

Tegaderm transparent dressing (3M) with antibiotic ointment for treatment of infectious corneal ulcer: Antibiotic Wet Therapy

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Abstract

Purpose

To retrospectively review cases of infectious corneal ulcer treated with Tegaderm transparent dressing (3M) with an antibiotic ointment.

Subjects and methods:

A series of 29 eyes of 29 patients with possible infectious corneal keratitis were treated in Wakayama Medical University Hospital between January 1st, 2016 and December 31st, 2018. The age of the patients ranged from 26 to 92 years (mean 68.0 ± 17.8). At the first visit, the corneal infection lesion was scraped from the epithelium to the substantially superficial layer, and the scraped matter was submitted to Gram staining and culture examination. Cases suspected of fungi and Acanthamoeba were examined directly with potassium hydroxide (KOH) treatment. For several days until drug sensitivity results were obtained, initial treatment was Antibiotic Wet Therapy (AWT) with ophthalmic eye ointment and transparent Tegaderm (3M) dressing. We retrospectively reviewed the culture results of corneal scrapings (detected bacteria and drug resistance) and the therapeutic outcome of AWT.

Results

Nineteen eyes in which the causative bacteria were not identified and five eyes in which the causative bacteria (*Pseudomonas aeruginosa*, methicillin-susceptible *Staphylococcus aureus* (MSSA), *Streptococcus*, *Corynebacterium*.) were identified were successfully treated using AWT with ofloxacin ointment. methicillin-resistant *Staphylococcus aureus* (MRSA) was detected in 3 of 5 eyes in which AWT with ofloxacin was not successful, and filamentous fungi were detected in one eye. Two of the three eyes MRSA detected were healed by changing to vancomycin hydrochloride eye ointment, one of which was severely affected and was later enucleated. One eye with filamentous fungi was treated after changing to pimaricin eye ointment. A causative pathogen was not identified in the other eye, but because it was suspected to be fungal the ointment was changed to a pimaricin eye ointment, which led to healing.

Conclusion

AWT may be an option for initial treatment of corneal infections when the causative organism is unknown.

Introduction

It is important that the injured or infected cornea remains transparent after treatment [1–3]. Scarring following wound healing in the corneal stroma results in opacification and irregular astigmatism, both of

which impair visual function [4, 5]. Therefore, initial treatment of corneal infection is critical for a final outcome of healing with minimal scarring. In a clinical setting, application of a broad-spectrum antibiotic eye drop is the first choice of treatment until bacteriology examination identifies the specific pathogen [6, 7]. For over ten years, we have treated infectious corneal ulcers using Antibiotic Wet Therapy (AWT, an antibiotic ophthalmic ointment with Tegaderm (3M) transparent dressing) as the initial treatment. In this study, we retrospectively reviewed the culture results of corneal scrapings (detected bacteria and drug resistance) and the therapeutic outcomes of AWT in cases from January 1st, 2016 to December 31st, 2018. AWT was successful in most cases, even without identification of a causative pathogen.

Subjects

This retrospective study was approved by the Ethical Review Board of Wakayama Medical University Hospital (#2620). The study included a series of 29 eyes of 29 patients with suspected infectious corneal disorder treated in Wakayama Medical University Hospital during the between January 1st, 2016 and December 31st, 2018. Patients were aged 26 to 92 years (mean 68.0 ± 17.8).

At the first visit, the corneal infection lesion was scraped from the epithelium to the substantially superficial layer, and the scraped matter was submitted to Gram staining and culture examination. Cases suspected of fungi and *Acanthamoeba* were examined directly with potassium hydroxide (KOH) treatment [8, 9].

Pimaricin eye ointment was used to treat confirmed fungal infection. Ophthalmic eye ointment was used for suspected pathogens sensitive to new quinolone, such as *Pseudomonas aeruginosa*, as the initial treatment for unknown pathogens. When methicillin-resistant *Staphylococcus aureus* (MRSA) or fungi were detected with culture examination, treatment was changed from ophthalmic ointment to vancomycin hydrochloride or pimaricin ointment.

