

In-Office Care of the Emergency Patient: Corneal Urgencies and Emergencies

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- Dr. Harthan has no direct financial or proprietary interest in any companies, products or services mentioned in this presentation.
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2



Overview

- Corneal Abrasions
- Corneal Erosions
- Chemical Injuries
- Corneal Lacerations
- Corneal Foreign Bodies
- Corneal Ulcers
- Corneal Hydrops
- Epidemic Keratoconjunctivitis
- Herpes Simplex Virus Dendritic Keratitis
- Herpes Zoster Ophthalmicus



Format for Today's Discussion

- Presentation of Case
- Review Etiology of Condition
- Discuss Management Options



Triage

- Emergent Situation
 - Requires **immediate** action
 - Patient is seen **same day**
- Urgent Situation
 - Requires patient be seen within **24-36 hours**
- Routine Situation
 - Requires patient to be seen within a **few days to a week**

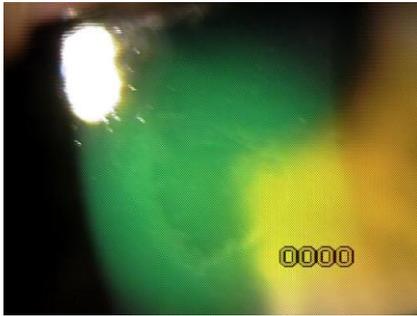


Symptoms can point you in the right direction...

- Redness
- Discharge
- Foreign body sensation
- Itching
- Burning
- Lid edema
- Photophobia
- Pain
- Changes in vision

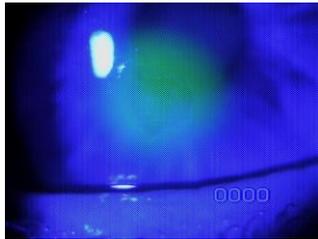


65 y/o WM



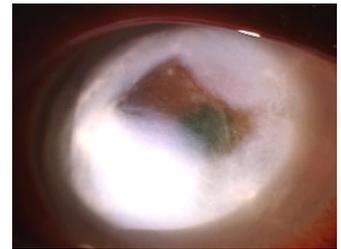
Corneal Abrasion Management

- Antibiotic bid to q2hr
- Ointment qid
- Copious Lubrication
- NSAID
- Cycloplegic
- Bandage CL
- Pressure Patch
- Amniotic Membranes
- Follow up every 24 hours



Potential Complications

- Corneal scarring
- Infectious keratitis
- Decreased vision
- Recurrent erosions



90 y/o AAF



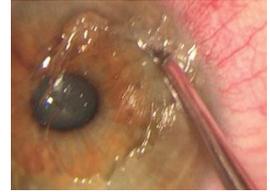
Recurrent Corneal Erosion (RCE) Etiology and Pathophysiology

- Previous traumatic corneal abrasion
 - Fingernail, tree branch, paper
 - Corneal dystrophies
 - Anterior basement membrane, Lattice, Granular
 - Disturbance to Bowman's layer
- Repeated episodes of spontaneous superficial erosions
- Age: 24-73 (highest prevalence between 3rd and 4th decade)
 - M=F (slightly higher female)
 - Interval between initial abrasion and first recurrence: 2 days to 16 years
 - 10% cases bilateral



RCE Acute Management

- Similar to treatment for abrasions
 - Antibiotics
 - Copious Lubrication
 - Cycloplegics
 - NSAIDs (topical vs oral)
 - Bandage CL
 - Follow up every 24 hours to several days
- May need to debride
 - If not healing in 24-48 hours



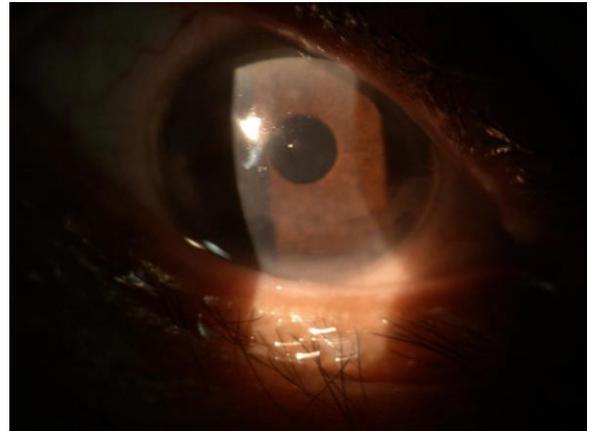
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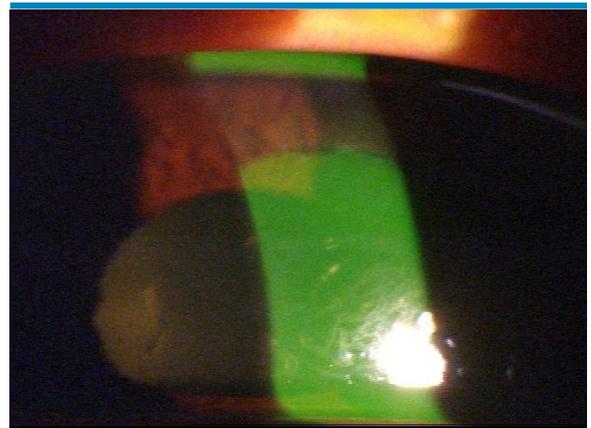
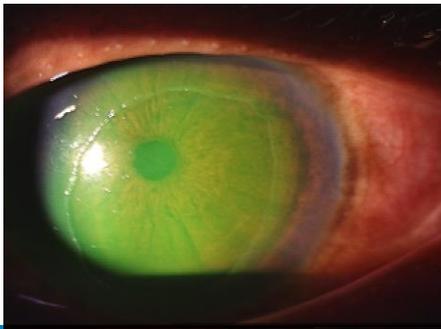
RCE Prophylactic/Long-term Management

