MICROBIAL KERATITIS IN CONTACT LENS WEAR
BACTERIAL, AMOEIC, FUNGAL AND THE GREAT UNKNOWN

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FINANCIAL DISCLOSURE STATEMENT

* CLINICAL INVESTIGATOR
  Alcon
  Allergan
  AMO
  Bausch & Lomb
  Ciba
  Cooper
  Paragon Vision
  SynergEyes
  Johnson & Johnson

* Optometric Editor, Primary Care Optometry News
* Independent Director, TLC Vision

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

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

CASE REPORT: LV 50 YOHF

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 labs done
Quixin 1 gtt OS q2h initiated
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

CASE REPORT: LV 50 YOHF (DAY 1 F/U)

- C/O eye feels worse, using Quixin 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 YOHF (DAY 3 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 – still no growth
- Plan: Homatropine 5% qd, Vigamox q2h & Tobramycin q2h

(DAY 10 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 qid & Tobramycin qid & Pred forte qid

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

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

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Relative risk of microbial keratitis in contact lens wear?

- Daily wear soft lenses
  1 in 4,000 patient wearing years (Cheng, et al 1999)
- Extended wear with conventional lenses
  1 in 500 patient wearing years (Poggio, et al 1989)
- Continuous wear silicone hydrogel lenses
  1 in 4,000 patient wearing years (Holden, et al 2003)
**CONTACT LENS COMPLICATIONS**

**MICROBIAL KERATITIS**

* PureVision
  * N = 8 cases of microbial keratitis in 30,000 patient years.

*Contact lens microbial keratitis*


Relative risk of contact lens related microbial keratitis

- 12 month, prospective, hospital based study
- Non-severe keratitis (NSK) vs severe keratitis (SK)
- Population based controls (per 10,000 patient wearing years)
- Incidence of SK:
  - Daily wear GP -> 2.9
  - Daily disposables -> 4.9
  - Daily wear disposable soft CL's -> 6.4
  - Conventional EWSCL’s -> 96.4
  - Continuous wear silicone hydrogels -> 19.8

**CONTACT LENS COMPLICATIONS**

**MICROBIAL KERATITIS**


- N = 4999 Subjects -> 5,561 Patient Wearing Years
- ~ 80% Wore Night & Day for 3+ Continuous Weeks
- "Presumed" Microbial Keratitis Dx based on Signs & Symptoms

Annual Rate of 'Presumed' Microbial Keratitis ~ 18 per 10,000

- 2 Cases with Loss of BCVA (3.6 per 10,000)
- 8 Cases without BCVA Loss (14.4 per 10,000)

"Rate of Microbial Keratitis was actually slightly lower for those wearing lenses cw > 3wks per month"
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Silicone hydrogel microbial keratitis


- 12 month prospective population surveillance study in Australia
- 285 cases of microbial keratitis and 1798 controls
- Annualized incidence of microbial keratitis (per 10,000 wearers)
  - Gas permeable – 1.2
  - Daily wear soft – 1.9
  - Occasional overnight – 2.2
  - Daily disposable – 2.0
  - Occasional overnight (DD) – 4.2
  - Overnight wear soft lenses – 19.5
  - Overnight wear silicone hydrogels – 25.4

Are certain patients at higher risk?

- Systemic profile
  - Immunocompromised
  - Metabolic disorders
  - Alcohol & drug abuse
  - Dermatologic conditions … atopy & rosacea
- Ocular profile
  - Ocular surface disease
  - Neurotrophic, degenerative, & dystrophic cornea
- Exogenous factors
  - Contact lenses & care products
  - Foreign body & toxic keratitis

What is the risk of 2+ line loss of bcva?

Nilsson & Montan
20,000 ewscI eyes (0.015%)

Gimbel, etal
1000 LASIK eyes (0.1%)

Schein, etal
Ophth 112(12):2005
5561 Si-Hy CW Years (0.036%)

Is there a ‘domino’ effect to microbial keratitis?

