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Candida dubliniensis: A novel cause of fungal keratitis

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ABSTRACT

A 45-year-old female with history of contact lens wear presented with a persistent corneal ulcer that was unresponsive to topical moxifloxacin. The patient's exam was concerning for fungal keratitis. Cultures were obtained, and the patient was started on fortified amphotericin B drops and oral voriconazole. The cultures identified *Candida dubliniensis* as the causative organism. The patient's exam worsened despite treatment, and the decision was made for surgery. At the time of surgery, her cornea was found to have unexpectedly perforated. She underwent cryotherapy; tectonic penetrating keratoplasty; anterior chamber tap; intracameral voriconazole, amphotericin B, and cefuroxime; and a partial conjunctival flap. Pathology from the cornea showed GMS and PAS stains positive for fungal forms.

C. dubliniensis is a yeast closely related to *Candida albicans* that was first described in 1995 as a cause of oral candidiasis in patients with AIDS. There are a few published cases of endophthalmitis due to *C. dubliniensis* in the ophthalmology literature, but to our knowledge, no cases of fungal keratitis due to this organism have been reported. *C. dubliniensis* is a novel cause of fungal keratitis that can be difficult to identify and treat but is felt to be less virulent than *C. albicans* and generally susceptible to available anti-fungal therapies.

Introduction

Candida albicans has long been recognized as a cause of ocular infections including fungal keratitis. In recent years, newer related *Candida* species have also been identified as unique causes of ocular infection [1]. The purpose of this case report is to describe a case of infectious keratitis due to *Candida dubliniensis*. This organism has been described most frequently in the ophthalmologic literature as a cause of endophthalmitis [2–7], but this is the first reported case of fungal keratitis to our knowledge.

Case presentation

A 45-year-old female with history of soft contact lens wear presented with eye pain, redness, and decreased vision for 2 months and a persistent corneal ulcer that was unresponsive to topical moxifloxacin. She was referred to our institution for further management of her recalcitrant corneal ulcer. At presentation, her vision was hand motion. Her external exam showed reactive ptosis. She had diffuse conjunctival injection and a round 2.0 mm fluffy white corneal infiltrate nasally with an overlying epithelial defect as well as surrounding microcystic edema and stromal haze. Her anterior chamber had 2+ cells with a layered 2.4 mm hypopyon. It was felt that the patient's exam was concerning for fungal keratitis. Accordingly, bacterial and fungal cultures were obtained, and the patient was started on fortified amphotericin B drops and oral voriconazole. The cultures identified *C. dubliniensis* as the causative organism.

The patient's exam worsened despite treatment, and the decision was made to take the patient to surgery for cryotherapy, intracameral anti-fungals, and a partial conjunctival flap. At the time of surgery, her cornea was found to have unexpectedly perforated after overlying mucus and necrotic debris were removed. Accordingly, she underwent cryotherapy; tectonic penetrating keratoplasty with VisionGraft gamma-irradiated human cornea; anterior chamber tap; intracameral voriconazole, amphotericin B, and cefuroxime; and a partial conjunctival flap (Fig. 1). At the time of surgery, the corneal tissue was submitted to pathology which showed necrotizing keratitis as well as GMS and PAS stains positive for fungal forms (Figs. 2 and 3).

She did well post-operatively with improvement in her symptoms and exam. The conjunctival flap started to retract by the post-operative week one visit and was fully retracted by the

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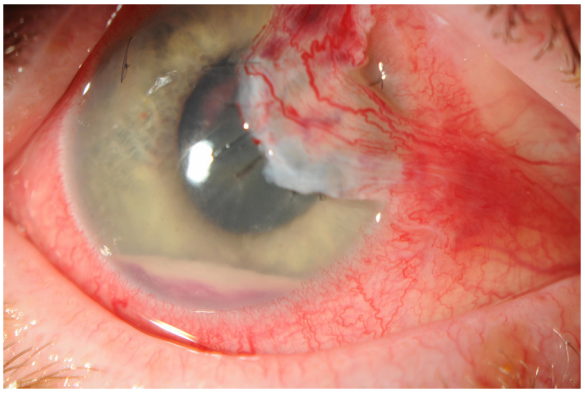

Fig. 1. Post-operative external photo showing the patient's nasal conjunctival flap with underlying tectonic patch graft.