- Hypertonic therapy
 - Muro 128 drops or ung qid
 - Doxycycline (50-100 mg bid)
 - Vitamin C
 - Azasite
 - Restasis and punctal plugs
 - Bandage and/or scleral lenses
- Amniotic membranes
 - Autologous Serum
 - Topical corticosteroids
 - Lotemax
 - Surgical
 - Anterior stromal puncture
 - Phototherapeutic keratectomy (PTK)
 - Superficial keratectomy

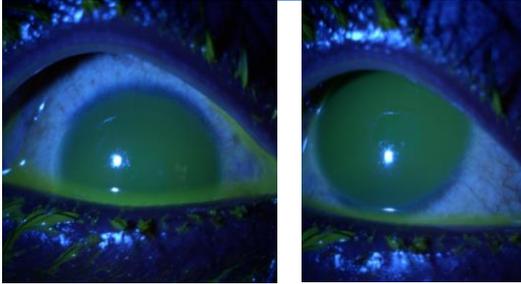
****Most require combination therapy*****



61 y/o AAF



24 y/o AAF



Chemical Injuries

- Potentially vision threatening!
- No matter how busy... Chemical burns are seen FIRST!
- By-pass VA, quickly check pH, then begin immediate irrigation
IRRIGATE, IRRIGATE, IRRIGATE!!
- Time and action are critical
- Severity is related to:
 - Properties of the chemical
 - Area of affected surface
 - Duration of exposure

Mild = red eye (good prognosis)

Severe = white eye (poor prognosis)



Etiology

- Eye injuries account for 4-7% of workplace injuries
 - 84% are chemical burns
- Incidence
 - 30 per 10,000
 - 82-91% men (16-45 y/o)
 - 90% accidental
 - Alkali 2x more common
 - 2/3 occur at work
 - 10% Intentional
 - Assault



Chemical Injuries

- Acidic Burns
 - Sulfuric (battery acid), hydrofluoric, hydrochloric
 - Usually a self-limiting burn
 - **Low pH: 6.9 or lower**
- Alkali Burns
 - Lime, ammonia, sodium hydroxide
 - Very damaging- can easily penetrate all ocular layers
 - **High pH: 7.1 or greater**



Grading of Severity

- Grade I
 - Involves corneal epithelium only
 - Limbal stem cells spared
 - No limbal ischemia
 - Cornea remains clear
 - Prognosis: Excellent
- Grade II
 - Partial loss of limbal stem cells
 - Focal limbal ischemia
 - <1/3 of limbus
 - Hazy cornea
 - Anterior segment structures are visible
 - Prognosis: Good



Grading of Severity

- Grade III
 - Total loss of corneal epithelium
 - Loss of most limbal stem cells
 - Stromal haze
 - Extensive limbal ischemia
 - 1/3 to 1/2 of limbus
 - Prognosis: Guarded
- Grade IV
 - Complete loss of corneal epithelium and limbal stem cells
 - Opaque cornea
 - No view of iris or pupil
 - "Porcelainization"
 - > 1/2 Limbal ischemia
 - Prognosis: Extremely poor



Chemical Injuries Management

- Depends upon severity of burn
 - Severe burns (aka significant ischemia, open globe, periocular open wounds) = immediate external referral
 - Mild to moderate = treat the problem
- Copious irrigation with normal saline for at least 30 min and repeat every 30 minutes until neutral pH is reached**



Medical Management

Goals of Treatment: Reduce inflammation, promote epithelial regeneration, and prevent corneal ulceration

- Double eversion of the upper eyelid
- Debridement of necrotic epithelium
- Artificial tears
- Antibiotic ointment
- Cycloplegic agents
- Follow up every 24 hours!
- Steroids
- BCL
- Sclerals
- Ascorbic acid (Vitamin C)
- Citric acid
- Doxycycline
- Punctal plugs



