

# OCULAR Outlook

A QUARTERLY PUBLICATION FOR THE VETERINARY COMMUNITY FROM EYE CARE FOR ANIMALS

## CORNEAL EDEMA: CAUSES AND TREATMENT



**Heather Kaese,  
DVM, MS, DACVIM, DACVO**

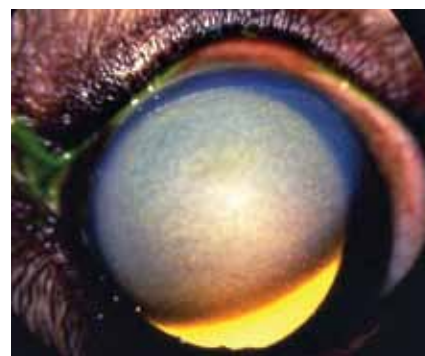
Maintenance of corneal clarity is paramount to normal ocular function and is largely achieved by steady-state hydration. Compared with other tissues, the cornea exists in a relative state of dehydration (or deturgescence). Overhydration of the cornea (or edema) disrupts the normal architecture of the collagen lamellae and causes varying degrees of opacity that appears as a white to bluish-grey haze (Figure 1). Corneal edema first reduces visual acuity, but depending on severity, it has potential to cause blister-like structures of the epithelium (corneal bullae or bullous keratopathy), corneal ulcers, ocular pain, and blindness.

Intraocular pressure can affect corneal hydration, but has minimal impact within the normal range of intraocular pressure in an otherwise normal cornea. The corneal epithelium and endothelium are the

primary factors that control hydration. A breach of the epithelium (i.e., an erosion or ulcer) causes edema when tears or topically applied medications enter the corneal stroma. The corneal endothelium has an active cellular “pump” that redirects aqueous humor back into the anterior chamber. The endothelium has the greater role in regulating hydration. Therefore, diseases that disrupt the endothelium or endothelial function cause more profound and diffuse corneal edema.

Corneal edema is not a specific finding, and it can be associated with a variety of disease conditions. Focal or localized edema is common with corneal ulcers and is most prevalent in and around the area of ulceration. Diffuse edema is more often associated with diseases affecting the endothelium including uveitis, glaucoma, and corneal endothelial degeneration.

Treatment of corneal edema depends on the cause and may include topical antibiotic, anti-inflammatory, hypotensive, or hyperosmotic treatments. Sodium chloride is the only approved hyperosmotic treatment for corneal edema and is available as a 5% solution or ointment (e.g., Muro-128®). These preparations can be obtained over the counter at any pharmacy. The osmolarity of the corneal stroma is approximately 300 mOsm, whereas the osmolarity of 5% sodium chloride is 1500 mOsm. The osmotic gradient created with hypertonic treatment is intended to draw fluid from the stroma or epithelium into the tear film.



**Figure 1:  
Acute endotheliopathy  
and corneal edema of  
undetermined cause in a dog.**

Determining the cause of edema is not usually difficult with routine diagnostic tests and a reasonable differential diagnosis list. Fluorescein stain should be applied to any edematous cornea to determine if an ulcer is present. Edema associated with an ulcer usually resolves as the ulcer heals, and in most instances, hyperosmotic treatment is not required. Some advocate topical hyperosmotic treatment of chronic, superficial, and non-healing ulcers (aka spontaneous chronic corneal epithelial defects), where such treatment may facilitate epithelial

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OCULAR *Outlook*

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**CORNEAL EDEMA: CAUSES AND TREATMENT**

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attachment or reduce the risk of recurrence. However, such treatment is of unproven benefit in dogs, and its efficacy in the treatment of similar ulcers in people has recently been disputed.



**Figure 2:**  
**Uveitis, secondary glaucoma, and diffuse edema associated with blastomycosis in a dog.**

For edema associated with non-ulcerative inflammatory conditions, topical anti-inflammatory treatment with a steroid (e.g., prednisolone or dexamethasone) or nonsteroidal (e.g., flurbiprofen or diclofenac) preparation may be appropriate. Such instances might include non-infectious keratitis or anterior uveitis. Though now rarely seen, the marked corneal edema characteristic of post-vaccination "blue eye" was due to immune-mediated uveitis. Unless there is permanent endothelial damage or inflammatory membranes on the endothelium, the edema of uveitis usually resolves with resolution of the inflammation. When due to uveitis alone, the cornea should be negative to fluorescein stain, and the intraocular pressure normally is low.

Increased intraocular pressure (i.e., glaucoma) is often associated with corneal edema because high fluid pressure overwhelms the endothelial pump. In instances of acute-onset glaucoma, the edema is temporary and quickly resolves with reduction in intraocular pressure. The diagnosis is easily made by concurrent signs that may include decreased vision, a dilated and unresponsive pupil, and increased intraocular pressure

confirmed by tonometry. Some of the most dramatic instances of corneal edema occur in eyes having both uveitis and glaucoma, as the adverse effects on the endothelium are additive. While the degree of edema may increase concurrent with fluid pressure, severe edema in a glaucomatous eye suggests concurrent uveitis and possible secondary glaucoma (Figure 2)

Corneal endothelial degeneration (or dystrophy) is a condition of middle aged or older dogs that is typically bilateral but may be asymmetric in progression. It can occur in any breed, but there is predilection for the Boston terrier, Dachshund, Chihuahua and the Italian Greyhound. It often begins as subtle edema of the temporal cornea, but over a period of months or years, it may progress to involve the entire cornea of both eyes (Figure 3). Affected dogs are nonpainful in the early stages, but corneal bullae and secondary



**Figure 3: Age-related corneal endothelial degeneration (or dystrophy) in a dog.**

ulcers are common as the disease progresses. Fluorescein staining and tonometry are indicated to eliminate other causes of edema from consideration. Affected dogs usually have intact pupillary light reflexes and normal intraocular pressures, so the condition is easily distinguished from glaucoma. They may also have ulcers, but the ulcers alone cannot account for the degree of edema present. Topical anti-inflammatory treatment is of limited benefit, but may be indicated in early treatment to eliminate concurrent uveitis from consideration. Topical treatment is palliative with hypertonic saline and may be effective to reduce or prevent

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# ARTICLE SPOTLIGHT

*Editor's note:* The spotlight is intended to provide practitioners with clinically relevant information from journals not available to most veterinarians. Old and new articles are included and are selected by the reviewer. This article was provided by Dr. Keith Collins.



