Recognizing, Treating, and Avoiding Microbial Keratitis
In Contact Lens Wear

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CONTACT LENS COMPLICATIONS
Microbial Keratitis

So, is there a take home here?
Things aren’t always as they first appear.

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

CDC’s Morbidity & Mortality Weekly Report
November 13, 2014
- 1 million Doctor’s visits due to keratitis (2010) at cost of $175 million
- 230,000 involved CL’s and 25,000 diagnosed as ulcer
- those who wear CL’s overnight are 20x more likely to get keratitis. “... not taking care of them properly is the single biggest risk factor”

August 20, 2015
- Contact Lens Risk Survey – 99% engage in at least one risky behavior
- 82% expired lenses / 55% ‘top off’ solutions / 50% sleep in their lenses

August 21, 2017
- 6 out of 7 adolescent CL wearers have at least one risk factor for keratitis, including sleeping, improper replacement, poor lens & case hygiene

August 17, 2018
- Six cases of microbial keratitis 2016 – 2018. All involved overnight wear
- Swimming, delayed care, illegally obtaining lenses additional risks

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: LY 65 yof
- Previous hx of contact lens overwear
- Wears SiHy OU as CW x 60-90 days
- Systemic Hx: Breast CA  Social Hx: smoker
- C/O redness, discharge, pain, & photophobia OD x 3 day

Dx: Presumed infectious corneal ulcer OD

Tx:
- 5% Homatropine in office
- Vigamox q30 min x 4 hrs, then q1h
- f/u in 24 hrs

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: LY 65 yof 1 Day F/U
- C/O continued pain, photophobia, & discharge
- VA cc 20/50- OD
- SLE: diffuse conjunctival injection, corneal infiltrate w epithelial defect, gr 1+ AC rxn

Tx:
- 5% Homatropine
- Vigamox q2h
- Polytrim q2h
- f/u 24-48 hrs
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: LY 65 yof 4 Day F/U
- Feels much better, still photophobic
- VA cc 20/30 OQ
- SLE: minimal conjunctival injection, epithelium intact w infiltrate, AC quiet.

Tx:
- Vigamox qid
- Polytrim qid
- f/u 3 days

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: LV 50 yof
- Previous CL wearer commences EWSCL x 4 days with expired CL's
- C/O redness, pain, discharge OS x1 day
- Bacterial corneal ulcer diagnosed in ED one day prior
- Blood, chocolate, gram, and acanthamoeba cultures performed
- Ofloxacin OS q2h initiated

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: LV 50 yof
- C/O eye feels worse, using Ofloxacin OS q2h
- VA cc 20/400
- SLE - Corneal ulcer with hypopyon
- Cultures – no growth

Plan:
- Homatropine 5% qd
- Vigamox q1h
- Tobramycin (1.3%) q1h

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: LV 50 yof
- C/O eye feels much better, using all meds.
- VA cc 20/200
- SLE - ulcer border well defined, reduced AC reaction, trace hypopyon
- Cultures – still no growth

Plan: Homatropine 5% qd, Vigamox q2h & Tobramycin q2h

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: LV 50 yof
- C/O eye feels much better, using all meds.
- VA cc 20/100
- SLE - healing epithelial defect, trace AC reaction, no hypopyon
- Culture – positive for pseudomonas aeruginosa

Plan: Homatropine 5% qd, Vigamox q2h & Tobramycin q2h & Pred forte qd

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MICROBIAL KERATITIS

TOPICS FOR CONSIDERATION

- Epidemiology & risk factors
  - Is overnight wear the predominant risk factor?
  - Have silicone hydrogels mitigated risk?
  - Are certain patients inherently at greater risk?
- Pathophysiology
- Differential diagnosis
- Treatment strategies
- Prevention

Relative risk of microbial keratitis in contact lens wear?
- Extended wear with conventional lenses
  - 1 in 500 patient years (Poggio, et al 1989)
- Daily wear soft lenses
  - 1 in 4,000 patient years (Cheng, et al 1999)
- Continuous wear silicone hydrogel lenses
  - 1 in 4,000 patient years (Holden, et al 2003)

Morgan, etal Br J Ophth 89(4):2005
- Incidence of severe keratitis: OW SiHy > 19.8 per 10,000 patient years
Schein, etal Ophthalmology 112(12):2005
- Annual Rate of ‘Presumed’ MK – 18 per 10,000 patient years
- Overnight wear silicone hydrogels – 25.4 per 10,000 patient years

- MK in daily disposables? ON wear, every day wear, hand hygiene, smoking
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Are certain patients at higher risk?

