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

Optometric Management Symposium
November 2, 2018
Orlando, FL

Michael DePaolis, OD, FAAO
Flaum Eye Institute - UR Medicine
mgadep@gmail.com
Michael.depaolis@urmc.rochester.edu

Michael DePaolis, OD, FAAO
FINANCIAL DISCLOSURE STATEMENT
▪ Associate Professor of Clinical Ophthalmology
Flaum Eye Institute @ UR Medicine
▪ Clinical Investigator, Advisor, Consultant, Lecturer
  ▪ Alcon
  ▪ Allergan
  ▪ AMO
  ▪ Bausch & Lomb / Valeant
  ▪ Clerio Vision
  ▪ Cooper Vision
  ▪ Paragon Vision Sciences
  ▪ Shire
  ▪ SynergEyes
  ▪ J&J Vision Care
▪ Optometric Editor, Primary Care Optometry News
▪ Professional Editorial Review Board, allaboutvision.com

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS
So, is there a take home here?
Things aren't always as they first appear.

Case report: LY 65 yof
▪ Previous hx of contact lens overwear
▪ Refit into PureVision 2 daily, 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 OD in office
▪ Vigamox OD 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
▪ D/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 OD
▪ Vigamox OD q2h
▪ Polytrim OD q2h
▪ F/U 24 hrs

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS
November 13, 2014 CDC’s Morbidity & Mortality Weekly Report
▪ In 2010, nearly 1 million Doctor’s visits due to keratitis
▪ Cost to society of $175 million
▪ 230,000 involved contact lenses and 25,000 diagnosed as ulcer
▪ Jennifer Cope, MD, MPH, of the CDC, “… who wear contact lenses ON are more than 20x more likely to get keratitis.” “… not taking care of them properly is the single biggest risk factor for keratitis.”

August 20-24, 2015 CDC’s Morbidity & Mortality Weekly Report
▪ 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 17, 2018 CDC’s Morbidity & Mortality Weekly Report
▪ Six cases of microbial keratitis 2016 – 2018 … all involved ON wear
▪ Swimming, delayed care, illegally obtaining lenses additional risks
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

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

Tx:
- Vigamox OD qid,
- Polytrim OD 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 1 Day F/U
- C/O eye feels worse, using Ofloxacin OS q2h
- VA cc 20/400 (-) Adenopathy
- SLE - Corneal ulcer with hypopyon
- Cultures – no growth

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

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: LV 50 yof 3 Day F/U
- C/O eye feels much better, using all meds.
- VA cc 20/200
- SLE - ulcer border well defined, reduced AC reaction, trace hypopyon
- Culture – positive for pseudomonas aeruginosa
- Plan: Homatropine 5% qd, Vigamox q2h & Tobramycin q2h

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: LV 50 yof 10 Day F/U
- 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 qid
- Ultimate BCVA 20/50

TOPICS FOR CONSIDERATION

- Epidemiology & risk factors
- Is overnight wear the predominant risk factor?
- What role do silicone hydrogels play in mitigating against 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)

- Annual Rate of ‘Presumed’ MK – 18 per 10,000 patient years

- Incidence of severe keratitis: OW SiHy > 19.8 per 10,000 patient years

- Overnight wear silicone hydrogels – 25.4 per 10,000 patient years
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Are certain patients at higher risk?

Systemic profile
- Immunocompromised
- Metabolic disorders
- Substance abuse ...
- Smoking
- Dermatologic conditions ...
- Atopy & rosacea

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

- Gut & ocular microbiota influence susceptibility to \( \text{P. aeruginosa} \) keratitis in mice

CONTACT LENS COMPLICATIONS
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

Contact lens complications

MICROBIAL KERATITIS

Pathophysiology of microbial keratitis

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

Sullivan A. ARVO 2012
- \( \text{P. aeruginosa} \) T3SS most virulent

- Tear fluid increases T3SS expression in contact lens \( \text{P. aeruginosa} \) biofilms

- \( \text{P. aeruginosa} \) mobile genetic elements (MGE’s) translate resistance

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS DIAGNOSIS

Is it a sterile or infectious process?

