The curse of the contact lens

Puvaneswaran B[1], Rizal I[1], Figueredo F[2], Narayanan M[1]

1. Department of Microbiology 2. Department of Ophthalmology

Royal Victoria Infirmary, Newcastle upon Tyne Hospitals NHS Foundation Trust

The Newcastle Upon Tyne Hospitals NHS Foundation Trust

Background

An ubiquitous parasite, Acanthamoeba is a free–living, amoebic protozoa. It is commonly found in both domestic (taps, swimming pools) and natural (soil, lakes, air) environments. Its life cycle involves two stages (Figure I): the trophozoite form, which is active and commonly feeds on a variety of organisms, and the dormant form which is characterized by a double walled cyst. The cystic form is resilient with the ability to survive in adverse conditions including extremes of temperature, chemical exposure and nutrient deficient environments[1].

Despite its ubiquitous nature, Acanthamoeba is not a common infectious pathogen in immunocompetent humans. The exception being when there is breach in the corneal epithelial barrier. This is most commonly seen from contact lens wear or corneal trauma. The pathogenesis of infection involves binding of the trophozoite to corneal epithelial cells causing a parasite mediated cytolysis and phagocytosis. This allows the trophozoite to invade through the stromal layers of the cornea and dissolve the stromal matrix. This inflammatory response and cell death can result in debilitating keratitis and potentially sight loss[2].

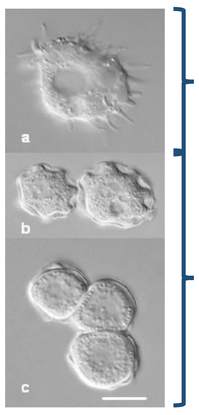
Acanthamoeba Keratitis (AK) typically presents with pain disproportionate to the clinical signs. It is also associated with photophobia and blurred vision[1]. It may commonly be mistaken for bacterial or herpes keratitis and as such, its inclusion in the differential diagnosis is important.

Diagnosis of Acanthamoeba Keratitis

Confirmatory diagnosis of AK can be made using two methods:

1. **Non-invasive:** Confocal microscopy which commonly identifies the cystic form. The sensitivity and specificity of diagnosis using confocal microscopy compared to culture is described as 88% and 91%, respectively[3].

2. **Invasive:** Cultivation of corneal scrapings or biopsy which aim to help with multiplication of amoeba on minimal-nutrient agar flooded with Escherichia coli revealing typical track marks as the trophozoite form moves across the plate to feed. Cysts and trophozoites may also be seen through direct microscopy (Figure II) of the plates or identified through PCR.



Trophozoite
14 - 40 microns
motile

Cysts
Double-layered wall
12 – 16 microns
2 species shown

Figure I: Cysts and Trophozoites of Acanthamoeba

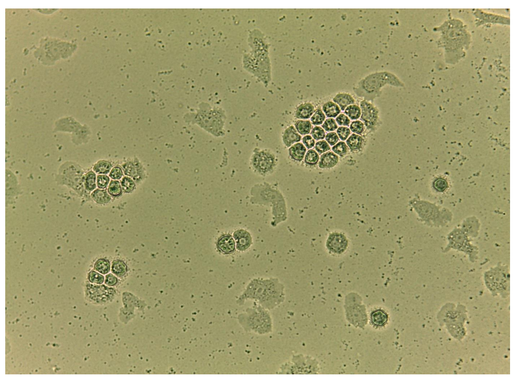


Figure II: Direct microscopy of culture from corneal scrape showing cysts of Acanthamoeba

Aim

AK remains difficult to treat with prognosis depending on early diagnosis. At Royal Victoria Infirmary, Newcastle upon Tyne, we have made improvement to our service, aiming to expedite diagnosis of AK (see below). The aim of this case series is to evaluate the use of our current service and subsequent patient outcomes.

Current Practice at NUTH

In order to ensure prompt diagnosis of AK, currently at NUTH, we provide a corneal scrape kit. Clinicians are provided with all the appropriate media and information to plate out a corneal scrape for culture and gram stain. In the lab, the plates are cultured for seven days and read daily after 48 hours of incubation. This aims to identify cases of bacterial, fungal and Acanthamoeba keratitis.