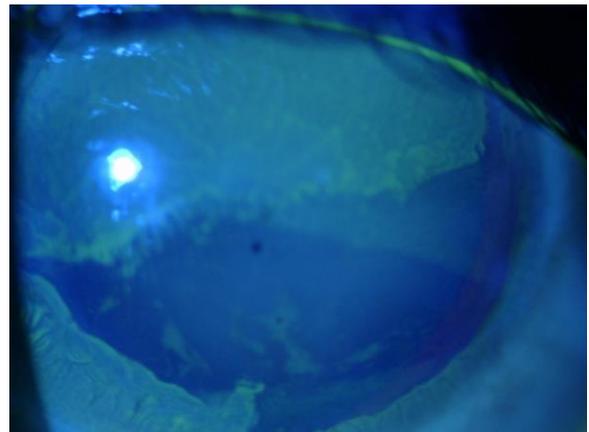
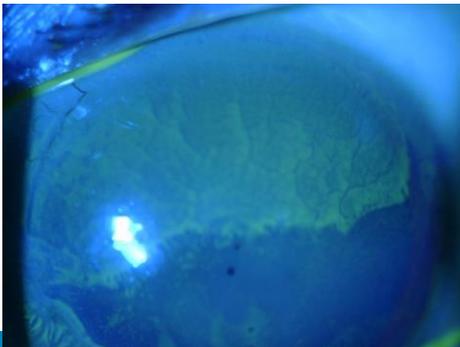
Surgical Management

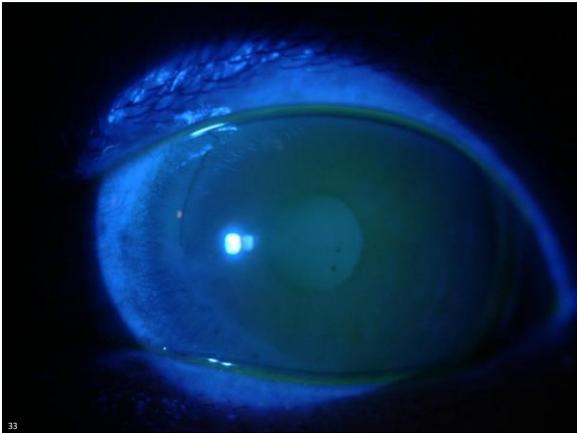
Goal: Promote revascularization of the limbus, restore limbal stem cells, re-establish fornices

- Limbal stem cell transplantation
- Amniotic membrane grafting
- Division of conjunctival bands
- Correction of eyelid deformities
- Tarsorrhaphy
- Penetrating Keratoplasty
- Keratoprosthesis



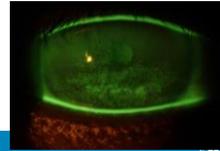
54 y/o CM



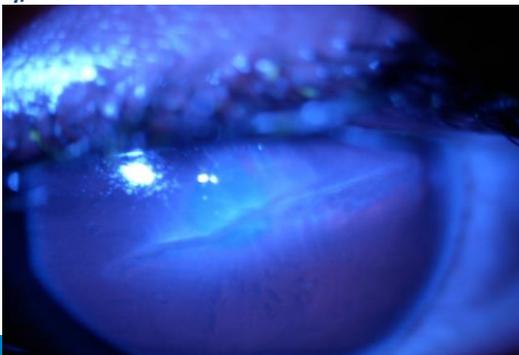


Potential Complications

- Corneal Opacification/Scarring
- Symblepharon
- Dry Eye
- Ocular Ischemia
- Corneal Neovascularization
- Loss of limbal stem cells – irregular corneal surface
- Punctal stenosis or occlusion
- Limbal stem cell deficiency
- Pannus formation
- Cataracts
- Glaucoma



17 y/o AAF



Corneal Lacerations

- Etiology:
 - Industrial accidents
 - Traffic accidents
 - Home accidents
 - Assault
 - Traumatic wound rupture

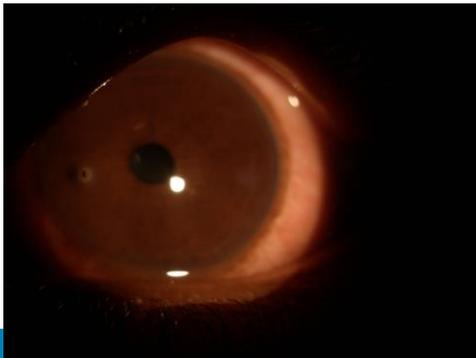


Corneal Lacerations

- **Immediate Referral**
- Small, partial-thickness lacerations may generally be treated as abrasions with patching therapy
- Larger wounds often require immediate surgery
- No ointment should be applied to the eye
- Seidel Test
 - Positive = full thickness
 - Negative = partial thickness
- Fox shield over eye for protection
 - Need to keep anterior chamber intact