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

CONTACT LENS COMPLICATIONS
INFLTRATIVE KERATITIS

Infiltrative Keratitis – the great corneal conundrum

- Cellular response – Neutrophils (pmn’s), lymphocytes, macrophages
- Originates 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
What are the relative risks for corneal infiltrative events (CIE’s)?

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

  - Increased risk with PO.1 / Actox MPS
  - Delfia, Stenotrophomonas, Achromobacter, Serratia

Szczotka-Flynn (2010)
- CIE’s statistically more likely in CL bioburden & smoking
- No correlation between corneal staining and CIE’s

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

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?
  - Cyclopia & antibiotic gtt

What is the best steroid-antibiotic suspension option?
- Cost vs compliance (goodrx.com – average cash price)
  - Tobramycin / Loteprednol = $240
  - Tobramycin / Dexamethasone = $108
  - Neomycin / Polymyxin / Dexamethasone = $29

- Post-op cataract prophylaxis
- Withstand for allergic reaction
- Tobra-Dex = 1% (1 out of 104)
- Neo-Poly-Gram = 9% (5 out of 57)
- Neo-Poly-Dex = 0% (0 out of 110)

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
CONTACT LENS COMPLICATIONS
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

Antimicrobial stewardship?

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

What laboratory tests are indicated?

- Cytology (scraping)
  Spatula & calcium alginate swab
  Microscope, slides, and reagent stains
- Culturing
  Mini-tip culturettes
  Spatula, agar plates, thioglycolate media

Which media are indicated?

- Blood agar – aerobic organisms & saprophytic fungi
- Chocolate agar – neisseria, moraxella, haemophilus
- Lowenstein-Jensen – nocardia & mycobacterium

CONTACT LENS COMPLICATIONS
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 & CL case cultures agreed

 ▪ 113 lens wearers with presumed microbial keratitis
 ▪ 29% bandage lenses / 71% cosmetic lenses
 ▪ Concordance between corneal and contact lens / case cultures
   ▪ Fungal 100%
   ▪ Amoebic 80%
   ▪ Bacterial 75% (Pseudomonas most common)

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

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

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Does culturing impact outcomes?

 ▪ N = 60 cases of microbial keratitis at LV Prasad Eye Institute
 ▪ Retrospectively compared culture negative with culture positive
 ▪ Size of infiltrate or history of trauma had no association with culture result
 ▪ Prior topical antibiotic use with culture negative
 ▪ Longer duration of symptoms and treatment with culture negative
 ▪ More major surgery in culture positive
 ▪ Outcomes …
   ▪ Treatment success in 90% of culture (+) and 83% of culture (-)
   ▪ Final VA 1.8 logMar in culture (+) and 2.3 logMar in culture (-)
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

When should we culture?
- Ulcer > 2mm from limbus and …
- Epithelial defect > 2mm and…
- Ulcer depth > 20% corneal thickness and…
- AC reaction > grade 2

Additional considerations …
- History of vegetative trauma
- Hospital exposure
- Immunocompromised
- Non responsive to first line therapy

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Are all ulcers created equal?
- Microbe virulence
- Host defense
- Time to treatment
- Appropriate treatment

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

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
- Systemic Hx: excellent. No meds. NKDA.
- Social Hx: Prior substance abuse
- Work Hx: Social coordinator at long term health care facility

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: MR 33 yof
- 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 OD, Vigamox OD qh, Valtrex 1000mg tid
3) F/U 24h

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: MR 33 yof
- VA OD cc 20/80
- No culture growth
- Vigamox OD q3h, Pred Forte OD qid
- Valtrex 1000mg tid
- SLE – ulcer re-epithelialized, stromal scar, AC deep & quiet

Plan: 1) Vigamox OD qid, Pred Forte OD qid, Valtrex 1000mg qd, 1u in 1 week.

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: MR 33 yof
- 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 q3h x 7d
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

HSV Clinical Pearls …

- Oral acyclovir alone as effective as topical antivirals in treating HSV epithelial keratitis (Cochrane Data Base 2010)
- Valacyclovir 1 gm 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

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

What does today’s microbial keratitis look like?

