CORNEAL ULCERS

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The outermost layer of the eye is the fibrous tunic, made up of the clear anterior cornea and the more posterior opaque sclera. Among the proposed reasons for the cornea’s transparency are its avascularity, relative dehydration compared to other body tissues, and regular arrangement of stromal collagen. The mammalian cornea is made up of the following layers from anterior to posterior: epithelium, stroma, Descemet’s membrane, and endothelium.

When corneal ulceration occurs, at least the outer epithelium is lost. Corneal ulcers can be named according to depth. Superficial ulcers may actually be more painful than deeper ones, as more pain receptors are located superficially within the cornea. Corneal erosions occur when the outer epithelium, but not its basement membrane, is lost. Superficial ulcers are shallow ulcers in which both the epithelium and its basement membrane are missing. Deep stromal ulcers involve loss of a substantial portion of the corneal stroma. When deep stromal ulcers reach the endothelial basement membrane, or Descemet’s membrane, a descemetocele occurs. In unfortunate cases, progression to corneal perforation occurs, in which all corneal layers are focally lost, resulting in leaking of the aqueous humor and often iris prolapse.

Simple corneal ulcers are most common, usually occur secondary to minor trauma, and heal readily. Appropriate therapy includes minimization of self-trauma through the meticulous placement of an Elizabethan collar and placement of a topical broad-spectrum antibiotic 3-4 times daily. Some degree of secondary anterior uveitis is almost universally present with ulceration and may benefit from treatment. Systemic anti-inflammatory therapy, usually with an oral nonsteroidal anti-inflammatory (NSAID) and topical atropine (to effect) for its mydriatic-cycloplegic effects, are both appropriate. Corneal healing in simple ulcers occurs via epithelial cell migration and mitosis, and results in minimal scarring.

Corneal ulcers that remain unhealed for one week following diagnosis are loosely categorized as complicated ulcers. Eyes with complicated ulcers may have an underlying condition that is delaying the healing process such as KCS, chronic corneal edema, foreign body, entropion, or ectopic cilia. Alternatively, active infection may be present or the patient may have a primary healing abnormality. These ulcerations vary significantly in presentation, but share a number of characteristics in common. All require more exhaustive examination and more aggressive treatment, and most would benefit from referral to a veterinary ophthalmologist. Many, but not all, will require surgery.

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With or without surgical intervention, the delay in healing, and resultant corneal vascularization and fibrosis, is more likely to result in a vision-threatening corneal scar. Three of the many specific types of complicated ulcers are discussed below.

Indolent ulcerations are superficial corneal ulcerations that do not respond to standard medical therapy. A number of confusing alternative names for this condition exist, including recurrent epithelial erosion, spontaneous chronic corneal epithelial defect (SCCED), Boxer ulcer, and basement membrane dystrophy. They are diagnosed based on a history of persistent and/or recurrent ulceration, and a characteristic appearance on ophthalmic examination. The superficial ulcer or erosion takes up fluorescein stain, and the stain is also seen to migrate beneath a loose peripheral “lip” of epithelium. Signalment can be very useful in diagnosis. Although any breed of dog, and even cats, can be affected, the Boxer breed is highly overrepresented. The condition is primarily thought to be related to an inherited dystrophy in this breed. Although possibly hereditary, it typically appears in middle-aged to older dogs. Secondary indolent ulcerations are occasionally diagnosed as well, usually occurring as the result of chronic corneal irritation (such as from entropion), chronic corneal edema, or chronic feline herpesvirus keratitis.