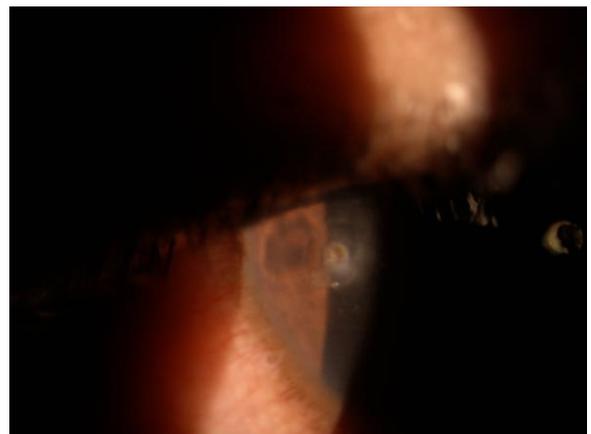
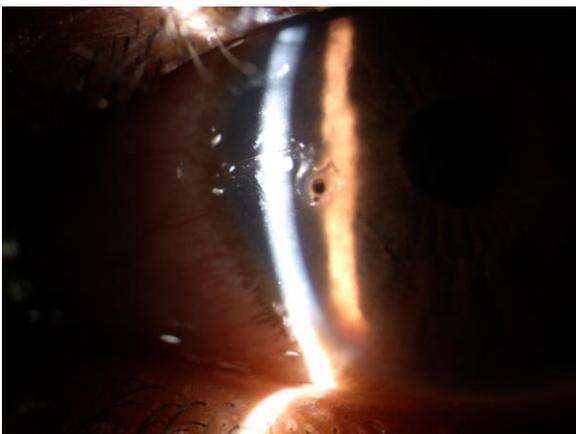


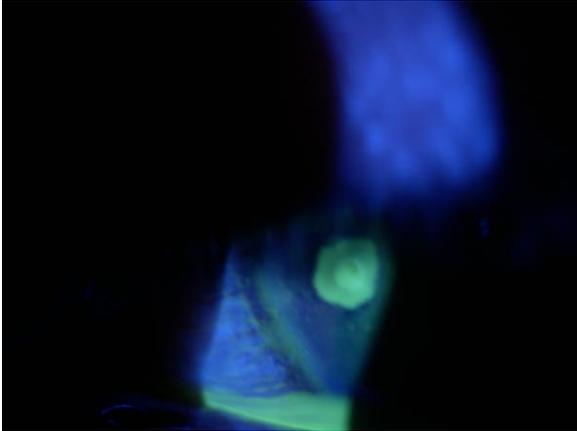
29 y/o CM



Corneal Foreign Body Removal

- *****Accurate assessment of depth of penetration before removal*****
 - Pupil irregularities, iris tears, transillumination defects, lens opacities, hyphema, shallow A/C, low IOP
- Irrigation
- Sterile cotton swab or sponge
- Spud
- Jeweler's forceps
- Needles
- Alger brush
- May need to remove deeper rust rings at a later date after they have migrated to the surface





Corneal Foreign Body Treatment

- After removal of foreign body
 - Measure size of resultant epithelial defect
 - Treat as for corneal abrasion
- Cycloplegic
- Antibiotic
- Bandage contact lens
- Corticosteroids
 - After re-epithelialization to reduce scarring
- Follow up
 - 24 hours

Look for signs of intraocular FB:

- Corneal laceration, iris tear, lens opacity, collapsed anterior chamber, low IOP



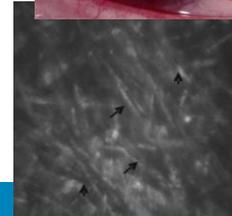
Corneal Ulcer

- **INFECTION** of the cornea by microbes
- Characterized by excavation of the corneal epithelium, Bowman's, and stroma
- Infiltration
- Necrosis of tissue
- Ideally all cases should be cultured
- Realistically...
 - >2mm in size
 - <3mm from visual axis
 - >1/4 corneal depth



Corneal Ulcer Etiology

- Bacterial
 - *S. aureus*
 - *S. pneumoniae*
 - *M. lacunata*
 - *P. aeruginosa*
- Fungal
 - *Fusarium*
 - *Aspergillus*
 - *Candida*
- Acanthamoeba



Corneal Ulcer Risk Factors

- Eyelid disorders
- Chronic corneal disease
- Refractive surgery
- Blepharitis
- Chronic lacrimal drainage obstruction
- Immunosuppression
- Trauma
- Contact lenses
 - Poor personal hygiene
 - Contaminated solutions
 - Lens surface deposits
 - Non-compliance with disinfection
 - Lens manipulation
 - Corneal hypoxia with extended wear

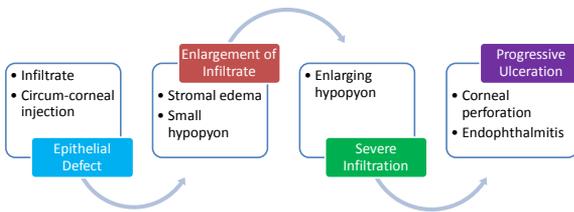


Corneal Ulcer Signs/Symptoms

- Clinical manifestations
 - Foreign body sensation
 - Followed by **increasing pain and photophobia**
 - Decreased VA
 - **Marked conjunctival hyperemia and inflammation**
 - Ciliary flush
 - Pupillary constriction
 - **Mucopurulent discharge**
 - **Anterior chamber reaction, with or without hypopyon**
 - Ragged, irregular epithelial ulceration with underlying necrotic stromal infiltration and surrounding epithelial edema



Signs in Chronological Order



51



Ulcer Vs. Infiltrate

PEDAL

52



Corneal Ulcer Treatment

- Discontinue CL wear
- Culture
- Broad spectrum topical antibiotic therapy
 - Consider loading dose of antibiotic
 - One drop q 5 min for 15-30 min
 - One drop q 30-60 min for 24 hrs
- Fortified subconjunctival or IV antibiotics
 - Cefazolin, vancomycin, gentamycin, tobramycin
- Cycloplegic
- Topical corticosteroids
 - SCUT study
- Amniotic Membrane
- PKP
- CXL?