Systemic profile
- Immunocompromised
- Metabolic disorders
- Substance addiction — smoking
- Dermatologic conditions — atopy & rosacea

Ocular profile
- Ocular surface disease
- Neurotrophic, degenerative, & dystrophic cornea

- Gut & ocular microbiota influence susceptibility to P. aeruginosa keratitis in mice

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MICROBIAL KERATITIS

PATHOPHYSIOLOGY

Pathophysiology of microbial keratitis


Corneal "homeostasis"
- Limbal stem cells -> migratory basal cells -> wing cells -> surface (squamous) cells
- ON wear diminishes cell shedding
- ON causes paradoxical epithelial thinning

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MICROBIAL KERATITIS

PATHOPHYSIOLOGY

Pathophysiology of microbial keratitis

Fleiszig S. Optom Vis Sci 83(12):2006
- P. aeruginosa secretes toxins to cross basal epithelium / gain access to stroma
- Infected epithelial cells defend by sloughing

Sullivan A. ARVO 2012
- P. aeruginosa T3SS most virulent

- Tear fluid increases T3SS expression in contact lens P. aeruginosa biofilms

- P. aeruginosa mobile genetic elements (MGE’s) translate resistance

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MICROBIAL KERATITIS

PATHOPHYSIOLOGY

Pathophysiology of microbial keratitis

What must go wrong in microbial keratitis?

Breached epithelial barrier function ???
- Microbial ‘seeding’
- Microbial adherence & multiplication
- Failure of host immune response
- Delayed or insufficient treatment

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

DIAGNOSIS

Is it a sterile or infectious process?

Key symptoms?
- Key findings?
- When to culture?

Infilitative Keratitis – the great corneal conundrum
- Cellular response – Neutrophil (pmn’s), lymphocytes, macrophages
- Originate from tears, limbal vasculature, basal epithelium?
- Epithelial disruption -> chemotaxis -> infiltration
- Caused by mechanical, toxic, immunogenic, or infectious agents

Corneal infiltrate does NOT equal infectious keratitis

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MICROBIAL KERATITIS

DIAGNOSIS

What are the relative risks for corneal infiltrative events (CIE’s)?

Chalmers (2013)
- Gram (+) bioburden = 3-8x
- Gram (-) bioburden = 5x
- Reusing Daily Disposable = 4x
- Overnight wear of SiHy = 2-5x
- < 25 yoa or > 50 yoa = 2x
- MPS = 3x

- Increased risk with POI / Aidex MPS
- Delftia, Stenotrophomonas, Achromobacter, Serratia

Szczotka-Flynn (2010)
- CIE’s statistically more likely in CL bioburden & smoking
- No correlation between corneal staining and CIE’s
CONTACT LENS COMPLICATIONS
INFILTRATIVE KERATITIS
- HEMA EW x 6 nights
- Looked at microbial colonization of the lower lid, upper bulbar conjunctiva, and lens surface
- Cultures over 3 yrs -> significant carriers

Carriers of gram (+) organisms on lens
- 3x as likely to have CLPU
- 5x as likely to have Asymptomatic Infiltrates
- CoNS & Corynebacterium

Carriers of gram (-) organisms on lens
- 5x as likely to have CLARE
- Haemophilus

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MICROBIAL KERATITIS
What must go wrong in infiltrative keratitis?
- Biofilm contamination of contact lens
- Endotoxin & lipopolysaccharide exposure
- Cytokine & other inflammatory mediators mobilized
- Corneal infiltrative event (CIE)

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INFILTRATIVE KERATITIS
Contact Lens Peripheral Ulcers (CLPU) ... is it really an ulcer?
- Histopathology of 3 lesions
- Focal loss of epithelium / underlying pmn’s

