CONTACT LENS COMPLICATIONS

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BASICS

DESCRIPTION

Complications from contact lens use can occur in any patient who wears contact lenses. Problems associated with contact lens use include infection (most commonly bacterial but rarely fungal or amoebal), allergic, overwear (corneal hypoxia and neovascularization), toxicity (from multipurpose cleaning solutions or improper use of hydrogen peroxide solutions), and corneal warpage (seen most commonly with rigid gas permeable lenses).

ALERT

While rare, always ask about exposure to fresh water from lakes or streams while wearing contacts, or cleaning contacts with tap water (especially from wells) as this is a risk factor for *Acanthamoeba* keratitis.

Pediatric Considerations

Teenagers are prone to improper use of contact lenses, including wearing contacts for extended periods of time, not changing contacts as directed, and wearing their contacts despite having red or painful eyes.

EPIDEMIOLOGY

Complications more commonly occur in patients who improperly clean or store their contacts, or who wear contacts with a low-oxygen permeability (Dk), or wear contact lenses overnight and/or for many days continuously.

Incidence

- Incidence of bacterial keratitis is estimated to be between 0.04 and 0.21%. The incidence is much higher in patients wearing contact lenses overnight and for extended periods of time without changing their lenses.
- Fungal and amoebal keratitis are rare, but rates can be higher when associated with epidemic outbreaks from contaminated water or from contact lens solutions.
- Incidence of giant papillary conjunctivitis (GPC) varies based on the types of lens, but has been reported at 4.6% for silicone hydrogel lenses.

Prevalence

As most contact lens problems are acute, prevalence generally equals incidence.

ALERT

There have been 2 major outbreaks of infectious keratitis related to multipurpose solutions (MPS). ReNu with MoistureLoc was linked to fungal (*Fusarium*) keratitis, and Complete was linked to *Acanthamoebal* keratitis. The incidence of infectious keratitis can increase sporadically, and practitioners should be aware if an outbreak of infectious keratitis has been reported.

RISK FACTORS

- Use of a contact lens with a low permeability for oxygen (Dk), especially if worn continuously
- Improper storage and disinfection of contact lenses
- Exposure to fresh water lakes and streams, or tap water (especially well water)
- Dry eyes
- Atopy
- Use of an MPS
  - Solutions which are intended to clean, disinfect, and store contacts are considered multipurpose solutions. Recent outbreaks of infectious keratitis have highlighted the fact that many contact lens wears improperly use their MPS, increasing the risk of infection.
  - Also, as these solutions are designed to be antimicrobial, they can cause toxicity to the corneal epithelium. This problem is more pronounced in people with risk factors for dry eyes.

GENERAL PREVENTION

- Avoidance of overnight and extended wear of contact lenses
- Following the manufacturers' recommended replacement, schedule for the particular contact lenses
- Use of daily disposable contact lenses (contacts designed to be worn once and then disposed)
- Avoidance of multipurpose solutions:
  - If multipurpose solutions are used, rub contact lenses with a solution prior to storage. Do not "top off" the solution in the contact lens case – dispose the old solution in the contact lens case and use a new solution from the bottle. Change the contact lens cases frequently.
- Use of hydrogen peroxide disinfection systems decreases the risk of complication by providing better disinfection of the contacts, and having less residual toxicity than multipurpose solutions (after complete neutralization of the hydrogen peroxide solution).
  - Hydrogen peroxide solutions can never be placed directly in the eye; otherwise a severe toxic keratitis will occur.
  - Use of 1-day disposable contacts reduces the overall risk of contact lens complications

PATHOPHYSIOLOGY

- Contact lenses can decrease the transmission of oxygen to the ocular surface, leading to hypoxia, neovascularization, and conjunctivalization of the cornea.
- Improperly cleaned contact lenses can increase the risk of infection.
- Toxicity from multipurpose solutions can damage the epithelial cells of the cornea, causing a keratitis.
- GPC is an immune reaction in the tarsal conjunctiva to the contact lens material, or to deposit on the contact lens material, or a combination of both.