Fungal Keratitis Treatment

- Filamentous fungi: Natamycin 5% (Natacyn) q1hr (including during sleep)
- Yeast: Amphotericin B 0.15% q5min x 1 hour, then q1hr
 - Flucytosine orally 150mg/kg/day or topically 1% 1gt q30mins to inhibit fungal growth
- No Steroids
- Consider hospitalization
- Voriconazole

**Natamycin is the only commercially available antifungal for ophthalmic use in the US



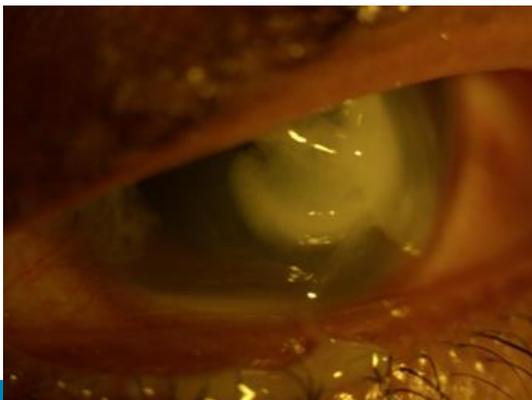
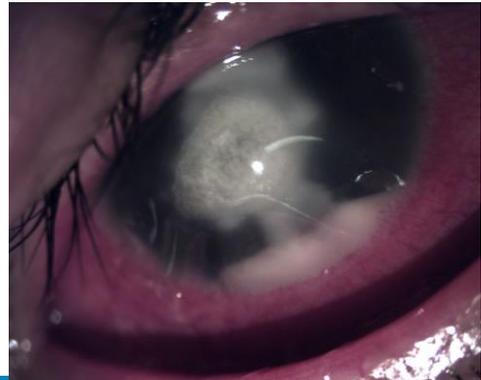
Acanthamoeba Keratitis Treatment

- Topical treatment often includes a combination of agents:
 - **Loading dose** (first 1-3 days)
 - Chlorhexidine 0.02% and/or PHMB (polyhexamethylene biguanide) 0.02%
 - AND
 - Propamidine isethionate 0.1% (Brolene™)
 - POSSIBLY INCLUDE
 - Neomycin solution or fluoroquinolone
- All meds q1hr (also during sleep)
- Each drug given at the same interval separated by 5 minutes



Corneal Ulcer

- Follow up every 24 hours
- Pain level, inflammation, and size of defect should decrease continually
- Taper medications as needed
- Refer non-compliant patients and worsening ulcers



25 y/o AAF presented to ER

- CC: "bubble on pupil" OD, x 1 day
- (+) tearing, blurred vision, eye rubbing
- (-) pain, photophobia
- Decreased VA, longstanding
- (-) CL wear
- (-) meds
- PMH: (+)HTN, seasonal allergies, developmental disability



- VAsc:
 - OD 20/400 @ 2 ft
 - OS 20/70-2
- PERRL(-)JAPD
- EOMS: FROM
- CVF:
 - Restricted OD
 - FULL OS



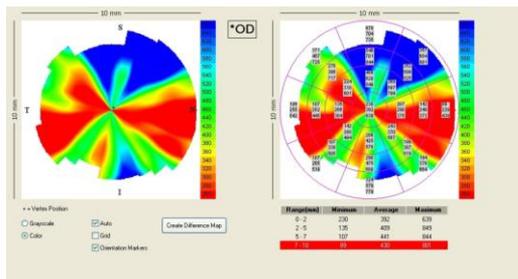
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62



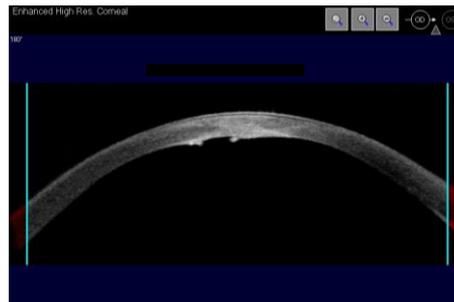
Pachymetry



63



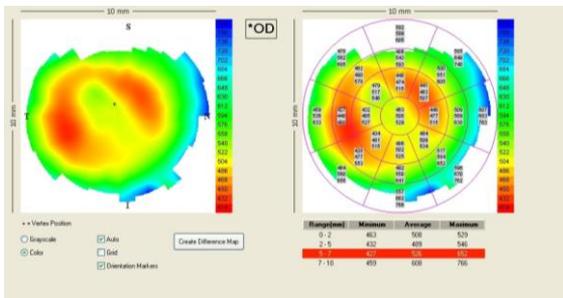
After 3 months of treatment



64



Pachymetry after 3 months



65



Corneal Hydrops- Signs & Symptoms

- Decreased vision
- Pain
- Redness
- Photophobia
- Epiphora
- CL Intolerance
- Conjunctival Injection
- Corneal Edema
- Break in Descemet's
- Bullae
- **Underlying Corneal Ectasia



Standard Treatment Regimen

Topical Antibiotic	Prevent infection from ruptured bullae
Topical Hypertonic Solution	Decrease corneal edema
Cycloplegic	Pain management
Copious Artificial Tears	Reduce surface irritation



Keratoconus and Inflammation?