In secondary cases, eliminating the underlying cause, combined with simple debridement of the loose epithelium using dry cotton-tipped applicators, and medical treatment as described for simple ulcers may be all that is necessary to promote healing. Almost all primary indolent ulcers, and many secondary ones, however, require surgical intervention. The most commonly performed procedure for dogs is currently keratotomy (either a linear grid or superficial punctate keratotomy, depending on surgeon preference). The goal of this procedure is to disturb an abnormal anterior stromal hyaline membrane which is acting as a barrier to healing. A keratectomy, in which the anterior stroma is excised, is only rarely required. Although the keratotomy procedure can be performed as a standing one with topical anesthesia, it is performed most thoroughly with deep sedation or general anesthesia. It is contraindicated in cats, in which keratotomy may precipitate sequestrum formation. Even with surgery, healing is still slow, averaging around three weeks. Clients should be warned of the possibility of recurrence or the development of the same problem in the other eye.

“Melting” corneal ulcers are those ulcers that have become infected with one of a small number of bacteria that result in the active and rapid breakdown of corneal stromal collagen.

Left alone, this condition can progress from infection to perforation in as little as 24 hours. Unfortunately, although the infection initiates the collagenolysis process, the process also becomes self-sustaining, such that antibacterial treatment alone will not immediately halt the process.

Aggressive broad-spectrum antibiotic therapy is imperative and anti-collagenase medications may be beneficial as well. Culture and sensitivity of the affected cornea is always appropriate, but the condition is so rapidly progressive that good empirical decisions must be made initially. The most well-known bacteria causing melting ulceration is Pseudomonas sp., but it is a mistake to target antibiotic therapy at this bacteria alone since, although less common, beta hemolytic Streptococcus species may be even more virulent. Additionally, many Pseudomonas strains are now gentamicin-resistant. A combination of a topical fluoroquinolone antibiotic with a topical antibiotic active...
against gram positive bacteria (ex: ofloxacin and Neo-Poly-Gram), or 4th generation fluoroquinolone monotherapy (ex: Zymar) can be effective. A number of anti-collagenases have been evaluated and found to have at least in vitro efficacy, including topical serum, plasma, EDTA, and acetylcysteine, as well as systemic doxycycline.

In most cases, emergency surgical intervention is indicated both to debride the most severely affected tissue and to place a conjunctival graft to provide rapid tectonic support and immediate blood supply. An exception may be the case of a very large melting ulcer for which surgery will be blinding. For cases in which surgical intervention is declined or deemed inadvisable, topical therapy should be aggressively pursued (q 1-2 hours) and follow-up visits spaced very closely.

Viral ulcerative keratitis is seen primarily in cats. Most cats harbor a latent feline herpesvirus-1 infection within their trigeminal nerves from a young age, which can recrudesce during times of stress or illness to cause ophthalmic disease. A large number of feline ophthalmic conditions have been attributed in whole or in part to FHV-1, including ophthalmia neonatorum, recurrent conjunctivitis, KCS, ulcerative keratitis, stromal keratitis, eosinophilic keratitis, and corneal sequestrum. Only adult-onset FHV-1-induced ulcerative keratitis will be discussed here. Superficial linear, branching or dendritic ulcers are pathognomonic for this condition, but geographic ulcers are more common. Diagnosis is based primarily on history and clinical suspicion, although a number of tests are available to help definitively diagnose the condition.

In addition to standard therapy as described for simple ulcers, and attempting to identify and eliminate any underlying cause and/or stress in the animal's life, specific antiviral therapy is indicated for active FHV-1 ulcerative keratitis. Unfortunately, all antiviral medications are virustatic, rather than virucidal. Available topical antivirals active against FHV-1 include trifluridine and idoxuridine. Disadvantages include their expense, irritant nature, and the need to apply frequently (at least QID). Systemic antivirals are under investigation. Of the products your clients may be familiar with from marketing toward human herpes infections, one is ineffective in cats (acyclovir), one is toxic (valcyclovir), and one shows promise (famcyclovir). Oral L-lysine may be useful as part of a strategy for reducing the frequency and severity of outbreaks. Supplementing the cat’s tear film quality may also be beneficial even if quantitative tear production is adequate. Viscoelastic and gel formulations (such as I-drop, Lubrithal, GenTeal severe, and Endura) are best. It is important to emphasize to the client that this condition is treatable, but not curable, and that recurrence is common.

