranteed (Brooks 2004).

Uveitis in horses

Uveitis is a common equine eye condition and is a leading cause of vision loss in horses (Gerding and Gilger 2016). The pathophysiology of uveitis in horses is complicated and not fully elucidated, but simply put, it can be categorised as primary or secondary. As discussed in the earlier sections, secondary uveitis is common in horses with primary complicated corneal disease (ulcers and/or abscesses), it can also arise as a manifestation of systemic inflammation. Primary uveitis can occur as a single episode as a result of trauma or as an ‘idiopathic’ episode. If a horse suffers from multiple primary uveitis episodes in one or both eyes, this is the definition of ‘equine recurrent uveitis’ (ERU) which is a multi-aetiological syndrome (Gerding and Gilger 2016). It’s well accepted as an immune-mediated condition influenced by several aetiological agents (e.g. *Leptospira* sp. infection), genetic factors (e.g. Appaloosas and German Warmbloods) and environmental stimuli (Pearce *et al.* 2007, Kulbrock *et al.* 2013, Fritz *et al.* 2014).

Classic clinical signs of acute-active uveitis in horses is miosis (constricted pupil), reduced intraocular pressure, conjunctival hyperaemia, corneal oedema, corneal neovascularisation (depending on duration), anterior flare (inflammatory proteins in the anterior chamber) and hypopyon (white blood cells in the anterior chamber). Chronic cases can develop corpora nigra atrophy, pigment changes of the iris and chorioretinal scarring. Uveitis cases are typically

fluorescein negative, however, some cases can lead to secondary corneal ulcers (keratitis) which is why recheck appointments are important once uveitis treatment has been initiated. Sequelae of chronic uveitis that can impair vision or cause blindness include synechiae formation, cataract development, lens subluxation/luxation and glaucoma (increased intraocular pressure).

The therapeutic principles for treating equine uveitis include: systemic analgesia/anti-inflammatory treatment (systemic NSAID, e.g. flunixin or phenylbutazone), topical atropine for cycloplegia, and if the eye is fluorescein negative topical corticosteroids (prednisolone or dexamethasone) can also be included. As for the other conditions discussed, a recheck appointment should be arranged within 3-7 days depending on disease severity. If the eye is fluorescein positive on recheck appointment, topical corticosteroids must be discontinued. For long-term treatment in cases where episodic frequency is increasing and/or there is increasing disease severity despite first-line treatments, referral treatments include cyclosporine suprachoroidal implantation (CSI) or intravitreal gentamicin injection (Gilger *et al.* 2010, Fischer *et al.* 2019; Launois *et al.* 2019). The latter is increasing in popularity with comparable efficacy to CSI and is considered a simpler, more affordable and more practical procedure to perform in NZ (as implants need to be imported from overseas).

Conclusion

Following the diagnosis of ulcerative keratitis, corneal stromal abscess or ERU, it is important to discuss longterm- and vision-related prognosis with the client. With a unilateral eye condition, it is still important that both eyes are assessed during a comprehensive equine ophthalmic exam – particularly in cases of uveitis. Recheck appointments are important to determine when to discontinue therapy or if diagnosis and therapeutic plans need revising. Additionally, referral should be offered for complicated corneal ulcers, stromal abscesses and complicated ERU cases. Taking and sharing photographs with colleagues and specialists can be hugely beneficial for receiving recommendations on how to proceed with complicated eye cases, making sure a good camera and light source are used to obtain diagnostic images. Investing time in owner education on how to apply eye medications goes a long way for patient (conditioning horses to tolerating application) and owner compliance. Housing indoors or a shady paddock in conjunction with placing an eye-mask or fly-veil should be recommended for all horses treated with topical atropine. In complicated cases requiring systemic NSAID therapy longer than 5-7 days, monitoring serum albumin as a proxy for protein-losing enteropathy while remaining on NSAIDs can assist in identifying subclinical right dorsal colitis. If a decreasing trend in albumin is identified over serial measurements, NSAID therapy should be discontinued.

References

Brooks DE. Inflammatory stromal keratopathies: medical management of stromal keratomalacia, stromal abscesses, eosinophilic keratitis, and band keratopathy in the horse. *Veterinary Clinics: Equine Practice* 20: 345-60, 2004

Clode AB, Davis JL, Salmon J, Michau TM, Gilger BC. Evaluation of concentration of voriconazole in aqueous humor after topical and oral administration in horses. *American journal of veterinary research* 67: 296-301, 2006

de Linde Henriksen M, Andersen PH, Thomsen PD, Plummer CE, Mangan B, Heegaard S, Toft N, Brooks DE. Equine deep stromal abscesses (51 cases 2004–2009) Part 1: the clinical aspects with attention to the duration of the corneal disease, treatment history, clinical appearance, and microbiology results. *Veterinary Ophthalmology* 17: 6-13, 2014

Dwyer AE, de Linde Henriksen M. Equine ocular examination and treatment techniques. *Equine Ophthalmology*, 1-89, 2022

Fischer BM, McMullen RJ, Reese S, Brehm W. Intravitreal injection of low-dose gentamicin for the treatment of recurrent or persistent uveitis in horses: Preliminary results. *BMC veterinary research* 15: 1-12, 2019
Fritz K, Kaese H, Valberg S, Hendrickson J, Rendahl A, Bellone R, Dynes K, Wagner M, Lucio M, Cuomo F. Genetic risk factors for insidious equine recurrent uveitis in A ppaloosa horses. *Animal genetics* 45: 392-9, 2014
Gerding J, Gilger B. Prognosis and impact of equine recurrent uveitis. *Equine veterinary journal* 48: 290-8, 2016
Gilger BC, Wilkie DA, Clode AB, McMullen Jr RJ, Utter ME, Komaromy AM, Brooks DE, Salmon JH. Long-term outcome after implantation of a suprachoroidal cyclosporine drug delivery device in horses with recurrent uveitis. *Veterinary Ophthalmology* 13: 294-300, 2010
Hendrix DV, Stuffle JL, Cox SK. Pharmacokinetics of topically applied ciprofloxacin in equine tears. *Veterinary Ophthalmology* 10: 344-7, 2007
Henriksen M, Andersen P, Plummer C, Mangan B, Brooks D. Equine corneal stromal abscesses: An evolution in the understanding of pathogenesis and treatment during the past 30 years. *Equine Veterinary Education* 25: 315-23, 2013
Kulbrock M, Lehner S, Metzger J, Ohnesorge B, Distl O. A genome-wide association study identifies risk loci to equine recurrent uveitis in German warmblood horses. *PLoS One* 8: e71619, 2013
Launois T, Hilarión LMG, Barbe F, Leurquin C, Bihin B, Hontoir F, Dugdale A, Vandeweerd J-M. Use of intravitreal injection of gentamicin in 71 horses with equine recurrent uveitis. *Journal of Equine Veterinary Science* 77: 93-7, 2019
McMullen Jr RJ, Gilger BC, Michau TM. Modified lamellar keratoplasties for the treatment of deep stromal abscesses in horses. *Veterinary Ophthalmology* 18: 393-403, 2015
Pearce JW, Galle LE, Kleiboeker SB, Turk JR, Schommer SK, Dubielizig RR, Mitchell WJ, Moore CP, Giuliano EA. Detection of Leptospira interrogans DNA and antigen in fixed equine eyes affected with end-stage equine recurrent uveitis. *Journal of Veterinary Diagnostic Investigation* 19: 686-90, 2007