The AWT method involves applying about 0.5g eye ointment in the lower conjunctival sac and affixing Tegaderm transparent dressing (3M) (Figure 1) to discourage eye opening and to develop a tear-filled environment inside the film.

Our hospital policy is to only remove the protective film for treatment, such as for corneal abrasion at examination. This usually occurs once per day, but if the wet state cannot be maintained, additional exchange is performed. We aim to ensure the eye is always moist, but film removal did not exceed 3 times per day if possible to avoid damaging the skin around the eyelid.

Methods

In this study, we retrospectively reviewed the culture results of corneal scrapings (including bacteria and drug resistance) and the therapeutic outcomes of AWT. The eyes were grouped two [Therapeutic response (+) group and Therapeutic response (-) group], and causative pathogens were assayed in each group.

Representative case was also shown here. In this patient we did not detect causative specific pathogens were detected, but AWT was successful.

Result

AWT was successful in the treatment of 19 eyes in which the causative bacteria were not identified and five eyes in which causative bacteria were identified as *Pseudomonas aeruginosa*, methicillin-sensitive *Staphylococcus aureus* (MSSA), *Streptococcus* and *Corynebacterium*. (Table 1)

Table 1
Number and types of causative pathogens with positive or negative response to AWT.

Therapeutic response +	24
<i>Pseudomonas aeruginosa</i>	3
MSSA	1
<i>Streptococcus</i>	1
<i>Corynebacterium</i>	1
	(Partially duplicated)
No detection	19
Therapeutic response -	5
MRSA	3
fungus	1
No detection	1

Of a further five eyes in which AWT had no therapeutic effect, three eyes had MRSA infection, one eye had causative fungus infection and one eye had an unknown cause of infection.

For the three eyes with MRSA infection, ofloxacin ointment was changed to vancomycin ointment and inflammation was improved in two out of three eyes, but one eye with severe MRSA infection required enucleation. The eye with a fungal cause of infection was improved by changing ofloxacin to pimaricin ointment, and in the eye with unknown cause of infection, but suspected to be fungal, the ointment was changed to a pimaricin eye ointment, which led to healing.

In this retrospective study, there was no recurrence of corneal infection.

Representative Case Report

A 67-year-old male patient complained of left eye pain and decreased visual acuity and was diagnosed with infectious keratitis. Two days later, a corneal ulcer appeared, and he visited our hospital. The findings at the first visit were visual acuity: Right = 0.7 (1.0) Left = 0.05 (no improvement with refractive correction). Congestion of the bulbar conjunctiva was prominent, and a central corneal ring-shaped ulcer and inflammatory cells in the anterior chamber were found. (Fig. 2)

As initial treatment, corneal lesion scrubbing and Gram staining was performed, but no causative bacteria were identified. Infectious corneal ulcer was suspected on the basis of clinical findings, and AWT was started. One week later, the genus *Streptococcus* was detected by culture examination, and sensitivity to levofloxacin was confirmed. The visual acuity on day 18 after the start of AWT was Right = 0.7 (1.0) and Left = 0.5 (no improvement with refractive correction). Bulbar conjunctival hyperaemia was reduced and inflammatory cells in the anterior chamber had disappeared. Although corneal opacity remained, epithelial surface was observed and the ulcer had healed. (Fig. 3) The treatment was terminated at this point, but it was noted that the patient had already lapsed treatment without relapse of corneal ulcer or keratitis.

Discussion

In the current study, 24 of 29 cases were successfully treated using AWT. The efficacy of the treatment strategy might depend on water retention and long-standing exposure of antibiotics to the lesion. The common use of dressings in treatment of cutaneous burn or decubitus [10, 11] led us to hypothesize that maintenance of a moist environment may be favourable in the treatment of corneal injury or infection. A wound-healing effect of tear retention might depend on activation of cell behaviours and provision of wound healing-related bioactive components, such as growth factors and extracellular matrix components like fibronectin [12–14].

