Culture positivity among donor corneas: a single eye bank series

Given the increased utilization of lamellar keratoplasties (LKs), appropriate management of potentially devastating complications such as interface infectious keratitis (IIK) is paramount. Because eye banks across North America are eliminating routine culturing for donor corneoscleral rims following transplant, we present this set of microbiologic and clinical data to guide ophthalmologists in clinical decision making.

IIK is an infection at the graft–host interface following LK. It can cause decreased corneal graft clarity, endophthalmitis, and irreversible blindness.[1] Thus, understanding patterns of infection and identifying risk factors are crucial to optimize visual outcomes. The current literature suggests that contaminated corneal donor tissue is a significant risk factor for IIK.[1] Collecting corneoscleral rim cultures of donor tissue is a standard protocol at the Eye Bank of British Columbia. Herein we report a retrospective chart review we performed of patients who underwent LK and penetrating keratoplasty (PK) from 1997 to 2022 in Vancouver, B.C.

This study included donor corneoscleral rim culture and sensitivity data for all keratoplasties performed from 1997 to 2022 in Vancouver. All donor tissues were stored in Optisol-GS (Bausch & Lomb Inc, Vaughan, Ont.). Keratoplasties included in this study were PK, Descemet stripping automated endothelial keratoplasty (DSAEK), Descemet membrane endothelial keratoplasty (DMEK), deep anterior lamellar keratoplasty (DALK), and others (e.g., lamellar patch grafts and keratoprostheses). The percentage of donor rims positive for microbial growth was calculated, and sensitivity data were reviewed. Patient charts were reviewed for the surgical indication and postoperative outcome. IIK was a clinical diagnosis by the responsible surgeon. This project was approved by the clinical research ethics board of the University of British Columbia.

There were 3950 donor corneoscleral cultures, including PK (n = 1814), DSAEK (n = 1316), DMEK (n = 433), DALK (n = 210), and other (n = 176). The donor rim culture positivity rate was 1.2% (n = 48). The culture positivity rates for each keratoplasty type were DMEK 2.1% (n = 9), DALK 1.9% (n = 4), PK 1.4% (n = 26), DSAEK 0.7% (n = 9), and other 0% (n = 0; Fig. 1). A decline in the positivity rate was noted over the last 4 years, with only 1 positive rim in 2019 and no positive donor rims between 2020 and 2022.

Eighteen different microbes were grown from donor rims, including 9 bacterial (58.3%), 8 fungal (43.7%), and 1 (2%) parasitic species (Fig. 2). Among fungal species, *Candida albicans* was the most common (29.1%). *Enterococcus faecalis* was the most frequently grown bacteria, representing 16.6% of total positive cultures. *Bacteroides fragilis*, *Staphylococcus epidermidis*, and *Pediococcus acidlactici* were resistant to fluoroquinolones, whereas *Escherichia coli* was susceptible to all antimicrobial agents on our antibiogram. *S. epidermidis* and methicillin-resistant *Staphylococcus aureus* (MRSA) demonstrated the most resistance because they were only suspectable to vancomycin. *Acanthamoeba* was the only parasitic species grown and was found in 1 culture (2% positivity). The average follow-up time was 71 months, with the minimum and maximum follow-up times being 1 and 177 months, respectively. No cases of IIK were observed during follow-up to date. The first culture positive for fungi was seen in 2009, accounting for 57% of positive rims (4 of 7) over the year. Between 2018 and 2019, fungi accounted for 60% of positive rims (6 of 10). The mean incidence of 2 sequential 5-year periods from 2009 to 2019 were 59% and 61% ($p = 0.46$) Among donor cornea used for PK, there was a 50% distribution (13 of 26) of bacteria and fungi. Comparatively for lamellar donors, fungal species represented 64% (16 of 25) of positive cultures, whereas bacteria accounted for 36% (9 of 25).

PK has been supplanted by LK because of the faster visual recovery and fewer complications. However, the existence of a lamellar host–donor interface offers a unique potential space for deep-seated fungal infections. Specifically, fungal keratitis is twice more likely in LK than in PK.[1] Although PKs do not have a lamellar interface, data were included for scientific interest.

Positive donor corneoscleral fungal cultures are strongly associated with infections in recipients, with a specificity of 85%.[2] Our culture positivity rate for donor rims was 1.2% for all keratoplasties. Rauen et al.[3] observed 2 cases of IIK after 7 positive cultures following 15 DSAEK surgeries (28%), whereas Mian et al.[4] observed 1 IIK case after 15 positive cultures following 15 DSAEK surgeries (6.7%). Applying these data, we expected 1.5–6.3 cases of IIK in our cohort. The absence of infections in this study may be attributable to a single-centre design and low culture positivity rate. Factors that may affect culture positivity include cornea preservation method, size of donor graft, preservation-to-surgery intervals, and geographic location (i.e., cooler temperatures, humidity). Host-specific risk factors include noninfectious indication for transplant, first-time transplant, and absence of ocular comorbidities. Clinician-driven preoperative screening for infections alongside optimal sterile technique also may explain the absence of postoperative infections. Given the absence of clinical signs and symptoms of infections, there were no changes in clinical care, such as additional follow-up or prophylactic treatment. Collectively, there are a multitude of donor-, host-, and surgeon-specific characteristics that may have attributed to our low culture positivity and no postoperative infections.

