INTRODUCTION

Infectious keratitis is the most common ocular disease in horses, often leading to blindness. In this lecture we will discuss how to identify corneal disease early and the best treatments to prevent progression.

The equine cornea is unique when compared to other animals. The cornea of horses is relatively slow to heal. Equine corneal injuries are prone to infection (Horses are more prone to infection than cows and other farm animals despite being in the same environment). Because of the prominent location of the eyes on a horse and because of the propensity for horses to throw their heads around, eyes of horses receive a lot of trauma. Horses can be difficult and frustrating to examine and treat because of their size and temperament. However, the anatomy and physiology of the equine cornea is similar to other species.

ULCERATIVE CORNEAL DISEASE

INTRODUCTION

Corneal ulceration is perhaps the most frustrating and potentially devastating disease of the equine eye. In most instances corneal ulceration is the result of an initial trauma, but secondary infection is common especially in those eyes treated with topical corticosteroids following ulceration.

CLINICAL SIGNS AND DIAGNOSIS.

A corneal ulcer is present when there is a break in the corneal epithelium. Clinically, this results in lacrimation, blepharospasm, photophobia, conjunctival hyperaemia, corneal oedema, and possibly miosis and aqueous flare. The diagnosis of a corneal ulcer is made based on these clinical signs and fluorescein staining of the cornea. Fluorescein stain will be retained by the underlying stroma and appear green in colour. A bacterial and fungal culture should be submitted from all corneal ulcers in the horse. Cultures should be obtained from the margin of the ulcer itself, prior to instilling any therapeutic or diagnostic agents in the eye. Once a culture is obtained and the cornea has been fluorescein stained, topical anaesthetic is applied and a scraping is obtained from the ulcer for cytologic examination. The cells are placed on a glass slide and stained to examine for bacteria, fungal hyphae, and cell type. Gram, Giemsa, and Diff-quik stains work well for examination. The presence of gram-negative rods indicates the possibility of an infection with...
Pseudomonas sp. The presence of fungal hyphae is pathognomonic for mycotic keratitis, with Aspergillus sp. being the most frequent corneal pathogen. Mixed bacterial and fungal infections are not uncommon.

A corneal ulcer should be characterized with regards to size, depth, and the presence or absence of cellular infiltration. In addition, the anterior chamber is examined for anterior uveitis. It is essential with all corneal ulcers to attempt to establish the cause for the ulceration and eliminate it. The palpebral conjunctiva and bulbar surface of the nictitans are examined for the presence of a foreign body, the blink response and tear film are evaluated, and a complete history is obtained with regards to trauma, and previous medication. Topical corticosteroids must not be administered in the presence of a corneal ulcer and a history of previous topical corticosteroid therapy increases the likelihood of infections, especially fungal, keratitis.

Some specific types of corneal ulcers seen in the horse include indolent ulcers, ulcers with eosinophilic cellular infiltrate, collagenase and mycotic ulcers, and possibly viral ulcerative keratitis.

**Simple uncomplicated corneal ulcers**

Simple uncomplicated corneal ulcers have the characteristics of having corneal epithelial cell loss with exposed corneal stroma, are acute in onset, do not have characteristics typical of infection (stromal malacia, cellular infiltrate, stromal defects) and a foreign body is not present. Diagnosis of a superficial uncomplicated corneal ulcer is based on the history of an acute-onset painful eye and findings on a complete ophthalmic examination of possible focal corneal oedema and fluorescein dye retention. Usually the fluorescein dye retention is intense and uniform across the ulcerated area.

**A search for the cause of the ulcer should be done!!**

Treatment for an uncomplicated superficial ulcer: A superficial uncomplicated corneal ulcer should have no microorganisms (on culture or cytology), no cellular infiltrate, no foreign body, and mild secondary uveitis. Treatment for an uncomplicated superficial ulcer should consist of a topical broad-spectrum antibiotic every 6 hours (e.g., neomycin, bacitracin, gramicidin; ofloxacin); topical 1% atropine once daily, and treatment of any secondary uveitis, if present (e.g., systemic non-steroidal anti-inflammatory medications [NSAIDS]). Topical corticosteroids are contraindicated in equine ulcerative keratitis and topical NSAIDS may delay re-epithelialization of the cornea and therefore also are contraindicated.

**Complicated corneal ulcers**

Complicated corneal ulcers are those that: Do NOT heal within 72 hours, have a collagenase component (i.e., melting corneal ulcers), have a mechanical obstruction to healing (i.e., foreign body, indolent), are infected (either with bacteria or fungus), and or are in danger of perforation.

**Indolent corneal ulcers**

Indolent corneal ulcers in horses are similar to small animal indolent ulcers. They are chronic, superficial corneal ulcers where the corneal epithelium will not adhere to the underlying corneal stroma. The characteristic appearance is a superficial ulcer with a redundant epithelial border. Other signs include minimal corneal neovascularization, focal edema, and moderate discomfort. Treatment of indolent ulcers includes searching for the cause (foreign bodies, ectopic cilia, eyelid...
abnormality, repeated trauma). Indolent ulcer treatment is similar to that for small animals (debridement, diamond burr keratotomy, soft contact lenses, topical broad-spectrum antibiotics [esp tetracycline-based], serum). Studies have demonstrated that grid keratotomy may not be as successful in horses as in dogs.