Physiological tear clearance is calculated as the sum of tear secretion, including tears lost from the conjunctiva, tear evaporation, and tear discharge to the nasolacrimal duct, and occurs at a stable rate. Human tear turnover rate is said to be around 10%-20% per minute [15, 16]. With frequent eye drops, the quantity of tears temporarily increases, but it is thought that this quantity increases over time and as the tears flow from the ocular surface. By applying Tegaderm to form an enclosed environment, the tears that would have evaporated were retained and accumulated in the space inside the Tegaderm transparent dressing. Antibiotic ointments mixed with tears were also stored inside this environment over a sustained period. Therefore, Tegaderm transparent dressing may have been useful in keeping antibiotics, growth factors and extracellular matrix components in contact with the eye for a long time.

Conclusion

In the cases reported here we applied ofloxacin ophthalmic ointment prior to obtaining results of bacteriology culture testing. In 19 cases the lesion was successfully treated with AWT treatment even though the bacteriology testing did not identify a specific pathogen. In five cases the bacteria were

sensitive to ofloxacin with favourable outcome. In five cases with MRSA or fungi, AWT did not yield satisfactory outcomes. However, the drug suitable to these pathogens showed effectiveness. We consider it is not suitable to continue AWT if effectiveness is not seen following several days of treatment. Another treatment strategy for bacterial keratitis is frequent instillation of an antibiotic eye drop. However, AWT treatment involves reduced drug instillation, which may be beneficial to both patient and medical team.

Abbreviations

AWT

Antibiotic Wet Therapy (AWT)

MSSA

methicillin-susceptible *Staphylococcus aureus*

MRSA

methicillin-resistant *Staphylococcus aureus*

Declarations

Ethics approval and consent to participate

This retrospective study was approved by the Ethical Review Board of Wakayama Medical University Hospital (#2620).

Consent for publication

Written informed consent for publication was obtained.

Availability of data and material

The datasets used during the current study are available from the corresponding author on reasonable request.

Competing interests

There is no financial disclosure.

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Authors' contributions

All authors contributed to project conception and critical review of manuscript. The author(s) read and approved the final manuscript.

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Authors' information (optional)

Not applicable.

