Acanthamoeba keratitis: an increasingly common infectious disease of the cornea

Acanthamoeba, a free-living protist that is ubiquitously distributed in the environment, is also an opportunistic pathogen and a host of phylogenetically distinct bacteria, fungi, viruses, and other protists. Acanthamoeba causes keratitis, a sight-threatening, painful, and difficult-to-treat ocular infection that is linked to contact-lens wear. The pathogen can also cause infections of the CNS and skin, which are associated with immunodeficiency, although these types of infection are less common than keratitis. Acanthamoeba has been recovered from the nasal mucosa and throat of healthy individuals, and might be part of normal human microbiota. Acanthamoeba keratitis is a rare eye disease, accounting for only 2% of corneal infections, but cases are increasing. Infamous for its resilience against anti/protozoal armamentaria, disinfectants, and harsh environments, Acanthamoeba poses a challenge to clinicians caring for patients infected with the pathogen. The lifecycle of Acanthamoeba includes an active trophozoite and a quiescent cyst stage, which can remain viable for several years. Acanthamoeba cysts can survive in corneal tissue and result in recurrent disease. Coinfections of Acanthamoeba and other pathogens such as Pseudomonas aeruginosa or Fusarium spp are reported in keratitis and could be due to the intracellular carriage of these microbes within the infecting Acanthamoeba.

More than 140 million people are contact-lens wearers globally, but the incidence of Acanthamoeba keratitis varies widely from 17–70 cases per million contact-lens wearers per year. The global epidemic of myopia and the use of contact lenses to cosmically change eye colour, as well as their use during sports activities, have put many people, especially young children, at the risk of having Acanthamoeba keratitis. Reported outbreaks have occurred due to ineffective contact-lens disinfecting solutions combined with unintended misuse of the solutions. An outbreak in 2007 was associated with the contact-lens multipurpose disinfecting solution MoisturePlus (Advanced Medical Optics, CA, USA), but despite the removal of this solution from the market, the base incidence of Acanthamoeba keratitis remained elevated in the USA, perhaps indicating a general rise in numbers of Acanthamoeba in the environment. Many contact-lens disinfecting solutions are ineffective against amoebal cysts. Furthermore, biofilms produced by bacteria on contact lenses (appendix) or in contact-lens disinfecting storage cases might act as a nutrient-rich environment and enhance the attachment of Acanthamoeba trophozoites to contact lenses and cases. Another major risk factor for Acanthamoeba keratitis is exposure to water during contact-lens wear. This exposure can occur during swimming or showering whilst wearing contact lenses, while using tap water to rinse contact lenses and storage cases, and while using wet hands to apply contact lenses to eyes. In people who do not wear contact lenses, exposure to contaminated water along with ocular trauma following corneal injury is the most important risk factor in non-contact wearers.

Management of patients with Acanthamoeba keratitis is difficult, partly due to potential delays in diagnosis and partly because effective antimicrobials are scarce. Acanthamoeba keratitis can appear similar to other ocular infections, especially keratitis caused by herpes simplex virus. If not treated promptly or effectively, extra-corneal complications are observed in prolonged and severe cases of Acanthamoeba keratitis, including scleritis, retinal necrosis, cataract, glaucoma, and iris atrophy. Often, resolution of disease requires surgical interventions, including corneal transplantation in approximately 30% of patients. Even with transplantation, there is the risk of not removing all Acanthamoeba cysts, which may excyst and invade the newly transplanted cornea. The gold standard for the diagnosis of Acanthamoeba keratitis is laboratory cultivation of the often slow-growing Acanthamoeba from clinical specimens. Additional diagnostic techniques such as in vivo confocal microscopic visualisation of the cysts and PCR assays are being increasingly used to aid diagnosis. Corneal biopsy for histology and immunofluorescence is used for recalcitrant cases.

No licensed topical anti-amoebic drugs for single effective treatment of Acanthamoeba keratitis exist. The most effective topical drugs active against
Acanthamoeba trophozoites and cysts are biguanides, such as 0.02% polyhexamethylene biguanide or chlorhexidine; however, these drugs can also be toxic to human corneal epithelial cells. In some cases, anti-fungal drugs are also used for treatment, but no convincing clinical trials have been done. Enzyme-acting oral anti-amoebic miltefosine is therapeutically more precise and being more widely used by most eye-care centers. Corticosteroids in combination with anti-amoebic have been prescribed to reduce the robust inflammation that occurs during Acanthamoeba keratitis. With the rise in cases of Acanthamoeba keratitis, improvements in contact-lens disinfecting solutions are required, so that these substantially reduce the number of Acanthamoeba in contact-lens storage cases. Contact-lens prescribers and wearers should maintain high standards of hygiene and avoid all exposure of contact lenses to water. A consensus diagnostic protocol should be established to reduce the chances of misdiagnosis. New drugs are needed to help successfully treat Acanthamoeba keratitis, which can eliminate both Acanthamoeba trophozoites and the resilient cysts.

We declare no competing interests.

Copyright © 2021 The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY 4.0 license.

*Binod Rayamajhee, Mark DP Willcox, Fiona L Henriquez, Constantinos Petsoglou, Nicole Carnt b.rayamajhee@unsw.edu.au

School of Optometry and Vision Science, Faculty of Medicine and Health, University of New South Wales, Sydney, NSW, Australia (BR, MDPW, NC); Institute of Biomedical and Environmental Health Research, School of Health and Life Sciences, University of the West of Scotland, Paisley, UK (FLH); Sydney and Sydney Eye Hospital, South Eastern Sydney Local Health District, Sydney, NSW, Australia (CP); and Save Sight Institute, University of Sydney, Sydney, NSW, Australia (CP)