- Keratoconus may be a “quasi-inflammatory” disorder
- Tears from keratoconic eyes showed elevated levels of
 - Pro-inflammatory marker IL-6
 - Pro-inflammatory marker TNF α
 - Tissue degrading MMP-9's
- Keratoconus may be due to an imbalance between pro-inflammatory and anti-inflammatory cytokines



Why Doxycycline?

- Inhibitor of MMP-9's
- Indirect anti-inflammatory properties
- Beneficial in treatment of recurrent corneal erosions
- Promotes corneal healing



Why Vitamin C?

- Excellent anti-oxidant properties
- Decrease apoptosis of corneal tissue
- Decreased scarring when used both orally and intravenously in cases of infectious keratitis



Epidemic Keratoconjunctivitis (EKC) Pathogenesis

- Occurs in two phases
 - Acute
 - Begins unilaterally, then less severe in fellow eye
 - Follows 7-16 day course
 - Sequelae
 - More severe corneal involvement



Epidemic Keratoconjunctivitis (EKC) Clinical Manifestations- Acute Phase

- Bilateral in majority of cases
- Preceded by URI
- One week to 10 days after inoculation:
 - Sudden onset of profuse serous discharge
 - Periorbital pain
 - Severe follicular conjunctivitis
 - Chemosis
 - Petechial hemes on palpebrum
 - Moderate to severe eyelid edema
- Pre-auricular lymphadenopathy
- Potential pseudomembrane formation
- Corneal involvement
 - SPK
 - May appear as early as first or second week
 - Virus-infected cells
 - May form focal keratitis



Epidemic Keratoconjunctivitis (EKC) Clinical Manifestations- Sequelae phase

- Variable course
- **Subepithelial infiltrates**
 - Within 7-14 days after onset of ocular symptoms
 - Early in third week
- Variable number, location and density
- Variable affect on VA
- Delayed hypersensitivity reaction to viral antigen in overlying epithelium.
- **Immunopathologic response to viral infection of keratocytes in the superficial corneal stroma.**

73

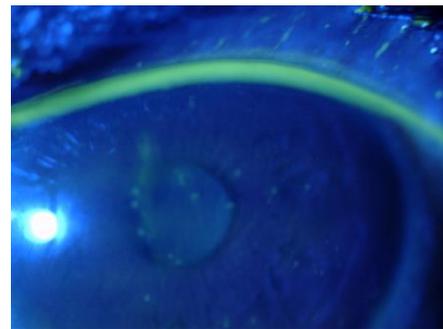


74

Photo courtesy of Dr. Stephanie Klemencic



75



76



Epidemic Keratoconjunctivitis (EKC) Management

- Patient is contagious!
- Patient education
- Hygiene!!!!
- Discard contact lenses
- Supportive therapy
- Peeling of pseudomembrane
- Topical corticosteroids
- Topical NSAID
- Cidofovir? (prophylaxis?)
- Zirgan
- Betadine 5% Sterile Ophthalmic Prep Solution
- Cyclosporine A 0.5-2.0%

77



78



5% Betadine Ophthalmic Prep Solution

- Used for pre-surgical prep
- Off-label use for moderate to severe EKC
 - 60 second treatment followed by lavage
 - Pre- and post- treatment with topical NSAID
 - Topical steroid *qid* x 4-6 days

79



80



81

Patient Concerns:

- Am I contagious?
- How long am I contagious for?
- Do I need to stay home from work/school?

82



Herpetic Eye Disease: Review

- HSV eye disease is a wide spectrum of clinical problems.
- Ranges from dermatitis of eyelid, blepharitis of the lid margin, conjunctivitis, epithelial keratitis, stromal keratitis and iritis.



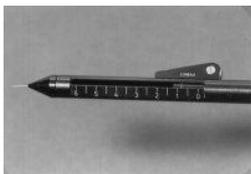
Herpes Simplex

- HSV I
 - Oral herpes
 - Upper body
 - Affects eye, mouth, skin above the waist and respiratory tract
 - Less commonly affects genitals
 - Transmission by direct contact
- HSV II
 - Genital herpes
 - Lower body
 - Less commonly affects the eye, but tends to be more severe
 - Sexual and neonatal transmission



Herpes Simplex

- Can affect anterior to posterior segment!
- Corneal aesthesiometry
 - Side that has herpetic infection will show reduced sensitivity!
 - Measurement:
 - Cochet-Bonnet aesthesiometer
 - Cotton wisp
 - Dental floss