- All cultured cases of microbial keratitis from Doheny Eye (DEI) and LA County USC Medical Center (LAC-USC) from 2008-2012.
- N = 290 cases from DEI > 63% culture positive
- N = 186 cases from LAC-USC -> 82% culture positive
- Gram (+) 69%
- P. aeruginosa most common gram (-)
- Ciprofloxacin effective against 73% of all isolates
- 44% of isolates ORSA

- N = 323 infectious keratitis cases at Will’s Eye Hospital (2009-2012)
- Contact lens wearers – p. aeruginosa and fusarium
- Non-lens related – s. aureus and candida
- Most cases in spring and fewest in winter
- p. aeruginosa and MSSA susceptible to fluoroquinolones
- 38% CNSA & all MRSA resistant to moxifloxacin and gatifloxacin
- Good susceptibility to tobramycin, gentamycin, and vancomycin
- Voriconazole effective against all fungi

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Is monotherapy acceptable? In mild to moderate cases, yes!


But, then … staph aureus resistance occurs

- % of s. aureus isolates resistant to fluoroquinolones: 11% > 28%
- Gram (+) / Gram (-) Ratio - 82%:18% in 1993 to 51%:49% in 1997

- Coag (+) S. 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

- Gram (+) / Gram (-) Ratio - 82%:18% in 1993 to 51%:49% in 1997

- Medical University of Innsbruck
- 123 cases of microbial keratitis 2010 – 2012
- Cultures positive in 56% of cases
- 59% gram (+) and 51% gram (-) and 7% fungal
- 30% mixed!!
- Combination of aminoglycoside and 2nd generation fluoroquinolone best initial treatment … 86% effective
- Fluoroquinolone alone less effective
**CONTACT LENS COMPLICATIONS**

**MICROBIAL KERATITIS**

**Which 'resistant' microbes should we be concerned about?**

- MRSA contains an enzyme that breaks β-lactam ring of antibiotics – increasing resistance to penicillin, methicillin, cephalosporins, and many fluoroquinolones
- ARMOR Surveillance: 39% 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

**How do we best treat MRSA?**

- Oral – Bactrim (trimethoprim 160mg / sulfamethoxazole 800mg) bid x 10d
- Topical – Bactroban (mupirocin)

  - Ocular TRUST found 3rd & 4th generation FQ’s effective against ~ 30% of MRSA isolates, while Polytrim effective against 95% of MRSA isolates
  - Up to 85% MRSA strains resistant to moxifloxacin & gatifloxacin
  - Besifloxacin greater efficacy against multi-drug resistant S aureus

**CONTACT LENS COMPLICATIONS**

**MICROBIAL KERATITIS**

**Which 'resistant' microbes should we be concerned about?**

Pseudomonas remains a viable threat

- Fluoroquinolone resistant Pseudomonas aeruginosa (biofilm) (Zegans 2001)
- Effectively treated with fortified aminoglycosides or cephalosporins (Kowalski 2001)
- Pseudomonas still prominent organism in contact lens related microbial keratitis – 80% in Iranian study (Hedayati 2015)
- Pseudomonas mobile genetic elements facilitates transfer of resistance to antibiotics (Subedi 2017)

**What therapeutic strategies are indicated?**

- Should you treat or refer?
- When in doubt … culture
- 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

**CONTACT LENS COMPLICATIONS**

**MICROBIAL KERATITIS**

**When does topical steroid use make sense?**

- Avoid steroid use in microbial keratitis Carmichael 1990
- No difference in complications, healing rates, or VA outcome Srinivasan Arch Ophth 2011
- No difference in perforation, scarring or BCVA between groups Blair, et al Can J Ophth 46(1):2011
- N = 30 ulcers treated with Zymar / Placebo vs Zymar / Dexameth
- No difference in healing, though smaller residual ulcer size in steroid tx Wilhemus Ophthalm 109(5):2002.

