Acanthamoeba keratitis: A review of current literature

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ACANTHAMOEBA KERATITIS:
A REVIEW OF CURRENT LITERATURE

BY

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ACANTHAMOEBA KERATITIS: A REVIEW OF CURRENT LITERATURE

ABSTRACT

Over the past ten years, Acanthamoeba has become recognized as the entity of a sight threatening chronic keratitis and corneal ulceration with increasing frequency. The reason for the recent prevalence of definitive diagnosis is primarily due to the increase in published information and a heightened awareness by eye care practitioners of this opportunistic organism. It is the intent of this paper to enhance the awareness of its readers and consolidate the information available in the current literature. (Key words: Acanthamoeba Keratitis, Ring Infiltrate, Keratoneuritis, soft contact lens, contaminated saline solution.)

INTRODUCTION

Although initially recognized in 1973, Acanthamoeba Keratitis remained a curiosity for the next ten years, producing only 11 published cases, five from the United
States and six from three countries in Europe. Since 1984 over 100 cases have been reported, the majority of which have been linked to a common risk factor: soft contact lens wear. As reports have risen to over 30 cases per year, information on this rare form of Keratitis has increased dramatically.

Acanthamoeba is a genus of small free-living amoebae which normally feed on bacteria and are ubiquitous throughout the world. They have been cultured from soil, fresh and salt water, brackish water, hot tubs, and sewage and sludge. In its amebic or trophozoite form, Acanthamoeba is a nonflagellate (an important microscopic diagnostic feature). The trophozoite form ranges from 15 to 45 microns in diameter. The motile trophozoites are uninucleate with a large, dense, centrally located and densely staining nucleolus. They characteristically produce very fine tapering cytoplasmic extrusions called acanthopodia.
Under unfavorable conditions, the trophozoites alter to a double walled cyst approximately 10 to 25 microns in size. The cyst has a characteristic wrinkled outer wall and a smooth inner wall. The ability to encyst in the face of adversity renders Acanthamoeba highly resistant to a variety of antimicrobial agents, freezing, and standard chlorination of water.

The cyst form of both Acanthamoeba and Naegleria (a close relative) is thought to be inhaled when passing through dust, freshly dug soil, or water containing the organism. After altering to the active trophozoite form, it invades the body through the cribriform plate. Once blood-borne, the trophozoite migrates through the olfactory system and manifests itself as an often fatal, rapidly progressive granulomatous meningoencephalitis. Although blood-borne Acanthamoeba infection has not involved the cornea, reports of iridocyclitis have been noted. Likewise, central nervous system infiltration has not occurred after corneal infection.
DISCUSSION

Initial ocular manifestations of both Acanthamoeba castellani and polyphaga infection are usually nonspecific and vary from case to case. They may include recurrent corneal epithelial breakdown or irregularities, circumlimbal injection, conjunctival hyperemia, corneal edema, mid-stromal infiltrates along corneal nerves, and subepithelial infiltrates.\textsuperscript{1,5}

The corneal epithelium is often found intact though patchy irregularities and periodic breakdown occur despite therapeutic intervention. The infection usually follows with focal and multifocal dendriform ulcerations as well as radial neurokeratitis and diffuse subepithelial infiltrates that seem to mimic Herpes simplex.\textsuperscript{1} This often leads to a misdiagnosis of Herpes simplex and a treatment regime that usually has no effect and perpetuates the ongoing keratitis.
As the disease progresses to almost two months after the initial trauma, an almost pathognomonic ring-shaped stromal infiltrate develops. It is thought to occur via interaction between polymorphonuclear leukocytes and infection byproducts. However, immune factors have not been defined. The ring-shaped infiltrate may be partial, complete, or even double and concentric. The central stroma within the ring will appear coarsely granular. Discrete oval areas of relative sparing may appear within areas of stromal infiltration and zones of endothelial "pseudoguttata" (or nonreflectivity) appear in the perimeter of the stromal keratitis.

Advanced infection progresses to a superlative necrotizing keratitis, hypopyon, and corneal descemetocele that resembles bacterial superinfection or fungal keratitis. Severe ocular pain accompanying the advanced infection is often out of proportion with the degree of keratitis. The persistent severity of ocular pain is often the basis for the decision of enucleation by the patient and ophthalmologist. If resolved in the
advanced stages by therapeutic means, penetrating keratoplasty is required to restore useful vision.

As previously mentioned, prompt diagnosis is usually very difficult when the examiner assesses the early presenting sign. The patient's ocular history is the most important deciding factor in the early diagnosis. Many of the cases reported in the literature follow a common recent history.\textsuperscript{6,10} 1) Minor ocular trauma involving the globe, 2) direct exposure to soil or standing water, and 3) contact lens wear (soft or rigid).

The disease most commonly mistaken as the diagnosis in patients with Acanthamoeba keratitis is Herpes simplex. Although minor trauma is frequently reported by patients with primary onset dendritic Herpes, there is usually no history of trauma associated with soil or standing water. Similarly, contact lens wear is not a frequent predisposing circumstance in Herpes simplex. Although varying degrees of infiltration can occur in
stromal herpes, it is rarely associated with the severe pain experienced in patients with amebic infiltration. In addition, the ring infiltrate that has been cited as an early sign of Acanthamoeba keratitis is rarely seen in stromal herpes. 6

Another entity often mistaken for amebic infection if fungal disease. Although the stromal keratitis and history of trauma with organic materials make its distinction from amebic disease very difficult, the severe pain and annular or concentric infiltrate ring may aid in clinical differentiation. 6