- N = 52 Patients with CLPU - 85% Single & 15% Multiple
- 50% (8/16) culture positive

CLPU Treatment Staging
- D/C CL's, lubricate, observe
- Steroid / antibiotic gtt ... is Neo/Poly/Dex OK?
- Cycloplegia & antibiotic gtt

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MICROBIAL KERATITIS
Infectious vs sterile infiltrative keratitis
- Retrospective analysis of 24 culture (+) and 24 culture (-) cases
- Infectious keratitis correlated with
  Patient Symptoms
  - Dull pain
  - Purulent discharge
  Clinical findings
  - Epithelial defect
  - Infiltration
  - Anterior chamber reaction

- Severe pain, lid edema, irregular infiltrate > 2mm, & AC involvement

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MICROBIAL KERATITIS
To culture, or not to culture: that is the question
Miller, et al. (Bascom Palmer Eye) ICAAC September 2015. San Diego
- N = 176 cases microbial keratitis
  - U of Miami Hospital ER in 2014
  - 52% treated without cultures
    - 92% broad spectrum AB’s
  - 44% those cultured were (+)
  - Combination therapy in 27%
    - MRSA and Fusarium

Are we good antimicrobial stewards?
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MICROBIAL KERATITIS

What laboratory tests are indicated?

- Cytology (scraping)
  - Spatula & calcium alginate swab
  - Microscope, slides, and reagent stains
- Culturing
  - Mini-tip culturettes (thioglycolate)
  - Spatula and agar plates
    - Blood agar – aerobic organisms & saprophytic fungi
    - Chocolate agar – neisseria, moraxella, haemophilus
    - Lowenstein-Jensen – nocardia & mycobacterium
- In Vivo Confocal Microscopy (IVCM)
    - N = 46 cases of microbial keratitis with IVCM
    - Good sensitivity & specificity in Fungal, Viral, Acanth, & Bacterial especially valuable in atypical / mixed cases

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MICROBIAL KERATITIS

Should we look beyond the eye?

  - Cultured 125 eyes with presumed microbial keratitis
  - Cultures (+) in 40% of corneas / 80% of CL cases / 92% of CL’s
  - 94% of cornea & CL cultures agreed
  - 77% of cornea & case cultures agreed
- Martins et al. CLAO 28(3):2002
  - 113 eyescl wearers with presumed microbial keratitis
  - 29% bandage lenses / 71% cosmetic lenses
  - Concordance between corneal and contact lens / case cultures
    - Fungal 100%
    - Amaebic 80%
    - Bacterial 75% (Pseudomonas most common)

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How important is case hygiene?

  - Innoculated contact lens cases with s. aureus (7.1 log CFU) or p. aeruginosa (8.4 log CFU) to establish adequate biofilm
  - Assess combinations of rinsing, wiping, and/or air drying of cases
  - Only MPS rinse, clean wipe, and air drying (6hr) effective
  - 0.9 log survival of p. aeruginosa
  - 3.4 log survival of s. aureus

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MICROBIAL KERATITIS

When should we culture?

  - N = 60 cases of microbial keratitis at LV Prasad Eye Institute
  - Retrospectively compared culture (+) with culture (-)
  - Size of infiltrate or history of trauma had no association with culture result
  - Prior topical antibiotic use & longer duration correlate with culture (-)
  - More major surgery in culture (+)
  - Outcomes …
    - Treatment success in 90% of culture (+) and 83% of culture (-)
    - Final VA 1.8 logMar in culture (+) and 2.3 logMar in culture (-)

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MICROBIAL KERATITIS

Does culturing impact outcomes?

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  - Outcomes …
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MICROBIAL KERATITIS

When should we culture?

- Ulcer > 2mm from limbus and …
- Epithelial defect > 2mm and …
- Ulcer depth > 20% corneal thickness and …
- AD reaction > grade 2

Additional considerations …

- History of vegetative trauma
- Hospital exposure
- Immunocompromised
- Non responsive to first line therapy
What influences microbial keratitis clinical course?