Extended wear -> reduced corneal metabolism, epithelial thinning,
epithelial fragility, and abrasions

88% of EWSCL corneal ulcer patients were non-compliant with 83%
having contaminated lens care systems

Damaged corneal epithelium is prone to s. aureus, s. pneumoniae, and
p. aeruginosa binding

Delayed corneal ulcer treatment -> poorer prognosis
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS PATHOPHYSIOLOGY
Pathophysiology of microbial keratitis


- Corneal “homeostasis”
- Limbal stem cells -> migratory basal cells -> wing cells -> surface (squamous) cells
- O/N wear diminishes cell shedding
- Paradoxical epithelial thinning

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS PATHOPHYSIOLOGY
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

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS
What must go wrong in microbial keratitis?

- Compromised epithelial barrier function
- Microbial ‘seeding’
- Microbial adherence & multiplication
- Failure of host immune response

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS DIAGNOSIS
Is it a sterile or infectious process?

- What are the key symptoms?
- What are the key findings?
- When should we culture?
- Should all ulcers be treated equally?
What is a corneal infiltrate?
- Cellular response vs microbial entities
- Originate from tears, limbal vasculature, basal epithelium?
- Epithelial disruption -> chemotaxis -> infiltration
- Caused by mechanical, toxic, immunogenic, or infectious agents

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

- N = 11 single CLPU’s
- Focal epithelial loss
- Mild irritation, tearing and photophobia
- Resolved w/o treatment w/in 1 week

Asymptomatic infiltrative keratitis (AIK) ~ 1.5%
Infiltrative keratitis (IK) ~ 1.7%
Contact lens acute red eye (CLARE) ~ 1.4%
Contact lens peripheral ulcer (CLPU) ~ 0.8%
CONTACT LENS COMPLICATIONS
INFLITRATIVE KERATITIS

‘Staged’ treatment
- Discontinue CL wear
- In office cycloplegia
- Observation with lubrication…or …
- Steroid-antibiotic gtt … or …
- Antibiotic gtt

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Infectious vs sterile infiltrative keratitis


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) -> 1+mm = 2 (2) -> >2mm (3)
Epithelial defect: Yes (1)
Corneal edema: Mild (1) vs Severe (2)
Endothelial debr: Yes (1)
Hypopyon: Yes (2)

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

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

- 113 ewsc wearers with presumed microbial keratitis
- 29% bandage lenses / 71% cosmetic lenses
- Concordance between corneal cultures and contact lens / case cultures
  - Fungal 100%
  - Amoebic 80%
  - Bacterial 75% (Pseudomonas most common)
**CONTACT LENS COMPLICATIONS**
**MICROBIAL KERATITIS**

When do we need to culture?
- Ulcer > 2mm from limbus and...
- Epithelial defect > 2mm and...
- Ulcer depth > 20% corneal thickness and...
- AC reaction > grade 2

How should we culture an ulcer?
- Mini-tip culturette
- Sensitivity & specificity similar to traditional culture techniques

**CONTACT LENS COMPLICATIONS**
**MICROBIAL KERATITIS**

What is ‘normal’ flora and what isn’t?
- S. epidermidis - 75-90% *
- C. xerosis - 20-33%
- S. aureus - 20-25% *
- S. viridans - 2-6%
- H. influenza - 3%
- S. pneumoniae - 1-3% *
- P. aeruginosa - 0-5% *

* Dominant organisms for microbial keratitis

**CONTACT LENS COMPLICATIONS**
**MICROBIAL KERATITIS**

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

**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 …
- Distinguish mild-moderate vs severe
- Prescribe broad spectrum
- Use frequent dosing levels
- Evaluate q 24-48 h
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Fundamentals of treatment

- Strong cycloplegia - 1gtt 5% Homatropine or 1% Atropine
- NSAIDS – Not!
- ANTIBIOTICS – monotherapy vs multi-drug therapy
- DAMAGE CONTROL – steroids, azithromycine, or oral doxycycline

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Is monotherapy appropriate?

