Anti-Infective Agents:
Making the Right Choice

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Ocular Infections

- Adnexa
  - Eyelid
  - Nasolacrimal system
  - Lacrimal gland
- Conjunctival
- Corneal
- Intraocular
- Orbital

Eyelid Infections

- Generally gram + organisms
  - Staphylococcus and streptococcus
  - Corynebacterium
- Anterior blepharitis
- Internal hordeolum
- External hordeolum
- Preseptal Cellulitis

Gram Positive vs. Gram Negative

- Gram positive
  - Thick and tough cell wall
  - Harder to kill with disinfectants than gram negative organisms
  - More likely to survive on dry surfaces longer
  - On skin, mostly find gram positive
  - Staph and Strep species predominate
  - Predominant organisms of the normal ocular and periocular flora
### Gram Positive vs. Gram Negative

- **Gram negative**
  - Thinner cell walls but bilayered
  - Harder to kill with antibiotics than gram positive
  - Will survive longer on a moist surface
  - More likely to be found in the gastrointestinal system
  - Common cause of urinary tract infections

### Anterior Blepharitis

- Staph epi and staph aureus predominantly
- **Mechanical debridement**
  - Hot compresses
  - Commercial lid scrubs
- **Ointments**
  - Bacitracin or erythromycin ointments
  - Rotate ointments monthly
  - Add steroid ointment if eyelid inflammation
    - Tobradex, maxitrol, lotemax

### Demodex

- Two types of ocular parasitic mites
  - Demodex folliculorum (anterior bleph)
  - Demodex brevis (posterior bleph)
- High incidence with age and anterior bleph
  - Seen in 84% of patients 60 years of age
  - Seen in 100% of patients 70 years of age
- Inflammation due to mite bacillus production
  - May be association with acne and ocular rosacea
- Cylindrical sleeves on the lashes
- Epilation and microscopic analysis

### Clinical Presentation

- Anterior blepharitis with inflammation
  - Eyelid itching, redness, burning, foreign body sensation, crusting of eyelashes
- Refractory to other treatments
- Increased symptoms in the morning
- Associated ocular and acne rosacea
- Mites visible at slit lamp and under microscope
Demodex Treatment

• Tea tree oil products
  – Commercially available Cliradex
  – Compounded 50% tea tree oil scrubs
    • To eyebrows and eyelids once weekly for one month
    • Apply to lid margin with Q-tip
  – Tea tree oil shampoo (10%) to hair, eyebrows, and eyelid margins nightly for one month
• Lid hygiene

Hordeolum

• Infection/inflammation of eyelid margin gland(s)
• Localized pain, erythema, swelling
• External hordeolum
• Internal hordeolum

External Hordeolum

• Localized infection of a ciliary gland
  – Zeiss or Moll
• Pain, redness, purulent discharge
• Staph aureus is causative organism in 95% of the cases

Internal Hordeolum

• Localized inflammation of a meibomian gland
• More likely obstructive etiology
• Less likely infectious etiology
• “Early chalazion”
Hordeola Treatment

- Topical medications are ineffective
- Manual expression in office
- Removal of associated lashes if applicable
- Hot compresses with massage are mainstay of therapy
- Oral antibiotic which covers gram positive organisms if necessary

Hordeola Treatment

- Oral antibiotic only if necessary which covers Staph aureus such as:
  - Amoxicillin 875mg BID
  - Keflex 500mg BID
  - Zpack
  - Doxycycline 100mg BID

Penicillins

- Beta-lactam antibiotic class
- Predominantly gram positive coverage
- Inhibits bacterial cell wall formation resulting in bacterial death
- Penicillin, ampicillin, amoxicillin, dicloxacillin, methicillin
- 10-15% of population are allergic to PCN
- Well tolerated and safe otherwise
- Can use in pregnancy and children