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

**CONTACT LENS COMPLICATIONS**

**MICROBIAL KERATITIS**

**New treatment 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 melimine bacteriocidal against P aeruginosa & S aureus
- No cytotoxicity in rabbit models
- Esculatin (frog skin antimicrobial peptide)
- Bacteriocidal against pseudomonas aeruginosa without cytotoxicity
- Effective at tid dosing in murine microbial keratitis model

- 50 yr literature review – Avoid steroid use in microbial keratitis Carmichael 1990
- 40 bacterial corneal ulcers tx w AB’s x 24 hrs, then steroid or placebo
- No difference in complications, healing rates, or VA outcome 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)

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

- 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 – AmbioDisc, 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
  - Silver salt infused Acuvue Advance lenses well tolerated
  - Melimine coated contact lenses reduced incidence of p. aeruginosa induced MK in rabbits

While clinical data supports the claims of safety and efficacy of silicone hydrogels, patient selection remains key -

Avoid continuous wear in ...
- Smokers
- History of CLARE
- Pre-existing ocular surface disease
- Young males (?)
- History of poor compliance
- Swimmers (and other water exposure)

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 lid edema, gr 2 conjunctival injection, 1mm epithelial defect, NO infiltrate, gr 1 AC reaction.

Impression: Corneal abrasion OD

PLAN:
- D/C contact lenses
- Homatropine OD
- Vigamox OD q2h (Ciprofloxacin)
- F/U 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, AC d&q.

Impression: Corneal ring infiltrate OD

PLAN:
▪ Homatropine OD
▪ Pred Forte OD q2h
▪ Ciloxan OD q2h
▪ F/U 48 hr or asap if symptoms
▪ R/O 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 OD q2h
▪ Pred Forte OD q2h
▪ Ciloxan OD q2h
▪ F/U 48 hr or asap if symptoms intensify

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 OD qid, Pred Forte OD qid, & Ciloxan OD qid

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
MICROBIAL KERATITIS

Acanthamoeba Keratitis

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

CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

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

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 20/25
• 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

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

LABORATORY TESTING

Corneal scrapings & biopsy
Non-nutrient agar (E-coli overlay)
Giemsa or trichrome stain
Immunofluorescent studies
Confocal microscopy
Polymorphonuclear leucocytes (pmn)
Pseudoguttata
Hypopyon -> Iritis -> Scleritis

Ring infiltrate not an early finding
Deep stromal involvement or the presence of a ring infiltrate independently associated with a poorer visual outcome

• AK diagnosis with polymerase chain reaction
• 31 patients with suspected AK
• 77% pos positive (91% A. castellani)
• Majority no contact lens history
• Confocal microscopy both sensitive (91%) and specific (100%) for AK
• AK culture sensitivity 53%
• AK smear and scrapings sensitivity 83%
CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

TREATMENT STRATEGIES – DO WE HAVE AN OPTIMAL IN-VITRO TEST?

- In vitro susceptibility of 19 strains of acanthamoeba
- Minimum [drug] to inhibit excystation
- Propamidine & Polyhexamethylene biguanides best activity

- In vitro susceptibility of acanthamoeba trophozoites & cysts
- Reculture technique up to 48 hours
- Chlorhexidine only agent effective against trophozoites & cysts

CONTEMPORARY TREATMENT PROTOCOLS

Amino-glycosides
- Neomycin

Cationic antiseptics (Biguanides)
- Chlorhexidine
- Polyhexamethylene biguanides

Aromatic Diamidines
- Propamidine isethionate

Imidazole Antifungals
- Miconazole
- Clotrimazole

CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

CONTEMPORARY CLINICAL TREATMENT OUTCOMES

- Propamidine & neomycin: > 47% (Meister, et al.)
- Propamidine & PHMB: > 80% (McCulley, et al.)
- Propamidine & PHMB: > 96% (Withmus, 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)

How persistent can acanthamoeba be?

Cysts persist up to 31 months post-treatment

Cysts & trophozoites isolated in cornea 52 weeks after 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 imperative
- No water exposure!

Thank you for attending!
Michael DePaolis, OD, FAAO