- Ciprofloxacin study group  Eifferman, etal  Ophth 103(11):1996
- Ofloxacin study group  O’Brien, etal  Ophth 104(11):1997
- In mild to moderate cases, these agents proved as effective as fortified antibiotics
  1 gtt q 15 min x 6 hrs, then 1gtt q 30 min x remainder waking hrs,
  and pm at night
  THESE AGENTS NO LONGER THE STANDARD OF CARE!

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Trends in resistance - gram (+)
Alexandrakis, Alfonso, Miller  Ophthal 107(8):2000
- Bacterial keratitis cultures (1468) at Bascom Palmer from 1990 – 1998
  s. aureus: 29% gram (+) in 1990 vs 48% gram (+) in 1998
  % of s. aureus isolates resistant to fluoroquinolones:  11% -> 28%
- N = 1053 ocular isolates at Campbell Microbiology Lab from 1993 - 1997
  Gram (-) : Gram (+) Ratio - 82%-18% in 1993 to 51%-49% in 1997
  35% of S. aureus strains resistant to ciprofloxacin & ofloxacin by 1997

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Trends in resistance – gram (-)
OMIG Mtg  Am Acad Ophthalmology  New Orleans, LA  November 2001
Zegans, etal  Hitchcock Med Ctr  Dartmouth U
- Fluoroquinolone resistant Pseudomonas aeruginosa (biofilm)
Kowalski, etal  Campbell Laboratory  U of Pittsburgh
- Resistant pseudomonas aeruginosa effectively treated with fortified
  aminoglycosides or cephalosporins
**CONTACT LENS COMPLICATIONS**  
**MICROBIAL KERATITIS**

**Trends in resistance – fluoroquinolone development**

**VIGAMOX** (moxifloxacin) & **ZYMAR** (gatifloxacin)
- C8 methoxy group – improved gram (+) efficacy
- DNA gyrase & topoisomerase IV activity – less ‘resistance’
- Solubility at physiologic pH – better penetration
- Excellent tissue retention – less dosing frequency

Mather, et al. AJO 133(4):2002
- 93 Endophthalmitis bacterial isolates MIC’s
- Ciprofloxacin & ofloxacin resistant staphylococcus and streptococcus
- All susceptible to moxifloxacin & gatifloxacin

**CONTACT LENS COMPLICATIONS**  
**MICROBIAL KERATITIS**

**4th 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

**CONTACT LENS COMPLICATIONS**  
**MICROBIAL KERATITIS**

**Current treatment strategies**

Moxifloxacin or gatifloxacin
- 1 gtt q 1 minute x 5
- 1 gtt q 60 minutes x 1 day
- Loading dose at bedtime

Appropriate 2nd line agents
- Bacitracin ung q3h (???)
- Fortified Tobramycin q2h
- Fortified Vancomycin q2h

Adjunct therapy
- Doxycycline
- Cyclosporine
- Azasite
- Topical Steroids
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

WHAT DOES THE FUTURE HOLD?

- Azithromycin vs Tobramycin in treatment of bacterial conjunctivitis
- 1% azithromycin in polymeric mucoadhesive gtt (InSite AzaSite)
- N = 710 patients with clinical diagnosis of bacterial conjunctivitis
- AzaSite bid x 2 days & qd x 3 days / Tobramycin qid x 5 days
- Similar microbial eradication and prevention of recurrence

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CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

MITIGATING AGAINST COLLATERAL TISSUE DAMAGE

- N = 34 horses with active bacterial keratitis
- Looked at tear film metalloproteinases (MMP) 2 & 9
- Found MMP’s reduced by …
  - 99% with EDTA (0.2%)
  - 96% with Doxycycline (0.1%)
  - 98% with N-acetylcysteine (10%)
  - 90% with Equine Serum (100%)

- N = 8 adult beagles with normal tear film gelatinase activity
- Found gelatinase activity reduced by …
  - 68% with cyclosporine A (1%)
  - 68% with EDTA (0.3%)
  - 76% with ciprofloxacin (0.3%)

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

MITIGATING AGAINST COLLATERAL TISSUE DAMAGE

When does topical steroid use make sense?