**Editor’s box**

**Ocular Outlook**

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Eye Care for Animals welcomes your comments on the Ocular Outlook. Please e-mail your feedback to jgamarano@eyecareforanimals.com or call Julie at (480) 424-3947 extension 111.
WHAT’S NEW AT EYE CARE FOR ANIMALS?

Recent Openings & Relocations

**Leesburg, Virginia Opening**
**June 7th, 2007**
We are located in The Life Centre at 165 Fort Evans Rd. NE Suite 107 Leesburg, VA. 20176
We are open on Thursdays, from 9am – 4pm, by appointment only
Hours will increase with clientele needs.
Please contact our office at 571-209-1190 to schedule an appointment.

**Albuquerque, New Mexico Relocation**
**June 25th, 2007**
Our new address is 8724 Alameda Park Drive NE, Suite C Albuquerque, NM. 87113
Please contact our Albuquerque office at 505-292-3600 to schedule an appointment

*These new locations allow us to continue providing your communities with state of the art medicine and compassionate care.*

Upcoming ECFA Continuing Education Lectures

**Palm Springs, California Continuing Education**
**Douglas Esson, DVM**
Topic: Glaucoma, Cataracts, ERs & Referrals
Location: Hilton Palm Springs
Date: July 7th, 2007
Time: 5:00-8:00pm
RSVP by July 2nd 909-949-9200

**North Scottsdale, Arizona Continuing Education**
**Jennifer Urbanz, DVM, DACVO**
Topic: “Cataracts and Cataract Surgery in Veterinary Medicine Today”
Location: 14202 N. Scottsdale Road Suite 157 Scottsdale, AZ. 85254
Date: July 18th, 2007
Time: 6:00-8:00pm
RSVP by July 11th 480-948-2362

**Gilbert, Arizona Continuing Education**
**Lisa Felchle, DVM, DACVO**
Title: “Cataracts and Cataract Surgery in Veterinary Medicine Today”
Topics: Cataract Surgery: Before, During & After
Location: 86 W Juniper Ave Gilbert, AZ. 85233
Date: September 12th, 2007
Time: 6:30-9:00pm
RSVP by September 5th, 2007 480-635-1110 prompt#4
Personal energy is an important component of personal and business productivity. Most people cycle between positive and negative energy states during the work week. But the percentage of time spent in positive and negative moods varies significantly. Some people seem to be overwhelmingly negative, while others in similar circumstances can remain much more positive. Increasing the time spent in positive states will improve personal productivity. The following ten tips suggest ways to facilitate a more positive attitude.

1. **Work first on your relationships.**
   Relationships are both our best sources of happiness and our biggest sources of problems and frustrations. Developing good relationships and improving or ending the poor relationships in your life will increase your personal energy. An effective tactic to start improving your relationships is to develop better personal boundaries and standards and work on reducing tolerations.

2. **Develop a routine to start every day in a positive mental state.**
   It is very helpful to start the day with a routine that creates positive energy. Many people find activities like an early morning walk, exercise, meditation, quiet time, etc., effective in getting their day off to a positive start. It is easier to stay positive, if you can start with a positive attitude.

3. **Learn how to monitor your current mental state and changes to it.**
   This is a complex area, but if you can link negative mood changes to a source or cause, then you are frequently in a position to quickly change back. The important point here is once you are in a negative state, get the message or value from the situation, then take some action to return to a positive state. This is discussed more in #6 below.

4. **Create an energizing physical environment.**
   Invest some time and money to make your personal surroundings pleasing and energizing to you. Some small items may make a big difference to how your personal space affects your moods. Poor lighting can lower your mental state, especially in the winter. Some people report a big improvement in their mood just by cleaning up their bedroom and making the bed before leaving for work. Clutter is de-energizing to many people. Music can offset feelings of isolation. Feng Shui is an entire discipline that addresses the harmony of physical surroundings.

