RESEARCH PAPER

Microbial Keratitis: A Case Series

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INTRODUCTION

Microbial keratitis is a vision-threatening corneal infection and a significant cause of preventable corneal blindness worldwide. It encompasses bacterial, fungal, viral, and protozoal infections, with bacterial and fungal pathogens accounting for the majority of cases. Prompt diagnosis, microbiological evaluation, and appropriate antimicrobial therapy are essential to prevent irreversible visual loss and preserve ocular integrity.

The clinical presentation and management of microbial keratitis vary depending on the causative organism, severity of infection, and time of presentation. While many patients respond to intensive medical therapy, some require surgical intervention to control infection and restore structural integrity.

This case series presents three patients with microbial keratitis managed at a tertiary care center, illustrating the varied clinical presentations, management strategies, and outcomes associated with this potentially sight-threatening condition.

CASE PRESENTATION

Case 1

A 68-year-old male presented with complaints of painful, progressively worsening diminution of vision in the left eye for two months, associated with redness and pricking sensation. There was no history of ocular trauma. He was a known case of type 2 diabetes mellitus for 20 years and had previously undergone cataract surgery in both eyes.

On examination, the visual acuity was perception of light with accurate projection of rays in the right eye and counting fingers at 1 metre in the left eye. Slit-lamp examination of the left eye revealed conjunctival congestion with a large central corneal infiltrate involving the visual axis, associated with diffuse stromal edema and an inferior layered hypopyon. The anterior chamber was formed, and the eye was pseudophakic. B-scan ultrasonography demonstrated a normal posterior segment.

Corneal microbiological evaluation isolated Staphylococcus epidermidis, confirming a bacterial etiology. The patient was treated with intensive topical antimicrobial therapy, including fortified tobramycin, along with other topical and systemic antibiotics as clinically indicated. Cycloplegics, antiglaucoma medication, doxycycline, vitamin C supplementation, and supportive therapy were also administered during the hospital stay. The patient showed clinical improvement with treatment and was discharged on topical medications with advice for regular follow-up.

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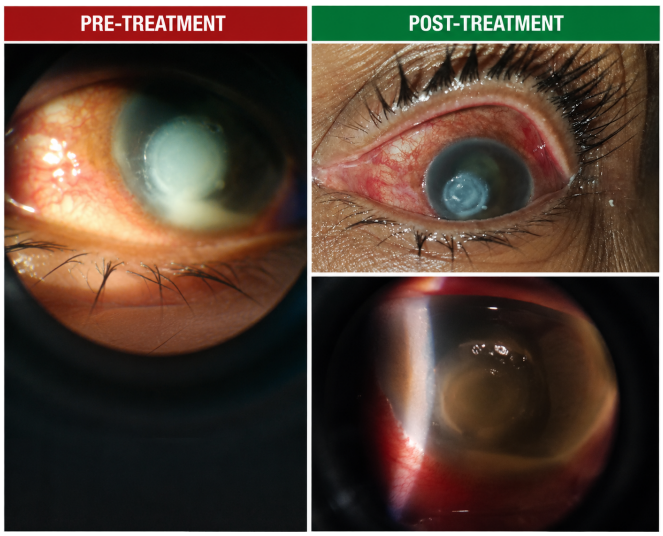
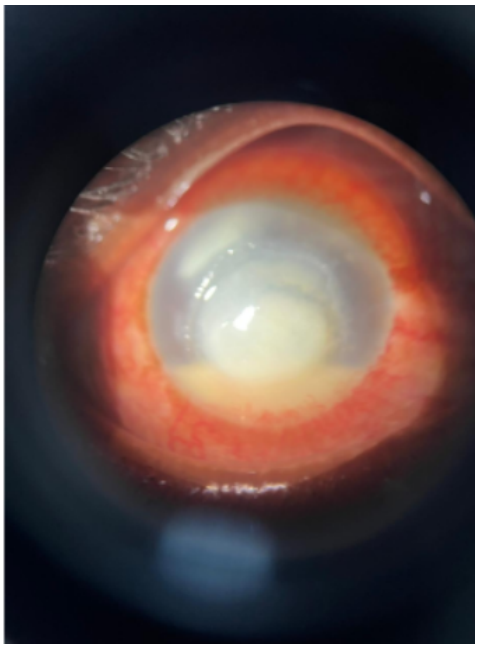


