**Cornea Overview**
Vet 433A Ophthalmology

Anatomy

Layers of the cornea

- Epithelium: 5-7 layers, hydrophobic properties, regular turnover
- Stroma: 75% water, 25% collagen, parallel arrangement of collagen fibers, hydrophilic, keratocytes
- Descemet's membrane: BM of endothelium, thickens with age, hydrophobic
- Endothelium: Monolayer of cells, non-regenerative, dehydrate stroma via pumping mechanism. Separates cornea from the inside of the eye

Axonal Reflex: Any stimulation of corneal nerves leads to reflex stimulation of cranial nerve V nerve branches to the anterior uveal tract

Corneal ulcer > Stimulation of CN V > reflex uveitis with painful ciliary body muscle spasm (can be relieved with cycloplegic drugs such as atropine)

**Corneal Ulcers**

- Scratch, wound or defect of the cornea that leads to a loss of variable amounts of corneal tissue
- *Most common presenting ophthalmic condition

Epithelial wound healing: Epithelial migration, proliferation, and adhesion

Stromal wound healing requires collagen production

Timeline of corneal wound healing

WBC move in the cornea at 8-6 mm/day!

Corneal blood vessels move at about 1 mm/day

Epithelial cells move ~ 0.6-1 mm/day

Epithelial cells may take up to 6 weeks to adhere to the BM

| Simple Corneal Ulcer | Complicated Corneal Ulcer |
|---|---|
| Superficial<br>Not infected<br>Heal in appropriate amount of time<br>No complicating factors<br>Should heal in 7 days! | Deep (loss of stroma)<br>Infected/melting<br>Other complicating factors present<br>Delayed healing |

*Complicating factors: Entropion, KCS, Eyelid tumors, Lagophthalmos, Ectopic cilia, Trigeminal neuropathy, Systemic disease (Cushing's, diabetes mellitus), distichiasis

Infected Ulcers

**Cornea Overview**
Vet 433A Ophthalmology

Bacterial: Various pathogens, Pseudomonas, Beta hemolytic streptococcus, staphylococcus

Most common: Staphylococcus ~38.5% Streptococcus ~14% Pseudomonas ~12%

Fungal (mostly in horses): Aspergillus sp. Fusarium sp.

Descemetoceles

Epithelium and stroma loss; DM exposed

Very thin!

DM may bulge creating a bubble-like appearance from the pressure of the aqueous humor (Do NOT try to pop this)

Fluorescein will only be present on AROUND the ulcer, not on the bed since the DM is hydrophobic

Corneal Perforations

Active leakage can be detected via a Seidel's Test

Fibrin Plug and Iris prolapse can also occur

Melting Cornea

Proteases/Collagenases

-Degradation of collagen (cornea has a lot of collagen)

-The cornea will develop a gelatinous appearance

-Can be due to bacteria, fungi, wbcs, or degenerate epithelial cells

Steps for addressing a corneal ulcer

1. Rule infection in or out
    a. Culture and sensitivity
        i. Do this prior to applying anything to the eye
        ii. Aerobic ophthalmic panel
        iii. Fungal panel, especially for horses
    b. Cytology
        i. Use topical anesthesia, cytobrush, and diff-quick/gram stain
2. Stain with Fluorescein
    a. Stains the stroma since it is hydrophilic!

**Cornea Overview**
Vet 433A Ophthalmology

**Five As of Medical Therapy of Corneal Ulcers**

Antiprotease: Reduce tear protease activity

- Topical anti-protease/anti-collagenase
- q1-6 hours, autologous serum (replace q7 days)
- EDTA solution, N-acetylcysteine 5%, Amnion drops
- Tetracycline, doxycycline 5mg/kg po q12 hours

Antimicrobial: Prevent or treat infection

- Gram-positive (Staph and B-hemolytic Strep) Cefazolin 33mg/ml; Fluoroquinolones (+/-)
- Gram-negative (Pseudomonas, E-coli): Tobramycin, Gentamicin; NeoPolyGram/bac; Fluoroquinolones
- *You should always give a broad-spectrum coverage because there is still an open wound on the cornea

Atropine: Treat reflex uveitis > axonal reflex

- All ulcers are associated with some iridocyclitis regardless of their initial cause
- Topical atropine 1% and systemic NSAIDs

Analgesia: Provide analgesia (NSAIDs)

Address Cause: Treat etiology *KCS, entropion, eyelid abnormalities

Medical Therapy of Corneal Ulcers

**<u>How to Treat Simple Ulcers</u>**

Broad-spectrum topical antibiotic TID-QID until healed

- Neomycin, Polymyxin B, Bacitracin (NPB) or Gramicidin (NPG) solution

Treat reflex uveitis (atropine 1% once at office or SID and oral NSAIDs)

Analgesia

**Cornea Overview**
Vet 433A Ophthalmology

Anti-protease +/-

Prevent self-trauma

## How to Treat Complicated Ulcers

Anti-protease q1-6 hours

- Serum, plasma, EDTA, NAC, Tetracyclines

Antimicrobials based on culture/sensitivity

- Abx, antifungals etc.