**B. Keith Collins,  
DVM, MS, DACVO**

*Title:* Thermal cautery of the canine third eyelid for treatment of cartilage eversion. *Vet Ophthalmol* 2012;1-4:DOI:10.1111/vop.12012

*Summary:* This article describes a simple, quick, and noninvasive procedure for correction of malformed nictitans cartilage. The cartilage abnormality was corrected in twelve eyes of ten dogs using either the tip of a disposable hand-held thermal cautery unit or an electrosurgical unit. The technique required placing the cautery tip in apposition to conjunctiva overlying the convex side of the bent cartilage. Heat applied near the affected cartilage causes temporary softening and is applied to effect. All dogs had good results with minimal complications.

*Comments:* The least amount of cautery required to achieve the desired effect is advised. For electrocautery, coagulation rather than cut settings were used. Care must be taken to avoid excessive

heat to the treated area or damaging adjacent ocular tissues (e.g., cornea). Overcorrection is possible but uncommon and can be reversed by treating the opposite side to “pull” the cartilage back.

*Conclusion:* This is an exciting new technique that offers an effective alternative to surgical excision of cartilage. While surgical excision is not difficult, it is more time consuming and expensive. Complications after excision are infrequent but can include overriding of cartilage edges and nictitans gland prolapse. The thermal cautery procedure should eliminate these complications. Thermal cautery was also effective in correcting bent tips of the cartilage bar at the leading edge of the nictitans; when performing excision, these areas are typically more difficult to correct compared with the proximal (vertical portion) of the nictitans cartilage.

## Upcoming EVENTS

April 7, 2013  
Annapolis, MD  
*Walk for the Animals and  
Tails & Trails 5K*

April 20, 2013  
Glendale, AZ  
*Phoenix Pet Expo*

April 28, 2013  
Advanced Veterinary Specialty Group  
Tustin, CA  
*Multi Specialty Wet Lab*

May 9-13, 2013  
Washington D.C  
*CVC Washington D.C*

June 2, 2013  
City of Angels  
Culver City, CA  
*Multi Specialty Wet Lab*

August 3-4, 2013  
Albuquerque, NM  
*Weekend With the Specialists*

For more information please  
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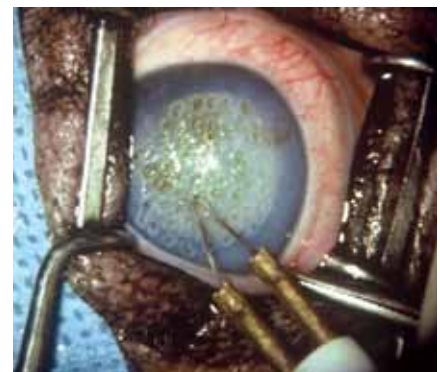
## CORNEAL EDEMA: CAUSES AND TREATMENT (CONTINUED FROM PAGE 2)



**Figure 4: Diffuse corneal edema with epithelial bullae that appear like blisters on the surface**

epithelial bullae (Figure 4), but dramatic corneal clearing is unlikely. Hypertonic preparations can be applied as often as every four hours, but client compliance with higher frequency is poor, and some pets are irritated by the treatment.

Surgery such as thermokeratoplasty or carbon dioxide laser keratoplasty is indicated for advanced cases with concurrent ulcers (Figure 5). Penetrating keratoplasty (or corneal transplant) is rarely performed in veterinary ophthalmology.



**Figure 5: The technique of thermokeratoplasty in a dog with endothelial dystrophy.**

## “CAN I PAY MY NEW EMPLOYEE A SET SALARY VERSUS PAYING BY THE HOUR?”



**Karen Webster, MBA**  
President & CEO, Eye Care for Animals

When hiring a new staff member (i.e., technician, client care representative, practice manager, doctor) small business owners frequently ask whether they can just pay the employee a set salary regardless of whether the employee works more than 40 hours a week or is on-call, thereby avoiding payment for overtime. The Department of Labor’s Wage and Hour Division is responsible for enforcing the Fair Labor Standards Act (FLSA) and makes this question easy to answer.

In order for an employee to be considered “salaried” and exempt from overtime the

employee’s primary duties must pass the FLSA’s test for exemption. The most common FLSA minimum wage and overtime exemption applies to executive, administrative, professional, outside sales, and computer employees. Each of these five categories has certain requirements that must be met in order to be considered a salaried employee and exempt from overtime. As such, technicians or client care representatives (i.e. front line receptionists) would not pass the FLSA’s test for exemption. Most likely, a practice manager or hospital administrator would, and certainly a doctor would pass the FLSA’s test for exemption. There

are 3 tests for exemption, salary level, salary basis, and job duties. If an employee job description or primary work duties do not pass the exemption test, then the employee would be paid hourly. Always ensure that non-exempt, or hourly paid employees, are paid for all hours worked, no exceptions. If there are still questions regarding how employees should be paid, the Department of Labor has “free information” on its website at [www.dol.gov](http://www.dol.gov).

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