Amoxicillin

- Penicillin antibiotic
  - Aminopenicillin
- Extended coverage over standard PCN
- Good for gram positive infections
- Resistant to beta lactamases
- Also has some gram negative coverage
- Inexpensive
- Ok with pregnancy and children
**Amoxicillin Dosage**

- Skin and soft tissue infections
- Adults 875mg q12h
- Children 20-40mg/kg/day divided q8h

  — How supplied
  - 125mg/5ml
  - 200mg/5ml
  - 250mg/5ml
  - 400mg/5ml

**Cephalosporins**

- Beta-lactam antibiotic class
- Increased coverage over penicillin class
- 3-10% cross-sensitivity to penicillin class in regards to allergic reactions
- Four generations of cephalosporins
  — Increasing gram negative activity from 1 to 4
- First and second generations better for ocular conditions (more likely gram positive)

**Cephalexin**

- Brand name KEFLEX®
- First generation cephalosporin
- Good gram positive coverage (Staph/Strep)
- Cheap
- Adult dose is 500mg bid
- Also available in suspension for children
  — 20-40mg/kg/day divided q8h

**Macrolides**

- Inhibit bacterial protein synthesis
- More gram positive coverage than gram negative
- Erythromycin, clarithromycin, azithromycin
- Use with caution in liver disease
- Drug interactions with class
- Great for penicillin allergic patients
Azithromycin

- Macrolide antibiotic with chemical structure changes leading to
  - Less drug interactions
  - Less GI side effects
  - Less frequent dosing
  - Better gram negative coverage
- OK in pregnancy and children

Azithromycin

- Z-pack
  - 500mg day one; 250mg days 2-5
  - Great for compliance
  - For milder ocular infections
    - Do not recommend for more aggressive infections

Tetracycline Derivatives

- Inhibits bacterial protein synthesis
- Tetracycline, Doxycycline, Minocycline
- Cannot use in children younger than 8
- Cannot use in pregnancy/nursing
- Causes photosensitivity and photophobia
- Doxycycline most commonly used in eye care
  - As an antibiotic for skin and soft tissue infections
  - Covers MRSA
  - As an anti-inflammatory agent for ocular rosacea/posterior lid disease

Doxycycline Pearls

- Can take with food
- Can take with dairy products
- Cannot take with antacids
  - Space 2 hours apart
- Cannot take before lying down
  - Wait 2 hours before lying down
- Can causes photosensitivity
- Long-term therapy associated with pseudotumor cerebri (rare)
  - More likely with Minocycline
Doxycycline Dosage

- Antibiotic use
  - 100mg bid x 10 days
- Posterior bleph and Dry eye
  - 50mg bid x 4-6 weeks then
  - 50mg qd x 3-6 months or indefinitely

Preseptal Cellulitis

- Generally follows acute hordeolum
  - Spreads from focal, localized gland infection
- Other causes:
  - Eyelid trauma
  - Insect bite
  - Spread from adjacent upper respiratory infection
- Larger and more diffuse eyelid and periorbital soft tissue erythema, edema, tenderness
- Occasional mild fever

Gram + Preseptal Pathogens

- Staph aureus
  - Methicillin susceptible
    - Amoxicillin 875mg BID
    - Keflex 500mg BID
  - Methicillin resistant (MRSA)
    - Septra DS 1 po BID or 2 po BID
    - Doxycycline 100mg BID
    - Clindamycin 300mg q6h
    - Levaquin 500 mg qd plus Rifampin 300mg BID
- Strep pyogenes
  - Amoxicillin 875mg BID

Why suspect MRSA?