Herpes Simplex: Dendritic Keratitis

- Symptoms:
 - Foreign body sensation
 - Increased lacrimation
 - Photophobia
 - Pain
- Signs:
 - Conjunctival hyperemia
 - Early SPK that then takes on dendrite pattern
 - Branching (dendritic) epithelial lesion
 - Knob-like end bulbs that stain with fluorescein and lissamine green



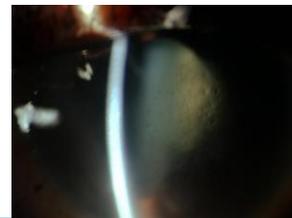
Herpes Simplex: Dendritic Keratitis

- **Treatment:**
 - **Topical antivirals**
 - Viroptic (Trifluridine) - 9x/day until re-epithelialization; then 5x/day x 7 days
 - Zirgan (Ganciclovir) – 5x/day until re-epithelialization; then tid x 7 days
 - **Oral antiviral as alternative or in conjunction**
 - Acyclovir 400mg 5x/day
 - Valacyclovir 500mg tid
 - Famciclovir 250mg tid



Herpetic Eye Disease

- **NEVER PUT A STEROID ON AN ACTIVE DENDRITE**
 - *But put one on just about every other ocular herpetic sequela*
 - Disciform keratitis
 - Stromal keratitis
 - Herpetic iritis
 - Pseudodendrites?



Mechanisms of Ocular Involvement

1. **Direct viral invasion** → epithelial keratitis or conjunctivitis
2. **Secondary inflammation** → episcleritis, scleritis, keratitis, uveitis
 - Inflammation and/or degeneration of peripheral nerves, central ganglia or altered CNS signal processing may attribute to PHN
3. **Reactivation** → necrosis and inflammation in ganglia → neurotrophic keratitis



varicella-zoster virus (VZV)

chicken pox (varicella)

shingles (herpes zoster)

Recurrent Infection: HZO Clinical Manifestation

Headache, malaise, fever, chills

Neuralgic pain and hyperesthesia/edema of dermatome(s)

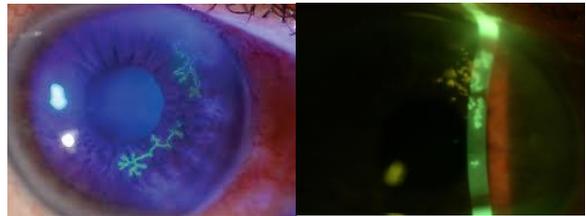
Clear vesicle eruption; followed by yellowing and possible scarring

HZV Dendrites vs. HSV Dendrites

- HZV Dendrites:**
 - Grayish-white
 - Raised
 - “Painted on” appearance
 - Coarse and fragmented
 - **No end bulbs**
 - **Stain poorly with NaFl**
 - **Stain well with RB**
 - **“Nummular Keratitis”**
- HSV Dendrites:**
 - Branching lesion
 - Flat
 - **Terminal end bulbs**
 - **Stain well centrally with NaFl**
 - **Peripheral cells/ end bulbs stain with RB/LG**

True Dendrite
Herpes Simplex

Pseudodendrite
Herpes Zoster



Modified from Nichols J, ed. Basic and clinical science course. External disease and the cornea, section 7. American Academy of Ophthalmology. San Francisco, CA, 1990.

Herpes Simplex vs Herpes Zoster

	Herpes SIMPLEX	Herpes ZOSTER
Dermatomal distribution	Limited	More complete
Dendrite appearance	Larger, more branching, discrete, delicate pattern, more central	Smaller, less branching, coarse, blunted pattern, usually peripheral
Epithelium	Ulcerated	Blunted dendrite with slightly raised edges
End bulbs	Present	Absent
Scarring of skin	Rare	Common
Postherpetic neuralgia	Rare	Common
Iris atrophy	Rare	Common

Modified from Nichols J, ed. Basic and clinical science course. External disease and the cornea, section 7. American Academy of Ophthalmology. San Francisco, CA, 1990.

Varicella Zoster: Herpes Zoster Ophthalmicus

- Management:**
 - Topical antivirals: not effective
 - **Oral antivirals:** dosage is double that for simplex
 - Best if initiated within 48-72 hours
 - Most debilitating sequelae: post-herpetic neuralgia
 - Each case is individual:
 - i.e. if uveitis, treat uveitis appropriately
 - Topical artificial tears
 - Topical erythromycin ointment
 - Can spread over lesions as they crust over

Ok to use a steroid with pseudodendrites!