- Microbe virulence
- Host defense
- Time to treatment
- Appropriate treatment

Case report: MR 33 yof
- Daily wear SCL / Variable MPS qhs
- C/O red, pain, tearing, blurry OD x 2 days
- Saw PCP yesterday and on gentamycin OD qid
- Social Hx: Prior substance abuse
- Work Hx: Social coordinator at long term health care facility

VA OD cc HM @ 1 ft
+ vesicular lesion on upper lip
No preauricular adenopathy
Decreased corneal sensation OD
SLE – central corneal ulcer, peripheral satellite lesions, & AC rxn

Impression: Corneal ulcer OD – bacterial vs herpetic
Plan: 1) Labs for bacteria, fungal, viral, and acanthamoeba
2) Atropine qd, Vigamox q1h, Valtrex 1g tid 3) f/u 24hr

VA OD cc 20/80
No culture growth
Vigamox OD qid, Pred Forte OD qid
Valtrex 1g tid
SLE – ulcer re-epithelialized, stromal scar, AC deep & quiet
Plan: 1) Vigamox qid, Pred Forte qid, Valtrex 1g qd, f/u in 1 week.

Would you have done anything differently during the work-up?
Culture nasal passages
What do you think was the offending microorganism?
HSV vs bacterial vs multi-organism
How would you treat it differently today? Zirgan Ophthalmic gel?

Oral acyclovir alone as effective as topical antivirals in treating HSV epithelial keratitis (Cochrane Data Base 2010)
Valacyclovir 1g tid 7-10 days (no lactose!)
Antiviral induced crystalline nephrotoxicity?
- Creatine clearance normal at 100ml / minute
- Lower? Valacyclovir 500mg bid to tid
- Or ... Zirgan 5x daily for 7 days
Valacyclovir + HIV (+) ... thrombotic thrombocytopenic purpura?
**CONTACT LENS COMPLICATIONS**

**MICROBIAL KERATITIS**

**To treat or refer?**

- Is monotherapy acceptable?
- What resistant microbes are of concern?
- What additional therapeutic agents are indicated?

If you elect to treat …

- Early recognition
- Do not pressure patch
- Strong cycloplegia - 5% H or 1% A
- NSAIDS not indicated
- **ANTIBIOTICS** – broad spectrum approach
- **DAMAGE CONTROL** – steroids, azithromycin, or oral doxycycline

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**CONTACT LENS COMPLICATIONS**

**MICROBIAL KERATITIS**

What does today’s microbial keratitis look like?


But, then … staph aureus resistance occurs


- % of s. aureus isolates resistant to fluoroquinolones: 11% → 28%
- Goldstein, et al. Ophthal 106(7):1999...
- Gram (-) : Gram (+) Ratio - 82%:18% in 1993 to 51%:49% in 1997


- CoNS epidermidis failed treatment with cefazolin (5%) & gatifloxacin (0.3%)
- Success with vancomycin (5%) and tobramycin (1.3%)


- P aeruginosa s/p PRK despite moxifloxacin prophylaxis
- MRSA keratitis s/p LASIK despite gatifloxacin prophylaxis
- Successfully treated with fortified aminoglycosides

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**MICROBIAL KERATITIS**

Is empirical treatment still acceptable?


- Medical University of Innsbruck
- 123 cases of microbial keratitis 2010 – 2012
- Cultures positive in 56% of cases
- 59% gram (+) and 21% gram (-) and 7% fungal
- 30% mixed !!
- **Combination of aminoglycoside and 2nd generation fluoroquinolone best initial treatment … 88% effective**
- Fluoroquinolone alone less effective

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**MICROBIAL KERATITIS**

Which ‘resistant’ microbes should we be concerned about?

- MRSA contains an enzyme that breaks B-lactam ring of antibiotics – increasing resistance to penicillin, methicillin, cephalosporins, and many fluoroquinolones
- ARMOR Surveillance: 38% S aureus & 30% CoNS are MRSA (Asbell 2016)
- 2% general population & 20% health care workers harbor MRSA
- 8%-13% of contact sports athletes harbor MRSA (Karanika 2016)
- In eye care MRSA occurs most frequently as post-op complication
- Athletes, dialysis, immunocompromised, & nursing home residents
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

How do we best treat MRSA?