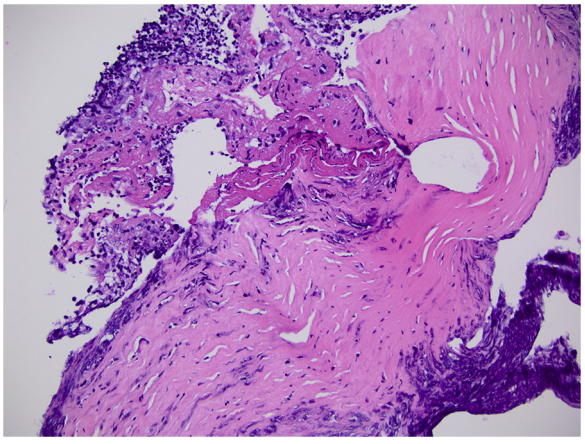

Fig. 2. Pathology from the patient's cornea demonstrating necrotizing keratitis and neutrophilic infiltrates (hematoxylin and eosin, 40X).

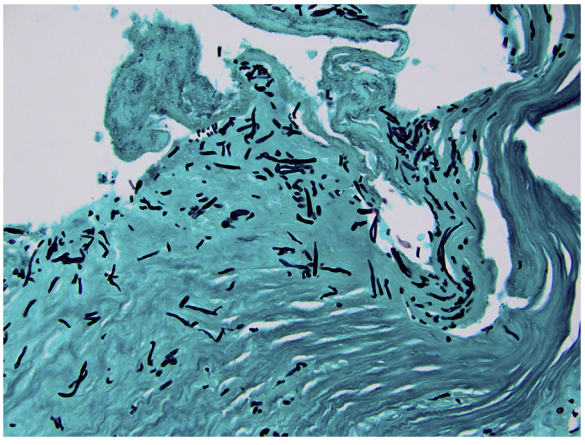

Fig. 3. Gomori methenamine silver (GMS) stain showing fungal pseudohyphae (400X).

post-operative month two visit. Her vision ultimately improved to 20/40 uncorrected, and she refracted to 20/30.

Discussion

C. dubliniensis is a yeast closely related to *Candida albicans* that was first described in 1995 as a cause of oral candidiasis in patients with AIDS [8]. However, it has likely been around much longer and can be easily misidentified as *C. albicans*. In fact, one retrospective review found *C. dubliniensis* in fungal stock collections going back to the 1970s where it had been misidentified as *C. albicans* [9]. Accordingly, while this may be the first case where *C. dubliniensis* was specifically identified as the causative organism, it is quite possible that other cases of fungal keratitis due to *C. dubliniensis* have existed previously that were simply misidentified as *C. albicans*.

While very similar to *C. albicans*, *C. dubliniensis* has been shown to be less virulent in both *in vitro* and *in vivo* studies [10,11]. This is likely due to the fact that it has a decreased ability to produce hyphae, is more susceptible to environmental stressors, and generates a more substantial early neutrophil response compared to *C. albicans* [10,11]. Chen et. al. in their study of the role of calcineurin in *C. dubliniensis* virulence actually created a mouse model of fungal keratitis where they demonstrated that *C. albicans* could cause infection in immunocompetent mouse corneas while *C. dubliniensis* could not and could only cause infection in the corneas of immunocompromised mice [12]. This is further supported by case series of endogenous endophthalmitis where visual outcomes have been shown to be better with *C. dubliniensis* as compared to *C. albicans* [5].

In the ophthalmology literature, *C. dubliniensis* was first described as a cause of fungal dacryocystitis [13] but has more recently been described as an emerging cause of endophthalmitis [2–7]. It has specifically been linked to several cases of endogenous endophthalmitis in IV drug users [3–6]. In fact, one such case was recently identified and treated at our institution by our retina colleagues.

