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

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FINANCIAL DISCLOSURE STATEMENT

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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

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, “People who wear contact lenses overnight are more than 20 times more likely to get keratitis.”
  She added, “Wearing contacts and 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% of lens wearers engage in at least one risky behavior
• 82% wear lenses longer than replacement interval
• 55% ‘top off’ solutions
• 50% sleep in their lenses

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Topics for consideration
• Epidemiology & risk factors
• Pathophysiology
• Differential diagnosis
• Treatment strategies
• Prevention

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: LY 65 yo

• Previous hx of contact lens overwear
• Refit into PureVision 2 au  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
  • Fr/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: lids flat, gr 1+ conj injection, corneal infiltrate w epithelial defect, gr 1+ AC rxn
- Tx:
  - 5% Homatropine OD
  - Vigamox OD q2h
  - Polytrim OD q2h
  - F/U 24 hrs

Case report: LV 50 yof 4 Day F/U

- Feels much better, still photophobic
- VA cc 20/30 - OD
- SLE: lids flat, conj trace injection, epithelium intact w infiltrate, AC D&Q
- Tx:
  - Vigamox OD qid
  - Polytrim OD qid
  - F/U 3 days

Case report: LV 50 yof 10 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
- Cultures - positive for pseudomonas aeruginosa
- Plan: Homatropine 5% qd, Vigamox qid & Tobramycin qid & Pred forte qid

Case report: LV 50 yof 3 Day F/U

- C/O eye feels worse, using Levofloxacin 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

TOPICS FOR CONSIDERATION

- Epidemiology & risk factors
- Is overnight wear the predominant risk factor?
- Is silicone hydrogels play in mitigating against risk?
- Are certain patients inherently at greater risk?
- Pathophysiology
- Differential diagnosis
- Treatment strategies
- Prevention
**CONTACT LENS COMPLICATIONS**

**MICROBIAL KERATITIS**

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)
- Continuous wear PureVision (Post-FDA surveillance data: 8 cases in 30,000 patient years)

**CONTACT LENS COMPLICATIONS**

**MICROBIAL KERATITIS**

Are certain patients at higher risk?

- **Systemic profile**
  - Immunocompromised
  - Metabolic disorders
  - Alcohol & drug abuse …. Tobacco abuse
  - Dermatologic conditions … atopy & rosacea

- **Ocular profile**
  - Ocular surface disease
  - Neurotrophic, degenerative, & dystrophic cornea
  - Exogenous factors
    - Contact lenses & care products
    - Foreign body & toxic keratitis

**CONTACT LENS COMPLICATIONS**

**MICROBIAL KERATITIS**

Pathophysiology of microbial keratitis

- P. aeruginosa affinity
- Secrets toxins to cross basal epithelium / gain access to stroma *
- Infected epithelial cells prevent infection by sloughing
- Alteration of tear chemistry and tear mixing compromises innate defenses

* A. Sullivan ARVO 2012
P aeruginosa with type 3 secretion system crosses epithelium
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS DIAGNOSIS

Is it a sterile or infectious process?

- Key symptoms?
- Key findings?
- Should we culture?
- Should all ulcers be treated equally?

CONTACT LENS COMPLICATIONS
INFILTRATIVE KERATITIS

Infiltrative Keratitis – the great corneal conundrum

- Cellular response – Neutrophils (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

CONTACT LENS COMPLICATIONS
INFILTRATIVE KERATITIS


- 324 CL patients
- Prevalence of focal infiltrates
- 2.6% of extended wearers
- 1.4% of daily wearers

Szczotka-Flynn, et al IOVS 51(11)2010

- 205 Lotrafilcon A patients in CE x 1 year
- Looked at corneal infiltrative events (CIE)
- Adjusted probability of remaining CIE free for 1 year 73%
- 53% of subjects had one or more visits with corneal staining
- No correlation between corneal staining and CIE events
- Significant bacterial bioburden present in 65% of CIE events
- CIE statistically linked with contact lens bacterial bioburden & smoking

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 at 1 nite, 1 wk, 1 mth, and q 3mth for 3 yrs -> significant carriers

Carriers of gram (+) organisms on lens
- 3x as likely to have CLPU
- 5x as likely to have Asymptomatic Infiltrates
- Coag (-) s aureus & corynebacterium

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

CONTACT LENS COMPLICATIONS
INFILTRATIVE KERATITIS

Contact Lens Peripheral Ulcers (CLPU) … is it really an ulcer?


