

Shewanella algae keratitis

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A 75-year-old male with a right eye history of chronic dry eye syndrome, glaucoma status post tube shunt, and Fuchs dystrophy status post Descemet stripping endothelial keratoplasty followed by penetrating keratoplasty (PKP) presented with a 2.7 × 4.2 mm corneal ulcer, culture positive for *Shewanella algae* and *Klebsiella oxytoca*. A topical antibiotic regimen of gentamicin 14 mg/mL and vancomycin 50 mg/mL was administered according to culture sensitivities. There was concurrent use of loteprednol 0.5% (Lotemax Gel, Bausch and Lomb, Rochester, NY, USA) and later addition of erythromycin 0.5% ointment. The corneal ulcer improved with antibiotic therapy but was complicated by poor patient follow-up. Descemetocele formation prompted PKP in the right eye. The graft was successful and visual acuity improved from a low of light perception to maximum of 20/200 Snellen.

Key words: *Shewanella*, *S. algae*; keratitis, cornea ulcer

Shewanella algae is a gram-negative, facultative anaerobic, motile bacillus representing the majority of human presentations of *Shewanella* species.^[1-5] *S. algae* can be differentiated by its features of mucoid colony formation with beta-hemolysis on blood agar, nitrite reduction, ability to grow in 6.5% NaCl, and growth at 42°C.^[1] Studies have attributed the increased virulence of *S. algae* over *Shewanella putrefaciens* to its hemolytic activity, formation of biofilms, and enzymatic activity.^[1-3] Human presentations are uncommon because of its saprophytic nature and predominance as marine environment microflora. Ocular infection with *Shewanella putrefaciens* has been reported in the case of ocular trauma while at sea as well as late-onset post laser *in situ* keratomileusis (LASIK).^[6,7] *Shewanella algae* has been isolated from soft tissue and skin, respiratory tract,

abdominal and biliary tract, ear, and other infections.^[2-5] Only one case of *S. algae* ocular infection has been thus far reported, presenting as posttraumatic endophthalmitis.^[8] Here is the first reported case of *S. algae* keratitis.

Case Report

A 75-year-old male, with a right eye history of chronic dry eye syndrome, pseudophakia, glaucoma status post tube shunt 3 years prior, and Fuchs corneal dystrophy status post Descemet stripping endothelial keratoplasty 3.5 years prior followed by penetrating keratoplasty (PKP) 11/11/14, 1.5 years prior, presented to the emergency department with a one-day history of decreased vision, pain, conjunctival injection, purulent discharge, and central white opacity. His most recent ocular examination 3 weeks before presentation revealed stable hand motion vision in the right eye with earlier graft failure and central 0.2 mm persistent epithelial defect with epitheliopathy.

Examination of his right eye revealed hand motion visual acuity, purulent discharge, moderate conjunctival injection, and a 2.7 × 4.2 mm central consolidated corneal infiltrate extending to 50% stromal depth with overlying epithelial defect in his previously failed PKP graft [Fig. 1]. The anterior chamber was quiet. Corneal swabs were obtained and used to inoculate slides for gram stain and fungal smear, as well as agar plates (blood, chocolate, Sabaroud's dextrose, Lowenstein-Jensen, and charcoal yeast), and finally thioglycolate broth, to identify potential bacteria, fungus, and acanthamoeba pathogens. The patient was empirically started on fortified vancomycin 50 mg/mL and gentamicin 14 mg/mL every 1 h while awake and every 2 h at bedtime. He was asked to continue loteprednol 0.5% (Lotemax, Bausch and Lomb, Rochester, NY, USA) twice a day in the right eye as well as his glaucoma medications.

Gram stain, direct microscopy, and mass spectrometry were used by the microbiology lab to reveal cultures positive for 4+ growth of *Shewanella algae* detected on day 1, and 2+ growth of *Klebsiella oxytoca* detected on day 2, both sensitive to all tested antibiotics except ampicillin. At this time, the patient reported improvement in his symptoms associated with reduction of his corneal ulcer and resolution of purulent discharge. The fortified gentamicin was maintained, the vancomycin was decreased, and the loteprednol 0.5% was increased over the course of treatment. The vancomycin was discontinued at day 12.

His corneal ulcer improved over a course of 22 days at which time he was noted to have a persistent 1 × 1 mm infiltrate with overlying 1.2 × 1.5 mm epithelial defect [Fig. 2]. He had stable 50% thinning of the cornea. Visual acuity had improved to count fingers. He was started on erythromycin 0.5% ointment every 4 h to promote epithelial healing while continuing his other medications. Against recommendation, the patient traveled out of the country for 7 weeks without

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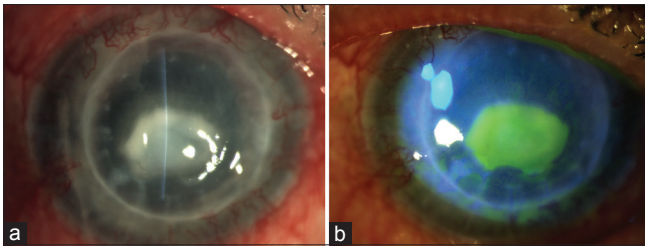


