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Footnotes and Disclosure

The authors have no proprietary or commercial interest in any materials discussed in this article.

***Staphylococcus pseudintermedius* of a semicircular facial flap with concomitant COVID-19 infection**



Staphylococcus pseudintermedius is a coagulase-positive staphylococci that is commonly associated with skin and soft tissue infections, otitis externa, and urinary tract infections in dogs.¹ Humans, especially those in the veterinary profession or who live in a household with a dog, can be transiently colonized by *S. pseudintermedius*, though the prevalence and duration of such colonization is largely unknown.¹ Although there have been reported cases of skin infections and colonization in nasal cavities, there have been no documented cases of *S. pseudintermedius* infections of facial skin and soft tissue after oculofacial surgery to the authors' knowledge. We describe for the first time, to our knowledge, a case of *S. pseudintermedius* infection of a semicircular facial flap following reconstruction of a large midface cutaneous defect in a patient with a concomitant COVID-19 infection. Informed written consent was obtained.

A 61-year-old female with a history of hypertension, hyperlipidemia, and hypothyroidism presented with a large basal cell carcinoma of the left lower eyelid and cheek. The lesion measured 12.5 × 15 mm and involved the left lower eyelid margin. The patient's visual acuity was 20/20 in each eye. Intraocular pressure was 9 mm Hg OD and 10 mm Hg OS. There was no relative afferent pupillary defect in either eye. A Mohs surgery coordinated with oculoplastic surgical reconstruction was recommended and accepted by the patient.

The patient underwent uncomplicated (Supplementary Fig. 1). She was afebrile, and all vital signs were normal. Examination showed a large cutaneous defect spanning the entirety of the left eyelid and left cheek to the level of the lateral alar crease. The wound was clean with early granulation but no evidence of infection.

The anterior lamellar defect was closed via a semicircular myocutaneous flap with the leading edge at the lateral canthus and continuing to the temple hairline and preauricular area down to the level of the lobule. The procedure was uneventful, and wounds were approximated with layered closure and customary tension. The patient was discharged home the same day with instructions to apply erythromycin ointment to the surgical site twice a day for 1 week.

The patient presented to the clinic on postoperative day 4 with mild erythema and pain at the site of the myocutaneous flap. Given concern for early infection and allergies to penicillin and sulfamethoxazole, she was prescribed 300 mg

of oral clindamycin 4 times a day for 10 days. She returned to the clinic for her second postoperative visit for suture removal 11 days after surgery. On examination, the surgical site appeared to be infected with honey-crusts and erythematous changes across the site (Fig. 1). The wound was cultured, and the patient was sent to the emergency department for systemic work-up and inpatient care.

Examination was notable for erythema, edema, and discharge of the left eyelid and cheek. The patient was mildly hypertensive, but otherwise vital signs were normal. Complete blood count, erythrocyte sedimentation rate, and a basic metabolic panel were normal. The patient was found to be COVID-19 positive on reverse-transcription polymerase chain reaction as part of standard hospital admission protocol. Blood and wound cultures were obtained prior to initiation of treatment. She was given 1 dose of 1 g ceftriaxone and started on 100 mg intravenous doxycycline in the emergency department and then was transitioned to 1 g intravenous vancomycin and ceftriaxone.

Wound culture was positive for 2+ *S. pseudintermedius* and 1+ coagulase-negative *Staphylococcus* with susceptibility to oxacillin and trimethoprim-sulfamethoxazole and resistance to erythromycin, penicillin G, and tetracyclines. On further questioning, the patient had notable domestic canine exposures because she lived with two pet indoor dogs. Based on infectious disease specialty recommendation, she was started on 2 g intravenous cefazolin every 8 hours for 1 week with a transition to 1 g oral cephalexin twice daily. The patient also was started on topical bacitracin applied 4 times per day to the wound sites.



Fig. 1—*Staphylococcus pseudintermedius* infection, postoperative day 11. External photograph of patient on postoperative day 11 demonstrating yellow crusting along the left lower eyelid, medial canthus, and lateral canthus; dehiscence of the lateral canthus and scalp; and mild erythema, edema, and induration along the incision line.



