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CASE REPORT

A retrospective study of nine cases of *Acanthamoeba* keratitis

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Purpose: To evaluate the clinical features of *Acanthamoeba* keratitis in nine patients diagnosed at Dokkyo Medical University Koshigaya Hospital, Saitama, Japan.

Methods: In nine eyes of nine patients, *Acanthamoeba* keratitis was diagnosed by direct light microscopy of corneal scrapings stained by the Parker ink-potassium hydroxide method between September 2006 and September 2009. Their clinical features and course were studied retrospectively. Antifungal eye drops, systemic antifungal therapy, and surgical debridement of the corneal lesions were performed in all patients.

Results: At presentation, the clinical stage was initial in six cases, transient in one case, and complete in two cases. The patients were all contact lens wearers who had washed their lens storage cases with tap water. After treatment, final visual acuity was improved in six cases, unchanged in one case, and worse in two cases. The patient with the worst final vision (hand motion) had rheumatoid arthritis and was taking oral prednisolone, which led to corneal perforation and prevented adequate debridement from being done.

Conclusion: *Acanthamoeba* keratitis is closely related to wearing contact lenses and washing the lens storage case with tap water. Although final visual acuity improved after treatment in most patients, insufficient surgical debridement resulted in a poor visual prognosis.

Keywords: surgical debridement, *Acanthamoeba* keratitis, contact lens wearers

Introduction

Acanthamoeba is a free-living amoeba that is ubiquitously found in the enviroment[1] and has been isolated from the soil, air, fresh water, and sea water.[2–5] The organism exists in two forms, which are the motile trophozoite (15–45 μm long) and the dormant double-walled cyst (10–25 μm in diameter).[1,6] The trophozoites feed on other microorganisms, such as bacteria and fungi, and thus are more prominent in environments rich in various microorganisms.[7]

Acanthamoeba keratitis was first reported in 1974[8] and was initially recognized as an extremely rare form of infectious keratitis occurring after ocular trauma. During the 1980s, a dramatic increase in the incidence of *Acanthamoeba* keratitis was seen in contact lens wearers, and it was then recognized to occur in association with use of contact lenses.[9,10] In Japan, *Acanthamoeba* keratitis has tended to show an increase since the first report of this condition in 1988.[11] Although daily disposable contact lenses were believed to be safe, *Acanthamoeba* keratitis has also occurred in persons wearing such lenses.[5,12]

Standard treatment for *Acanthamoeba* keratitis includes topical antiamoebic eye drops, systemic antifungal therapy, and surgical debridement.[6] We have treated this

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keratitis according to the method of Ishibashi,[6] and have obtained a good visual prognosis in some patients.[13,14] However, there was a patient who had been treated with oral prednisolone, in whom adequate debridement could not be performed and the visual prognosis was poor. There was another patient in whom treatment was stopped and keratitis recurred. Final visual acuity was 0.5 in this patient.

We present nine cases of *Acanthamoeba* keratitis that were managed at the Department of Ophthalmology of Dokkyo Medical University Koshigaya Hospital in Saitama, Japan.

Materials and methods

In nine eyes of nine patients, *Acanthamoeba* keratitis was diagnosed by direct light microscopy of corneal specimens stained by the Parker ink-potassium hydroxide method[6,15] between September 2006 and September 2009. Because a definite diagnosis was made by confirmation of *Acanthamoeba* in corneal lesions with direct examination or culture,[6,15] these patients were studied retrospectively.

The initial clinical stage, type of contact lens and multipurpose solution, method of washing the contact lens storage case, initial visual acuity, final visual acuity, and performance of surgical debridement were analyzed. We followed the criteria of Ishibashi's classification at the initial clinical stage.[6,15] Pseudodendrites of the epithelium, tiny white infiltrates, and radial keratoneuritis were seen in the initial stage. A ring infiltrate is seen in the transient stage. Corneal disciform structures are seen in the completed stage. Decimal visual acuity data were converted into the logarithm of the minimum angle of resolution (log MAR) values, and a change >0.2 log MAR was judged as improvement or worsening of vision. Counting fingers and hand motion were converted into a decimal visual acuity of 0.01 and 0.002, respectively. The method of surgical debridement is only to scrape the corneal lesion with a spatula, taking care not to perforate.