- Oral – Bactrim (trimethoprim 160mg / sulfamethoxazole 800mg) bid x 10d
- Topical – Bactroban (mupirocin)
- Ocular ... Polytrim, Besivance, and vancomycin

Ocular TRUST found 3rd & 4th generation FQ’s effective against ~30% of MRSA isolates, while Polytrim effective against 85% of MRSA isolates

McDonald & Blondou. Cut & Ref Surg 36(9):2010
- Up to 85% MRSA strains resistant to moxifloxacin & gatifloxacin
- Besifloxacin greater efficacy against multi-drug resistant S aureus

Ashbell, et al. Ophth Ther 7(2):2018
- All staphylococci susceptible to vancomycin. Besifloxacin similar MIC’s.

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MICROBIAL KERATITIS

What therapeutic strategies are indicated?

- Prescribe aggressively
  - Moxifloxacin, gatifloxacin, or besifloxacin
- Loading dose with frequent dosing
- Consider adjunct agents
  - Fortified tobramycin or amikacin (gram-)
  - Polytrim or vancomycin (gram+)
- Minimize collateral tissue damage
  - Topical azithromycin
  - Topical corticosteroids

Chojnacki & Wozniak. Antimicrobial & Chemotox Agents 2018
- Polytrim-Ritaprim combination
  - Effective in eradicating 75% of S. aureus & P. aeruginosa murine model keratitis

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MICROBIAL KERATITIS

New paradigms?

- Synthesized keratins from cytokeratin 6A (skin, hair, nails, cornea)
- Bacteriocidal against S pyogenes, E coli, S aureus, & P aeruginosa
- Possible non-toxic, biocompatible, and inexpensive anti-infective

Dutta, et al. AAOpt Seattle 10/2013
- Peptide melamine bacteriocidal against P aeruginosa & S aureus
- No cytotoxicity in rabbit models

- Esculatine (frog skin antimicrobial peptide)
- Bacteriocidal against pseudomonas aeruginosa without cytotoxicity
- Effective at tid dosing in murine microbial keratitis model

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

When does topical steroid use make sense?

- 50 yr literature review – Avoid steroid use in microbial keratitis

Srinivasan. Arch Ophth 2011
- 442 bacterial corneal ulcers treated with moxi-saline vs moxi-dex
- No difference in perforation, scarring or BCVA between groups
- Benefits? Severe keratitis and earlier intervention (w/in 2-3 days)

- N = 30 ulcers treated with Zymar / Placebo vs Zymar / Dexameth
- No difference in healing, though smaller residual ulcer size in steroid tx

Bottom Line? Is neutrophil inhibition a good thing ... or not?

Who should NOT get steroids? Suspected fungal, acanthamoeba, nocardia

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

What about non-pharmaceutical treatment strategies?

- N = 16 culture positive bacterial keratitis
  - Single tx with CCXL and .01% riboflavin
  - 12/14 eyes successfully treated

- PACK (PhotoActivated Chromophore for Keratitis) – CCXL
  - Corneal collagen cross-linking for infectious keratitis
  - Biomicroscope mounted cross-linking instrument & photosensitizing agent
  - Works by liberating reactive oxygen species for disinfection as well as increasing collagen resistance to proteolytic enzymes
  - Effective against a variety of bacterial, fungal, and amoebic species, but NOT viral species
What about non-pharmaceutical treatment strategies?