- Literature review 1950 – 2000
- Evaluated effect of corticosteroids on bacterial keratitis
- Summary
  - Pre-existing corneal disease + steroids -> ulcerative keratitis
  - Prior steroid use -> antibiotic failure
  - Role of steroids in conjunction with antibiotics unclear
  - The role of the SCUT study

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Prevention strategies

Patient consideration
- Compatible ocular surface
- Wear and care compliance
- Responsible behavior and reporting

Contact lens considerations
- Optimize oxygen transmission
- Optimize mobility
- Surface deposit resistance & replacement
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 (?)
- Swimmers (and other water exposure)
- History of poor compliance

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Is swimming a risk factor?


N = 15 subjects
PureVision vs Acuvue 2
30 minutes swimming
- Increased bacterial burden
- Colonization similar between materials
- S. Epidermidis most common isolate

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

CLINICAL CASE - 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

21 YOF - EXAMINATION
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
- 1gtt Homatropine OD
- 1gtt Ciloxan OD q2h
- F/U 48 hr or asap if Symptoms intensify
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

21 YOF - 4 DAY F/U EXAMINATION
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:
• 1gtt Homatropine OD
• 1gtt Pred Forte OD q2h
• 1gtt Ciloxan OD q2h
• F/U 48 hr or asap if symptoms intensify
• R/O Acanthamoeba

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

21 YOF - 6 DAY F/U EXAMINATION
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
• 1gtt Vancomycin OD q2h
• 1gtt Pred Forte OD q2h
• 1gtt Ciloxan OD q2h
• F/U 48 hr or asap if symptoms intensify

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

21 YOF - 8 DAY F/U EXAMINATION
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, lens clear. SLE – OS normal.

Impression: Resolving ring infiltrate OD
PLAN: 1gtt Vancomycin OD qid, Pred Forte OD qid, & Ciloxan OD qid

CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

21 YOF - QUESTIONS FOR CONSIDERATION

• Should we have cultured?
• What are the differential diagnoses of a corneal ring infiltrate?
• Was this infectious or was it a sterile immune response?
• How would you treat it today?
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

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

ANNUALIZED INCIDENCE
- 1-2 per 1,000,000 population
- Seals, et al Eye 17 (893); 2003
  
  - 1: 30,000 contact lens wearing years
  - 88% Hydrogel wearers / 12% GPCL wearers
  - Higher prevalence in Scotland and South Korea

- 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 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

- Diagnosis
  - History of contact lens wear
  - Coexisting trauma (abrasion)
  - Exposure to contamination
  - Pain disproportionate to findings
  - Non-responsive to treatment (MK and HSV)

External examination
- Ipsilateral adenopathy
CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

**Biomicroscopy**
- 'Patchy' non-specific epitheliopathy
- 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)

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- 72 cases of AK
  - 66% BCVA 20/25+
  - 33% BCVA < 20/25
- Deep stromal involvement or the presence of a ring infiltrate independently associated with a poorer visual outcome

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

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**Tu, et al. Cornea 27(7): 2008.**
- Confocal microscopy both sensitive (91%) and specific (100%) for AK
- AK culture sensitivity 53%
- AK smears and scrapings sensitivity 83%
## CONTACT LENS COMPLICATIONS
### ACANTHAMOEBA KERATITIS

#### Contemporary Treatment Strategies

- 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

#### Clinical treatment outcomes

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

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

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

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

Diamadine & cationic antiseptic current therapeutic approach

McCulley, et al.
- Propamidine & PHBG: 80%

Wilhemus, et al.
- Propamidine & PHBG: 96%

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

- Cysts persist up to 31 months post-treatment
CONTACT LENS COMPLICATIONS
MICROBIAL KERATITIS

Prevention strategies

Patient consideration
- Avoid exposure sources
- Wear and care compliance
- Responsible behavior and reporting

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

CONTACT LENS COMPLICATIONS
ACANTHAMOEBA KERATITIS

Basic tenets of lens care ....
- Hand hygiene essential prior to lens care
- Adherence to product instructions is essential
- “Rub and rinse” is imperative!
- Always use fresh solutions nightly
- Always store solutions in a sealed fashion
- Attention to lens case hygiene is imperative