The only bacterial pathogen producing a similar clinical picture to that of Acanthamoeba is a superlative corneal infection and lesion by the Mycobacterium species. Since these lesions are also associated in a large majority of cases with soil trauma to the eye, consideration of Mycobacterium is imperative and staining for acid-fast organisms as well as plating on Lowenstein-Jensen agar is mandatory for an accurate
differential diagnosis and resulting therapeutic treatment. 6

Laboratory assessment of corneal scrapings and biopsy yield the only definitive means for positive diagnosis of Acanthamoeba. Calcofluor white (CFW) is a chemofluorescent dye with an affinity for the polysaccharide polymers of amebic cysts. Using CFW staining with fluorescent microscopy, it has been demonstrated to provide rapid and highly reliable means in the diagnosis of Acanthamoeba keratitis. 7 Giemsa staining as well can be utilized. If necessary corneal scrapings can be rapidly screened by the method of indirect fluorescent antibody staining. 8

It is important to note that diagnosis of Acanthamoeba keratitis must be considered in all cases of chronic progressive corneal ulceration unresponsive to medical therapy.
Although much has been learned about Acanthamoebic infection over the past ten years, the optimal management of infections is currently a matter of debate between proponents of early surgical intervention via keratoplasty or initial medical management with subsequent keratoplasty where indicated.

Acanthamoeba infections are very resistant to chemotherapeutic agents, with no widely agreed upon medical approach. Initially, it was thought that ketoconazole, miconazole, neomycin, amphotericin B, polymyxin B, and a corticosteroid was the most efficacious therapy. However, the infection was rarely resolved and multiple keratoplasties and even enucleation resulted for most of those infected.

Previous surgical therapy consisted mostly of multiple penetrating keratoplasties, corneal cryotherapy, and, as a last resort, enucleation. Surgical intervention in conjunction with previous
medical therapy was only moderately successful. Many of the keratoplasty procedures resulted in reinfectivity requiring multiple keratoplasties or enucleation.

The current therapeutic regime utilized in Great Britain, and experimentally in the United States, reports an apparent medical cure of Acanthamoeba keratitis. The regime consists of topical dibrompropamidine (0.15%) ointment and propamidine isethionate (0.1%) eye drops (trade name: Brolene), as well as neomycin. Thus far, the report by Wright et al has been most favorable and may lead to a successful therapeutic regime in the United States as well.

CONCLUSION

Acanthamoeba keratitis is believed to result from direct corneal contact with contaminated material or water. Many of the infections occur in patients who have sustained minor ocular trauma or have predisposing
circumstances involving the cornea prior to invasion by Acanthamoeba.

Previously, the most common established risk factor of Acanthamoeba keratitis was the use of homemade saline from distilled water and salt tablets in contact lens patients who developed ocular symptoms. The effect of the inevitable removal of salt tablets from the public market has yet to be documented and the result can only be speculated upon. Ideally, treatment of Acanthamoeba, like other corneal diseases, requires definition of all associated risk factors and subsequent elimination. The four most likely situations in which Acanthamoeba keratitis may occur among contact lens wearers have been identified as follows: 11

The cornea becomes contaminated by water, soil, or airborne trophozoites or cysts (swimming, hot tubs, makeup, gardening, farming, etc.) and contact lens wear increases the ability of the protozoa to penetrate the cornea.

The contact lenses become contaminated by exposure to unsterile conditions (tap or distilled water, dirty
hands, saliva, solutions and storage cases, etc.) and inoculate the cornea upon insertion.

The contact lenses become contaminated with Acanthamoeba during or before wear, contaminate the storage cases and solutions used by the patient, and reinoculate the cornea from these reservoirs upon every insertion, thus increasing the contact time of the organism with the cornea.

The contact lenses become contaminated with various bacteria or fungi either during or before wear, and the lens material and/or associated contamination serves as a substrate for the amoebas, therefore increasing contact time with the cornea and simultaneously contaminating contact lens solutions and cases.

Upon recognizing the predisposing factors associated with amebic keratitis, the Contact Lens Association of Ophthalmologists have developed policies and guidelines to minimize the risk of Acanthamoeba keratitis among contact lens wearers. These guidelines include the following:

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1. Meticulous hand washing and extreme care in handling all contact lenses and contact lens materials should be observed.

2. Daily wear lenses should be removed daily for cleaning and disinfection, and extended wear lenses should be removed at regular and frequent intervals for cleaning and disinfection.

3. Lens storage cases should be cleaned.

4. After disinfection, contact lenses should not be rinsed with any non-sterile water, such as tap water, distilled water, or homemade saline prepared from either tap or distilled water and salt tablets.

5. Unit-dose non-preserved solutions should not be stored for reuse.
6. Since standard levels of chlorine do not destroy cysts, contact lenses should not be worn while swimming in pools or using hot tubs.

7. Contact lenses should not be worn while swimming in fresh or salt water.

8. Any atypical keratitis resistant to usual medication should be treated as potential Acanthamoeba infection and subjected to appropriate laboratory analyses, particularly if associated with severe ocular pain, ring shape infiltrate, or recurrent epithelial breakdown.

Although patient awareness to potential infection is of the utmost importance, the practitioners should assume the proper safeguards as well. Desiccation and freezing cause the trophozoites to encyst, thus enabling their continued survival. The wiping down of instruments with appropriate disinfectant chemicals
should virtually eliminate trophozoites, but cysts not physically removed by the wiping may remain. The practitioner should use heat disinfection for appropriate soft lenses at the office, as well as standard good hygiene practices to prevent transmission of viral and bacterial diseases. Continuing education of patients and office staff is required to increase awareness about this rare vision-threatening condition and other infectious diseases, and to lessen the potential for ocular infection.
BIBLIOGRAPHY


OTHER RESOURCES