- Histopathology of 3 lesions
- Focal loss of epithelium / underlying pmn’s


- 4 = 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
- Cycloplegia & antibiotic gtt

CONTACT LENS COMPLICATIONS
INFILTRATIVE 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
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS


Symptoms: None (0) to Severe (3)
Lid edema: None (0) / Present (2)
Conjunctival injection: Localized (1) vs diffuse (2)
Infiltrate shape: Round (1) vs Irregular (3)
Infiltrate size: <1mm (1) - > >1mm = 2 (2) -> >2mm (3)
Epithelial defect: Yes (1)
Corneal edema: Mild (1) vs Severe (2)
Endothelial debris: Yes (1)
Hypopyon: Yes (2)

CLPU < 7 / ‘GRAY ZONE’ 8 - 11 / CORNEAL ULCER > 12

CONTROVERSIES & EVOLUTIONS IN THE MANAGEMENT OF CORNEAL INFECTIOUS DISEASE

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

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
Loewenstein-Jensen – nocardia & mycobacterium

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 eyes with contact lens cases with presumed microbial keratitis
• 29% bandage lenses / 71% cosmetic lenses
• Concordance between corneal and contact lens / case cultures
  ▫ Fungal 100%
  ▫ Amebic 80%
  ▫ Bacterial 75% (Pseudomonas most common)

Controversies & Evolutions in the Management of Corneal Infectious Disease

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
Controversies & Evolutions in the Management of Corneal Infectious Disease

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

Are all ulcers created equal?
- 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
- Systemic Hx: excellent. No meds. NKDA.
- Social Hx: ? alcohol and substance abuse
- Work Hx: Social coordinator at long term health care facility

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report: MR 33 yof - 14 Day f/u
- 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 qd, 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 q24h, 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?
  - Herpes Simplex

- How would you treat it differently today?
  - Zirgan Ophthalmic gel q2h x 7d

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS TREATMENT

- Should you treat or refer?
- How is it best treated?
- Is monotherapy appropriate?
- When is additional treatment necessary?

If you elect to treat …

- Strong cycloplegia: 5% Homatropine or 1% Atropine
- NSAIDS: not indicated
- ANTIBIOTICS – broad spectrum approach
- DAMAGE CONTROL – steroids, azithromycin, or oral doxycycline

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

- Is monotherapy acceptable?
- What are the emerging trends in antimicrobial resistance?
- Which ‘resistant’ microbes should we be concerned about?
- What therapeutic strategies are indicated?
- Are we being good antimicrobial ‘stewards’?

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

The need for antimicrobial stewardship

Miller, et al. (Bascom Palmer Eye) ICAC, 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
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- Combination therapy in 27%
- MRSA and Fusarium

Controversies & Evolutions in the Management of Corneal Infectious Disease

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 -> 62% culture positive

- Gram (+) 70% @ DEI and 68% @ LAC-USC
- Coag (-) staph most common
- P. aeruginosa most common gram (-) @ DEI and LAC-USC
- Ciprofloxacin / levofloxacin effective against 73% of all isolates
- ORSA in 42% of DEI and 45% of LAC-USC isolates

-is monotherapy acceptable?
- In mild to moderate cases, proved as effective as fortified antibiotics

But, then …

Alexandrakis, Alfonso, Miller Ophthal 107(8):2000

- Bacterial keratitis cultures (1468) at Bascom Palmer from 1990 – 1998
- % of s. aureus isolates resistant to fluoroquinolones: 11% -> 28% Goldstein, Kowalski, Gordon Ophthal 106(7):1999.
- 1053 ocular isolates at Campbell Microbiology Lab from 1993 – 1997
- Gram (+) : Gram (-) Ratio - 62%:18% in 1993 to 51%:49% in 1997

Lead to development of C-8 methoxy fluoroquinolones …
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Newer generation fluoroquinolone resistance trends

- Case Report: Coagulase Negative Staph Epidermidis
- Failed treatment with cefazolin (5%) and gatifloxacin (0.3%)
- Success with vancomycin (5%) and tobramycin (1.3%)

- Case Reports: Bacterial keratitis s/p PRK and LASIK
- Pseudomonas aeruginosa s/p PRK despite moxifloxacin prophylaxis
- MRSA keratitis s/p LASIK despite gatifloxacin prophylaxis
- Successfully treated with fortified aminoglycosides

Simply put, more resistant strains an issue …

CONTACT LENS COMPLICATIONS
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
- 2% general population & 20% health care workers harbor MRSA
- 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 95% of MRSA isolates

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

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

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 (gram -) or amikacin (gram -)
  - Polytrim (gram +)
  - Vancomycin (gram +)
- Minimize collateral tissue damage
  - Topical azithromycin
  - Topical corticosteroids
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

When does topical steroid use make sense?

- 50 yr literature review – Avoid steroid use in microbial keratitis
Carmichael 1990
- 40 bacterial corneal ulcer patients
- Treated w antibiotics x 24 hrs and then randomized to steroid group
- No difference in complications, healing rates, or VA outcome
Srinivasan Arch Ophth 2011
- 442 bacterial corneal ulcers treated with moxifloxacin (2006-2010)
- Randomized to receive steroid or NaCl placebo gtt
- No difference in perforation, scarring or BCVA between groups
Blair, etal 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

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

What about non-pharmaceutical treatment strategies?

