A Quick Guide to Corneal Ulcers

created by Dr. Shelby Reinstein, Board-Certified Veterinary Ophthalmologist & Vetrix®

1. **CLASSIFY**
   A thorough eye exam will allow classification of the ulcer as either SIMPLE or COMPLICATED.

2. **CAUSE**
   The eye exam should also attempt to identify an UNDERLYING CAUSE for the corneal ulcer.

3. **TREAT**
   A proper TREATMENT PLAN including EyeQ™ will reduce infection, inflammation & pain.

4. **HEAL**
   EyeQ™ AMNIOTIC EYE DROPS create a superior environment for rapid ulcer healing.

5. **RECHECK**
   Serial exams document ULCER HEALING and allow for modifications to the therapeutic plan.

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### 1. CLASSIFY THE CORNEAL ULCER

**SIMPLE CORNEAL ULCERATION**
- A superficial corneal ulcer with irregular edges (white & cobalt blue light)
- Remains superficial
- No evidence of infection
- No neovascularization or corneal melting
- Heals quickly (7-10 days) with appropriate treatment
- No scar formation

**COMPLICATED CORNEAL ULCERATION**
- Loss of part or all of corneal stroma
- Appearance of infection, corneal melting, neovascularization
- Often associated with an underlying ocular condition
- Requires aggressive medical and/or surgical therapy
- May threaten vision or integrity of the eye

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### 2. IDENTIFY THE UNDERLYING CAUSE

<table>
<thead>
<tr>
<th>MECHANICAL</th>
<th>PRIMARY CORNEAL DISEASE</th>
<th>INFECTIOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traumatic</strong></td>
<td><strong>Tear Film Disease</strong></td>
<td><strong>Viral</strong></td>
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<tr>
<td>Bite or claw injury</td>
<td>KCS</td>
<td>Feline Herpes Virus-1 (common)</td>
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<tr>
<td>Shampoo, chemical burn</td>
<td>Qualitative tear deficiency</td>
<td>Canine Herpes Virus-1 (rare)</td>
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<tr>
<td>Foreign body</td>
<td>Neurogenic KCS</td>
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</tr>
<tr>
<td><strong>Eyelid Abnormality</strong></td>
<td><strong>Corneal Deposits</strong></td>
<td><strong>Bacterial</strong></td>
</tr>
<tr>
<td>Ectropion</td>
<td>Lipid</td>
<td>Secondary infection common with:</td>
</tr>
<tr>
<td>Entropion</td>
<td>Cholesterol</td>
<td>- Staphylococcus</td>
</tr>
<tr>
<td>Eyelid mass</td>
<td>Calcium</td>
<td>- Beta-hemolytic Streptococcus</td>
</tr>
<tr>
<td>Lagophthalmos</td>
<td></td>
<td>- Pseudomonas</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cilia Abnormality</th>
<th>Corneal Edema</th>
<th><strong>Fungal</strong></th>
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<tbody>
<tr>
<td>Distichia</td>
<td>Glaucoma</td>
<td>Rare in dogs and cats</td>
</tr>
<tr>
<td>Ectopic cilia</td>
<td>Uveitis</td>
<td></td>
</tr>
<tr>
<td>Trichiasis</td>
<td>Endothelial dystrophy/degeneration</td>
<td></td>
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</table>
Topical NSAIDs are contraindicated in most cases of corneal ulceration, especially infected or melting ulcers.

Neomycin EyeQ™ Amniotic Eye Drops do not provide immediate structural support and are not meant to replace tectonic surgical grafts.

2. **Topical cefazolin eye drops are made by combining 16.7 mL of 0.9% saline with 1 g of cefazolin, resulting in a 60 mg/mL solution. Keep refrigerated, discard after 20 days.
3. **Topical NSAIDs are contraindicated in most cases of corneal ulceration, especially infected or melting ulcers.
4. **Intra-species use is acceptable. Keep refrigerated, discard after 20 days.
5. **EyeQ™ Amniotic Eye Drops do not provide immediate structural support and are not meant to replace tectonic surgical grafts.