Our findings agree with previous observations that LKs are associated with increased positive fungal rim cultures. [1] Since 2009, we have found that fungal species outnumber bacteria and parasites annually. The proportion of cornea

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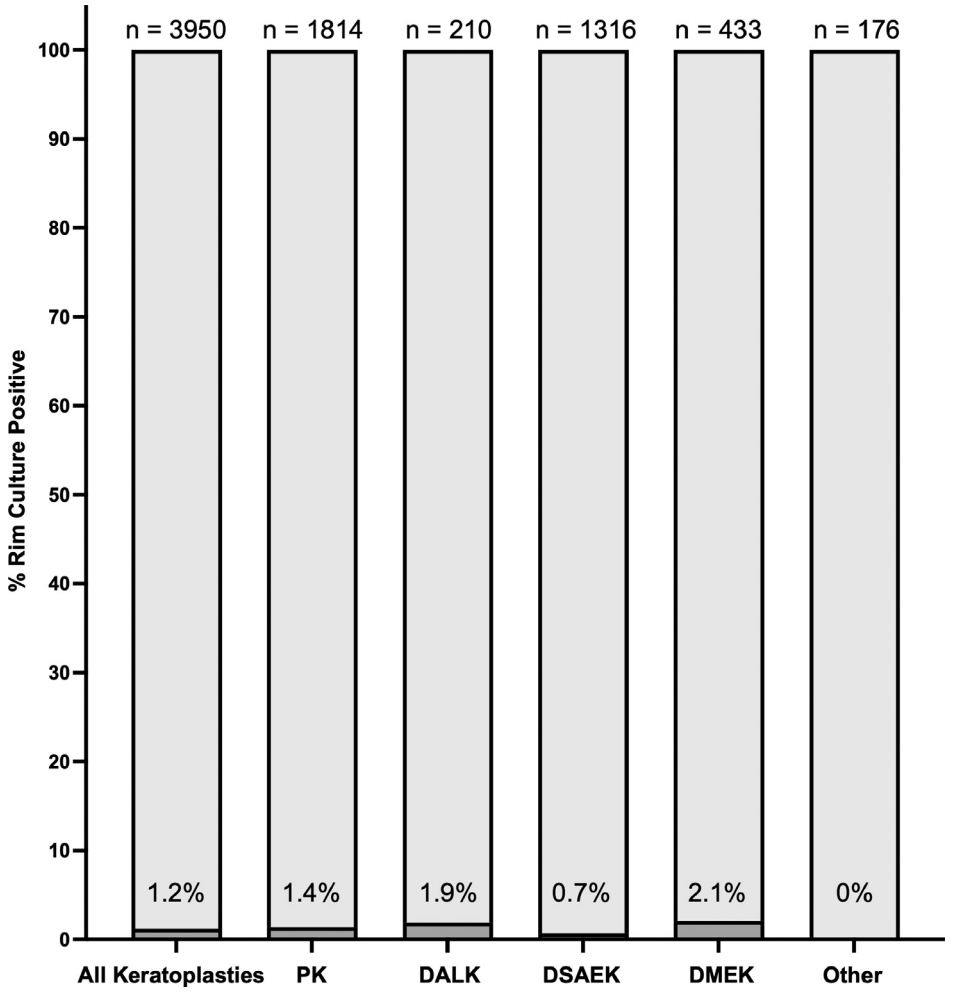

Fig. 1—Rim culture positivity rate for all keratoplasties performed between 1997 and 2022.

rim cultures positive for fungal species increased by 3% between 2009 and 2019. Other larger-scale studies also have shown a significant trend in increasing rates of fungal positivity and infections after transplantation. Our findings may be due to LK being performed more frequently over the last decade and a decreasing trend in bacterial culture positivity. *Candida* was the most common fungal organism identified on rim culture in this study, and *Candida* has been shown previously to be the most common fungi involved in IIK.[5] Whether antifungal agents should be added to donor media or injected intracamerally during surgery to prevent IIK continues to be debated.

IIK following keratoplasty is a significant postoperative complication that requires appropriate therapy for eradication of infection and maximal visual recovery. Because of the evolving nature of microbial populations, an update on

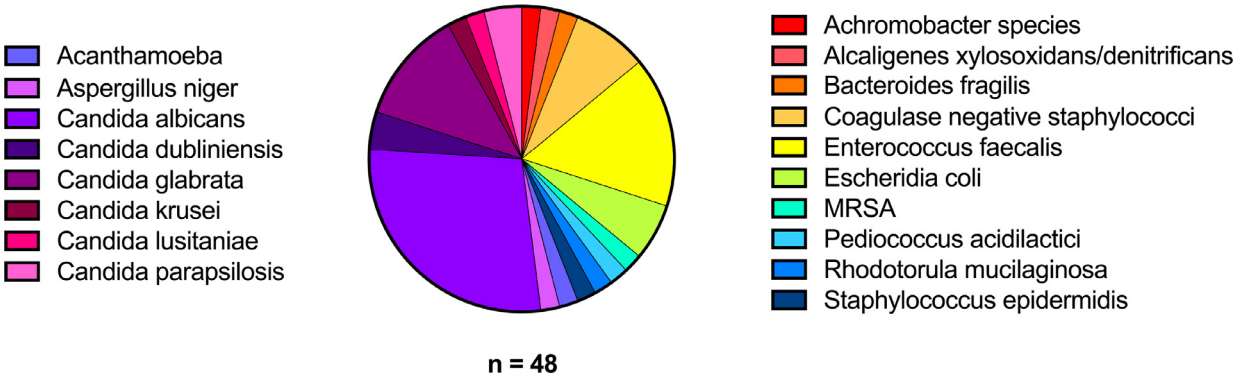

Fig. 2—Distribution of microorganisms identified in positive corneal rim cultures.

epidemiologic data could help guide management for future cases of IIK, especially given the increasing incidence seen at other sites with similar climates. The Eye Bank of British Columbia is the only Canadian centre that continues to culture donor cornea rims. This study provides specific epidemiologic and microbiologic data unique to Vancouver that may be applicable to other centres with similar geographic features and population groups to guide clinical decision making in cases of IIK.

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Footnotes and Disclosure

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