Case 2

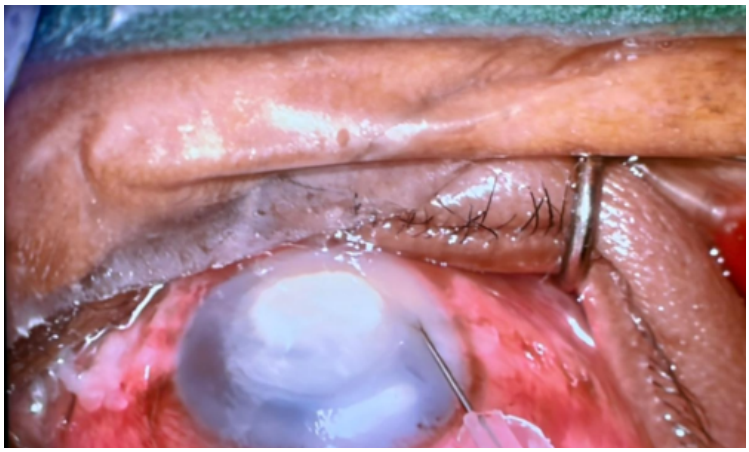
A 30-year-old male driver from Chikkodi presented with complaints of pricking sensation, itching, and redness in the right eye for 15 days, followed by pain and whitish discharge for 10 days and progressive diminution of vision for 7 days. He gave a history of vigorous eye rubbing in response to persistent itching and had been prescribed topical ciprofloxacin with dexamethasone by a local doctor. There was no history of ocular trauma, previous ocular surgery, contact lens wear, long-term topical medication use, swimming, fever, or similar complaints in the past.

On examination, visual acuity was perception of light with inaccurate projection of rays in the right eye and 6/12 in the left eye. Slit-lamp examination of the right eye revealed a corneal ulcer with associated corneal opacity and anterior segment inflammation. The posterior segment could not be visualized adequately due to media opacity, while B-scan ultrasonography showed no vitreous echoes. Corneal scraping and conjunctival swab were sent for microbiological evaluation. Gram staining was negative for bacterial elements, while KOH mount was positive for fungal elements and culture isolated *Aspergillus fumigatus*.

Based on the clinical findings and microbiological investigations, a diagnosis of right eye fungal corneal ulcer secondary to *Aspergillus fumigatus* was made. The patient was managed with intensive topical antifungal therapy including natamycin, voriconazole, and fluconazole, along with fortified antibiotics, cycloplegics, antiglaucoma medications, and supportive therapy. Intrastromal voriconazole 0.05% was subsequently administered. The patient was monitored during his hospital stay and managed accordingly.



Presentation



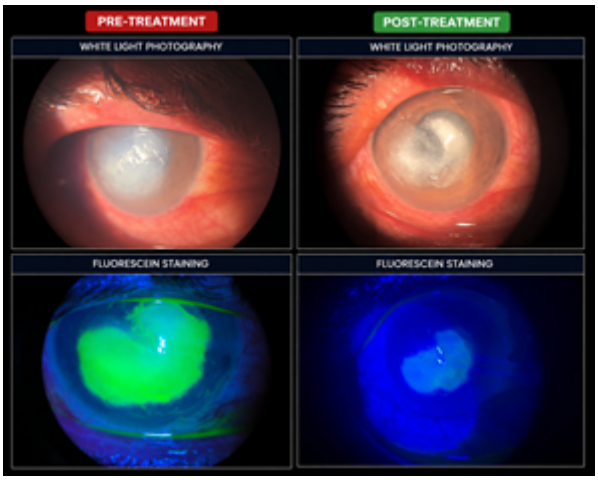
Intrastromal voriconazole administration

Case 3

A 45-year-old male presented with complaints of pain, redness, photophobia, and diminution of vision in the right eye for 2 weeks. He initially consulted a local clinic and was prescribed topical steroid eye drops, which he used for approximately 2 weeks without improvement. He subsequently consulted another hospital, where he was started on topical antifungal therapy. There was no significant history of systemic illness.

On examination, visual acuity in the right eye was hand movements close to face. Slit-lamp examination of the right eye revealed a corneal infiltrate measuring approximately 6 × 6 mm with stromal edema and satellite lesions, without hypopyon. The anterior chamber was formed. An outside corneal ulcer swab for fungal elements showed a 10% KOH preparation demonstrating a tangled mass of broad, septate, branching fungal elements, confirming fungal keratitis.