ETIOLOGY

- Contact lens overuse and misuse
- Improper cleaning of contact lenses
- Toxicity from multipurpose solutions
- Inadequate disinfection of contacts from multipurpose solutions

COMMONLY ASSOCIATED CONDITIONS

- Dry eye
- Blepharitis
- Atopy

DIAGNOSIS

HISTORY

- History of contact lens use, especially with planned replacement lenses (lenses worn for more than 1 day at a time)
- History of multipurpose solution use
- Red, painful eyes
- Photophobia
- Conjunctival discharge (often clear and intermittent)
- History of frequent "eye infections"
  - Patients with a history of contact lens overwear often report a history of frequent red eyes, previously diagnosed or believed to be infections, but often represent a contact lenses-related condition
  - Severe pain out of proportion to clinical findings should raise suspicion for *Acanthamoeba*.

PHYSICAL EXAM

- Bacterial infection:
  - Dense, white corneal infiltrate with overlying epithelial defect
  - Corneal edema surrounding infiltrate
  - Conjunctival redness
  - Inflammation in anterior chamber (cell and flare seen in slit lamp)
  - Layered white blood cells (hypopyon) may be seen in the anterior chamber
- Fungal infections:
  - "Fluffy" corneal infiltrate, often with multiple, smaller, "satellite" lesions
  - May or may not have an associated epithelial defect
- Amoebal infections:
  - Diffuse epithelial irregularity and edema
  - Visible corneal nerves (radial keratoneuritis)
  - Ring-shaped corneal infiltrate – this is a late sign.
- Contact lens overwear:
  - Conjunctival redness
  - Diffuse punctate keratitis
  - May have subepithelial infiltrates – fine, white opacities in the anterior stroma with negative fluorescein staining
  - May have corneal neovascularization, old stromal scars, and other signs of previous episodes of contact lens overwear
- Multipurpose solution toxicity (or use of nonneutralized hydrogen peroxide solution):
  - Diffuse punctate keratitis
- Giant papillary conjunctivitis:
  - Large papillae on the tarsal conjunctiva (seen with upper lid eversion)
  - Conjunctival hyperemia

DIAGNOSTIC TESTS & INTERPRETATION

Imaging

- Corneal topography can be used to diagnose and monitor corneal warpage.
- Specular microscopy can be useful to see intrastromal amoebal cysts.

Diagnostic Procedures/Other

- For suspected bacterial, fungal, or amoebal infections, the cornea can be cultured to determine the infectious organism and get the antimicrobial sensitivities. A gram stain can also be useful in determining if the bacteria are gram positive or negative, or possibly fungal hyphae may be seen.
  - Amoeba can sometimes be cultured on specialized culture plates or seen with specular microscopy.

Pathological Findings

- Bacteria (gram positive or negative) or hyphae may be seen on gram staining.
- Bacteria, fungi, or amoeba may grow on the appropriate culture media.

DIFFERENTIAL DIAGNOSIS

- Viral conjunctivitis
- Herpetic keratitis
- Chronic dry eye
- Corneal scarring from old contact lens infection or inflammation
- Thygeson's keratitis

TREATMENT

MEDICATION

First Line

- For bacterial keratitis – fluoroquinolones (moxifloxacin, gatifloxacin, besifloxacin) eyedrops or a broad spectrum (combination eyedrop such as polymixin B/trimethoprim) is dosed frequently (1 drop every hour after an initial loading dose on 1 drop every 5 min for 15 min)
- For fungal keratitis – natacyn (natamycin) eyedrops 1 drop per h
  - If drops can be administered to patients around the clock, this is preferred. If cannot, consider a broad spectrum ophthalmic ointment at night time such as ciloxan or polysporin.
  - For *Acanthamoeba* keratitis – brolene (propamidine) and baquacil (PHMB) eyedrops
  - For GPC – mild topical steroid drops, such as alrex or FML (for short-term use). Topical antihistamines and mast cell stabilizers, such as pataday, are useful for chronic use.