Bacterial keratitis
Bacterial keratitis commonly induces blepharospasm, epiphora, ocular discharge, photophobia, and corneal opacification. However, unlike uncomplicated corneal ulcers, bacterial ulcers generally have stromal involvement that produces marked oedema, cellular infiltration, and deepening of the ulcer bed, potentially accompanied by keratomalacia, or “melting”. Secondary, anterior uveitis may be severe, resulting in miosis, aqueous flare, hypopyon, and hypotony. Culture and cytology should always be collected in cases of stromal ulcers. Treatment of the keratitis should be aggressive with frequent use of broad-spectrum topical antibiotics (e.g., moxifloxacin every 1-2 hours), topical atropine (q 12 hours), systemic NSAIDS, and an anticollagenase medication to counteract the keratomalacia. Commonly used anticollagenase medications include autogenous serum (q 1-2 hours), EDTA, and tetracycline-type medications (topical oxytetracyline, oral doxycycline). Rapidly progressing lesions should be managed surgically with use of a superficial keratectomy followed by a conjunctival graft or amniotic membrane graft.

Deep ulceration / Desmetocoele
Deep corneal ulceration in the horse is almost always the result of infectious keratitis in which there is progressive loss of stromal tissue. Whenever there is corneal stromal loss, it is important to collect bacterial and fungal cultures with antibiotic sensitivity testing and collect cytology samples to evaluate for the presence of organisms and cellular makeup of the infiltrate. The cytology is particularly helpful when making early decisions on therapy (i.e., is there bacterial or fungal organisms present?) while waiting for cultures results (typically return 48-72 hours after collection). The desmetocoele is a severe deep corneal ulcer where the overlying corneal stroma has sloughed exposing desemet’s membrane. Descemet’s membrane is easy to identify because is usually transparent (i.e., does not become oedematous) and does not retain fluorescein dye. Descemet’s membrane is very thin, easily ruptured, and therefore a descemetocele should be considered a surgical emergency in most horses.

Corneal perforation / Laceration
A main goal in corneal ulcer therapy is to NEVER allow a cornea to perforate. Once a cornea perforates, either as a result of a progressive corneal ulcer or penetrating trauma, the prognosis for vision and saving the globe in general, is poor. Therefore, when treating a corneal ulcer, if the lesion is greater than 50 percent depth of the cornea, then surgical therapy, such as a conjunctival or amnion graft should be considered to prevent possible perforation. The prognosis is worse if the corneal laceration involves the limbus; significant hyphema is present; the lens is perforated; if a large uveal prolapse through the incision is present; or if dazzle and consensual pupillary light reflexes are absent. Examination of a perforated eye should include complete ophthalmic examination (including evaluation of dazzle and consensual pupillary light reflexes) with the horse adequately tranquilized and eyelid nerve blocks done to ensure that no further damage is done as a result of the examination. If the posterior segment (vitreous and retina) of the eye cannot be visualized on the ophthalmic examination, then an ultrasound should be considered. If the vitreous is hyerechoic (i.e., blood or cellular infiltrate) or a retinal detachment is observed on the ultrasound, then the prognosis for return to vision is very poor. Repair of the laceration or correction of the perforation is recommended if the lens and posterior segment are normal and
should be done as soon as possible to prevent further inflammation and contamination of the intraocular structures. Enucleation should be considered if there is no consensual PLR; a large uveal prolapse is present, or if ultrasound results suggest a poor prognosis for return of vision.

**Mycotic corneal ulcers / Mycotic keratitis**

Fungal or mycotic keratitis is particularly common in horses, especially in the Southeastern United States, Southern Europe, and in other areas in which the climate is warm and humid. Corneal infections most commonly involve *Aspergillus* spp or *Fusarium* spp of fungi, but other fungal organisms have been reported. Most commonly, fungal keratitis appears clinically as a worsening, sub-acute keratitis that generally appears very painful, with severe secondary uveitis. There are 4 common clinical presentations of fungal keratitis: superficial ulcerative / plaque, stromal ulcerative, stromal non-ulcerative, and deep stromal-endothelial non-ulcerative (abscess). Diagnosis of fungal keratitis is made by history, clinical appearance, and demonstration of the organisms on cytology or culture. In general, the diagnosis of fungal keratitis carries a poor prognosis and requires long-term aggressive therapy. Treatment must be directed at killing the fungus, killing secondary bacteria, and controlling secondary uveitis. Because most fungal ulcers also have a bacterial component, treatment is initially similar to severe midstromal ulcers (frequent topical antibiotics, atropine). Antifungal therapy needs to be started early, be aggressive, and involve both topical and systemic therapy. Surgical treatment of fungal keratitis is generally indicated in most cases, but especially when there is no response to medical management, if a corneal furrow develops, or if the lesion is very deep in the cornea.

**Stromal abscess**

Corneal stromal abscessation is common in the horse. The likely pathogenesis is that a penetrating corneal injury causes an inoculation of microorganisms or foreign material into the corneal stroma. The corneal epithelium heals over the wound then 1 to 3 weeks later an abscess forms in the deeper stroma. Clinical appearance of stromal abscess varies greatly depending on severity, however all have a creamy-yellow cellular corneal infiltrate. Most abscesses have deep corneal vascularization. Characteristically, horses with corneal stromal abscesses have severe blepharospasm as a result of severe secondary uveitis. Diagnosis of corneal stromal abscess is usually by clinical appearance and history. A culture and cytology would be helpful, but unfortunately this frequently requires surgery to get below the intact corneal epithelium. In our practice, these stromal abscesses are due to fungal infections. Treatment depends on the level of vascularization. If the lesion is completely vascularized, then use of oral and topical antibiotics (and the control of secondary uveitis) will many times allow the abscess to eventually resolve. If the lesion is covered with intact epithelium, this needs to be removed so that the antibiotics can penetrate into the abscess. If the abscess is severe, and not surrounded by vascularization, then surgery (e.g., surgical excision and grafting) may speed resolution.
Further Reading