- Purulent with or without abscess
- Initial appearance like a pimple or spider bite
- Pain and edema out of proportion with clinical appearance
- History of previous MRSA infection
- History of recent hospitalization
- Health care worker
- Student athlete
- Prison inmate
- Unresponsive to standard antibiotic therapy
Sulfamethoxazole/Trimethoprim

- aka Septra DS or Bactrim DS
- 2 antibiotics working synergistically to stop production of bacterial folic acid and therefore bacterial DNA
- Less drug resistance
- High penetration rate into various tissues
- Covers a wide variety of gram positive and gram negative organisms including:
  - Staph, strep, haemophilus
  - MRSA
    - Best oral choice if not allergic
    - May need 2 DS tablets bid instead of 1 DS tablet bid

Sulfamethoxazole/Trimethoprim

- Cannot be used in sulfa allergic patients
- Risk of allergy is approximately 3%
  - Allergy generally presents as rash
  - Can develop delayed life-threatening Stevens-Johnson syndrome
  - Risk of allergy increased if allergic to other medications/substances (such as PCN)
- Allergy to non-antibiotic sulfonamides is rare

Clindamycin

- Lincosamide antibiotic that disrupts bacterial protein synthesis
- Highly gram positive in coverage
- Category B
- More associated with pseudomembranous colitis than other antibiotics
- MRSA dosage 300mg po TID
  - MRSA clindamycin resistance is variable by location. Check with local health dept./hospital for culture and sensitivity reports in your area
- Also used for treatment of ocular toxoplasmosis

Levaquin

- A fourth-generation fluoroquinolone
- Ok in PCN and/or sulfa allergic patients
- Covers MRSA on sensitivity testing but least recommended due to increasing resistance of hospital acquired MRSA infections to fluoroquinolones
  - Recommended use with Rifampin to avoid monotherapy and increased resistance
  - Levaquin 500mg QD and Rifampin 300mg BID
Oral Fluoroquinolones

• Can use in PCN and/or sulfa allergic patients
• Can NOT use in children/pregnancy/nursing
• Caution in athletes secondary to tendon rupture
• Blocks bacterial DNA synthesis
• Ciprofloxacin (CIPRO®) is prototype
  – Heavily prescribed for urinary tract infections
  – Overprescribed in the 1990s
  – Little staphylococcal coverage now
  – Not recommended for ocular skin/soft tissue infections
  – Mainly used for gram negative urinary tract infections

Fluoroquinolone Drug Interactions

• Antacids/vitamins
  – Wait 2 hours before or 3 hours after
• Caffeine
  – Wait 2 hours before or 2 hours after
• Warfarin (Coumadin™)
• Insulin
• Oral antidiabetic medications
• Theophylline

Gram – Preseptal Pathogens

• Haemophilus influenza
  – In past, was more common pathogen in preseptal cellulitis in children
  – Cellulitis often with bluish hue to eyelid
  – Much less common pathogen now secondary to widespread H flu vaccination
  – Augmentin 875 BID

Preseptal vs. Orbital

• Refer if any signs of orbital cellulitis
  – APD
  – Decreased VA
  – Diplopia/restricted EOMs
  – Proptosis
  – Globe involvement
  – Fever
• Obtain orbital CT
• Orbital cellulitis will need broad spectrum IV antibiotics
• Patient is admitted to the hospital
Nasolacrimal System

- Canaliculitis
- Dacryocystitis

Canaliculitis

- Common misdiagnosis/delayed diagnosis
- 5:1 female
- Chronic conjunctivitis with epiphora
  - Inferior nasal conjunctivitis
- Pouting puncta
- Expression of canalicular debris/concretions
- Pain, erythema, redness
- No NLD obstruction
  - Can be caused by old punctual plug

Canaliculitis Pathogens

- Actinomyces
  - Most common pathogen especially in older patients
  - Gram positive bacilli
  - Facultative anaerobe
  - Concretions associated with actinomyces
- Staph and strep species
- Herpes simplex
  - Most common cause of patients under 20
- Less commonly fungal causes

Canaliculitis Treatment

- Removal of any blockages
  - Dacryolith expression
  - Removal of retained plug
  - Surgical canaliculotomy when indicated
    - Followed by DCR if unsuccessful
- Warm compresses
- Antimicrobial therapy
  - Topical antibiotic/steroid combination
  - Plus systemic amoxicillin, cephalaxin, doxycycline, or clarithromycin
  - Systemic acyclovir and trifluridine if HSV suspected
Dacryocystitis