Studies of *C. dubliniensis* susceptibility have demonstrated emerging fluconazole resistance but nearly all reported isolates have shown susceptibility to amphotericin B and voriconazole [11,14]. Our patient, however, did not initially respond to topical amphotericin B and oral voriconazole but did ultimately do well with intracameral amphotericin B and voriconazole at the time of surgery as well as continued topical amphotericin B and oral voriconazole post-operatively.

In conclusion, *C. dubliniensis* is a novel cause of fungal keratitis that can be difficult to identify and treat but is fortunately likely less virulent than *C. albicans* and generally susceptible to available anti-fungal therapies.

CRediT author statement

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Conflict of interest statement

The authors have no conflicts of interest to disclose.

References

[1] Motukupally S.R., Nanapur VR, Chathoth KN, Murthy SI, Pappuru RR, Mallick A, et al. Ocular infections caused by Candida species: type of species, in vitro susceptibility and treatment outcome. Indian J Med Microbiol 2015;33(4) October-December):538–46.

[2] Sedeek RW, Shah M, Gentile R, Samson CM. First case report of Candida dubliniensis endogenous endophthalmitis. Invest Ophthalmol Vis Sci 2008;49 (May):952.

[3] Pelegrín L, Mesquida M, Adán A, Cervera C, Bosch-Mestres J, Esteban-Redondo, et al. Candida dubliniensis endophthalmitis in a HIV-infected intravenous drug abuser. Mycoses 2011;54(6) November):e856–8.
[4] Espinosa-Heidmann DG, McMillan BD, Lasala PR, Stanley J, Larzo CR. Candida dubliniensis endophthalmitis: first case in North America. Int Ophthalmol 2012;32(1) Febuary):41–5.
[5] Moloney TP, Park J. Candida dubliniensis endophthalmitis: five cases over 15 years. J Ophthalmic Inflamm Infect 2013;3(1) November):66.
[6] Rosenberger E, Youssef DA, Safdar S, Larzo CR, Myers J. Third case of Candida dubliniensis endogenous endophthalmitis in North America: case report and review of the literature. Int Ophthalmol 2014;34(4) August):945–50.
[7] McMillan BD, Miller GJ, Nguyen J. Rare case of exogenous Candida dubliniensis endophthalmitis: a case report and brief review of the literature. J Ophthalmic Inflamm Infect 2014;4(May):11.
[8] Sullivan DJ, Westerneng TJ, Haynes KA, Bennett DE, Coleman DC. Candida dubliniensis sp. nov.: phenotypic and molecular characterization of a novel species associated with oral candidosis in HIV-infected individuals. Microbiology 1995;141(Pt 7) July):1507–21.
[9] Odds FC, Van Nuffel L, Dams G. Prevalence of Candida dubliniensis isolates in a yeast stock collection. J Clin Microbiol 1998;36(10) October):2869–73.
[10] Sullivan D, Coleman D. Candida dubliniensis: characteristics and identification. J Clin Microbiol 1998;36(2) Febuary):329–34.
[11] Sullivan DJ, Moran JP, Pinjon E, Al-Mosaid A, Stokes C, Vaughan C, et al. Comparison of the epidemiology, drug resistance mechanisms, and virulence of Candida dubliniensis and Candida albicans. FEMS Yeast Res 2004;4(4-5) January):369–76.
[12] Chen YL, Brand A, Morrison EL, Silao FG, Bigol UG, Malbas Jr FF, et al. Calcineurin controls drug tolerance, hyphal growth, and virulence in Candida dubliniensis. Eukaryot Cell 2011;10(6) June):803–19.
[13] Obi E, Roy A, Bates V, Sandy C. Bilateral chronic fungal dacryocystitis caused by Candida dubliniensis in a neutropenic patient. J Clin Pathol 2006;59(11) November):1194–5.
[14] Sebti A, Kiehn TE, Perlin D, Chaturvedi V, Wong M, Doney A, et al. Candida dubliniensis at a cancer center. Clin Infect Dis 2001;32(7) April):1034–8.