- Rose Bengal Photodynamic Antimicrobial Therapy (RB-PDAT)
- Rabbit model to assess keratocytes, LSC, and endothelial safety
- Free-radical oxidation into stroma w/o collateral damage

Naranino, et al. AJO 2019
- RB-PDT in 18 eyes non-responsive to anti-microbial therapy
- Acanthamoeba, Fusarium, and Pseudomonas most common isolates
- Successful in 72% of cases
- Average time to resolution 46 days

- N = 6 eyes with infectious keratitis and descemetocele
- Non-responsive to antibiotic therapy
- Amniotic Membrane Therapy for 3 months
- All eyes recovered BCVA of 20/30 – 20/50

- N = 49 eyes AB gtt/AM vs 50 eyes AB gtt alone
- AB/AM group better VA and smaller residual scar
- Cryopreserved – Prokera
- Dehydrated – AmnioDisc, BioDOptix, Blythe Anl, VisiDisc, AlphaVision, ReNovaAT, Amnio Tek-C

Patient consideration in prevention
- Compatible ocular surface
- Wear and care compliance
  - Responsible behavior and reporting – contact lenses w/o prescription
- Contact lens considerations in prevention
  - Optimize oxygen transmission & mobility
  - Surface characteristics
    - Lakkis, et al. (AAO Boston 2011)
    - Silver salt infused Acuvue Advance lenses well tolerated
    - Melimine coated contact lenses reduced incidence of p. aeruginosa induced MK in rabbits

Case report – ES 21 yof
Hx: OD painful, red, photophobic, discharge x 2 days
Wears: B&L SofLens toric OU qd x 12 hr
Contact Lens Care: Variable
Systemic Hx: Mononucleosis 2 months prior
No medications NKDA
Family Hx: Maternal keratoconus & Paternal BRVO

BUT ....
- Current contact lenses 3 months old
- Wearing EW x 1 week
- Water skiing & swimming yesterday
- Still wearing lenses !!

Case report – ES 21 yof
OD pupil miotic, no APD, No ipsilateral adenopathy
VA cc OD 20/30 & OS 20/30+
SLE OD - Gr 1 edema, gr 2 conjunctival injection, 1mm epithelial defect, NO infiltrate, gr 1 AC reaction.

Impression: Corneal abrasion OD

PLAN:
- D/C contact lenses
- Homatropine 5% in office
- Vigamox q2h (Ciprofloxacin)
- IU 48 hr or asap if sx intensity
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report - ES 21 yof 4 Day F/U

CC: ‘Eye feels much better’ VA cc OD 20/30 & OS 20/25+
SLE OD – Lids flat, trace conjunctival injection, 4mm ring infiltrate, no endothelial precipitates, trace AC rxn.

Impression: Corneal ring infiltrate OD

PLAN:
▪ Homatropine 5% in office
▪ Pred 1% q2h
▪ Ciprofloxacin q2h
▪ Fu 48 hr or asap if symptoms
▪ no Acanthamoeba

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report - ES 21 yof 6 Day F/U

CC: ‘Eye feels better, but slightly cloudy’ VA cc OD 20/30
SLE OD – No change.

Impression: Corneal Ring Infiltrate

Plan:
▪ Telephone corneal consult
▪ Vancomycin 20mg/ml q2h
▪ Pred 1% q2h
▪ Ciloxan q2h
▪ Fu 48 hr or asap if symptoms intensity

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report – ES 21 yof 8 Day F/U

CC: ‘Eye feels much better” VA cc OD 20/30
SLE OD – Lids flat, trace conjunctival injection, ring infiltrate fading with intact epithelium, AC d&q.

Impression: Resolving ring infiltrate OD

PLAN: Vancomycin qid, Pred 1% qid, & Ciprofloxacin qid

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report – ES 21 yof 14 Day F/U

CC: Eye feels 100%, drops burn” VA cc OD 20/20
SLE OD – Lids flat, conjunctiva white, cornea gr 1 diffuse spk.

Plan: Discontinue all medications. Resume CL wear in 1 week.

CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

Acanthamoeba Keratitis

▪ Species with ocular morbidity
▪ Risk factors & pathogenesis
▪ Diagnosis
▪ Treatment
▪ Prevention

Protozoan
▪ Ubiquitous in water sources
▪ Trophozoite or cystic forms
▪ Ocular morbidity: A. castellani, A. polyphaga, & A. hatchetti

RISK FACTORS
▪ Antecedent trauma
▪ Sources of contamination (water, soil, sewage)
▪ Contact lenses (poor hygiene)