5. **Carefully monitor your self-talk.**
   Negative self talk is a common source of low moods. When you are hearing negative self talk, be alert to the unrealistic, overly negative messages. Focus on getting any truthful message, then shifting out of overly self-defeating criticism.

6. **Develop methods of shifting yourself to a more positive state.**
   Once you are aware of your negative moods, and have developed your own method of getting the value out of the bad mood, then craft methods of moving back to a positive mood. These methods can include positive self talk, taking action towards a desirable goal, interacting with another person. One creative method is to maintain a Truth Journal in which you write down your personal Truth about various topics. This Truth can include past successes, what you are really good at, things you enjoy, compliments you have received, progress towards goals, etc. Then, when you are feeling negative about a topic, read the Truth Journal.

7. **Deal with problems effectively.**
   Problems are a part of life. Few people enjoy problems. But, in many cases we can learn from problems. It may help to ask yourself several questions, such as:
   - What am I contributing to this problem?
   - What Life Lesson have I been missing here?
   - What is the worst that can happen and how can I improve on that?
   - What am I doing right?
   - What am I going to do differently?
   Getting into a habit of using problems as learning experiences can help us avoid becoming de-energized when they occur.

8. **Focus your energy on attracting more of what you want.**
   Time and energy spent dwelling on problems is frequently better spent pursuing desirable goals. It helps to examine your own contribution to any difficulties and understand how you may need to change. Then be sure to ask others directly for what you want from them; don’t fall into the trap of under communicating. In this way, you are always making course corrections and moving forward. I have found it helpful to print out a list of goals, and my theme for the week first thing Monday morning. This seems to help me get started on a positive note.

9. **Be a positive energy source with others.**
   Negative energy seems to attract negative results. Keeping your own mood positive can encourage positive moods and suppress negative behavior in others.

10. **Avoid negative energy as an energy source.**
    Many people have a shortage of positive energy in their lives and use negative energy as their energy source. They create busyness, use deadlines, crises, and problems to keep them going. In many cases, their motivation patterns shift entirely from seeking pleasure to avoiding pain. In most cases, serious burnout is the eventual result of becoming dependent on negative energy sources.
Corneal Dystrophy and Degeneration

Corneal dystrophy and degeneration present similarly as deposits or accumulations of lipids, cholesterol, and/or calcium in the corneal stroma. Generally these will appear as white to crystalline corneal opacities. Corneal dystrophy refers to a primary, bilateral, often symmetric, inherited or breed-related condition, which is not accompanied by inflammation or systemic disease. Corneal degeneration may occur secondary to trauma, systemic disease, or metabolic changes and can be unilateral or bilateral. Both conditions can lead to corneal ulcers, irritation, scarring, and mineral sloughing, although these are more commonly seen with corneal degeneration.

Breeds predisposed to corneal dystrophy include the Beagle, Siberian Husky, Cavalier King Charles Spaniel, Rough Collie, Shetland Sheepdog, and Airedale Terrier. The diagnosis of corneal dystrophy can often be made based on breed, history, and clinical appearance. Further diagnostic testing is indicated when corneal degeneration is suspected. Diagnostic testing may include serum cholesterol, high-density lipoprotein, low-density lipoprotein, fasting blood glucose, triglycerides, calcium, phosphorus, as well as thyroid and adrenal function tests. The hallmark clinical feature of corneal degeneration is corneal vascularization, which is not usually seen in cases of corneal dystrophy.

Treatment of corneal dystrophy and degeneration can be frustrating. Generally, corneal dystrophy does not warrant treatment, but a low fat diet may decrease progression of the lesions. Treatment of any underlying conditions may decrease the progression of corneal degeneration, and a low fat diet may also be helpful in these cases. Severe or ulcerated cases may benefit from treatment with topical EDTA, and occasionally superficial keratectomy with or without conjunctival grafting may be necessary to promote healing.