- Localized pain, erythema, edema in the medial canthal region with lacrimal sac infection and/or inflammation
- Most often due to clogged NLD
- With associated epiphora and purulent discharge from puncta
- May extend toward nose and cheek
- May have associated preseptal cellulitis
- Mattering of the lids is common
- Conjunctivitis is common secondary to pathogen exotoxin activity
- Extension into the sinus cavities can result in orbital cellulitis

Dacryocystitis

- More common in females 60-70 years old
- Less common in African-American patients
- More often on the left side
- 99% bacterial; only 1% fungal
- Acquired form can be acute or chronic

Dacryocystitis

- The most common pathogens are gram positive
  - Strep pneumonia
    - Part of the normal nasopharynx flora
    - Can also cause associated keratitis
  - Staph epi (most common but likely a contaminant)
  - Staph aureus (methicillin sensitive and resistant)
  - Beta-hemolytic streptococci

Dacryocystitis

- Gram negative organisms have also been isolated
  - E coli (suspect if copius purulent discharge)
  - Haemophilus (more common in children)
  - Pseudomonas
Treatment

– Acute: quick onset of symptoms
  • Treat with hot compresses and oral antibiotic
  • Drain abscess if necessary
  • Augmentin 875mg BID
  • First or second generation cephalosporin
  • PCN allergic consider clindamycin
  • Need for surgical intervention is low
– Chronic: longer presentation of epiphora/mattering
  • Likely need DCR

Augmentin

• Augmentin = Amoxicillin + Clavulanic acid
• Cannot use if penicillin allergic
• Clavulanic acid is a “suicide inhibitor”
  – Protects amoxicillin from beta-lactamases
  – Does not have antibiotic action itself
• Allows increased coverage with less destruction by beta-lactamases
• Allows for increased coverage against gram positive, gram negative, and anaerobes
• Does NOT cover MRSA

Augmentin Info

• Can use in pregnancy (Category B)
• Can use in children
• Can cause nausea/vomiting/diarrhea
• Take with food/yogurt
• 875 mg BID is standard adult dosing
• Few drug interactions
  – Allopurinol/probenecid (for gout)
• Generic available but still more expensive than amoxicillin alone

Lacrimal Gland

• Dacryoadenitis
Dacryoadenitis

- Infection/inflammation of lacrimal gland
- Located supratemporal orbit
- Chronic vs acute
- Inflammation often systemic in origin
- Infection thought to originate from conjunctiva and migrate through lacrimal tubules into lacrimal gland

Clinical Presentation

- Variable presentation
  - Inflammatory etiology
    - More common than infectious
    - Chronic mild redness, edema, pressure, not as painful
    - Unilateral or bilateral
    - Systemic associations
      - Sarcoïd, Sjogren’s, Lupus, Chron’s, TB, Grave’s, Lyme, Tumor
  - Infectious etiology
    - Acute unilateral, severe pain, redness, can be purulent
    - Most commonly viral or bacterial
      - HSV, EBV, CMV, mumps
      - Staph, strep, Gonococcus, Moraxella, Klebsiella

Dacryoadenitis Treatment

- Depends on etiology
- Acute presentations more likely viral or bacterial
- Compresses
  - Cold compresses if viral suspected
  - Hot compresses if bacterial suspected
- Empiric antibiotic therapy in most cases is initiated
  - Amoxicillin 875mg BID
  - Keflex 500mg BID
  - Septra DS BID
  - Levaquin 500mg QD

Animal or Human Bites

- Periocular skin/soft tissue infection initiated by human or animal bite
- Polymicrobial risk
  - Antibiotic needs anaerobic coverage
  - Augmentin 875mg BID
  - If penicillin allergic:
    - Sulfamethoxazole-trimethoprim plus clindamycin
    - Oral fluoroquinolone plus clindamycin
Conjunctivitis