CONTACT LENS PATHOLOGY
FUNGAL KERATITIS

SPECIES WITH OCULAR MORBIDITY

RISK FACTORS & PATHOGENESIS

DIAGNOSIS

TREATMENT

PREVENTION

CONTACT LENS PATHOLOGY
FUNGAL KERATITIS

MULTICELLULAR FILAMENTOUS (MOLDS)

NON-PIGMENTED (MONILIACEAE)
- Fusarium
- Aspergillus
- Acremonium
- Paecilomyces
- Penicillium

PIGMENTED (DEMATIACEAE)
- Curvularia
- Alternaria
- Phialophora
- Cladosporium

- Epithelium intact or ulcerated
- Infiltrate single or multiple
- Feathered edges
- Non-suppurative
CONTACT LENS PATHOLOGY
FUNGAL KERATITIS

UNICELLULAR (YEASTS)
- Candida
- Cryptococcus

DIMORPHIC FUNGI
- Blastomyces
- Coccidioides
- Histoplasma
- Sporothrix

Endophthalmitis secondary to fungemia
Contact lens wear

CONTACT LENS COMPLICATIONS
FUNGAL KERATITIS

RISK FACTORS

BANDAGE LENSES
- Non-healing epithelial defect
- Post penetrating keratoplasty
- Prolonged topical steroid use

COSMETIC LENSES
- Corneal abrasion (vegetative matter)
- Warm, humid environment
- Multipurpose lens care products?

CONTACT LENS COMPLICATIONS
FUNGAL KERATITIS

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CONTACT LENS COMPLICATIONS
FUNGAL KERATITIS

RISK FACTORS

BANDAGE LENSES
- Non-healing epithelial defect
- Post penetrating keratoplasty
- Prolonged topical steroid use

COSMETIC LENSES
- Corneal abrasion (vegetative matter)
- Warm, humid environment
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CONTACT LENS PATHOLOGY
CLINICAL CONSIDERATIONS

What about other lens care related complications?

Fusarium
- Filamentous fungi
- Ubiquitous plant pathogen
- Found in bathrooms
- Emerging cause of opportunistic mycosis
- Enter through epithelial defect -> mycotoxins can penetrate Decemet's

CONTACT LENS PATHOLOGY
CLINICAL CONSIDERATIONS

What about other lens care related complications?

Suspect fungal infection in a non-responsive keratitis in which:
- Feathery margins
- Rough texture
- Elevated borders
- Pigmentation
- Endothelial plaque
- Satellite lesions

Labs include:
- Sabouraud's broth
- Brain-heart infusion broth (w/o cycloheximide)
- Anticipate growth in 3-7 days
- Corneal scrapings (giemsa) limited benefit, but debulking is good!

CONTACT LENS PATHOLOGY
CLINICAL CONSIDERATIONS

What about other lens care related complications?

Contemporary treatment strategies for fusarium keratitis
- Topical antifungals q1h during day and q2h at night
- NO steroids until infection control is established
- Treat for 12 weeks
- Topical Polyenes
  - Amphotericin B – yeasts
  - Natamycin – filamentous
- Oral Azoles
  - Ketoconazole, Miconazole, Fluconazole, Itraconazole & Clotrimazole

CONTACT LENS PATHOLOGY
CLINICAL CONSIDERATIONS

What about other lens care related complications?

The ReNu with MoistureLoc Story
- April 10, 2006 US CDC reported 28 confirmed cases of fusarium keratitis with disproportionate bias to MoistureLoc
- May 15, 2006 B&L withdraws MoistureLoc from market
- Non-compliance leads to solution evaporation
- Polymer component of solution 'shields' fusarium, rendering Alexidine ineffective
CONTACT LENS COMPLICATIONS
FUNGAL KERATITIS

WHAT ABOUT LENS CARE PRODUCT EFFICACY?

STAND ALONE TESTING
- Qualifies individual solutions as adequate disinfectants
- Standard FDA isolates are added to the solution
- Evaluates the soak only phase of the system
- 3 std bacteria -> at least 3 log reduction during soak time
- 2 std fungi (yeast/mold) -> at least 1 log reduction
- No microbe increase during an additional 16 – 24 hour soak time

CONTACT LENS PATHOLOGY
CLINICAL CONSIDERATIONS

What about other lens care related complications?

