MICROBIAL KERATITIS IN CONTACT LENS WEAR

BACTERIAL, AMOEBIC, 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

Relative risk of microbial keratitis in silicone hydrogel continuous wear

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

(Chart showing cases of microbial keratitis per year for different types of contact lenses)

CONTACT LENS COMPLICATIONS
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


- Case control study
- 367 presumed cases of microbial keratitis
- 1069 hospital controls & 639 population controls
Relative risk for developing microbial keratitis (Soft PRP as referent)
- gpcis 0.16x
- daily disposables 1.56x
- Overnight wear lens 5.42x

No difference between silicone hydrogels and other soft lenses
Vision loss less likely to occur in daily disposable continuous wear
**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
  - Octal wear 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
CLAO 20:97-225, 1994
20,000 eyes (0.015%)

Gimbel, et al
1000 LASIK eyes (0.1%)

Schein, et al
Ophthalmology 112(12):2005
5561 Si-Hy CW Years (0.036%)
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


- 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?
CONTACT LENS COMPLICATIONS
INFILTRATIVE KERATITIS

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 COMPLICATIONS
INFILTRATIVE KERATITIS

- 2324 CL patients
- Prevalence of focal infiltrates
  - 2.6% of extended wearers
  - 1.4% of daily wearers

Annualized incidence of EW related infiltrates
- 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
INFILTRATIVE KERATITIS

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

CONTACT LENS COMPLICATIONS
INFILTRATIVE KERATITIS

- Histopathology of 3 lesions
- Focal loss of epithelium / Bowman’s OK
- Dense underlying of pnm’s

Are all CLPU’s benign?

Donshik, Suchecki, Ehlers
N = 52 Patients with CLPU
- 85% Single infiltrate
- 15% Multiple infiltrates
- 40% Disposable ewsl
- 21% Conventional ewsl
- 33% Daily wear scl

50% (8/16) culture positive
CONTACT LENS COMPLICATIONS
INfiltrative Keratitis

CONTACT LENS PERIPHERAL CORNEAL ULCERS (CLPU)

‘Staged’ treatment

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

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 (scrapping)
  Spatula & calcium alginate swab
  Microscope, slides, and reagent stains

- Culturing
  Mini-tip culturettes
  Spatula, agar plates, thioglycolate media


- 113 ewcl 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, azithromycin, or oral doxycycline

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

Is monotherapy appropriate?
- In mild to moderate cases, these agents proved as effective as fortified antibiotics
- 1gtt q 15 min x 6 hrs, then 1gtt q 30 min x remainder waking hrs, and prn at night
- THESE AGENTS NO LONGER THE STANDARD OF CARE!

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

**Trends in resistance - gram (+)**
- 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 (-)**
- Fluoroquinolone resistant Pseudomonas aeruginosa (biofilm)
- Resistant pseudomonas aeruginosa effectively treated with fortified aminoglycosides or cephalosporins
- Kowalski, et al. Campbell Laboratory. U of Pittsburgh
**CONTACT LENS COMPLICATIONS**

**MICROBIAL KERATITIS**

Trends in resistance – fluoroquinolone development

**VIGAMOX** (moxifloxacin) & ZYMAR (gatifloxacin)
- C-8 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

- Levofloxacin 1.5% (Iquix) vs Gatifloxacin 0.3%
- Corneal Tissue & Aqueous Humor penetration
- N = 59 patients undergoing PKP received 2 gtt prior to surgery
- Higher tissue and ac levels of levofloxacin

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


Literature review 1950 – 2000
Evaluation 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
    - 230 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
  - 1gt Homatropine OD
  - 1gt 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

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

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, etal  Eye 17 (893): 2003
  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 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)

**Contact Lens Complications**
ACANTHAMOEBA KERATITIS

**Biomicroscopy**
- Ring infiltrate
- Pseudoguttata
- Hypopyon -> Iritis ->Scleritis

**Tu, et al Ophth 115(11):2008.**
- 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

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

**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**

  - Combined therapy: Propamidine & neomycin -> 72%

**Contemporary Treatment Protocols**

- **Aminoglycosides**
  - Neomycin

- **Cationic antiseptics**
  - Chlorhexidine
  - Polyhexamethylene biguanides

- **Aromatic diamidines**
  - Propamidine isethionate

- **Imidazole antifungals**
  - Miconazole
  - Clotrimazole

- **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

- 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
Feathery edges
Non-suppurative
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

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!

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

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

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 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


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 LENS 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

MICROBIAL KERATITIS
FUNGAL KERATITIS
TREATMENT PROTOCOLS (TOPICAL)

POLYENES
AMPHOTERICIN B 1.5% / NATAMYCIN 5%

PYRIMIDINES
FLUCYTOSINE 1-2%

IMIDAZOLES
MICONAZOLE 1% / KETOCONAZOLE 2-5%

TRIAZOLES
ITRACONAZOLE 1% / FLUCONAZOLE 0.2-0.5%

CONTACT LENS COMPLICATIONS
FUNGAL KERATITIS

N = 24 CULTURE (+) FUNGAL KERATITIS CASES

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

TREATMENT
TOPICAL NATAMYCIN & AMPHOTERICIN B
ORAL FLUCONAZOLE / KETOCONAZOLE / ITRACONAZOLE

OUTCOMES
PENETRATING KERATOPLASTY = 25%
BCVA OF 20/100 OR BETTER = 54.1%
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

MICROBIAL KERATITIS
MICROSPORIDIA KERATITIS

MULTIFOCAL SPK & STROMAL KERATITIS

RISK FACTORS:
TRAUMA,
IMMUNOCOMPROMISED,
DRUG ABUSE

TREATMENT:
ALBENDAZOLE
FUMAGILLIN BICYCLOHEXYLAMMONIUM SALTS