Fig. 2—Infection resolution, postoperative day 81. External photograph of patient on postoperative day 81 demonstrating scarring near the left nose and left temple with no evidence of infection.

After 7 days, there was clinical improvement with reduced pain, erythema, and discharge. The patient was discharged on 500 mg oral cephalexin twice daily for 1 week and the topical bacitracin ointment. Two days later, the patient returned to the emergency department reporting increased swelling, redness, and pain to the left eyelid. Visual acuity was 20/20 OU, and intraocular pressure was 12 mm Hg OD and 14 mm Hg OS. The intraocular examination including dilated fundus exam was normal in each eye. External examination revealed yellow crusting along the left lower eyelid, medial canthus, and lateral canthus. There was mild wound dehiscence at the lateral canthus and temple with mild erythema, edema, and induration along the incision line. The patient was restarted on intravenous cefazolin and readmitted to the hospital.

After 4 days of intravenous treatment, the patient reported improved swelling and pain. Wound culture again grew few *S. pseudintermedius* with similar antibiotic susceptibilities and resistances. Infection recurrence was thought to be due to oral cephalexin underdosing. The new recommendations included 2 weeks of intravenous cefazolin with transition to 500 mg oral cephalexin 4 times daily for 7 days.

At her last postoperative visit 81 days after surgery, the patient's incisions had healed well with scarring near the left nose and left temple. There were no signs of active infection (Fig. 2).

To the authors' knowledge, there have been no prior cases of *S. pseudintermedius* infection complicating oculo-facial surgery or with a coexisting COVID-19 infection. Since its distinction from *Staphylococcus intermedius* in 2005, there have been approximately 80 cases of human *S. pseudintermedius* infection reported worldwide. The present case supports the importance of culture-directed therapy and corroborates an association with canine exposure and soft tissue infections.

In a case series of *S. pseudintermedius* infections, 24 patients with 27 isolates were included, with 91.7% of patients having confirmed contact with dogs.² Of the noted cases, 75% involved skin and soft tissue infections, whereas

the remaining 25% involved nares colonization and blood-stream or joint infections. Three patients (22.2% of isolates) demonstrated methicillin resistance with other multidrug resistances to various antibiotic classes.² Many of the additional reported cases involved sinonasal *S. pseudintermedius* isolates in patients with chronic rhinosinusitis.³ In a case study involving 33 patients with *S. pseudintermedius*-positive chronic rhinosinusitis, 82% demonstrated resistance to penicillin, 58% to clindamycin, 45% to trimethoprim-sulfamethoxazole, 33% to doxycycline, and 27% to oxacillin.³ Infection resolution in cases of chronic rhinosinusitis was noted only after administering culture-directed therapy. The present case is similar in the initial poor response to common empirical antibiotic regimens, a corresponding dog exposure, and clinical improvement only after initiating culture-directed therapy.

Recent studies emphasize the rising rate of methicillin- and multidrug-resistant strains of *S. pseudintermedius*. Studies involving *S. pseudintermedius* isolates of largely human origin demonstrated 82.6%, 67.8%, and 23.5% susceptibility to ciprofloxacin, erythromycin, and penicillin, respectively; 33% of isolates also were found to be methicillin resistant.⁴ Although studies have suggested that antibiotic resistance is more common among animal isolates, the prevalence of multidrug-resistant *S. pseudintermedius* in humans is largely underestimated, likely due to potential misclassification as *S. aureus* and the questionable specificity of tests.¹ Emerging multidrug-resistant strains of *S. pseudintermedius* underscore the gravity of the antibiotic resistance crisis and the importance of antibiotic stewardship and other measures to combat it.

The patient's concomitant COVID-19 infection is worth considering because the rate of nosocomial bacterial infections in COVID-19-positive patients was approximately 8.5%.⁵ This value is higher than the nosocomial infection rate (5.5%) prior to the COVID-19 pandemic, of which about 90% were bacterial.^{5–7} Urinary tract infections (32.6%), bacteremia (31.9%), pneumonia (31.8%), and skin and soft tissue infections (6.7%) were the most common infections, and gram-positive cocci (54.1%) were the most frequent isolate.⁵ Although the primary infection in this case cannot be retrospectively determined, COVID-19 infection may have had implications regarding the patient's susceptibility to *S. pseudintermedius* or vice versa. However, any conclusions are beyond the scope of this single case report.