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Figures

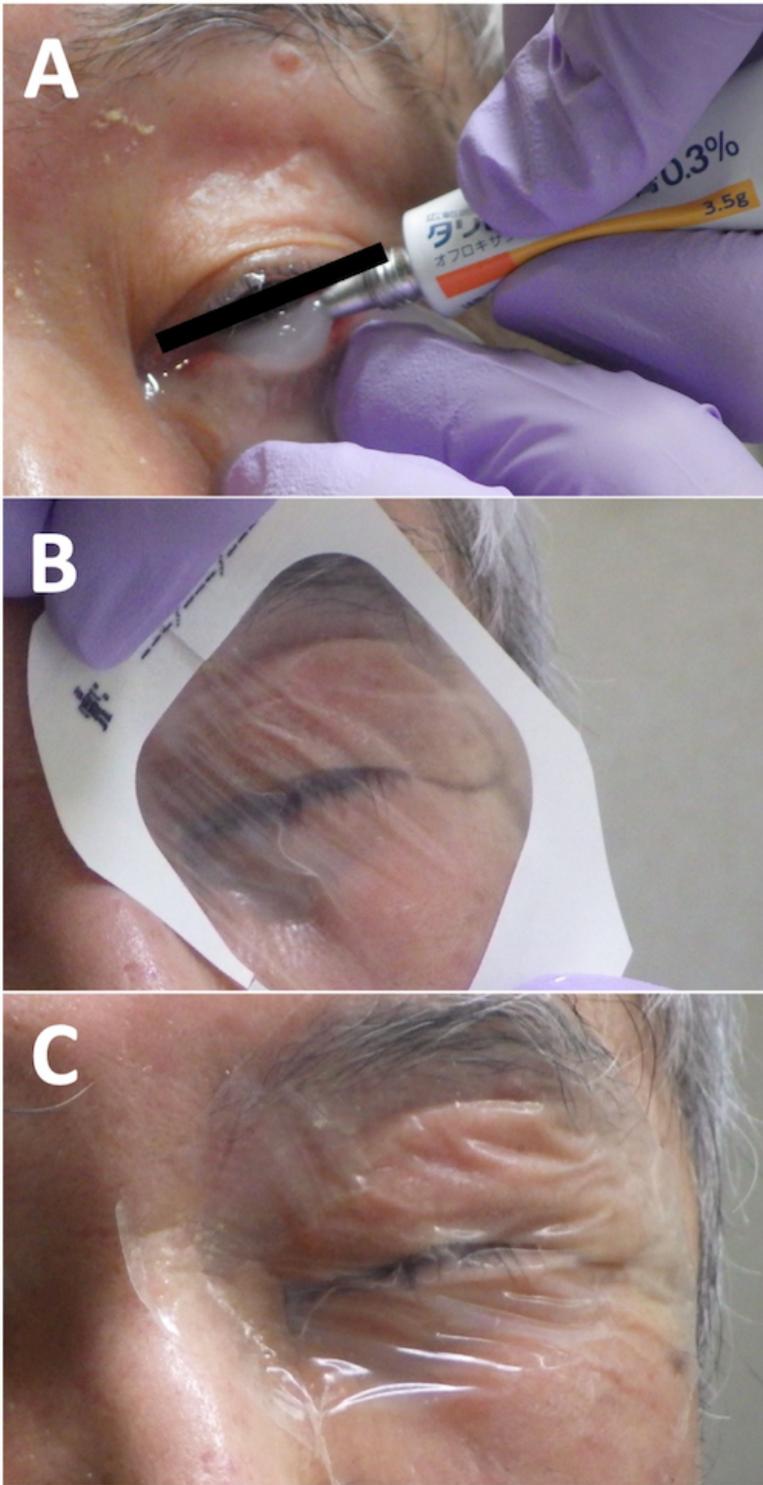


Figure 1

A: Approximately 0.5g appropriate eye ointment is applied to the lower eyelid. B: Tegaderm transparent dressing (3M) is affixed over and around the eye. C: The eye is closed under Tegaderm transparent dressing (3M).