Hutchinson's Sign



97



Herpes Antiviral Treatment

	Herpes Simplex	Herpes Zoster
Acyclovir (Zovirax)	400 mg 5x/day PO	800 mg 5x/day PO
Valacyclovir (Valtrex)	500 mg TID PO	1000 mg TID PO
Famcyclovir (Famvir)	250 mg TID PO	500 mg TID PO

• Goal: Tx within 72 hours of Sn/Sx to ↓ risk of PHN and risk of ocular complications

• Ideally Tx with prodromal Sn/Sx (tingling, numbness along CN V1 dermatome) to achieve maximum benefit of Tx

98



Oral Antivirals

- **Contraindications:**
 - Caution with renal insufficiency – consult PCP
- **Side effects:**
 - Gastric distress
 - Mild nausea
- **Notes:**
 - Drink more water while taking antivirals
 - Start within 72 hours for best effect
 - Can also be used to prevent recurrence of stromal disease by approximately 50%
 - Acyclovir: 400mg bid x 1 year+
 - Valacyclovir: 500mg qd x 1 year+

99



Oral Antivirals

- Effectively treats all expressions of acute herpes simplex disease
 - i.e. orals expressed in tears, can treat epithelial HSK
- High efficacy and high safety profile
 - Very well tolerated
 - Few side effects and little resistance
- All clinically perform identically
 - Aim to Rx least dosage, usually valacyclovir
 - However, acyclovir is least expensive
- Note that acyclovir comes as a liquid suspension
 - Kids or adults with difficulty swallowing pills

100



Herpetic Eye Disease Study: HEDS

- **Older HEDS: focused on treatment of active disease**
 - No benefit to adding oral acyclovir in stromal keratitis if the patient is already taking topical steroids and antivirals
 - Topical prednisone is helpful in treating stromal keratitis
- **Newer HEDS: focused on prevention of recurrence**
 - **Oral acyclovir 400mg bid reduced rate of recurrence of ANY form of ocular herpes in the following year by 41%**
 - Gives 50% reduction in the recurrence of severe forms of ocular herpes
 - If patient already taking trifluridine gives no added benefit in preventing epithelial disease from developing into stromal disease or iritis

101



Herpetic Prophylactic Treatment

Acyclovir 400mg bid
Valacyclovir 500mg qd
Famcyclovir 250mg qd

- All reduce:
 - Frequent debilitating recurrences
 - Bilateral involvement
 - HSV infection in a monocular patient

102



Important Patient Education ...Questions that may arise

Am I contagious?

- Yes
- Lesions contain high concentrations of VZV
- Spread via **contact and airborne** route
- Can cause primary varicella (**chicken pox**) in **susceptible persons**

For how long?

- Once rash appears **until lesions crust**
- Approximately 14 days

103



Varicella Zoster

- Primary Infection = Chicken Pox
 - Varivax vaccine
- Secondary Infection = Zoster/Shingles
 - Zostavax vaccine

Recommend Zostavax vaccine to all patients >50 y/o



Ocular Complications of HZO

- Conjunctivitis
- Pupil anomalies (Horner Syndrome, tonic pupil)
- Lid scarring
- Lipid-filled granulomata
- Keratitis → nummular, stromal, disciform, mucous plaque, neurotrophic
- Episcleritis
- Scleritis
- Uveitis
- Iris atrophy
- Cataracts
- Glaucoma, secondary to trabeculitis
- CN palsies (CNIII most common)
- Optic neuritis
- Choroidretinitis
- Acute retinal necrosis
- Progressive outer retinal necrosis

Make sure to dilate!

Ocular manifestations can occur 4 to 6 days after skin vesicles erupt

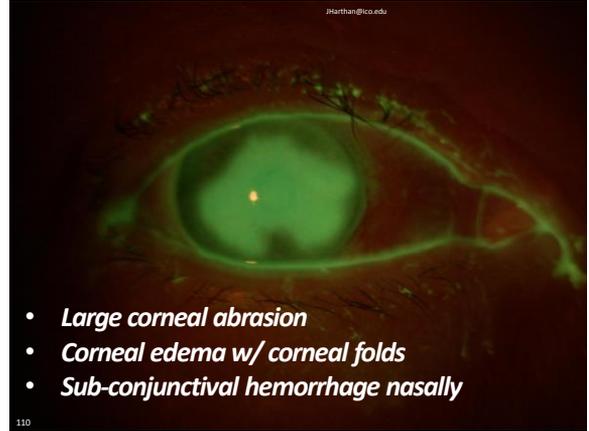
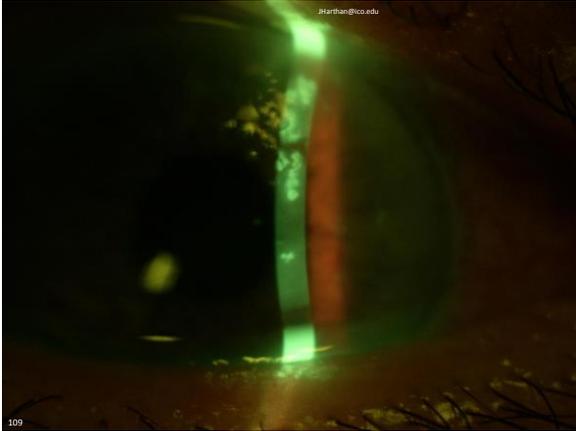
105



107



108



- *Large corneal abrasion*
- *Corneal edema w/ corneal folds*
- *Sub-conjunctival hemorrhage nasally*

Clinical Pearls

- Thorough history
- Symptoms can point you in the right direction
- Careful examination
- Treat each case individually
 - Consider newer approaches
- Follow up appropriately
- Refer as necessary

Thank You!
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