- Bacterial conjunctivitis
- Viral conjunctivitis
  - Adenovirus
  - Molluscum contagiosum
  - Simplex conjunctivitis
  - Zoster conjunctivitis

Bacterial Conjunctivitis

- More common in children
- Highly contagious
- Can be unilateral but generally starts in one eye and spreads to the other
  - Affects second eye with less intensity
- Yellow-greenish discharge, hyperemic conjunctiva, clear cornea
- PA node uncommon
- Self-limiting in general

Bacterial Conjunctivitis

- Staph and strep species most common etiologic organisms in adults and children
  - Tobramycin (gentamicin is more corneotoxic)
  - Ofloxacin, Moxifloxacin, Gatifloxacin
  - Ciprofloxacin has poor staph coverage
- However, can see Haemophilus as well in children
  - Polytrim (used commonly in pediatric cases)
    - Polymixin B and trimethoprim

Topical Fluoroquinolones

- Increased gram positive coverage with later generations
- Third generation still used for prophylaxis, bacterial conjunctivitis, known gram negative etiology
- Fourth generation recommended for emperic bacterial keratitis
  - Moxifloxacin, Gatifloxacin, Besifloxacin
Bacterial Conjunctivitis

- Can see Haemophilus as well
  - Especially in children
- Moraxella
- Polytrim (used commonly in pediatric cases)
  - Polymixin B and trimethoprim

Gonococcal Conjunctivitis

- Neisseria gonorrhoeae
  - Gram negative
- Hyperacute infection associated with copious purulence
- Severe lid edema more common than with other types of bacterial conjunctivitis
- More common in newborns and sexually active patients
- Treat with one gram Rocephin IM or IV then Doxycycline 100mg bid x 2 weeks
- Not treated topically unless cornea becomes involved
  - Use fourth generation fluoroquinolone

Chlamydial Conjunctivitis

- Chlamydia trachomatis
  - An intracellular parasite
- Seen more often in developing countries with severe sequelae leading to blindness
  - Often in newborns in endemic areas
- Positive PA node
- Increased suspicion with a chronic, follicular conjunctivitis
  - Especially in sexually active patients
- Treat with one gram azithromycin
  - Consider repeat azithromycin in 2 weeks

Viral Conjunctivitis

- Common in children and adults
- Can be unilateral but generally starts in one eye and spreads to the other
  - Affects second eye with less intensity
- Clear, watery discharge with mild amounts of mucous
- Highly contagious, follicular conjunctivitis
- Positive PA node but not always
- History of recent cold or upper respiratory infection or exposure to red eye patients
- Can cause more destruction than common bacterial conjunctivitis
  - Pseudomembranes
  - Subepithelial infiltrates
Common Viral Conjunctivitis

- Adenoviruses (up to 90% of conjunctivitis)
  - Subtypes 8 and 19 most common
- Picornaviruses (hemorrhagic conjunctivitis)
  - Enterovirus 70
  - Coxsackievirus A24

Common Viral Conjunctivitis

- Virus must run its course
- Treatment is supportive
  - Cold compresses
  - Artificial tears
  - Vasoconstrictors
  - Betadine wash
  - Topical steroids
    - Severe pain and inflammation
    - Pseudomembranes
    - Subepithelial corneal infiltrates

Other Viral Conjunctivitis

- Molluscum contagiosum
- Herpes Simplex
- Herpes Zoster

Molluscum Conjunctivitis

- Consider in chronic, unilateral cases
- Look for typical pearly-white, dome-shaped, raised papule with an umbilicated center
- Found on the eyelids and/or eyelid margins
- More common in children
- Lesion(s) must be removed for cure of chronic conjunctivitis
**Herpes Simplex Conjunctivitis**

- Type I herpes virus
  - Initial infection
  - May not even be aware of infection
  - Recurrent infections
  - Virus lies dormant and is triggered by various factors
  - Occurs in one eye only, same eye each recurrence
- Conjunctivitis often with periocular skin vesiicles
  - Self limiting in most cases
  - Can observe with AT and cold compresses
  - Can use antiviral if severe
  - Conjunctivitis (trifluridine qid or Zirgan tid)
  - For skin lesions do Acyclovir 400mg tid po
- Watch for corneal involvement