Randleman, etal OSN 30(13):2012
- N = 16 culture positive bacterial keratitis
- Single tx with CCXL and .01% riboflavin
- 12/14 eyes successfully treated
Said, etal Ophthal 2014
PACK (PhotoActivated Chromophore for Keratitis) – CXL
- 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

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Prevention strategies

Patient consideration
- Compatible ocular surface
- Wear and care compliance
  + Dumbleton, etal Cont Lens & Ant Eye 2011
- Responsible behavior and reporting

Contact lens considerations
- Optimize oxygen transmission & mobility
- Surface deposit resistance & replacement
  + Lakkis, etal (AAO Boston 2011)
  + Silver salt infused Acuvue Advance lenses well tolerated
  + Dutta, etal (AAO Seattle 2013)
- Melamine bound CL’s demonstrate antimicrobial activity

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

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)

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

New treatment paradigms?

Tam, etal J Clin Invest 10:2012
- 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, etal AAOpt Seattle 10/2013
- Peptide melamine bacteriocidal against P aeruginosa & S aureus
- No cytotoxicity in rabbit models
Kolar, etal Cell Mol Life Sci 8-14-2014 pub
- Esculatin (frog skin antimicrobial peptide)
- Bacteriocidal against pseudomonas aeruginosa without cytotoxicity
- Effective at tid dosing in murine microbial keratitis model

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Case report - ES 21 yof

Hx: OD painful, red, photophobic, discharge x 2 days
Wears: B&L SofLens 66 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 !!
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

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, lens clear. SLE OS – Normal.

Impression: Corneal Abrasion OD

PLAN:
• D/C contact lenses
• Homatropine OD
• Vigamox OD q2h (Ciprofloxacin)
• F/U 48 hr or asap if symptoms intensify

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, lens clear. SLE – OS normal.

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. SLE OS – normal.

Impression: No change

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, conjunctiva white, cornea gr 1 diffuse spk.

Impression: Resolving ring infiltrate OD

PLAN:
• Vancomycin OD qid, Pred Forte OD qid, & Ciloxan OD qid

14 DAY F/U VISIT EXAMINATION
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

ES 21 yof – Questions for consideration

• Should we have cultured? (hindisght always 20/20)
• What are the differential diagnoses of a corneal ring infiltrate (PATH)?
• Was this infectious or was it a sterile immune response? (yes ...?)
• How would you treat it today? (no more mr nice guy!)

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

what about orthokeratology / vision shaping therapy?
- N = 23 cases of MK in orthokeratology wearers in Hong Kong
- 2 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
- N = 9 (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

- 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 from UIC Corneal services / 100 controls
- 92% of AK cases and 47% of controls wore soft contact lenses
- Exclusive use of AMO Complete Moisture Plus associated with AK (OR 15.67)
- 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

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 ptosis

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
- Polymerase chain reaction (PCR)
CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

- AK diagnosis with polymerase chain reaction (PCR)
- 31 patients with suspected AK
- 77% PCR positive (91% A. castellani)
- Majority no contact lens history

- Confocal microscopy both sensitive (91%) and specific (100%) for AK
- AK culture sensitivity 53%
- AK smears and scrapings sensitivity 83%

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- AK culture sensitivity 53%
- AK smears 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 best activity

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

CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

Contemporary Treatment Protocols

Aminoglycosides
- Neomycin

Cationic antiseptics (biguanides)
- Chlorhexidine
- Polyhexamethylene biguanides

Aromatic diamidines
- Propamidine isethionate

Imidazole antifungals
- Miconazole
- Clotrimazole

CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

Contemporary clinical treatment outcomes

Meisler, et al.
- Propamidine & neomycin -> 47%

McCulley, et al.
- Propamidine & PHMB -> 80%

Wilhemus, et al.
- Propamidine & PHMB: -> 96%

Seals, et al.
- Propamidine & chlorhexidine -> 96%

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

CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

Clinical treatment outcomes – what about monotherapy?

- Compared monotherapy of PHMB vs chlorhexidine
- N (PHMB) = 23 eyes and N (chlorhex) = 26 eyes
- Treatment successes
  - 78% PHMB
  - 86% Chlorhexidine
- 5 eyes worsened on PHMB
- 4 eyes worsened on Chlorhexidine

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
MICROBIAL KERATITIS

Prevention strategies

Patient consideration
- Avoid exposure sources
- Wear and care compliance
  - Rub and rinse / fresh solutions nightly / daily storage case hygiene
- Responsible behavior and reporting

Contact lens considerations
- Optimize oxygen transmission
- Optimize mobility
- Surface deposit resistance & replacement
- Proper lens hygiene