Treat reflex uveitis

- Atropine and oral NSAIDs

Provide analgesia

Consider surgical stabilization

- Stromal loss is >50% of the corneal thickness, vascular support, fibroblasts, physical support
- Conjunctival grafts
- Biological grafts

Prevent Self-Trauma (some dogs can lick their eyes!)

Topical corticosteroids are **CONTRAINDICATED** in the presence of corneal ulceration *Especially melting!

Also better to avoid topical NSAIDs because they may induce melting

## Iris prolapse

Think about two things:

1. Does this eye have the potential to see? – Menace, Dazzle, Consensual PLR, Fundic exam
2. Is the perforation sealed?

How to treat: Treat as a complicated/deep/infected corneal ulcer

Add oral broad-spectrum abx

NO OINTMENTS > Granulomatous uveitis in response to petroleum base

**Cornea Overview**
Vet 433A Ophthalmology

Careful with atropine, let the iris plug up the hole

Surgical repair if there is the potential for vision > Refer to DACVO TODAY!

**<u>What should you do if an ulcer is not healing?</u>**

Check eyelid position, look for lash abnormalities, check tear production, look for the presence of foreign bodies (especially behind the third-eyelid), look for infection

If none of the above are present, it may be an indolent ulcer

**<u>Canine Indolent Ulcers</u>**

Also known as "Boxer" ulcers, non-healing ulcers, or SCCEDS (Spontaneous Chronic Corneal Epithelial Defect Syndrome)

Chronic blepharospasm, epiphora, photophobia

Superficial corneal ulcer with epithelial lip

Fluorescein diffuses under epithelium

Why does this happen: There is a failure of normal cell-cell adhesion between epithelium and its basement membrane and underlying stroma (hemidesmosomes). Hyaline membrane forms over the ulcer and the epithelium cannot adhere to the hyaline membrane further creating a cyclic issue

Treatment options:

Cotton tip applicator for debridement (50% heal with this)

Use topical anesthetic then clean the eye with diluted betadine prior to removing the loose lips of epithelium *always use a dry Q-tip

Median healing is 21 days

Cotton tip applicator for debridement and grid keratotomy or diamond burr to disturb the hyaline membrane

Sedation, topical anesthesia, Q-tip debridement, 25g needle, +/- hemostats to hold the needle at the tip

Grid: Scratch superficial lines across the ulcer bed, should involve approximately 1mm of healthy cornea on either side of the ulcer bed (85-95% success rate)

Diamond Burr: AlgerBrush II, rotating 3.5mm burr tip, safer than grid (no risk of going deeper) creates fine abrasions in anterior stroma

Median healing is 12 days

**Pannus (Chronic Superficial Keratitis)**

Immune mediated, non-ulcerative keratitis

Common in German Shepherds and Sighthounds

Young adults, no apparent sex predilection

Non-painful, progressive, and exacerbated by exposure to UV light

Clinical signs:

Superficial fibrovascular invasion (starts laterally and progresses axially)

Pigmentation follows vessels

Third eyelid thickening *you can also only have this sign = atypical pannus

Treatment: *Lifelong*

Topical Steroid – Dexamethasone or prednisolone

Topical immunomodulators

Cyclosporine A 1-2% or Tacrolimus 0.03%

Subconjunctival CsA implant

**Feline Herpesvirus-1**

Most common cause of corneal ulcers in cats!

May have concurrent blepharitis, conjunctivitis, or respiratory disease (Upper resp)

Virus remains dormant in neurons, recrudescence elicited by a stressful event

Diagnostics: Full-strength fluorescein and magnification, do not flush the eye!

Dendritic ulcers are pathognomonic, this is usually a clinical diagnosis and does not require additional tests

Treatment:

Topical anti-viral therapy

Cidofovir 0.5% solution BID

Idoxuridine 1% solution 4-6x/day

Trifluridine 1% solution 4-6x/day

Systemic anti-viral therapy

Famciclovir 90mg/kg PO BID

L-lysine, 250-500 mg PO BID

Minimize stress

## **Feline Corneal Sequestrum**

Necrotic corneal stroma due to chronic irritation, trauma to the cornea, +/- FHV-1, Brachycephalics are predisposed!

Definitive Treatment: Surgical resection, keratectomy +/- graft (conjunctival graft, amniotic membrane graft, sliding corneal-conjunctival transposition)

What if they cannot refer?

The sequestrum may vascularize and slough off, may heal or may become a deep ulcer and the cornea can rupture

Healing may take months

Meds: Topical abx, if fluorescein positive, analgesia if needed