### DESIGN TREATMENT PLAN

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>SIMPLE CORNEAL ULCER</th>
<th>COMPLICATED CORNEAL ULCER</th>
</tr>
</thead>
</table>
| **ANTIBIOTIC** | Broad-spectrum drop or ointment  
- Dog: NPB/NPG\(^2\), Terramycin, Ciprofloxacin  
- Cat: Erythromycin, Ciprofloxacin  
- Applied every 6-8 hours for 7-10 days  
- Until fluorescein stain negative  
- **Oral antibiotics not indicated** | Targeted Gram+ and Gram- coverage  
- Gram + coverage  
- Ofloxacin, Moxifloxacin, Cefazolin\(^2\)  
- Gram- coverage, esp. Pseudomonas  
- Gentamicin, Tobramycin  
- **Frequent application necessary**  
- Every 2-4 hours for first 2-3 days  
- Slow reduction in frequency weekly  
- BID therapy recommended 1-2 weeks beyond ulcer being fluorescein stain negative  
- **Oral antibiotics often indicated**  
- Doxycycline 10 mg/kg PO q24 x10-14 days  
- **Also an anti-collagenase & anti-inflammatory**  
- Amoxicillin-clavulanic acid or enrofloxacin  
- **If corneal perforation is impending or present** | 

### ANTI-INFLAMMATORY

- Oral NSAIDs x 3-5 days prn\(^3\)  
- For reflex uveitis (aqueous flare, hypopyon)

### ANTI-COLLAGENASE

- **Not indicated**

### ATROPINE

- Indicated only if pupil is miotic  
- Single application may be sufficient  
- Only use ointment in cats (↓ salivation)  
- Harvested from patient or donor\(^4\)

### ANALGESIA

- Additional pain control PO prn  
- PO: Gabapentin, tramadol, buprenorphine (OTM)  
- Inj: Methadone, buprenorphine, hydromorphone

### AMNIOTIC EYE DROPS

- **EyeQ™ Amniotic Eye Drops** can be used for simple or complicated ulcers  
- Delivers natural **ANTI-MICROBIAL & ANTI-INFLAMMATORY** components to aid traditional therapies  
- Provides a **BIOSCAFFOLD** to enhance corneal cell growth & migration\(^5\)  
- Unique, powderized amniotic membrane drop rapidly delivers components to the ulcer  
- Dual-chamber bottle provides for extended shelf life and simple, on-demand product preparation  
- Convenient dropper bottle tip allows for easy administration by pet owners  
- Applied every 6-8 hours, separated from other medications by ~ 5 minutes  
- Duration of treatment depends upon severity of ulceration and rate of healing  
- Complicated ulcers often require 1-2 months of therapy (approximately 2-3 bottles of EyeQ™)

### Rethink Healing: Combine EyeQ™ Amniotic Eye Drops with traditional therapy for more RAPID healing!

### PROMOTE BETTER HEALING

- **EyeQ™ amniotic eye drops** mimic corneal basement membrane structure to enhance the growth of corneal epithelial cells
- **EyeQ™** can reduce corneal scar formation via suppression of fibroblast growth factors
- **EyeQ™** contains heavy-chain hyaluronic acid (HC-HA) for long-lasting lubrication & protection of the corneal surface during healing

### RECHECK & MODIFY PLAN

12y DSH with a complicated (deep, infected, chronic) corneal ulcer

**Day 0**
- Ofloxacin, Tobramycin, EyeQ™ TID  
- Atropine q24h  
- Buprenorphine OTM q8h

**Day 14**
- Ofloxacin, Tobramycin, EyeQ™ TID  
- Buprenorphine OTM prn

**Day 60**
- Ofloxacin, Tobramycin BID (Day 30-60)  
- EyeQ™ TID  
- All medications discontinued TID Day 60