Based on the clinical findings and microbiological examination, a diagnosis of right eye fungal keratitis was made. The patient was managed with intensive topical antifungal therapy including natamycin and voriconazole, along with oral itraconazole, cycloplegics, doxycycline, vitamin C, and supportive therapy. On subsequent follow-up, the patient was symptomatically better with evidence of healing of the fungal ulcer, and antifungal treatment was continued with close follow-up.



DISCUSSION

Microbial keratitis remains an ophthalmic emergency because progression of stromal infection can result in rapid tissue destruction, corneal thinning, perforation, secondary endophthalmitis, and permanent visual loss. The present three-case series demonstrates the broad clinical spectrum of microbial keratitis, ranging from a severe central bacterial ulcer in a patient with long-standing diabetes mellitus to filamentous fungal keratitis requiring intensive antifungal therapy and, in one case, intrastromal voriconazole. The cases also emphasize the importance of early microbiological investigation and the potential adverse impact of inappropriate topical corticosteroid use before fungal keratitis is recognized.

The first case illustrates severe, vision-threatening bacterial keratitis in an elderly pseudophakic patient with a 20-year history of type 2 diabetes mellitus. The large central infiltrate, stromal edema and hypopyon, together with very poor presenting vision, indicate advanced corneal infection involving the visual axis. Diabetes may impair ocular surface defense mechanisms and host immune responses and can therefore increase susceptibility to infectious corneal disease. Although the diagnosis in this case was made clinically and the patient improved with intensive antimicrobial therapy, the absence

of documented microbiological identification is a limitation. In severe or atypical ulcers, corneal scraping for microscopy and culture is valuable for confirming the organism and allowing subsequent modification of antimicrobial therapy.

The second and third cases demonstrate important features of fungal keratitis. In Case 2, vigorous eye rubbing and antecedent treatment with ciprofloxacin combined with dexamethasone were followed by a severe ulcer. KOH examination was positive for fungal elements and culture identified Aspergillus fumigatus. In Case 3, the clinical picture of a 6 × 6 mm infiltrate with stromal edema and satellite lesions, together with broad, septate, branching fungal elements on KOH preparation, was strongly supportive of filamentous fungal keratitis. Satellite lesions and an indolent course are recognized clinical clues that should raise suspicion of fungal infection, although microbiological confirmation remains important whenever feasible.

A particularly relevant observation is the prior use of topical corticosteroids in Cases 2 and 3. Empirical steroid therapy in an undiagnosed infectious corneal ulcer may suppress local host defenses and permit progression of fungal infection. Published literature associates corticosteroid exposure before recognition of fungal keratitis with more severe disease and poorer outcomes; therefore, fungal infection should be excluded before considering topical corticosteroids in an infectious corneal ulcer. In bacterial keratitis, corticosteroids have a more selective adjunctive role after appropriate antimicrobial therapy has been established, but this evidence should not be extrapolated to fungal keratitis.

The antifungal treatment used in the present series reflects the importance of early and intensive therapy. Natamycin remains an important first-line topical agent for filamentous fungal keratitis, while voriconazole may be used as an adjunct in selected cases, particularly when there is deep stromal involvement or inadequate response to conventional therapy. Randomized trials have demonstrated better overall outcomes with topical natamycin than with voriconazole monotherapy for filamentous fungal keratitis, particularly in Fusarium infection. More recent evidence also suggests that routine addition of topical voriconazole to natamycin does not significantly improve outcomes in all cases, supporting an individualized approach based on organism, depth, severity and response to treatment.

Intrastromal voriconazole was used in Case 2 as an adjunct to intensive topical therapy. Intrastromal delivery can be considered in selected recalcitrant deep stromal infections when adequate drug penetration is difficult to achieve with topical therapy alone. Evidence from randomized studies, however, does not support routine intrastromal voriconazole for all fungal ulcers; it is best considered an adjunct in carefully selected, non-responding cases under specialist corneal care. The favorable clinical response in this case highlights its potential role as a rescue strategy rather than a replacement for topical antifungal therapy.

The three cases also demonstrate the importance of supportive treatment. Cycloplegics help relieve ciliary spasm and anterior segment discomfort, while intraocular pressure should be monitored and treated when elevated. Systemic therapy may be considered in severe, deep or recalcitrant fungal infections, although its role should be individualized. Nutritional and supportive measures used in the present cases were adjunctive and should not substitute for definitive antimicrobial therapy.