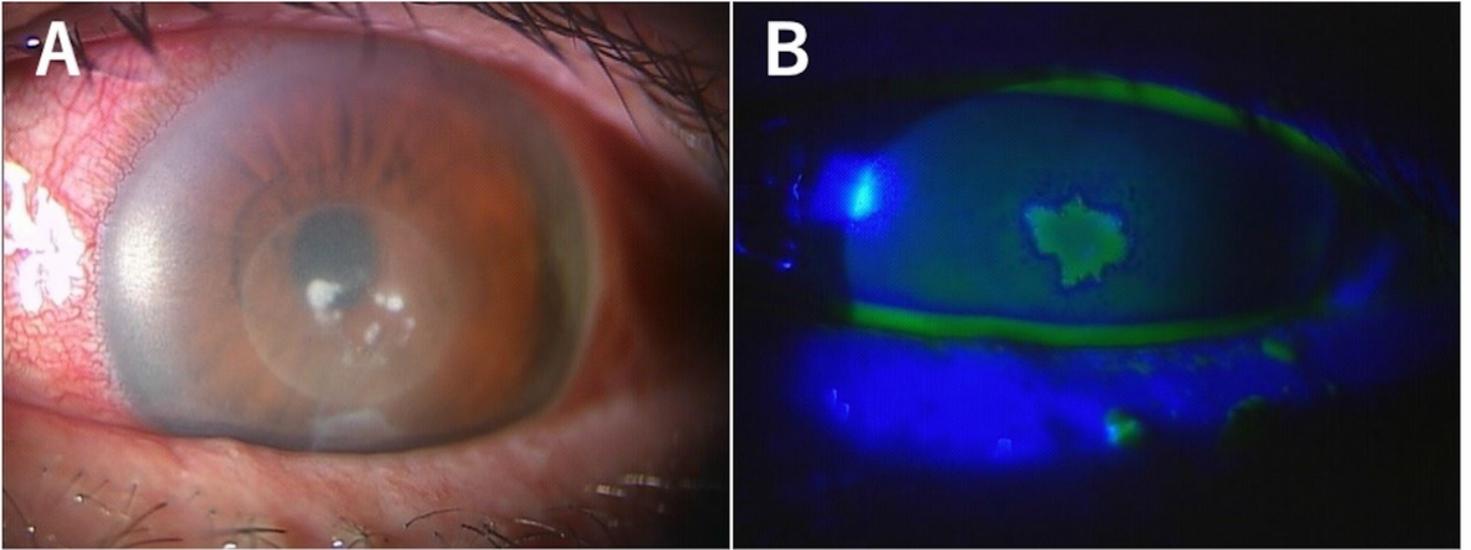


Figure 2

Central corneal ring ulcer with opacity. A: Anterior segment photograph. B: Photograph showing fluorescein staining.

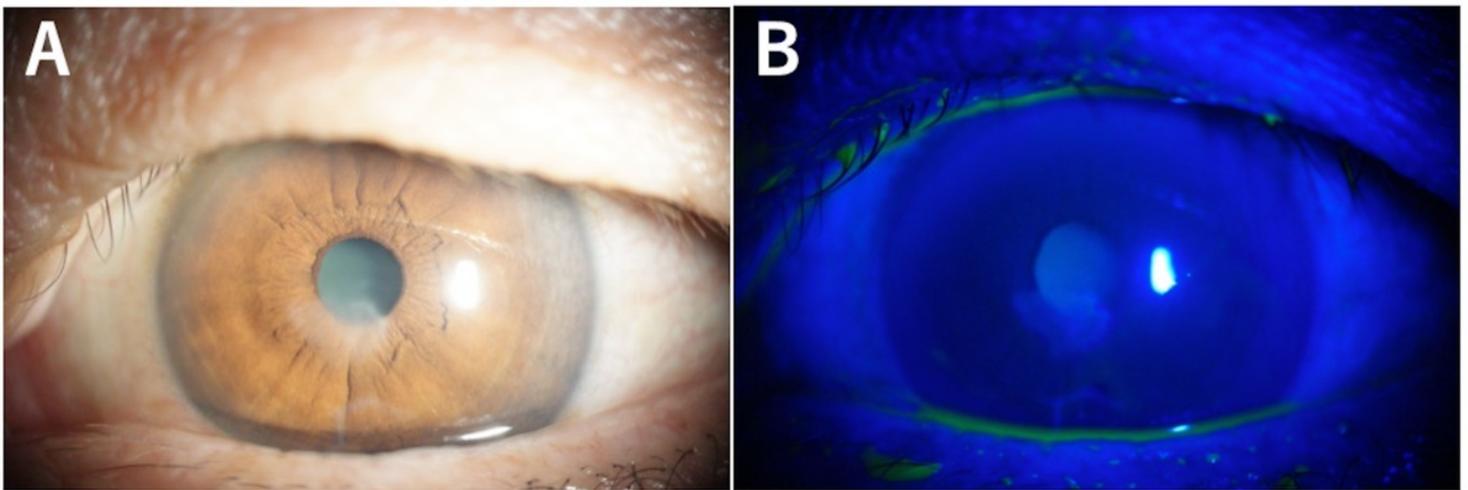


Figure 3

The ulcer and edema disappeared, although opacity remained in the central cornea. This resolved without recurrence even after discontinuation of AWT. A: Anterior segment photograph. B: Photograph showing fluorescein staining.