**Herpes Zoster Conjunctivitis**

- Type 3 herpes virus
- Associated with same-sided facial and periocular lesions that respect midline
- More common in elderly & immunocompromised patients
- Patients need high dose oral antivirals ASAP
- Conjunctivitis
  - Most common ocular condition caused by zoster
  - Hyperemia, watery discharge, petechial hemorrhages
  - May be associated with keratitis and/or uveitis
  - Treat conjunctivitis conservatively unless corneal or intraocular involvement
    - Cold compresses, artificial tears, vasoconstrictors, topical NSAID

**Microbial Keratitis**

- Bacterial keratitis
- Acanthamoeba
- Fungal
- Viral

**Contact Lens Associated Bacterial Keratitis**

- Up to 65% of keratitis cases in the US are secondary to CL wear
- Risk has not decreased with the use of silicone hydrogel lenses
- 5-10x more likely to ulcerate with extended wear
- Risk is less in RGP
  - Due to tear exchange under the lens
- Risk is less in daily disposable soft CL
  - Due to lack of contamination with solutions/cases
### Gram + Contact Lens Infections

- Staph aureus most common etiologic organism of all contact lens ulcers
  - Oval, creamy dense infiltrate
  - Overlying epithelial defect
  - Sterile AC reaction common
- **Streptococcus pneumonia**
  - Round
  - Overlying epithelial defect with creeping, serpiginous characteristics
  - Sterile AC reaction common
  - Can lead to perforation

### Staphylococcal Resistance

- **MRSA**
  - Methicillin-resistant staph aureus
  - Once only nosocomial, now community-acquired
- **MRSE**
  - Methicillin-resistant staph epidermidis

### Contact Lens Associated Bacterial Keratitis

- **Gram negative**
  - Pseudomonas aeruginosa is most virulent
    - Causative agent in up to 40% of CL keratitis
    - Rapid in progression
    - Virulent due to bacterial exotoxins
  - Serratia
    - More in RGP than SCL wear infections
  - Klebsiella

### Pseudomonas Aeruginosa

- Suppurative (soupy) appearance secondary to stromal necrosis
- Overlying epithelial defect
- Can form ring infiltrate
  - Antigen-antibody reaction
- May see sterile hypopyon
Trauma Induced Microbial Keratitis
- Associated with indolent presentation
  - Minimal symptoms early
  - Dramatic
- More likely to involve atypical organisms
- Not part of normal flora
- Wide distribution in soil
- Trauma involving organic or metallic foreign bodies as primary risk factor
  - In up to 90% of cases

Atypical Organisms
- Mycobacterium (nontuberculous)
  - Unusual, focal, waxy “cracked windshield” appearance
  - May develop satellite lesions or ring infiltrate
- Nocardia
  - Patchy, wreath-like stromal infiltrates
  - Pinhead-sized dense opacities
  - May produce feathery margins like fungal
- Fungi

Emperic Treatment
- Clinical presentation often dictates empiric broad-spectrum treatment
  - Small, superficial, non-central infiltrates
- Fourth-generation fluoroquinolones
- Cover most common and even some atypical organisms
  - Moxifloxacin (Vigamox, Moxeza)
  - Gatifloxacin (Zymaxid)
  - Besifloxacin (Besivance)
- Resistance is increasing with only 15-30% MRSA strains susceptible

Acanthamoeba Keratitis
- Free-living, protozoa
- 95% of infections associated with CL wear
  - Highest risk is silicone hydrogel
- Commonly misdiagnosed for an average of 6 weeks
- Most frequently misdiagnosed as herpetic keratitis
Acanthamoeba Keratitis