Microbiological evaluation is central to the management of severe microbial keratitis. Corneal scraping for Gram stain, KOH preparation and culture can distinguish bacterial from fungal disease and guide targeted therapy. In Case 2, KOH microscopy and culture directly changed the diagnostic and therapeutic pathway by identifying Aspergillus fumigatus. In Case 3, KOH examination provided rapid evidence of fungal infection. These cases reinforce that microbiology is particularly important when there is a large central ulcer, atypical clinical appearance, poor response to empirical treatment, prior corticosteroid exposure, or suspicion of fungal disease.

The main limitations of this case series are the small sample size, heterogeneous etiologies, absence of microbiological confirmation in the bacterial case, and limited documentation of long-term visual outcomes. Therefore, the observations cannot be used to compare treatment efficacy statistically. Nevertheless, the series provides clinically relevant examples of the need for early recognition, microbiological confirmation, prompt initiation of appropriate antimicrobial therapy, and close monitoring for treatment response and complications.

MANAGEMENT

Initial assessment and microbiological work-up

- Perform a detailed history focusing on trauma, agricultural/vegetative exposure, contact lens use, previous ocular surgery, topical medication or corticosteroid use, systemic disease, and prior treatment.
- Document visual acuity, ulcer location and size, epithelial defect, stromal depth, infiltrate characteristics, hypopyon, anterior chamber reaction, thinning or perforation, intraocular pressure where appropriate, and posterior segment status. B-scan ultrasonography is useful when media opacity prevents adequate fundus visualization.
- For severe, central, atypical, deep, non-responding or suspected fungal ulcers, obtain corneal scrapings before antimicrobial therapy whenever clinically feasible. Send specimens for Gram stain, KOH/calcofluor preparation and bacterial/fungal culture, with susceptibility testing when indicated.

Bacterial keratitis

- Start intensive topical broad-spectrum antibacterial therapy promptly after microbiological sampling in severe disease. Choice of a fluoroquinolone versus fortified antibiotics should be guided by ulcer severity, local resistance patterns and clinical response.
- Use cycloplegics for pain and anterior uveitis. Monitor intraocular pressure and treat secondary ocular hypertension when present.
- Review frequently during the initial phase. Modify treatment according to smear, culture, susceptibility results and clinical response. Progressive thinning, impending perforation or failure of medical therapy warrants early corneal surgical consultation.

Fungal keratitis

- For filamentous fungal keratitis, topical natamycin 5% is an important first-line therapy. Voriconazole may be added or substituted in selected cases based on clinical response, organism and depth of infection.
- Treatment should be intensive initially and continued until there is clear microbiological and clinical resolution, followed by gradual reduction according to response. Deep or recalcitrant disease may require adjunctive systemic therapy or targeted intrastromal antifungal therapy.
- Topical corticosteroids should not be started empirically in suspected fungal keratitis. If a patient has already received steroids, the need for discontinuation or tapering should be assessed by the treating corneal specialist while ensuring adequate antifungal therapy.

Surgical management

- Consider therapeutic keratoplasty when there is progressive corneal melt, impending or actual perforation, uncontrolled infection despite appropriate medical therapy, or other structural complications threatening the integrity of the globe.
- Other adjunctive procedures, including tissue adhesive or conjunctival procedures, may be considered for selected cases of thinning or small perforation. Surgical decisions should be individualized according to the site, size and depth of the lesion and the degree of infection control.

Follow-up

- Patients with severe microbial keratitis require close follow-up, often daily during the early phase, with serial documentation of ulcer dimensions, epithelial healing, stromal infiltrate, hypopyon and visual acuity.
- Once infection is controlled, treatment should be tapered cautiously and patients should be monitored for residual corneal opacity, irregular astigmatism, elevated intraocular pressure and other sequelae that may limit final vision.

CONCLUSION

This case series highlights the diverse and potentially devastating presentation of microbial keratitis. Severe bacterial and fungal ulcers may present with profound visual loss and can progress rapidly if appropriate treatment is delayed. Diabetes, prior topical corticosteroid exposure and atypical clinical features should heighten clinical suspicion and prompt microbiological evaluation. KOH microscopy and fungal culture were particularly useful in identifying fungal disease in two cases. Intensive, organism-directed topical therapy remains the cornerstone of management, with adjunctive systemic or intrastromal therapy reserved for selected severe or recalcitrant infections. Early diagnosis, avoidance of inappropriate corticosteroid use, close monitoring and timely surgical intervention when required are essential to preserve globe integrity and maximize visual outcomes.

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Note: Because this is a three-patient case series, the discussion describes clinical patterns and management considerations rather than drawing comparative efficacy conclusions between treatments.