The moral of the story ....
- Hand hygiene essential prior to lens care
- Adherence to product instructions is essential
- “Rub and rinse” isn’t such a bad thing!
- Always use fresh solutions nightly
- Always store solutions in a sealed fashion
- Attention to lens case hygiene is imperative

CONTACT LENS COMPLICATIONS
FUNGAL KERATITIS

WHAT ABOUT LENS CARE PRODUCT EFFICACY?

REGIMEN TESTING
- Qualifies individual solutions as part of a lens care system
- Contact lenses are inoculated with standard FDA isolates
- Evaluates “contribution of elements” (rub, rinse, soak)
- No more than 10 microbes recovered from the contact lens and soaking solution at completion of the regimen

CONTACT LENS COMPLICATIONS
FUNGAL KERATITIS


29 CASES CULTURE (+) FUNGAL KERATITIS
51 CASES CULTURE (+) BACTERIAL KERATITIS

FUNGAL KERATITIS SIGNIFICANTLY MORE LIKELY ...
TO BE ASSOCIATED WITH TRAUMA
TO LEAD TO PERFORATION
REQUIRE CORNEAL TRANSPLANTATION

BACTERIAL KERATITIS SIGNIFICANTLY MORE LIKELY ...
TO BE ASSOCIATED WITH CL WEAR & PRE-EXISTING OCULAR SURFACE DISEASE
CONTACT LENS COMPLICATIONS
FUNGAL KERATITIS

N = 24 CULTURE (+) FUNGAL KERATITIS CASES

DEMOGRAPHICS
58% FEMALE / 42% MALE
AGE OF ONSET 19 - 86 YRS (M = 59)

RISK FACTORS
OCULAR SURFACE DISEASE = 41.7%
CONTACT LENSES WEAR = 29.2%
ATOPIC DISEASE = 16.7%
STEROID USE = 16.7%
OCULAR TRAUMA = 8.3%

LABORATORY TESTING
STAINING TECHNIQUES
GRAM, GIEMSA, GMS,
PAS, KOH & CALCOFLUOR
AGAR PLATES
SABOURAUD DEXTROSE,
BLOOD, & BRAIN INFUSION
CORNEAL BIOPSY

CORNEAL SCRAPINGS (+) = 75%
CANDIDA = 45.8% /  FUSARIUM = 25%

TREATMENT
TOPICAL NATAMYCIN & AMPHOTERCIN B
ORAL FLUCONAZOLE / KETOCONAZOLE / ITRAConAZOLE
OUTCOMES
PENETRATING KERATOPLASTY = 25%
BCVA OF 20/100 OR BETTER = 54.1%

MICROBIAL KERATITIS
FUNGAL KERATITIS
TREATMENT PROTOCOLS (TOPICAL)

POLYENES
AMPHOTERICIN B .15% / NATAMYCIN 5%

PYRIMIDINES
FLUCYTOSINE 1-2%

IMIDAZOLES
MICONAZOLE 1% / KETOCONAZOLE 2-5%

TRIAZOLES
ITRAConAZOLE 1% / FLUCONAZOLE 0.2-0.5%
MICROBIAL KERATITIS
FUNGAL KERATITIS

TREATMENT PROTOCOLS (ORAL)

FLUCYTOSINE 150 mg/kg po qd
KETOCONAZOLE 400 mg po qd
ITRACONAZOLE 400 mg po qd
FLUCONAZOLE 200 mg po qd

SURGICAL OPTIONS

EXCIMER LASER PTK
PENETRATING KERATOPLASTY

MICROSPORIDIA KERATITIS

MULTIFOCAL SPK & STROMAL KERATITIS

RISK FACTORS:
TRAUMA,
IMMUNOCOMPROMISED,
DRUG ABUSE

TREATMENT:
ALBENDAZOLE
FUMAGILLIN BICYCLOHEXYL-AMMONIUM SALTS