Figure 1: (a) Day 1 – *S. algae* infected corneal ulcer measuring 2.7 × 4.2 mm (b) Day 1 – Corneal ulcer with fluorescein staining under cobalt blue light

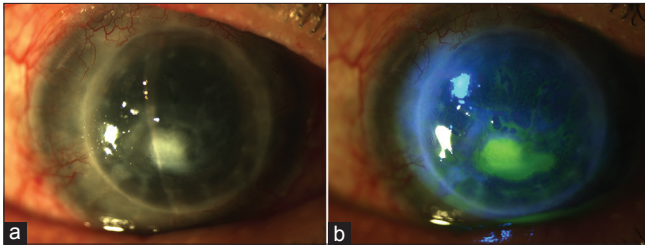


Figure 2: (a) Day 22 – Resolving corneal ulcer with residual infiltrate and epithelial defect (b) Day 22 – Resolving corneal ulcer with fluorescein staining under cobalt blue light

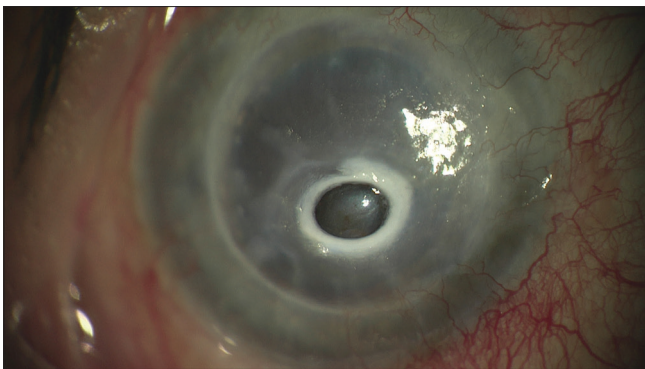


Figure 3: Week 18 – Central descemetocoele

receiving ongoing ophthalmic evaluations. Upon return, he was only using erythromycin 0.5% ointment twice a day and was found to have a 1.3 × 1.9 mm central descemetocoele [Fig. 3]. He underwent PKP 6 days later [Supplemental Digital Content]. Cultures performed at the time of surgery and pathology results including special stains were all negative for organisms. His course thereafter was unremarkable with improvement in his visual acuity to 20/200 Snellen.

Discussion

Shewanella species belong to the microflora of the marine environment. They have also been isolated from soil, dairy, animal products, and aquatic environments, including both fresh and saltwater sources.^[1] In 1997, the two species of *S. algae* and *S. putrefaciens* were classified by rRNA analysis, shedding light on the predominance of *S. algae* over *S. putrefaciens* in clinical cases.^[2] *Shewanella* species are known to be susceptible to aminoglycosides, erythromycin, carbapenems, quinolones, cephalosporins, and ampicillin, with resistance to penicillin.^[2-7] One case of corneal *Shewanella putrefaciens*

6 years post LASIK showed response to a combination of tobramycin 14 mg/mL plus cefazolin 50 mg/mL administered hourly.^[7] A fourth-generation fluoroquinolone was added once gram stain revealed gram-negative rods, and visual acuity was restored to 20/25. One case of endophthalmitis due to *S. putrefaciens* along with two other organisms following trauma from a fishhook resulted in enucleation.^[6] Another similar mechanism of trauma from a fishhook resulted in endophthalmitis caused instead by *S. algae*, also leading to enucleation.^[8] Case reports of *S. algae* in other sites have indicated prompt recovery following correct identification and administration of antibiotics.^[3-5]

This patient had multiple ocular risk factors for infection, including graft failure in the right eye with epithelial irregularity and persistent epithelial defect. The patient's concurrent infection with *Klebsiella oxytoca* indicates a polymicrobial keratitis; however, the quantities of colony growth of *S. algae* far exceeded that of *K. oxytoca* in the microbiology lab, which means there was a greater presence of the former bacteria in the inoculum from the patient's cornea. As such, it can be confirmed that at the time of presentation, *S. algae* was the predominant pathogen in our patient's infectious keratitis.

Cases of *Shewanella* often follow exposure to seawater in an opportunistic host.^[3-8] Most interesting is the patient's history of exposure to flood water following hurricane Harvey in Houston, TX, the largest natural disaster suffered by the city. In the weeks afterwards, he had been working outdoors at his residence with plants and soil that had been exposed to flood waters. It has been shown that cases of *Shewanella* infection increase following summer and monsoon season, most notably in farmers and fishermen.^[3]

Conclusion

In summary, this report describes the first case of keratitis predominantly because of the bacterium *S. algae*. Gradual resolution of the corneal ulcer occurred after administration of targeted therapy, although the ultimate condition of the eye necessitated corneal transplant. This case adds to the growing evidence of *Shewanella* species as culprits of human infection, and highlights the importance of considering *Shewanella* in nonmarine environments following natural disasters and weather anomalies.

Supplemental Digital Content

Intraoperative video with OCT imaging of sterile corneal scar with Descemetocoele prior to and at completion of penetrating keratoplasty [Video 1].

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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