S. pseudintermedius infection after oculo-facial surgery and with concurrent COVID-19 infection is rare. This case corroborates canine exposure as a risk factor for *S. pseudintermedius* infection and suggests that rising antimicrobial resistance may influence management (Supplementary Fig. 1).

Supplementary Materials

Supplementary material associated with this article can be found in the online version at [doi:10.1016/j.jco.2023.03.016](https://doi.org/10.1016/j.jco.2023.03.016).

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Green algae keratitis



Algae are rare causes of human infection, usually as cutaneous or subcutaneous infections. Most cases have been due to achlorophyllous *Prototheca* species, which originate from environmental sources worldwide and primarily infect cows and dogs.¹ Far fewer cases of infection by unicellular green algae containing chloroplasts have been reported,^{1,2} including 6 cases in humans.^{1–5} All the human cases were cutaneous infections of an extremity, and 4 occurred following incidents of freshwater-related trauma. *Desmodesmus* species were identified in 3 cases using polymerase chain reaction analysis.^{2,5} *Desmodesmus* and *Chlorella* are morphologically unique, with *Chlorella* typically appearing as smaller, singular spheres with a cup-shaped chloroplast and *Desmodesmus* appearing as multiple ovoid- to elliptical-shaped organisms stacked laterally.⁶ *Desmodesmus* species also have spines,² most often on the terminal cells in a stack.⁶

Only 4 accounts of human ocular infection by *Prototheca* have been reported and successfully treated despite the lack of a standard, optimized treatment protocol.⁷ We present the first human corneal infection by green algae and its successful treatment.

A 5-year-old male had penetration of an organic foreign body through his right cornea while rolling in a pile of leaves. Emergency room examination revealed a wooden splinter that penetrated the cornea into the anterior chamber. The anterior chamber was formed without hypopyon; visual acuity was 20/25 OU. An 8 to 9 mm strawlike splinter was removed under general anaesthesia.

Fungal cultures of the splinter grew *Fusarium scirpi*, a bacterial culture grew *Bacillus cereus* and *Enterobacter cloacae*, and anaerobic culture grew rare diphtheroids. The child was treated with a Hessburg subpalpebral lavage system alternating with the following topical infusions: amphotericin B 0.1% for 15 minutes, flush for 5 minutes; vancomycin 100 mg/L for 10 minutes, flush for 2.5 minutes; miconazole 1% for 10 minutes, flush for 2.5 minutes; and gentamicin 100 mg/L for 10 minutes, flush for 5 minutes. This was repeated hourly around the clock. Oral fluconazole was given 100 mg qd, and intravenous vancomycin and ceftazidime were administered for 2 days postoperatively. After 9 days, the infection was deemed well controlled, the subpalpebral lavage system was removed, and a bandage contact lens was placed for comfort. The patient was discharged home on topical therapy to the right eye consisting of amphotericin B 0.15%, miconazole 1%, vancomycin 20 mg/mL, and tobramycin 14 mg/mL, each 1 drop every 4 hours.

Sixteen days after the corneal injury, the child developed a new, deep dark grey–brown inferotemporal corneal infiltrate overlying a 2.5 × 2.2 mm epithelial defect. Cultures of the new corneal ulcer grew *Candida parapsilosis* and green algae. He was treated with oral itraconazole 100 mg PO bid and topical itraconazole 1% formulated by an ocular pharmacist. The corneal infection was felt to be clinically regressing after 5 days of therapy. The child was discharged from the hospital the next day on topical itraconazole 1% q1h, miconazole 1% q4h, amphotericin B 0.15% q4h, vancomycin q8h, tobramycin q8h, atropine 1% qd, and oral itraconazole 100 mg bid.

A lamellar keratoplasty removed a pigmented area of the corneal stroma (Fig. 1A) approximately 2 months after the