Second Line

- For bacterial keratitis – fortified antibiotics made in a compounding pharmacy or in the in-patient hospital pharmacy. Use fortified vancomycin or ancef, to cover gram-positive bacteria, in conjunction with fortified tobramycin or gentamicin to cover gram-negative bacteria. For suspected pseudomonas, add fortified ceftazidime.
- For fungal keratitis – fortified amphotericin B or fortified voriconazole
  - For *Acanthamoeba* – chlorhexidine, neomycin, and miconazole eyedrops

ADDITIONAL TREATMENT

General Measures

- The use of 1-day disposable contact lenses is often very effective in the treatment for GPC.
  - A brief cessation of contact lens use is also often beneficial in GPC.
  - For corneal warpage from rigid gas permeable lenses, the contact lens use should be discontinued, and the lens should be refit, or changed to a soft lens.

Issues for Referral

Any corneal infection not resolving or getting worse on first-line therapy should be referred to a corneal specialist.

Additional Therapies

Avelox 400 mg per 24 h by mouth may be considered as adjunctive therapy for bacterial corneal ulcers, as it has a high penetration through the blood–retina barrier in the inflamed eye.

SURGERY/OTHER PROCEDURES

- In rare cases, for bacterial, fungal, or amoebal corneal infections not responding to hourly fortified antibiotics, antifungal or antiamoebal therapy, a corneal transplant can be considered.
  - There is a risk of recurrence of the infection in the corneal transplant.

IN-PATIENT CONSIDERATIONS

Initial Stabilization

If patients are admitted to the hospital, administer a loading dose of fortified eyedrops.

Admission Criteria

In select cases, patients may be admitted for round-the-clock eyedrops for severe corneal infections.

Nursing

Patients need to be admitted to a ward where nurses can administer drops every 30–60 min.

Discharge Criteria

Patients can be discharged when the corneal ulcer has resolved or significantly resolved.

ONGOING CARE

FOLLOW-UP RECOMMENDATIONS

For bacterial, fungal, and amoebal corneal infections, the patient should be seen every day for a few days, until the condition is stabilized.

Patient Monitoring

After the contact lens complication is resolved, it is important to maintain routine eye care to monitor the contact lens use, and monitor for risk factors for further contact lens problems.

PATIENT EDUCATION

Proper contact lens care and usage

PROGNOSIS

- Good for most problems from contact lens overwear
- Good for most small and peripheral corneal infections
- Central, large corneal infections can cause decreased vision
- GPC can be chronic and difficult to treat

COMPLICATIONS

- Central bacterial or fungal infections can lead to vision loss and possibly the need for a corneal transplant.
- Use of topical steroid eyedrops on active bacterial, fungal, or amoebal infections can significantly prolong the infection and worsen the clinical course.

ADDITIONAL READING

- Chang DC, Grant GB, O'Donnell K, et al. Multistate outbreak of fusarium keratitis associated with use of a contact lens solution. *JAMA* 2006;296:956.
- Foulks GN. Prolonging contact lens wear and making contact lens wear safer. *Am J Ophthalmol* 2006;141(2):369–373.
- Levinson BA, Hammersmith KM, Cohen EJ. Fungal keratitis in contact lens wearers. In: Tasman W, Jaeger EA, ed. *Duane's Ophthalmology*. Lippincott Williams & Wilkins, 2010.
- Levinson BA, Rutzen AR. New antimicrobials in ophthalmology. *Ophthalmol Clin North Am* 2005;18(4):493–509.
- Suchecki JK, Donshik P, Ehlers WH. Contact lens complications. *Ophthalmol Clin North Am* 2003;16(3):471–484.

CODES

ICD9

- 370.00 Corneal ulcer, unspecified
- 371.82 Corneal disorder due to contact lens
- 372.30 Conjunctivitis, unspecified

CLINICAL PEARLS

- It is critical to obtain a thorough history of the contact lens use, including wear time (hours/day or any overnight wear), the exact brand and type of the contact lens and the type of solution used to clean and/or store the contact lens and the frequency of replacement of the lens
- Be very cautious in the use of topical steroids. Steroids should only be used if infectious etiologies have been ruled out or fully treated.