Table 1 shows the treatment of the patients. All nine patients were diagnosed and treated by a single ophthalmologist.

Results

The clinical stage at presentation was initial in six cases, transient in one case, and complete in two cases. Case 1 showed improvement of visual acuity to 1.0 by three weeks after the start of treatment, and no amoebae were found in corneal scrapings after six weeks of treatment. Therefore, her keratitis was judged to be cured and treatment was stopped. However, one month later, the keratitis recurred and progressed to the complete stage. Case 3 was initially diagnosed as having uveitis, and referral to the special corneal clinic of our hospital was delayed. Accordingly, the keratitis had reached the transient stage before treatment was started (Table 2).

All nine patients were contact lens wearers, with the type of lens being frequent replacement contact lens in six cases, planned replacement contact lens in two cases, and daily disposable contact lens in one case. All patients occasionally wore their lenses for longer than recommended (Table 2). The type of multipurpose solution used was identified in five patients but remained unknown in four patients (Table 3).

All patients also washed their lens storage cases with tap water. Case 7 sometimes used her daily disposable contact lens for 2–3 days at a time, keeping the lenses in the storage case at night (Table 3).

Initial decimal visual acuity ranged from counting fingers 0.01 to 0.9 or from 0.046 to 2.0 as log MAR values. Final decimal visual acuity ranged from hand motion 0.002 to 1.2, while the log MAR values were from –0.079 to 3.699. When both final visual acuity and initial visual acuity were compared as log MAR values, visual acuity was improved in six cases, was unchanged in one case, and was worse in two cases (Table 4).

Surgical debridement was performed 3–14 times. In Case 7, debridement was inadequate because she had been taking oral prednisolone for rheumatoid arthritis and corneal perforation occurred after six debridement procedures. Subsequently, she wore a contact lens to protect the anterior chamber, and received antifungal eye drops plus systemic

Table 1 Treatment of *Acanthamoeba* keratitis

1. Topical antifungal eye drops, 0.2% fluconazole, 0.1% miconazole, 0.1% micafungin sodium (one or two drugs)
2. Systemic antifungal therapy oral itraconazole (200 mg/day)
3. Surgical debridement (once or twice weekly)

Notes: Topical 1% atropine sulfate and antibiotic eye drops as supportive therapy.

Table 2 Clinical summary of the nine patients: Part 1

Case No.	Initial clinical stage	Age	Sex	Lens type
1	Initial	33	F	PRCL (Monthly Fine®)
2	Initial	16	F	FRCL (2 WEEK ACUVUE®)
3	Initial	41	M	FRCL (Medalist®)
4	Initial	30	F	FRCL (2 WEEK ACUVUE®)
5	Initial	21	M	PRCL (O_2OPTICS®)
6	Initial	20	F	FRCL (2 WEEK AQUA1R®)
7	Transient	37	F	DDCL (1-DAY ACUVUE®)
8	Complete	17	F	FRCL (2 WEEK ACUVUE®)
9	Complete	45	M	FRCL (2 WEEK ACUVUE®)

Abbreviations: F, female; M, male; PRCL, Planned Replacement Contact Lenses; FRCL, Frequent Replacement Contact Lenses; DDGL, Daily Disposable Contact Lenses.

Table 3 Clinical summary of the nine patients: Part 2

Case No.	Multipurpose solution	Washed contact lens storage case with tap water
1	Concept quick®	+
2	Concept quick®	+
3	Unknown	+
4	Soft one cool®	+
5	Soft one®	+
6	OPTI-FREE®	+
7	Unknown	+
8	Unknown	+
9	Unknown	+

antifungal therapy for about three months. Although her keratitis soon progressed to the complete stage, there was eventually a response to treatment and the perforation healed. She subsequently underwent surgical debridement a further seven times and the keratitis resolved (Table 3), but vision was only hand motion.

