

## **Infectious Corneal Disease In The Horse**

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Treating corneal infections in horses can be challenging for veterinarians. The high cost and lack of approved ophthalmic products, the need for more concentrated topical medications, and the often time-consuming and labor-intensive treatment protocols are just a few of the contributing factors. A compounding pharmacist can provide valuable assistance to the veterinarian by preparing topical and injectable antibiotics and antifungals that are not available commercially or by fortifying commercially available products. When cost is a major factor, the pharmacist can also make recommendations for the most economically feasible treatment options and can obtain human approved medications.

Bacterial and fungal infections often originate from a corneal ulcer. Corneal ulcers in horses are common and often are initiated by a trauma to the corneal epithelium, which then may become infected by bacteria or fungi, either commensal or pathogenic. Other additional or predisposing causes for infected ulcers include previous treatment with topical antibiotics, which may change the conjunctival flora from gram-positive to gram-negative, depending on the antibiotic used.

Keratomycosis, a fungal infection of the cornea, is more common in the horse than in dogs and cats. In addition to the predisposing factors mentioned above, a warm to hot, humid climate may increase the likelihood of a horse developing a corneal fungal infection. The typical patient history reveals a trauma occurring at least two weeks or longer ago and no response to a variety of antibiotic or antibiotic-steroid ophthalmic preparations. In fact, application of topical steroids often worsens a fungal infection by increasing the virulence of the fungus. Steroids also diminish the corneal tissue's resistance and enhances proliferation of the fungi, possibly by inhibiting cellular defense mechanisms. Bacterial keratitis also occurs in horses, as well as mixed infections of bacteria and fungi. In fact, at least half of fungal ulcers in horses also have a concurrent bacterial infection.

The clinical signs of corneal ulceration are nonspecific and include ocular pain exhibited by blepharospasm, photophobia, and varying degrees of serous to mucoid ocular discharge. Upon examination, there may be obvious signs of corneal inflammation such as loss of corneal epithelium and stroma, corneal edema, corneal neovascularization, and secondary uveal inflammation. Since corneal re-epithelization normally occurs in 5 to 7 days, a longer healing time is a good indicator of infection. Rapidly developing keratitis in a previously normal eye or rapid worsening of symptoms in a horse with a corneal ulcer are other indicators of microbial infections.

Diagnosis of keratomycosis or bacterial keratitis is made using a combination of cultures and cytology sampling, followed by an ophthalmic examination that includes fluorescein staining. Topical anesthetics are not usually recommended prior to obtaining cultures, since preservatives in the product may limit the yield of organisms on the culture. Some veterinary ophthalmologists, however, use topical anesthetics to facilitate collection and claim they do not significantly affect culture results.

Treatment of corneal infections may include surgical and medical components. Surgical intervention is more likely to be necessary in fungal infections than bacterial. The medical component usually involves a combination of products, which include anti-inflammatories, pain medication, and antimicrobials. The route of administration and choice of products depend upon the type and severity of infection. Since many antibiotics and antifungals do not achieve good corneal penetration and concentrations when systemically administered due to the avascular nature of the cornea and the blood-ocular barrier, topically applied medications are most often used in the treatment of corneal infections. In addition to antimicrobial treatment, systemic nonsteroidal anti-inflammatory drugs (NSAIDs), such as flunixin or ketoprofen are used to control inflammation, while topically applied parasympatholytic drugs (such as Atropine 1%) help prevent posterior synechia, reduce uveal inflammation, and reverse ciliary spasm (1) (2).

Timely initiation of antimicrobial therapy is important in the presence of a corneal infection. Pending culture/sensitivity results, empiric therapy is indicated based on patient history, examination, and cytology.

Antimicrobial treatment for minor bacterial corneal ulcers (confined to the corneal epithelium) generally includes a topical triple antibiotic solution applied four times daily (for 3 to 4 days, then as needed). If there is any association with plant material or foreign bodies, a topical antifungal should also be considered. For minor fungal ulcers, topically applied silver sulfadiazine or miconazole applied four times daily is usually effective. Neither silver sulfadiazine nor miconazole is available commercially as an ophthalmic preparation, but can be formulated by a compounding specialist.

If there is evidence of stromal infection (less than one-third stromal depth). Topical broad-spectrum antibiotics (cefazolin and gentamicin or tobramycin) should be applied, preferably via lavage every 4 to 6 hours, until culture results are known. For fungal infections involving the stroma, based on history or cytology results, topical natamycin, itraconazole or miconazole should be applied via lavage every three to four hours (1).

Natamycin (Natacyn® by Alcon) is a thick white suspension, which may complicate the use of a subpalpebral lavage apparatus. The drug tends to plug up the tubing systems and will cause dramatic swelling and pain in the upper eyelid if it leaks out of the tubing into the subcutaneous tissues of the eyelid (3).

In the presence of obvious stromal loss (between one-third depth down to Descemet's membrane) or other signs indicating more complicated infections, fortified topical antibiotics (cefazolin and amikacin) should be applied (pending culture results) via lavage every hour for 4 to 6 hours, then every 2 to 3 hours for the remaining 24 to 48 hours, then every 4 hours thereafter. Subconjunctival antibiotics should also be administered every 12 hours along with atropine and systemic NSAIDs. If the cornea is perforated, systemic antibiotics should be added to the treatment regimen (systemically administered antibiotics achieve higher corneal concentrations when the cornea is perforated or inflamed). Antifungals are administered every 1 to 2 hours via lavage along with a daily subconjunctival injection of miconazole 5 to 10mg. The frequency of administration of the topical antibiotics may be decreased to every 6 hours once improvement is noted. Four to six weeks of treatment is not uncommon for fungal keratitis cases.

Following initial intensive topical antifungal therapy, corneal disease often worsens before getting better, which may be associated with the death of the fungi and the release of intracellular constituents. Aggressive systemic NSAID therapy during the initial treatment may help but can also be detrimental to the healing process. Another recommendation is to initiate topical antifungals more slowly. Administration four to six times daily is associated with less secondary anterior uveitis than administration 12 times a day and permits less aggressive use of systemic NSAIDs.

#### References:

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3. Plumb, DC. *Veterinary Drug Handbook*, 3rd ed. Ames: Iowa State University Press, 1999.