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Molecular diagnosis of Acanthamoeba infection

Acanthamoeba spp. are a family of free-living protozoans ubiquitously distributed in the environment, commonly found in soil and fresh water. There are two stages to the *Acanthamoebae* life cycle: dormant cysts that survive in air, soil, dust and water; and a trophozoite stage that feeds on small algae, bacteria and other protozoa (Dart *et al.*, 2009). Due to the ingestion of other microbes during the trophozoite stage, *Acanthamoeba* may act as a reservoir for human pathogens as endosymbionts.

Most people will be exposed to this organism during their lifetime, but very few will become sick from this exposure as infection is rare. In these cases, the protozoa enter the eye typically through contact lens use or damage to the cornea, or enters the body through skin wounds or inhalation into the lungs with the potential to cause disease.

Examples of diseases caused by Acanthamoeba:

- Acanthamoeba keratitis
 - An infection of the eye that typically occurs in healthy persons and can result in permanent visual impairment or blindness.

• Disseminated infection

- A widespread infection which can affect the skin, sinuses, lungs, and other organs.
- More common in immunocompromised patients.
- A further risk that organism will disseminate from the primary infection site to other areas such as the brain parenchyma (Anderson *et al.*, 2012).
- Granulomatous Amoebic Encephalitis (GAE)
 - A serious and life-threatening infection of the brain and spinal cord with a high mortality rate (Kaushal *et al.*, 2008).
 - Typically occurs in the immunocompromised/immunosuppressed.

Acanthamoeba infections can be split into Acanthamoeba keratitis and non-keratitis Acanthamoeba infections. Acanthamoeba keratitis occurs when the amoeba infects the cornea. Acanthamoeba keratitis infections are not restricted to any patient in particular, however, risk factors include:

- corneal trauma
- corneal surgery; for example, laser treatment
- the use of contact lenses (the improper use of contact lenses e.g. swimming and showering in lenses or not appropriately storing and cleaning lenses)
- exposure to contaminated water

Acanthamoeba user information sheet - Version: 3.2. Index: S - 1515. Printed: 12-Mar-2025 17:33

The symptoms and presentation of *Acanthamoeba* keratitis can be highly variable and are often indistinguishable from herpetic keratitis, leading to misdiagnosis. *Acanthamoeba* keratitis is challenging to treat and often leads to permanent loss of vision, with the likelihood of poor visual outcomes significantly increasing where diagnosis, and therefore, treatment, is delayed.

Keratitis causes high morbidity and may result in permanent loss of vison, therefore early detection followed by prompt treatment is essential for a good prognosis (Dart *et al.*, 2009). Traditional culture techniques involve inoculating the specimen onto a lawn of *Escherichia coli* on non-nutrient agar for 3-6 days with occasionally up to 3 weeks (Dart *et al.*, 2009; Maubon *et al.*, 2012). This is not in keeping with the urgency of the situation as the disease develops. Not only does PCR offer a more rapid diagnosis but it has also been suggested that detection by molecular amplification can also aid in the detection of extra-corneal spread of *Acanthamoeba* since accurate histological confirmation is often difficult (Dart *et al.*, 2009).

Non-keratitis *Acanthamoeba* infections are rare and primarily occur in immunocompromised individuals. *Acanthamoeba* can enter the body though cuts/wounds or by inhalation and cause serious infection. Such infections include: Granulomatous amoebic encephalitis, cutaneous acanthamoebiasis (skin infection), *Acanthamoeba* rhinosinusitis and disseminated infection. Granulomatous amoebic encephalitis is almost always fatal.

Acanthamoeba meningoencephalitis is a slowly progressing infection with typical symptoms including headache, fever, neck stiffness, seizures, altered mental status and neurological symptoms leading to coma and death within one week to several months after onset. Treatment is difficult due to poor rates of diagnosis and a lack of antimicrobial therapy, resulting in the high mortality rate of the disease (Anderson *et al.*, 2012). There are reports of successful treatment of patients using a combination of trimethoprim-sulfamethoxazole, rifampicin and ketoconazole (Singhal *et al.*, 2001).

Service users may wish to refer samples to us where keratitis aetiology is unknown, where clinical history is indicative of *Acanthamoeba* spp. infection or where GAE meningitis is suspected. Accredited specimen types are CSF, corneal scrape, eye swab and contact lens fluid; other specimen types can be tested but will be reported alongside an appropriate caveat stating that the assay is not UKAS accredited for testing of alternative sample types.

At Micropathology Ltd we perform a probe-based PCR assay for *Acanthamoeba* spp. detection based on molecular amplification with a two-day target turnaround time.

References

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