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Future of Corneal Donation and Transplantation: Insights From COVID-19 Pandemic

AQ:1

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On March 11, 2020, the World Health Organization declared COVID-19 a pandemic,¹ a mere 3 months after the first case of this novel coronavirus was reported in Wuhan, China.² The gravity of the disease and its rapid global spread have been alarming; the global incidence of the disease has exceeded 17,901,750 with over 685,792 deaths.³ It has profoundly affected governments, societies, and the day-to-day lives of individual citizens. Moreover, it has strained all aspects of health care throughout the world, with corneal transplantation and eye banking being no exception.

Early on, in the pandemic, with little data available about this new disease and its effect on ocular tissue, eye bank associations around the world rapidly put into place new screening recommendations to reduce the yet unknown risk of donor–recipient transmission during corneal transplantation.⁴ In the United States, the Eye Bank Association of America (EBAA) released its first screening recommendations on February 3, 2020. This early advisory, based in part on the guidance from the US Center for Disease Control on patient screening, included recommendations to defer ocular donors with the diagnosis of COVID-19, the presence of signs and symptoms of COVID-19, any history of close contact with a confirmed COVID-19 case, or any history of travel to endemic areas.⁵

By mid-March, COVID-19 was spreading rapidly throughout the United States. Concerns about the asymptomatic transmission of COVID-19, the lack of adequate testing, the potential overwhelming of our healthcare system, and the need to conserve essential medical supplies led to drastic shutdown measures in the United States and throughout the world. The EBAA COVID-19 screening recommendations continued to evolve to keep pace with the rapidly changing nature of the pandemic with updates released on March 2, 2020, and April 14, 2020. With so many unknowns, the donor screening recommendations were extremely conservative, resulting in significant donor deferrals. Fortunately, this decrease in ocular donors corresponded with a recommendation from the American Academy of Ophthalmology on March 18, 2020, for immediate cessation of any ophthalmic treatment other than urgent or emergent care.⁶ In the matter of a week, ophthalmic care in the United States virtually ground to a halt, including elective corneal transplantation. In a survey conducted by the EBAA of the US eye banks, the volume of tissue distributed for corneal transplantation procedures declined to approximately 6% and 7% of the normal volume for domestic surgeries and 4% and 1% of the normal volume for international surgeries in March (with 50 eye banks reporting) and April (34 eye banks reporting), respectively (K. Corcoran, personal communication, July 31, 2020).

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As COVID-19 restrictions were gradually lifted throughout the United States in May and June, elective surgeries including corneal transplantation procedures resumed and, according to the same EBAA survey, were at approximately 71% of their usual volume by the beginning of June (42 eye banks reporting) and 81% by the beginning of July (37 eye banks reporting). In an effort to keep up with the increased demand for corneal tissue as stay-at-home restrictions lifted, the EBAA COVID-19 screening recommendations were cautiously adjusted in mid-May to increase the donor pool safely, but there remains a reduction of 24% to 29% in donors because of COVID-19 screening rule outs.

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For corneal surgeons in the United States, this reduction of potential donors will likely not be felt as acutely as in the rest of the world. In 2019, 85,601 corneal transplants were supplied by the US eye banks. The US surgeons performed 51,336 (60.0%) of those corneal transplants, and a third of the tissue recovered, over 28,000 donor corneas, was exported to international recipients.⁷ Even with a reduction of the donor pool in the United States, the eye banks will likely be able to meet the surgical demand domestically. However, the amount of tissue being distributed for corneal transplantation internationally has yet to recover since COVID-19 remaining low at 34% and 27% of the prepandemic volume in June and July, respectively.

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The potential ramifications worldwide of fewer available donor corneas must not be overlooked. Even before the COVID-19 pandemic, there was a severe imbalance between corneal tissue supply and demand.⁸ In 2016, Gain et al⁸ found that at least 53.3% of the world's population had almost no access to corneal tissue, and for every 70 corneas needed, only 1 was available. It can be expected that this imbalance will be further aggravated by the pandemic. A decrease in corneal donors throughout the world because of COVID-19, combined with a decline in the number of donor corneas being exported from countries such as the United States, will potentially lead to severe corneal tissue shortages around the world.

Additional challenges may await eye banks in their efforts to resume regular operations as quickly as possible. In addition to a decreased donor pool, decreased airline flights may make it more difficult to import or distribute tissue particularly internationally. Shortages of supplies may strain eye bank operations especially as COVID-19 numbers continue to increase in many places. Eye banks may also struggle to keep preservation times low because the current EBAA COVID-19 screening recommendations frequently necessitate review by eye bank medical directors for donor eligibility, which may delay the release of tissue. Donor testing for severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2), if performed, will further add cost and time to the distribution of corneal tissue while potentially providing a false sense of security because testing has not been validated for cadaveric samples and have varying rates of false-negative results. Eye banks may start to see push back from surgeons who are noticing a difference in donor tissue characteristics compared with what they were used to pre-COVID in part because of the decreased volume of available tissue and the increased time required for donor tissue screening.

For now, though, this is the state of eye banking in the era of COVID-19. Current screening recommendations seem appropriate, given what we know, and are allowing eye banks to sustain operations as safely as possible. Fortunately, to date, there have been no reported cases of recipient-donor SARS-CoV-2 transmission through human cell or tissue. Adding to this reassurance is a recent study by Bayyoud et al⁹ that did not detect SARS-CoV-2 RNA in corneal tissues (epithelium, stroma, and endothelium) or in the anterior chamber fluid or conjunctival tissue of COVID-19 patients' postmortem, although the sample size was small. However, if the pandemic lingers and a shortage of corneal tissue become more acutely felt, the debate on routine donor

testing will, no doubt, come to the foreground. At this time, donor testing is not advocated by either the EBAA³ or the US Food and Drug Administration¹⁰ for the reasons previously stated. Unfortunately, serologic testing for COVID-19 antibodies is inappropriate for screening active infection in donors, and COVID-19 reverse transcriptase polymerase chain reaction testing availability continues to vary from community to community, as does the ability to obtain results in a timely manner. At the end of the day, more research must be conducted on the true risk of viral transmission through donor corneal tissue.

It is said that nothing brings people together more than a crisis, and it is now more important than ever that we come together in support of our eye banks. In the absence of a vaccine, eye banks must continue to take extra measures not only to provide safe corneal tissue but also to ensure the health of their workforce with adequate social distancing measures and personal protective equipment; all the while, they have to navigate the economic impact of lost revenue from fewer donor corneas being transplanted. Countries that rely heavily on international tissue imports should begin to focus on expanding local tissue donation and procurement. At a time like this, we must all become advocates for corneal donation in our own communities and for our local eye banks. Surgeons should remember and take to heart the lessons learned from the Corneal Preservation Time Study by accepting donor corneas with longer preservation times¹¹ and remembering that neither donor age nor preoperative donor endothelial cell counts have been shown to affect graft success¹²; now is not the time to be a "picky" surgeon. Ultimately, by emphasizing the gift of donation and the role and impact eye banks make in the management of corneal blindness, we can inspire cooperation among all stakeholders. Driven by humanity's strongest drive, the instinct to survive, we can improve our resilience and emerge stronger from this pandemic.

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