- Irregular, disrupted epithelium characterizes early stages
  - Punctate erosions
  - Pseudodendrite formation
  - Small, cystic infiltrates
  - Without epithelial defect
- Pain out of proportion to clinical appearance
  - Subepithelial infiltrates along radial corneal nerves
  - Radial perineuritis results in severe pain
- No improvement with antibiotics/antivirals
- Culture on Ecoli media
- Confocal microscopy

Acanthamoeba Keratitis

- Later stages produces increased destruction
- Ring infiltrate
  - Seen in only 6% of early cases
  - Seen in only 16% of late cases
- Hypopyon
- Progressive corneal thinning
- Risk of perforation
- Corneal opacification
- Transplantation often end result

PHARMACOLOGICAL TREATMENT

- Biguanides
  - Polyhexamethylene biguanide (PHMB) 0.02%
  - Chlorhexidine (CHX) 0.02%
- Diamidines
  - Propamidine isethionate (Brolene) 0.1%
  - Hexamidine 0.1%
- Antifungals
  - Miconazole, ketoconazole, itraconazole
- Aminoglycosides
  - Neomycin

TREATMENT

- Epithelial debridement
- Can use a combination of PHMB, CHX, and Brolene
  - Dosed q1hr initially, then 6-8 times a day, then qid
  - Slow taper, on treatment for several months
- Antibiotic coverage qid until epithelium heals
- Pain management
  - Cycloplegic
  - Opioid pain control
  - Cautious addition of steroid after improvement
**Fungal Keratitis**

- Increasing cause of keratitis
  - 10-20% cases are trauma related
    - Especially vegetative/agricultural trauma
  - 20-35% cases are CL related
- Contact lens solution spike 2004-2006
- Unicellular yeasts
  - Candida species in temperate zones
- Multicellular molds
  - Fusarium in tropical zones

**Treatment**

- Commercially available Natamycin 1%
  - Can be used as monotherapy
  - Good against mold species
    - Fusarium
    - Aspergillus
- May need compounded medications
  - Amphotericin or voriconazole
- Consider addition of oral fluconazole 400mg qd

**Viral Keratitis**

- Herpes Simplex keratitis
- Dendritic keratitis

**Fungal Keratitis**

- Clinical presentation is extremely varied
- Often indolent, forming over weeks
- 87% of cases are misdiagnosed as bacterial/viral
- Patchy, grayish infiltrates with feathery margins
- Satellite lesions
- With or without an epithelial defect
- Hypopyon, endothelial plaques, immune ring may develop
- Needs culture on Sabourauds
Marginal Ulceration

- Aka “Sterile infiltrates”
- Bacterial exotoxin sensitivity in non-CL wearers
  - Stap
- CL wearers more likely overwear

Infectious ulceration vs Non-infectious (sterile) ulceration

**Infectious**
- >1 mm in size
- Diffuse injection
- Central to paracentral
- Generally single infiltrate
- Excavated center of ulcer matches underlying infiltrate
- Severe pain
- Treat with topical antibiotics

**Non-infectious**
- <1 mm in size
- Sectoral injection
- Limbal to midperipheral
- Often numerous pinpoint infiltrates
- Area of staining smaller than infiltrate
- Less pain
- Treat with topical steroids

Phlyctenulosis

- Unilateral or bilateral tearing, photosensitivity, ocular irritation, history of previous episodes
- Hypersensitivity to bacterial antigens
  - Staph (most common cause in US), TB, rosacea, Chlamydia, etc.
- Corneal or conjunctival
  - Conjunctival
    - A raised, 1-3 mm hard, triangular shaped, yellow-white nodule with surrounding hyperemia on inferior conjunctiva
  - Corneal
    - More symptomatic. A white, initially limbal lesion that migrates onto and moves perpendicularly across the corneal surface. It is vascularized and leaves infiltrative area behind as it moves.

Phlyctenule Treatment

- Lid hygiene/staph control
  - Warm compresses and scrubs
  - Bacitracin/erythromycin ointment
  - Possibly oral doxycycline
- Topical steroids
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