Discussion

In the present series of nine patients with *Acanthamoeba* keratitis, all patients had unilateral disease, all were contact lens wearers, and all had washed their lens storage cases in tap water. Two patients could have been managed better. Case 1 was incorrectly judged to have been cured and treatment was stopped, but keratitis recurred and progressed to the complete stage. Case 3 was initially treated as uveitis, and the keratitis had reached the transient stage when the correct treatment was initiated. To avoid such cases in the future, because *Acanthamoeba* is not a corneal parasite based on light microscopy findings, topical antifungal eye drops should be given if the possibility of this condition exists, and we must also educate other ophthalmologists about *Acanthamoeba* keratitis. Bilateral cases are very rare, although an initial stage difference between the right and left eyes has been reported.[16] It is unclear why the initial stage can differ between sides or why most cases are unilateral when there are generally no differences of contact lens storage and wearing between the right and left eyes. Although all patients in the present series were contact lens wearers, about 10% of amoebic keratitis occurs in patients with eye trauma and the diagnosis is often delayed in such cases.[15] The incidence of *Acanthamoeba* keratitis should be very low in wearers of daily disposable lenses because they are not exposed to the risk of inadequate disinfection and contaminated lens storage cases. However, these lenses are not safe when worn improperly. Many of the patients did not know what type of multipurpose solution they had used. Generally, their consciousness of contact lens care was poor. All of the patients in this series believed that the contact lens storage case was sterile after washing with tap water and soap. However, *Acanthamoeba* is found in tap water,[16] and does not die even if the lens case is dried. Strictly speaking, washing the face and hands with tap water before wearing contact lens may cause *Acanthamoeba* keratitis. At least, contact lens wearers should not wash their storage cases with tap water and should exchange old storage cases for new ones.

The treatment result was generally good, except in cases 1 and 7. Ishibashi reported that when treatment was started at the initial stage, final visual acuity was ≥1.0, while final visual acuity was 0.8 and 1.2 when treatment was started at the transient stage.[17] In case 7, surgical debridement was performed 13 times in total, but debridement had to be suspended because of corneal perforation and the final visual acuity was hand motion. This was the worst outcome, and it may have been better if debridement could have been performed freely. Ishibashi and Miyanaga reported that surgical debridement is most effective, followed by antiamoebic eye drops and then systemic antifungal drugs.[15] Regeneration of the corneal epithelium seems to be very

Table 4 Clinical summary of the nine patients: Part 3

Case No.	Initial visual acuity	Initial visual acuity (logMAR)	Final visual acuity	Final visual acuity (logMAR)	Change of visual acuity	Surgical debridement (No. of procedures)
1	0.5	0.301	0.5	0.301	unchanged	14
2	0.5	0.301	1.2	–0.079	improved	3
3	0.9	0.046	1.2	–0.079	unchanged	13
4	0.1	1	1.2	–0.079	improved	3
5	0.05	1.301	1.2	–0.079	improved	5
6	0.07	1.155	1.2	–0.079	improved	5
7	0.01	2	HM	3.699	worsened	13
8	CF	2	0.5	0.301	improved	14
9	0.04	1.399	0.7	0.155	improved	3

Abbreviations: CF, counting fingers; HM, hand motion.

slow in patients with diabetes mellitus or those taking oral steroids. If *Acanthamoeba* keratitis occurs in such patients, there is a high risk of corneal perforation with poor final visual acuity, as in case 7. We should have performed surgical debridement more gently in case 7. Kandori et al performed surgical debridement up to five times, in addition to phototherapeutic keratectomy or lamellar keratoplasty.[18] However, the results of therapeutic penetrating keratoplasty are poor in patients with *Acanthamoeba* keratitis, and some of them suffer from recurrence of amoebic infection in the graft.[19] More study is needed to establish effectiveness of phototherapeutic keratectomy and lamellar keratoplasty for preventing graft recurrence of amoebic infection.

Topical polyhexamethylene biguanide and propamidine treatment are effective for this amoebic keratitis[5–7,11,12,15,17] but topical antifungal drugs are also effective.[6,7,11–18] It is difficult for us to obtain polyhexamethylene biguanide and propamidine in Japan. On the other hand, it is easy to obtain antifungal drugs. Given their scarcity, and the fact that the efficacy of topical polyhexamethylene biguanide and propamidine treatment and antifungal drug treatment were similar in previous studies,[12–14] we elected to use the antifungal drugs.

Judging from the present nine cases, no contact lens are completely safe, and washing contact lens storage cases in tap water is clearly dangerous. More education is needed for contact lens wearers in order to prevent such infections. Surgical debridement may be a useful adjunct to treatment for *Acanthamoeba* keratitis.

Disclosure

The authors report no conflicts of interest in this work.

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