Figure III: Corneal scrape kit

Method

A retrospective analysis of the presentation and management of patients treated for laboratory confirmed AK between May 2013 and January 2018 at Newcastle-upon-Tyne Hospitals NHS Foundation Trust was executed. The case definition for AK was positive Acanthamoeba culture in a patient presenting with ocular pain. Patients were identified using Cognos Impromptu and APEX laboratory IT system. Details of patient demographics, ocular presentation, ocular imaging, culture diagnosis, treatment and visual outcomes were collected.

Results

29 patients were identified having corneal or contact lens positive results for Acanthamoeba from our lab. Seven were excluded as they were followed up outside the region and a further two did not have evidence of active Acanthamoeba infection. The remaining 20 were followed up in our analysis.

Patient Demographics:
Of the 20 patients reviewed, there were no significant gender differences with 9 male and 11 female cases. The median age was 27years (range 18 – 76years). All were found to be contact lens users.

Clinical Presentation:
All cases presented with pain. AK was immediately suspected in 11 cases, however, in the remaining 9, there was a delay in corneal scraping with mean delay time of 10.4 days (range 3 – 21 days). Alternative diagnosis resulting in delay were herpetic, bacterial and allergic keratitis. In seventeen cases perineural infiltrates were noted. One case suspected an infected suture but corneal scraping was carried out on admission leading to no delay in diagnosis. With the remaining 2 cases which did not show perineural infiltrates, there was a delay in diagnosis by 5 days and 23 days. Confocal Microscopy was performed in only 8 cases, 5 of which revealed double walled cysts.

Microbiology:
Eighteen of the samples received were from corneal scrapes, two were from contact lens. The mean time to positivity was 3.9 days (range 2 -7days).

Treatment and Outcome
All cases initiated treatment with Polyhexamethylene biguanide (PHMB) and Brolene. 4 cases subsequently required Chlorhexidine and Hexamidine. 2 of these required surgical intervention with amniotic membrane transplant and superficial keratectomy. A further 2 patients, who were treated with PHMB and Brolene alone, required amniotic membrane transplant and keratoplasty. All other cases showed clinical signs of improvement.

Discussion

In this case series, we describe twenty patients with AK, all of whom are contact lens users, presenting with ocular pain. Given that Acanthamoeba is a ubiquitous organism, contacts lens colonisation is unsurprising. This can be reduced by adequate hygiene measures, avoidance of over use and avoidance of cleaning contact lenses with tap water[2].

At NUTH we provide a service which aims to aid Ophthalmologists in making a prompt diagnosis of AK. The corneal scrape kits are readily available in the ophthalmology department with clear instructions for use. This allows prompt identification and communication to the clinical team as evidenced by the mean time to positivity. Whilst this service is available, consideration of AK within the differential is the most important step in diagnosis. In our case series we identified a delay in diagnosis in 9 cases. This may be multifactorial including risk factors for other causes of keratitis being present, the experience of the ophthalmologist seeing the patient and missing early stages of the disease. Importantly, in all our cases where AK was not considered initially, they were all followed up, with subsequent inclusion of AK within the differential.

Whilst in vitro treatment has proven to be effective at eliminating cysts and trophozoites with diamidines and biguanides[4], clinical practice does not reflect this. Furthermore, later stages of the disease have proven to be difficult to treat [1]. In our case series, most patients showed improvement with medical therapy alone (16 cases). This suggests that our corneal scrape kit is aiding early diagnosis and prompt treatment resulting in excellent clinical outcomes.

References

1. Medical interventions for acanthamoeba keratitis. Majed Alkharashi, Kristina Lindsley, Hua Andrew Law, Shameema Sikder. Cochrane Database Syst Rev. 2015; 2: CD010792
2. **The pathogenesis of Acanthamoeba keratitis.** Niederkorn JY, Alizadeh H, Leher H, McCulley JP. Microbes Infect. 1999 May;1(6):437-43.
3. Vaddavalli PK, Garg P, Sharma S, Sangwan VS, Rao GN, Thomas R. Role of confocal microscopy in the diagnosis of fungal and acanthamoeba keratitis. Ophthalmology. 2011; 118(1):29–35
4. Dart JK, Saw VP, Kilvington S. Acanthamoeba keratitis: diagnosis and treatment update 2009. American Journal of Ophthalmology. 2009; 148(4):487–99.