ANNUALIZED INCIDENCE
▪ 1-2/ per 1,000,000 wearers
▪ 1-30,000 contact lens wearing years
▪ 88% Hydrogel wearers / 12% GPCL wearers
▪ Higher prevalence in Scotland and South Korea
CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

- 40 cases of AK in Chicago between 2003 & 2005
- Diagnosis made by confocal microscopy, histology, or culture (+)
- 95% wore contact lenses
- Uneven RR between Cook and surrounding counties
- Current AK rates > historical rates (RR 6.67)

- Retrospective review of 39 AK cases @ UIC / 100 controls
- 92% of AK cases wore soft contact lenses
- Exclusive use of AMO Complete Moisture Plus with AK (OR 16.67)
- 38% of AK cases never used AMO Complete Moisture Plus

Pattern of risk with …
- Showering with lenses
- Reusing solutions
- Lack of rubbing

CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

What about orthokeratology / vision shaping therapy?
- N = 23 cases of MK in orthokeratology wearers in Hong Kong
- 3 cases AK from corneal scrapings & 5 cases AK from CLs and case
- Mean treatment 31 days: No emergency surgery. BCVA 20/28
- Early diagnosis of MK in orthokeratology patients critical

- N = 37 AK cases in GPCLs from 2 investigations (2007, 2011) in US
- 24% in orthokeratology
- Significant risk factors for AK …
- Orthokeratology
- Sleeping with GPCL’s
- Storing GPCL’s in tap water
- Topping off contact lens solutions

CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

Diagnosis
- History of contact lens wear with poor compliance
- Coexisting trauma (abrasion)
- Exposure to contamination
- Pain disproportionate to findings
- Non-responsive to treatment (MK and HSV)
- External examination
- Ipsilateral adenopathy
- Reactive piosis
- Biomicroscopy
- “Patchy” Epithelopathy
- Non-suppurative stromal keratitis
- Radial keratoneuritis

CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

Laboratory Testing
- Corneal scrapings & biopsy
- Non-nutrient agar (e-colli overlay)
- Giemsa or trichrome stain
- Immunofluorescent studies

Confocal microscopy
  - Confocal microscopy both sensitive (91%) and specific (100%) for AK

Polymerase chain reaction (PCR)
  - 31 cases with suspected AK - 77% PCR positive (91% A. castellani)
  - Sched Exp Parasitol 2017
    - AK genotype 4 escaped PCR detection!

CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

Aminoglycosides
- Neomycin

Cationic antiseptics (Biguanides)
- Chlorhexidine
- Polyhexamethylene biguanides

Aromatic Diamidines
- Propamadine isethionate

Imidazole Antifungals
- Miconazole
- Clotrimazole
CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

Contemporary clinical treatment outcomes
• Propamidine & neomycin -> 47% (Meisler, et al)
• Propamidine & PHMB -> 80% (McCulley, et al)
• Propamidine & chlorhexidine -> 96% (Seals, et al)

Diamidines & biguanides appear to be synergistic and are the best current therapeutic approach

Lim, et al. AJO 2008
Neither chlorhexidine or PHMB monotherapy effective

Impavido (miltefosine)
 Achieved FDA orphan drug status in 2016
Oral antimicrobial used to treat mucosal leishmaniasis
Antimicrobial alters membrane structure of FLA

CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

‘Adjunct’ treatment protocols
• Topical corticosteroids - Not During Active Infection
• Cryotherapy - Results Have Been Unsatisfactory
• Conjunctival flaps - Not During Active Infection
• Penetrating keratoplasty - Early In The Event Of Impending Perforation & Late For Visual Restoration
• Corneal collagen cross-linking? (Randleman, ASCRS 2012)

• Vinegar ??? Elden, et al. J Parasit Dis 2019
  • vinegar cysticidal in concentrations from 0.04 – 5%

How persistent can acanthamoeba be?

Cysts persist up to 31 months post-treatment

CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

Basic tenets of lens care ….

• Hand hygiene essential
• ‘Rub and rinse’ recommended
• Always use fresh solutions nightly
• Always store solutions in a sealed fashion
• Attention to lens case hygiene is imperative
• No water exposure!

Thank you for attending!
Michael DePaolis, OD, FAAO